

USC Aiken Penland Mechanical Systems Upgrades

State Project Number: H29-9548

Location: University of South Carolina- Aiken

471 University Parkway

Aiken, SC 29801



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SE-310**INVITATION FOR CONSTRUCTION SERVICES****PROJECT NAME:** USC Aiken Penland Building Mechanical Systems Upgrades**PROJECT NUMBER:** H29-9548**PROJECT LOCATION:** University of South Carolina - Aiken, Aiken,SC**BID SECURITY REQUIRED?** Yes No **PERFORMANCE BOND REQUIRED?** Yes No **PAYMENT BOND REQUIRED?** Yes No **NOTE:** Contractor may be subject to a performance appraisal at the close of the project.**CONSTRUCTION COST RANGE:** \$ 450,000 - 475,000**DESCRIPTION OF PROJECT:** Upgrades to the mechanical system in the Penland Administration Building located on the USC Aiken campus. Work to include chiller replacement along with related electrical and mechanical components. Minority and small business participation is encouraged.**BIDDING DOCUMENTS/PLANS MAY BE OBTAINED FROM:** http://purchasing.sc.edu (see Facilities Construction Solicitations & Awards)**PLAN DEPOSIT AMOUNT:** \$ _____ **IS DEPOSIT REFUNDABLE** Yes No N/A Bidders must obtain Bidding Documents/Plans from the above listed source(s) to be listed as an official plan holder. Only those Bidding Documents/Plans obtained from the above listed source(s) are official. Bidders that rely on copies of Bidding Documents/Plans obtained from any other source do so at their own risk. All written communications with official plan holders & bidders **WILL** **WILL NOT** be via email or website posting.**IN ADDITION TO THE ABOVE OFFICIAL SOURCE(S), BIDDING DOCUMENTS/PLANS ARE ALSO AVAILABLE AT:**Bidders are responsible for obtaining all updates to bidding documents from the USC Purchasing website. (http://purchasing.sc.edu)*All questions & correspondence concerning this Invitation shall be addressed to the A-E.***A-E NAME:** ING Consulting**A-E CONTACT:** Steven A. Petersen, PE**A-E ADDRESS:** Street/PO Box: 550 11th Street, PO Box 1586City: AugustaState: GAZIP: 30903-**EMAIL:** spetersen@ingconsultinginc.com**TELEPHONE:** (706) 774-1020**FAX:** (706) 774-0065**AGENCY:** University of South Carolina**AGENCY PROJECT COORDINATOR:** Juaquana Brookins**ADDRESS:** Street/PO Box: 743 Greene StreetCity: ColumbiaState: SCZIP: 29208-**EMAIL:** jbrookin@fmc.sc.edu**TELEPHONE:** 803.777.3596**FAX:** 803.777.7334**PRE-BID CONFERENCE:** Yes No **MANDATORY ATTENDANCE:** Yes No **PRE-BID DATE:** 11/12/2015 **TIME:** 10:00 am**PLACE:** 471 University Pkwy, Penland Admin Bld Rm 110, Aiken SC 29801**BID CLOSING DATE:** 11/24/2015 **TIME:** 2:00 pm**PLACE:** 743 Greene St, Columbia SC 29208**BID DELIVERY ADDRESSES:****HAND-DELIVERY:**Attn: Juaquana Brookins (BID ENCLOSED)743 Greene StreetColumbia, SC 29208**MAIL SERVICE:**Attn: Juaquana Brookins (BID ENCLOSED)743 Greene StreetColumbia, SC 29208**IS PROJECT WITHIN AGENCY CONSTRUCTION CERTIFICATION? (Agency MUST check one)**Yes No **APPROVED BY:** _____*(OSE Project Manager)***DATE:** _____

AIA Document A701
Instructions to Bidders

Original AIA Document on file at:
Office of Facilities, Planning, and Construction
743 Greene Street
Columbia, SC 29208

OSE FORM 00201**STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS****AGENCY:** University of South Carolina**PROJECT NAME:** USC Aiken Penland Mechanical Systems Upgrades**PROJECT NUMBER:** H29-9548**PROJECT LOCATION:** University of South Carolina - Aiken, Aiken,SC**PROCUREMENT OFFICER:** _____**1. STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS**

- 1.1 These Standard Supplemental Instructions to Bidders amend or supplement Instructions to Bidders (AIA Document A701-1997) and other provisions of Bidding and Contract Documents as indicated below.
- 1.2 Compliance with these Standard Supplemental Instructions is required by the Office of State Engineer (OSE) for all State projects when competitive sealed bidding is used as the method of procurement.
- 1.3 All provisions of the A701-1997, which are not so amended or supplemented, remain in full force and effect.
- 1.4 Bidders are cautioned to carefully examine the Bidding and Contract Documents for additional instructions or requirements.

2. MODIFICATIONS TO A701-1997**2.1 Delete Section 1.1 and insert the following:**

1.1 Bidding Documents, collectively referred to as the **Invitation for Bids**, include the Bidding Requirements and the proposed Contract Documents. The Bidding Requirements consist of the Advertisement, Instructions to Bidders (A-701), Supplementary Instructions to Bidders, the bid form (SE-330), the Notice of Intent to Award (SE-370), and other sample bidding and contract forms. The proposed Contract Documents consist of the form of Agreement between the Owner and Contractor, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda issued prior to execution of the Contract, and other documents set forth in the Bidding Documents. Any reference in this document to the Agreement between the Owner and Contractor, AIA Document A101, or some abbreviated reference thereof, shall mean the AIA A101, 2007 Edition as modified by OSE Form 00501 – Standard Modification to Agreement between Owner and Contractor. Any reference in this document to the General Conditions of the Contract for Construction, AIA Document A201, or some abbreviated reference thereof, shall mean the AIA A201, 2007 Edition as modified by OSE Form 00811 – Standard Supplementary Conditions.

- 2.2 *In Section 1.8, delete the words "and who meets the requirements set forth in the Bidding Documents".*
- 2.3 *In Section 2.1, delete the word "making" and substitute the word "submitting."*
- 2.4 *In Section 2.1.1:*
After the words "Bidding Documents," delete the word "or" and substitute the word "and."

Insert the following at the end of this section:

Bidders are expected to examine the Bidding Documents and Contract Documents thoroughly and should request an explanation of any ambiguities, discrepancies, errors, omissions, or conflicting statements. Failure to do so will be at the Bidder's risk. Bidder assumes responsibility for any patent ambiguity that Bidder does not bring to the Owner's attention prior to bid opening.

- 2.5 *In Section 2.1.3, insert the following after the term "Contract Documents" and before the period:*
and accepts full responsibility for any pre-bid existing conditions that would affect the Bid that could have been ascertained by a site visit. As provided in Regulation 19-445.2042(B), a bidder's failure to attend an advertised pre-bid conference will not excuse its responsibility for estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expense to the State.

2.6 Insert the following Sections 2.2 through 2.6:**2.2 CERTIFICATION OF INDEPENDENT PRICE DETERMINATION**

GIVING FALSE, MISLEADING, OR INCOMPLETE INFORMATION ON THIS CERTIFICATION MAY RENDER YOU SUBJECT TO PROSECUTION UNDER SECTION 16-9-10 OF THE SOUTH CAROLINA CODE OF LAWS AND OTHER APPLICABLE LAWS.

OSE FORM 00201

STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

- A. By submitting an bid, the bidder certifies that—
1. The prices in this bid have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other bidder or competitor relating to—
 - a. Those prices;
 - b. The intention to submit an bid; or
 - c. The methods or factors used to calculate the prices offered.
 2. The prices in this bid have not been and will not be knowingly disclosed by the bidder, directly or indirectly, to any other bidder or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a negotiated solicitation) unless otherwise required by law; and
 3. No attempt has been made or will be made by the bidder to induce any other concern to submit or not to submit a bid for the purpose of restricting competition.
- B. Each signature on the bid is considered to be a certification by the signatory that the signatory—
1. Is the person in the bidder's organization responsible for determining the prices being offered in this bid, and that the signatory has not participated and will not participate in any action contrary to paragraphs A.1 through A.3 of this certification; or
 2.
 - a. Has been authorized, in writing, to act as agent for the bidder's principals in certifying that those principals have not participated, and will not participate in any action contrary to paragraphs A.1 through A.3 of this certification [As used in this subdivision B.2.a, the term "principals" means the person(s) in the bidder's organization responsible for determining the prices offered in this bid];
 - b. As an authorized agent, does certify that the principals referenced in subdivision B.2.a of this certification have not participated, and will not participate, in any action contrary to paragraphs A.1 through A.3 of this certification; and
 - c. As an agent, has not personally participated, and will not participate, in any action contrary to paragraphs A.1 through A.3 of this certification.
- C. If the bidder deletes or modifies paragraph (a)(2) of this certification, the bidder must furnish with its offer a signed statement setting forth in detail the circumstances of the disclosure.

2.3 DRUG FREE WORKPLACE

By submitting a bid, the Bidder certifies that Bidder will maintain a drug free workplace in accordance with the requirements of Title 44, Chapter 107 of South Carolina Code of Laws, as amended.

2.4 CERTIFICATION REGARDING DEBARMENT AND OTHER RESPONSIBILITY MATTERS

- A. 1. By submitting an Bid, Bidder certifies, to the best of its knowledge and belief, that-
- a. Bidder and/or any of its Principals-
 - (i) Are not presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any state or federal agency;
 - (ii) Have not, within a three-year period preceding this bid, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, state, or local) contract or subcontract; violation of Federal or state antitrust statutes relating to the submission of bids; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, or receiving stolen property; and
 - (iii) Are not presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in paragraph A.1.a.(ii) of this provision.
 - b. Bidder has not, within a three-year period preceding this bid, had one or more contracts terminated for default by any public (Federal, state, or local) entity.
2. "Principals," for the purposes of this certification, means officers; directors; owners; partners; and, persons having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager; head of a subsidiary, division, or business segment, and similar positions).
- B. Bidder shall provide immediate written notice to the Procurement Officer if, at any time prior to contract award, Bidder learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
- C. If Bidder is unable to certify the representations stated in paragraphs A.1, Bidder must submit a written explanation regarding its inability to make the certification. The certification will be considered in connection with a review of the Bidder's responsibility. Failure of the Bidder to furnish additional information as requested by the Procurement Officer may render the Bidder nonresponsible.

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STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by paragraph A. of this provision. The knowledge and information of a Bidder is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

- D. The certification in paragraph A. of this provision is a material representation of fact upon which reliance was placed when making award. If it is later determined that the Bidder knowingly or in bad faith rendered an erroneous certification, in addition to other remedies available to the State, the Procurement Officer may terminate the contract resulting from this solicitation for default.

2.5 ETHICS CERTIFICATE

By submitting a bid, the bidder certifies that the bidder has and will comply with, and has not, and will not, induce a person to violate Title 8, Chapter 13 of the South Carolina Code of Laws, as amended (ethics act). The following statutes require special attention: Section 8-13-700, regarding use of official position for financial gain; Section 8-13-705, regarding gifts to influence action of public official; Section 8-13-720, regarding offering money for advice or assistance of public official; Sections 8-13-755 and 8-13-760, regarding restrictions on employment by former public official; Section 8-13-775, prohibiting public official with economic interests from acting on contracts; Section 8-13-790, regarding recovery of kickbacks; Section 8-13-1150, regarding statements to be filed by consultants; and Section 8-13-1342, regarding restrictions on contributions by contractor to candidate who participated in awarding of contract. The state may rescind any contract and recover all amounts expended as a result of any action taken in violation of this provision. If contractor participates, directly or indirectly, in the evaluation or award of public contracts, including without limitation, change orders or task orders regarding a public contract, contractor shall, if required by law to file such a statement, provide the statement required by Section 8-13-1150 to the procurement officer at the same time the law requires the statement to be filed.

2.6 RESTRICTIONS APPLICABLE TO BIDDERS & GIFTS

Violation of these restrictions may result in disqualification of your bid, suspension or debarment, and may constitute a violation of the state Ethics Act. (a) After issuance of the solicitation, *bidder agrees not to discuss this procurement activity in any way with the Owner or its employees, agents or officials*. All communications must be solely with the Procurement Officer. This restriction may be lifted by express written permission from the Procurement Officer. This restriction expires once a contract has been formed. (b) Unless otherwise approved in writing by the Procurement Officer, *bidder agrees not to give anything to the Owner, any affiliated organizations, or the employees, agents or officials of either, prior to award*. (c) Bidder acknowledges that the policy of the State is that a governmental body should not accept or solicit a gift, directly or indirectly, from a donor if the governmental body has reason to believe the donor has or is seeking to obtain contractual or other business or financial relationships with the governmental body. Regulation 19-445.2165(C) broadly defines the term donor.

2.7 IRAN DIVESTMENT ACT CERTIFICATION

(a) The Iran Divestment Act List is a list published by the Board pursuant to Section 11-57-310 that identifies persons engaged in investment activities in Iran. Currently, the list is available at the following URL: <http://procurement.sc.gov/PS/PS-iran-divestment.phtm>(.) Section 11-57-310 requires the government to provide a person ninety days written notice before he is included on the list. The following representation, which is required by Section 11-57-330(A), is a material inducement for the State to award a contract to you. (b) By signing your Offer, you certify that, as of the date you sign, you are not on the then-current version of the Iran Divestment Act List. (c) You must notify the Procurement Officer immediately if, at any time before posting of a final statement of award, you are added to the Iran Divestment Act List.

2.7 Delete Section 3.1.1 and substitute the following:

3.1.1 Bidders may obtain complete sets of the Bidding Documents from the issuing office designated in the Advertisement in the number and for the deposit sum, if any, stated therein. If so provided in the Advertisement, the deposit will be refunded to all plan holders who return the Bidding Documents in good condition within ten days after receipt of Bids. The cost of replacement of missing or damaged documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the Bidding Documents and the Bidder's deposit will be refunded.

2.8 Delete the language of Section 3.1.2 and insert the word "Reserved."**2.9 In Section 3.1.4, delete the words "and Architect may make" and substitute the words "has made."****2.10 Insert the following Section 3.1.5**

3.1.5 All persons obtaining Bidding Documents from the issuing office designated in the Advertisement shall provide that office with Bidder's contact information to include the Bidder's name, telephone number, mailing address, and email address.

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- 2.11** *In Section 3.2.2:*
Delete the words "and Sub-bidders"
Delete the word "seven" and substitute the word "ten"
- 2.12** *In Section 3.2.3:*
In the first Sentence, insert the word "written" before the word "Addendum."
Insert the following at the end of the section:
As provided in Regulation 19-445.2042(B), nothing stated at the pre-bid conference shall change the Bidding Documents unless a change is made by written Addendum.
- 2.13** *Insert the following at the end of Section 3.3.1:*
Reference in the Bidding Documents to a designated material, product, thing, or service by specific brand or trade name followed by the words "or equal" and "or approved equal" shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition.
- 2.14** *Delete Section 3.3.2 and substitute the following:*
3.3.2 No request to substitute materials, products, or equipment for materials, products, or equipment described in the Bidding Documents and no request for addition of a manufacturer or supplier to a list of approved manufacturers or suppliers in the Bidding Documents will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least ten days prior to the date for receipt of Bids established in the Invitation for Bids. Any subsequent extension of the date for receipt of Bids by addendum shall not extend the date for receipt of such requests unless the addendum so specifies. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the work of other contracts that incorporation of the proposed substitution would require, shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.
- 2.15** *Delete Section 3.4.3 and substitute the following:*
3.4.3 Addenda will be issued no later than 120 hours prior to the time for receipt of Bids except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.
- 2.16** *Insert the following Sections 3.4.5 and 3.4.6:*
3.4.5 When the date for receipt of Bids is to be postponed and there is insufficient time to issue a written Addendum prior to the original Bid Date, Owner will notify prospective Bidders by telephone or other appropriate means with immediate follow up with a written Addendum. This Addendum will verify the postponement of the original Bid Date and establish a new Bid Date. The new Bid Date will be no earlier than the fifth (5th) calendar day after the date of issuance of the Addendum postponing the original Bid Date.
3.4.6 If an emergency or unanticipated event interrupts normal government processes so that bids cannot be received at the government office designated for receipt of bids by the exact time specified in the solicitation, the time specified for receipt of bids will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which normal government processes resume. In lieu of an automatic extension, an Addendum may be issued to reschedule bid opening. If state offices are closed at the time a pre-bid or pre-proposal conference is scheduled, an Addendum will be issued to reschedule the conference.
- 2.17** *In Section 4.1.1, delete the word "forms" and substitute the words "SE-330 Bid Form."*
- 2.18** *Delete Section 4.1.2 and substitute the following:*
4.1.2 Any blanks on the bid form to be filled in by the Bidder shall be legibly executed in a non-erasable medium. Bids shall be signed in ink or other indelible media.
- 2.19** *Delete Section 4.1.3 and substitute the following:*
4.1.3 Sums shall be expressed in figures.
- 2.20** *Insert the following at the end of Section 4.1.4:*
Bidder shall not make stipulations or qualify his bid in any manner not permitted on the bid form. An incomplete Bid or information not requested that is written on or attached to the Bid Form that could be considered a qualification of the Bid, may be cause for rejection of the Bid.

OSE FORM 00201**STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS****2.21** *Delete Section 4.1.5 and substitute the following:*

4.1.5 All requested Alternates shall be bid. The failure of the bidder to indicate a price for an Alternate shall render the Bid non-responsive. Indicate the change to the Base Bid by entering the dollar amount and marking, as appropriate, the box for "ADD TO" or "DEDUCT FROM". If no change in the Base Bid is required, enter "ZERO" or "No Change." For add alternates to the base bid, Subcontractor(s) listed on page BF-2 of the Bid Form to perform Alternate Work shall be used for both Alternates and Base Bid Work if Alternates are accepted.

2.22 *Delete Section 4.1.6 and substitute the following:*

4.1.6 Pursuant to Title 11, Chapter 35, Section 3020(b)(i) of the South Carolina Code of Laws, as amended, Section 7 of the Bid Form sets forth a list of subcontractor specialties for which Bidder is required to identify only those subcontractors Bidder will use to perform the work of each listed specialty. Bidder must follow the Instructions in the Bid Form for filling out this section of the Bid Form. Failure to properly fill out Section 7 may result in rejection of Bidder's bid as non-responsive.

2.23 *Delete Section 4.1.7 and substitute the following:*

4.1.7 Each copy of the Bid shall state the legal name of the Bidder and the nature of legal form of the Bidder. Each copy shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid submitted by an agent shall have a current power of attorney attached certifying the agent's authority to bind the Bidder.

2.24 *Delete Section 4.2.1 and substitute the following:*

4.2.1 If required by the Invitation for Bids, each Bid shall be accompanied by a bid security in an amount of not less than five percent of the Base Bid. The bid security shall be a bid bond or a certified cashier's check. The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and will, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty.

2.25 *Delete Section 4.2.2 and substitute the following:*

4.2.2 If a surety bond is required, it shall be written on AIA Document A310, Bid Bond, and the attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of the power of attorney. The bid bond shall:

- .1 Be issued by a surety company licensed to do business in South Carolina;
- .2 Be issued by a surety company having, at a minimum, a "Best Rating" of "A" as stated in the most current publication of "Best's Key Rating Guide, Property-Casualty", which company shows a financial strength rating of at least five (5) times the contract price.
- .3 Be enclosed in the bid envelope at the time of Bid Opening, either in paper copy or as an electronic bid bond authorization number provided on the Bid Form and issued by a firm or organization authorized by the surety to receive, authenticate and issue binding electronic bid bonds on behalf the surety.

2.26 *Delete Section 4.2.3 and substitute the following:*

4.2.3 By submitting a bid bond via an electronic bid bond authorization number on the Bid Form and signing the Bid Form, the Bidder certifies that an electronic bid bond has been executed by a Surety meeting the standards required by the Bidding Documents and the Bidder and Surety are firmly bound unto the State of South Carolina under the conditions provided in this Section 4.2.

2.27 *Insert the following Section 4.2.4:*

4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until either (a) the Contract has been executed and performance and payment bonds, if required, have been furnished, or (b) the specified time has elapsed so that Bids may be withdrawn or (c) all Bids have been rejected.

2.28 *Delete Section 4.3.1 and substitute the following:*

4.3.1 All copies of the Bid, the bid security, if any, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall, unless hand delivered by the Bidder, be addressed to the Owner's designated purchasing office as shown in the Invitation for Bids. The envelope shall be identified with the Project name, the Bidder's name and address and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail or special delivery service (UPS, Federal Express, etc.), the envelope should be labeled "BID ENCLOSED" on the face thereof. Bidders hand delivering their Bids shall deliver Bids to the place of the Bid Opening as shown in the Invitation for Bids. Whether or not Bidders attend the Bid Opening, they

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shall give their Bids to the Owner's procurement officer or his/her designee as shown in the Invitation for Bids prior to the time of the Bid Opening.

2.29 *Insert the following Section 4.3.6 and substitute the following:*

4.3.5 The official time for receipt of Bids will be determined by reference to the clock designated by the Owner's procurement officer or his/her designee. The procurement officer conducting the Bid Opening will determine and announce that the deadline has arrived and no further Bids or bid modifications will be accepted. All Bids and bid modifications in the possession of the procurement officer at the time the announcement is completed will be timely, whether or not the bid envelope has been date/time stamped or otherwise marked by the procurement officer.

2.30 *Delete Section 4.4.2 and substitute the following:*

4.4.2 Prior to the time and date designated for receipt of Bids, a Bid submitted may be withdrawn in person or by written notice to the party receiving Bids at the place designated for receipt of Bids. Withdrawal by written notice shall be in writing over the signature of the Bidder.

2.31 *In Section 5.1, delete everything following the caption "OPENING OF BIDS" and substitute the following:*

5.1.1 Bids received on time will be publicly opened and will be read aloud. Owner will not read aloud Bids that Owner determines, at the time of opening, to be non-responsive. .

5.1.2 At bid opening, Owner will announce the date and location of the posting of the Notice of Intended Award.

5.1.3 Owner will send a copy of the final Bid Tabulation to all Bidders within ten (10) working days of the Bid Opening.

5.1.4 If Owner determines to award the Project, Owner will, after posting a Notice of Intended Award, send a copy of the Notice to all Bidders.

5.1.5 If only one Bid is received, Owner will open and consider the Bid.

2.32 *In Section 5.2, insert the section number "5.2.1" before the words of the "The Owner" at the beginning of the sentence.*

2.33 *Insert the following Sections 5.2.2 and 5.2.3:*

5.2.2 The reasons for which the Owner will reject Bids include, but are not limited to:

- .1 Failure by a Bidder to be represented at a Mandatory Pre-Bid Conference or site visit;
- .2 Failure to deliver the Bid on time;
- .3 Failure to comply with Bid Security requirements, except as expressly allowed by law;
- .4 Listing an invalid electronic Bid Bond authorization number on the bid form;
- .5 Failure to Bid an Alternate, except as expressly allowed by law;
- .6 Failure to list qualified Subcontractors as required by law;
- .7 Showing any material modification(s) or exception(s) qualifying the Bid;
- .8 Faxing a Bid directly to the Owner or their representative; or
- .9 Failure to include a properly executed Power-of-Attorney with the bid bond.

5.2.3 The Owner may reject a Bid as nonresponsive if the prices bid are materially unbalanced between line items or sub-line items. A bid is materially unbalanced when it is based on prices significantly less than cost for some work and prices which are significantly overstated in relation to cost for other work, and if there is a reasonable doubt that the bid will result in the lowest overall cost to the Owner even though it may be the low evaluated bid, or if it is so unbalanced as to be tantamount to allowing an advance payment.

2.34 *Delete Section 6.1 and substitute the following:*

6.1 CONTRACTOR'S RESPONSIBILITY

Owner will make a determination of Bidder's responsibility before awarding a contract. Bidder shall provide all information and documentation requested by the Owner to support the Owner's evaluation of responsibility. Failure of Bidder to provide requested information is cause for the Owner, at its option, to determine the Bidder to be non-responsible

2.35 *Delete the language of Section 6.2 and insert the word "Reserved."*

2.36 *Delete the language of Sections 6.3.2, 6.3.3, and 6.3.4 and insert the word "Reserved" after each Section Number.*

OSE FORM 00201**STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS****2.37** *Insert the following Section 6.4***6.4 CLARIFICATION**

Pursuant to Section 11-35-1520(8), the Procurement Officer may elect to communicate with a Bidder after opening for the purpose of clarifying either the Bid or the requirements of the Invitation for Bids. Such communications may be conducted only with Bidders who have submitted a Bid which obviously conforms in all material aspects to the Invitation for Bids and only in accordance with Appendix D (Paragraph A(6)) to the Manual for Planning and Execution of State Permanent Improvement, Part II. Clarification of a Bid must be documented in writing and included with the Bid. Clarifications may not be used to revise a Bid or the Invitation for Bids. [Section 11-35-1520(8); R.19-445.2080]

2.38 *Delete Section 7.1.2 and substitute the following:*

7.1.2 The performance and payment bonds shall conform to the requirements of Section 11.4 of the General Conditions of the Contract. If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid.

2.39 *Delete the language of Section 7.1.3 and insert the word "Reserved."***2.40** *In Section 7.2, insert the words "CONTRACT, CERTIFICATES OF INSURANCE" into the caption after the word "Delivery."***2.41** *Delete Section 7.2.1 and substitute the following:*

7.2.1 After expiration of the protest period, the Owner will tender a signed Contract for Construction to the Bidder and the Bidder shall return the fully executed Contract for Construction to the Owner within seven days thereafter. The Bidder shall deliver the required bonds and certificate of insurance to the Owner not later than three days following the date of execution of the Contract. Failure to deliver these documents as required shall entitle the Owner to consider the Bidder's failure as a refusal to enter into a contract in accordance with the terms and conditions of the Bidder's Bid and to make claim on the Bid Security for re-procurement cost.

2.42 *Delete the language of Section 7.2.2 and insert the word "Reserved."***2.43** *Delete the language of Article 8 and insert the following:*

Unless otherwise required in the Bidding Documents, the Agreement for the Work will be written on South Carolina Modified AIA Document A101, 2007, Standard Form of Agreement Between Owner and Contractor as modified by OSE Form 00501 – Standard Modification to Agreement Between Owner and Contractor.

2.44 *Insert the following Article 9:***ARTICLE 9 MISCELLANEOUS****9.1 NONRESIDENT TAXPAYER REGISTRATION AFFIDAVIT INCOME TAX WITHHOLDING IMPORTANT TAX NOTICE - NONRESIDENTS ONLY**

Withholding Requirements for Payments to Nonresidents: Section 12-8-550 of the South Carolina Code of Laws requires persons hiring or contracting with a nonresident conducting a business or performing personal services of a temporary nature within South Carolina to withhold 2% of each payment made to the nonresident. The withholding requirement does not apply to (1) payments on purchase orders for tangible personal property when the payments are not accompanied by services to be performed in South Carolina, (2) nonresidents who are not conducting business in South Carolina, (3) nonresidents for contracts that do not exceed \$10,000 in a calendar year, or (4) payments to a nonresident who (a) registers with either the S.C. Department of Revenue or the S.C. Secretary of State and (b) submits a Nonresident Taxpayer Registration Affidavit - Income Tax Withholding, Form I-312 to the person letting the contract.

For information about other withholding requirements (e.g., employee withholding), contact the Withholding Section at the South Carolina Department of Revenue at 803-898-5383 or visit the Department's website at: www.sctax.org

This notice is for informational purposes only. This Owner does not administer and has no authority over tax issues. All registration questions should be directed to the License and Registration Section at 803-898-5872 or to the South Carolina Department of Revenue, Registration Unit, Columbia, S.C. 29214-0140. All withholding questions should be directed to the Withholding Section at 803-898-5383.

PLEASE SEE THE "NONRESIDENT TAXPAYER REGISTRATION AFFIDAVIT INCOME TAX WITHHOLDING" FORM (Available through SC Department of Revenue).

OSE FORM 00201**STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS****9.2 CONTRACTOR LICENSING**

Contractors and Subcontractors listed in Section 7 of the Bid Form who are required by the South Carolina Code of Laws to be licensed, must be licensed at the time of bidding.

9.3 SUBMITTING CONFIDENTIAL INFORMATION

For every document Bidder submits in response to or with regard to this solicitation or request, Bidder must separately mark with the word "CONFIDENTIAL" every page, or portion thereof, that Bidder contends contains information that is exempt from public disclosure because it is either (a) a trade secret as defined in Section 30-4-40(a)(1), or (b) privileged & confidential, as that phrase is used in Section 11-35-410. For every document Bidder submits in response to or with regard to this solicitation or request, Bidder must separately mark with the words "TRADE SECRET" every page, or portion thereof, that Bidder contends contains a trade secret as that term is defined by Section 39-8-20 of the Trade Secrets Act. For every document Bidder submits in response to or with regard to this solicitation or request, Bidder must separately mark with the word "PROTECTED" every page, or portion thereof, that Bidder contends is protected by Section 11-35-1810. All markings must be conspicuous; use color, bold, underlining, or some other method in order to conspicuously distinguish the mark from the other text. Do not mark your entire bid as confidential, trade secret, or protected! If your bid, or any part thereof, is improperly marked as confidential or trade secret or protected, the State may, in its sole discretion, determine it nonresponsive. If only portions of a page are subject to some protection, do not mark the entire page. By submitting a response to this solicitation, Bidder (1) agrees to the public disclosure of every page of every document regarding this solicitation or request that was submitted at any time prior to entering into a contract (including, but not limited to, documents contained in a response, documents submitted to clarify a response, & documents submitted during negotiations), unless the page is conspicuously marked "TRADE SECRET" or "CONFIDENTIAL" or "PROTECTED", (2) agrees that any information not marked, as required by these bidding instructions, as a "Trade Secret" is not a trade secret as defined by the Trade Secrets Act, & (3) agrees that, notwithstanding any claims or markings otherwise, any prices, commissions, discounts, or other financial figures used to determine the award, as well as the final contract amount, are subject to public disclosure. In determining whether to release documents, the State will detrimentally rely on Bidders's marking of documents, as required by these bidding instructions, as being either "Confidential" or "Trade Secret" or "PROTECTED". By submitting a response, Bidder agrees to defend, indemnify & hold harmless the State of South Carolina, its officers & employees, from every claim, demand, loss, expense, cost, damage or injury, including attorney's fees, arising out of or resulting from the State withholding information that Bidder marked as "confidential" or "trade secret" or "PROTECTED".

9.4 POSTING OF INTENT TO AWARD

Notice of Intent to Award, SE-370, will be posted at the following location:

Room or Area of Posting: Lobby

Building Where Posted: Facilities Management Center

Address of Building: 743 Greene Street, Columbia, SC 29208

WEB site address (if applicable): http://purchasing.sc.edu

Posting date will be announced at bid opening. In addition to posting the notice, the Owner will promptly send all responsive bidders a copy of the notice of intent to award and the final bid tabulation

9.5 PROTEST OF SOLICITATION OR AWARD

Any prospective bidder, offeror, contractor, or subcontractor who is aggrieved in connection with the solicitation of a contract shall protest within fifteen days of the date of issuance of the applicable solicitation document at issue. Any actual bidder, offeror, contractor, or subcontractor who is aggrieved in connection with the intended award or award of a contract shall protest within ten days of the date notification of intent to award is posted in accordance with Title 11, Chapter 35, Section 4210 of the South Carolina Code of Laws, as amended. A protest shall be in writing, shall set forth the grounds of the protest and the relief requested with enough particularity to give notice of the issues to be decided, and must be received by the State Engineer within the time provided.

Any protest must be addressed to the CPO, Office of State Engineer, and submitted in writing:

A. by email to protest-ose@mmo.sc.gov,

B. by facsimile at 803-737-0639, or

C. by post or delivery to 1201 Main Street, Suite 600, Columbia, SC 29201.

By submitting a protest to the foregoing email address, you (and any person acting on your behalf) consent to receive communications regarding your protest (and any related protests) at the e-mail address from which you sent your protest.

OSE FORM 00201

STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

9.6 SOLICITATION INFORMATION FROM SOURCES OTHER THAN OFFICIAL SOURCE

South Carolina Business Opportunities (SCBO) is the official state government publication for State of South Carolina solicitations. Any information on State agency solicitations obtained from any other source is unofficial and any reliance placed on such information is at the bidder's sole risk and is without recourse under the South Carolina Consolidated Procurement Code.

9.7 BUILDER'S RISK INSURANCE

Bidders are directed to Article 11.3 of the South Carolina Modified AIA Document A201, 2007 Edition, which, unless provided otherwise in the bid documents, requires the contractor to provide builder's risk insurance on the project.

9.8 TAX CREDIT FOR SUBCONTRACTING WITH MINORITY FIRMS

Pursuant to Section 12-6-3350, taxpayers, who utilize certified minority subcontractors, may take a tax credit equal to 4% of the payments they make to said subcontractors. The payments claimed must be based on work performed directly for a South Carolina state contract. The credit is limited to a maximum of fifty thousand dollars annually. The taxpayer is eligible to claim the credit for 10 consecutive taxable years beginning with the taxable year in which the first payment is made to the subcontractor that qualifies for the credit. After the above ten consecutive taxable years, the taxpayer is no longer eligible for the credit. The credit may be claimed on Form TC-2, "Minority Business Credit." A copy of the subcontractor's certificate from the Governor's Office of Small and Minority Business (OSMBA) is to be attached to the contractor's income tax return. Taxpayers must maintain evidence of work performed for a State contract by the minority subcontractor. Questions regarding the tax credit and how to file are to be referred to: SC Department of Revenue, Research and Review, Phone: (803) 898-5786, Fax: (803) 898-5888. The subcontractor must be certified as to the criteria of a "Minority Firm" by the Governor's Office of Small and Minority Business Assistance (OSMBA). Certificates are issued to subcontractors upon successful completion of the certification process. Questions regarding subcontractor certification are to be referred to: Governor's Office of Small and Minority Business Assistance, Phone: (803) 734-0657, Fax: (803) 734-2498. Reference: SC §11-35-5010 – Definition for Minority Subcontractor & SC §11-35-5230 (B) – Regulations for Negotiating with State Minority Firms.

9.9 OTHER SPECIAL CONDITIONS OF THE WORK

END OF DOCUMENT

Note: AIA Document A310

Contractor to Provide

Bid Bond

In the form of

AIA A310

**SE-330
LUMP SUM BID FORM**

Bidders shall submit bids on only Bid Form SE-330.

BID SUBMITTED BY: _____
(Bidder's Name)

BID SUBMITTED TO: University of South Carolina
(Owner's Name)

FOR: PROJECT NAME: USC Aiken Penland Mechanical Systems Upgrades
PROJECT NUMBER: H29-9548

OFFER

§ 1. In response to the Invitation for Construction Services and in compliance with the Instructions to Bidders for the above-named Project, the undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into a Contract with the Owner on the terms included in the Bidding Documents, and to perform all Work as specified or indicated in the Bidding Documents, for the prices and within the time frames indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

§ 2. Pursuant to Section 11-35-3030(1) of the SC Code of Laws, as amended, Bidder has submitted Bid Security as follows in the amount and form required by the Bidding Documents:

- Bid Bond with Power of Attorney
- Electronic Bid Bond
- Cashier's Check

(Bidder check one)

§ 3. Bidder acknowledges the receipt of the following Addenda to the Bidding Documents and has incorporated the effects of said Addenda into this Bid:

(Bidder, check all that apply. Note, there may be more boxes than actual addenda. Do not check boxes that do not apply)

- ADDENDA:** #1 #2 #3 #4 #5

§ 4. Bidder accepts all terms and conditions of the Invitation for Bids, including, without limitation, those dealing with the disposition of Bid Security. Bidder agrees that this Bid, including all Bid Alternates, if any, may not be revoked or withdrawn after the opening of bids, and shall remain open for acceptance for a period of **60** Days following the Bid Date, or for such longer period of time that Bidder may agree to in writing upon request of the Owner.

§ 5. Bidder herewith offers to provide all labor, materials, equipment, tools of trades and labor, accessories, appliances, warranties and guarantees, and to pay all royalties, fees, permits, licenses and applicable taxes necessary to complete the following items of construction work:

§ 6.1 **BASE BID WORK** *(as indicated in the Bidding Documents and generally described as follows):* Upgrades to the mechanical system in the Penland Administration Building located on the USC Aiken campus. Work to include chiller replacement along with related electrical and mechanical components. Miniorty and small business participation is encouraged.

\$ _____, which sum is hereafter called the Base Bid.

(Bidder - insert Base Bid Amount on line above)

**SE-330
LUMP SUM BID FORM**

§ 6.2 **BID ALTERNATES** as indicated in the Bidding Documents and generally described as follows:

ALTERNATE # 1 (Brief Description): _____

ADD TO or **DEDUCT FROM BASE BID:** \$ _____

(Bidder to Mark appropriate box to clearly indicate the price adjustment offered for each alternate)

ALTERNATE # 2 (Brief Description): _____

ADD TO or **DEDUCT FROM BASE BID:** \$ _____

(Bidder to Mark appropriate box to clearly indicate the price adjustment offered for each alternate)

ALTERNATE # 3 (Brief Description): _____

ADD TO or **DEDUCT FROM BASE BID:** \$ _____

(Bidder to Mark appropriate box to clearly indicate the price adjustment offered for each alternate)

§ 6.3 **UNIT PRICES:**

BIDDER offers for the Agency's consideration and use, the following **UNIT PRICES**. The **UNIT PRICES** offered by **BIDDER** indicate the amount to be added to or deducted from the **CONTRACT SUM** for each item-unit combination. **UNIT PRICES** include all costs to the Agency, including those for materials, labor, equipment, tools of trades and labor, fees, taxes, insurance, bonding, overhead, profit, etc. The Agency reserves the right to include or not to include any of the following **UNIT PRICES** in the Contract and to negotiate the **UNIT PRICES** with **BIDDER**.

No.	ITEM	Unit of Measure	ADD	DEDUCT
1.	_____	_____	\$ _____	\$ _____
2.	_____	_____	\$ _____	\$ _____
3.	_____	_____	\$ _____	\$ _____
4.	_____	_____	\$ _____	\$ _____
5.	_____	_____	\$ _____	\$ _____
6.	_____	_____	\$ _____	\$ _____

**SE-330
LUMP SUM BID FORM**

§ 7. LISTING OF PROPOSED SUBCONTRACTORS PURSUANT TO SECTION 3020(b)(i), CHAPTER 35, TITLE 11 OF THE SOUTH CAROLINA CODE OF LAWS, AS AMENDED
(See Instructions on the following page BF-2A)

Bidder shall use the below-listed Subcontractors in the performance of the Subcontractor Classification work listed:

SUBCONTRACTOR CLASSIFICATION By License Classification and/or Subclassification <i>(Completed by Owner)</i>	SUBCONTRACTOR'S PRIME CONTRACTOR'S NAME <i>(Must be completed by Bidder)</i>	SUBCONTRACTOR'S PRIME CONTRACTOR'S SC LICENSE NUMBER <i>(Requested, but not Required)</i>
BASE BID		
n/a		
ALTERNATE #1		
ALTERNATE #2		
ALTERNATE #3		

If a Bid Alternate is accepted, Subcontractors listed for the Bid Alternate shall be used for the work of both the Alternate and the Base Bid work.

LUMP SUM BID FORM

**INSTRUCTIONS FOR
SUBCONTRACTOR LISTING**

1. Section 7 of the Bid Form sets forth a list of subcontractor classifications for which Bidder is required to identify by name the subcontractor(s) Bidder will use to perform the work of each listed classification. Bidder must identify only the subcontractor(s) who will perform the work and no others.
2. For purposes of subcontractor listing, a Subcontractor is an entity who will perform work or render service to the prime contractor to or about the construction site. Material suppliers, manufacturers, and fabricators that will not perform physical work at the site of the project but will only supply materials or equipment to the bidder or proposed subcontractor(s) are not subcontractors and Bidder should not insert their names in the spaces provided on the Bid Form. Likewise, Bidder should not insert the names of sub-subcontractors in the spaces provided on the Bid Form but only the names of those entities with which Bidder will contract directly.
3. Bidder must only insert the names of subcontractors who are qualified to perform the work of the listed classifications as specified in the Bidding Documents and South Carolina Licensing Laws.
4. If under the terms of the Bidding Documents, Bidder is qualified to perform the work of a classification listed and Bidder does not intend to subcontract such work, but to use Bidder's own employees to perform such work, the Bidder must insert its own name in the space provided for that classification.
5. If Bidder intends to use multiple subcontractors to perform the work of a single classification listing, Bidder must insert the name of each subcontractor Bidder will use, preferably separating the name of each by the word "and". If Bidder intends to use both his own employees to perform a part of the work of a single classification listing and to use one or more subcontractors to perform the remaining work for that classification listing, Bidder must insert his own name and the name of each subcontractor, preferably separating the name of each with the word "and".
6. Bidder may not list subcontractors in the alternative nor in a form that may be reasonably construed at the time of bid opening as a listing in the alternative. A listing that requires subsequent explanation to determine whether or not it is a listing in the alternative is non-responsive. If Bidder intends to use multiple entities to perform the work for a single classification listing, Bidder must clearly set forth on the Bid Form such intent. Bidder may accomplish this by simply inserting the word "and" between the names of each entity listed for that classification. Owner will reject as non-responsive a listing that contains the names of multiple subcontractors separated by a blank space, the word "or", a virgule (that is a /), or any separator that the Owner may reasonably interpret as a listing in the alternative.
7. If Bidder is awarded the contract, Bidder must, except with the approval of the owner for good cause shown, use the listed entities to perform the work for which they are listed.
8. If Bidder is awarded the contract, Bidder will not be allowed to substitute another entity as subcontractor in place of a subcontractor listed in Section 7 of the Bid Form except for one or more of the reasons allowed by the SC Code of Laws.
9. Bidder's failure to insert a name for each listed classification will render the Bid non-responsive.

SE-330
LUMP SUM BID FORM

§ 8. LIST OF MANUFACTURERS, MATERIAL SUPPLIERS, AND SUBCONTRACTORS OTHER THAN SUBCONTRACTORS LISTED IN SECTION 7 ABOVE (FOR INFORMATION ONLY):

Pursuant to instructions in the Invitation for Construction Services, if any, Bidder will provide to Owner upon the Owner's request and within 24 hours of such request, a listing of manufacturers, material suppliers, and subcontractors, other than those listed in Section 7 above, that Bidder intends to use on the project. Bidder acknowledges and agrees that this list is provided for purposes of determining responsibility and not pursuant to the subcontractor listing requirements of SC Code Ann § 11-35-3020(b)(i).

§ 9. TIME OF CONTRACT PERFORMANCE AND LIQUIDATED DAMAGES

a) CONTRACT TIME

Bidder agrees that the Date of Commencement of the Work shall be established in a Notice to Proceed to be issued by the Owner. Bidder agrees to substantially complete the Work within 120 Calendar Days from the Date of Commencement, subject to adjustments as provided in the Contract Documents.

b) LIQUIDATED DAMAGES

Bidder further agrees that from the compensation to be paid, the Owner shall retain as Liquidated Damages the amount of \$ 250.00 for each Calendar Day the actual construction time required to achieve Substantial Completion exceeds the specified or adjusted time for Substantial Completion as provided in the Contract Documents. This amount is intended by the parties as the predetermined measure of compensation for actual damages, not as a penalty for nonperformance.

§ 10. AGREEMENTS

- a) Bidder agrees that this bid is subject to the requirements of the laws of the State of South Carolina.
- b) Bidder agrees that at any time prior to the issuance of the Notice to Proceed for this Project, this Project may be canceled for the convenience of, and without cost to, the State.
- c) Bidder agrees that neither the State of South Carolina nor any of its agencies, employees or agents shall be responsible for any bid preparation costs, or any costs or charges of any type, should all bids be rejected or the Project canceled for any reason prior to the issuance of the Notice to Proceed.

§ 11. ELECTRONIC BID BOND

By signing below, the Principal is affirming that the identified electronic bid bond has been executed and that the Principal and Surety are firmly bound unto the State of South Carolina under the terms and conditions of the AIA Document A310, Bid Bond, included in the Bidding Documents.

ELECTRONIC BID BOND NUMBER: _____

SIGNATURE AND TITLE: _____

**SE-330
LUMP SUM BID FORM**

CONTRACTOR'S CLASSIFICATIONS AND SUBCLASSIFICATIONS WITH LIMITATION

SC Contractor's License Number(s): _____

Classification(s) & Limits: _____

Subclassification(s) & Limits: _____

By signing this Bid, the person signing reaffirms all representation and certification made by both the person signing and the Bidder, including without limitation, those appearing in Article 2 of the Instructions to Bidders, is expressly incorporated by reference.

BIDDER'S LEGAL NAME: _____

ADDRESS: _____

TELEPHONE: _____

EMAIL: _____

SIGNATURE: _____ **DATE:** _____

PRINT NAME: _____

TITLE: _____

AIA Document A101

Standard Form of Agreement Between Owner and Contractor

Original AIA Document on file at:

Office of Facilities, Planning, and Construction

743 Greene Street

Columbia, SC 29208

OSE FORM 00501**STANDARD MODIFICATIONS TO AGREEMENT BETWEEN OWNER AND CONTRACTOR****AGENCY:** USC Aiken Penland Mechanical Systems Upgrades**PROJECT NAME:** H29-9548**PROJECT NUMBER:** University of South Carolina - Aiken, Aiken, SC**1. STANDARD MODIFICATIONS TO AIA A101-2007**

- 1.1** These Standard Modifications amend or supplement the *Standard Form of Agreement Between Owner and Contractor* (AIA Document A101-2007) and other provisions of Bidding and Contract Documents as indicated below.
- 1.2** All provisions of A101-2007, which are not so amended or supplemented, remain in full force and effect.

2. MODIFICATIONS TO A101

- 2.1** *Insert the following at the end of Article 1:*
Any reference in this document to the Agreement between the Owner and Contractor, AIA Document A101, or some abbreviated reference thereof, shall mean the AIA A101, 2007 Edition as modified by OSE Form 00501 – Standard Modification to Agreement Between Owner and Contractor. Any reference in this document to the General Conditions of the Contract for Construction, AIA Document A201, or some abbreviated reference thereof, shall mean the AIA A201, 2007 Edition as modified by OSE Form 00811 – Standard Supplementary Conditions.
- 2.2** *Delete Section 3.1 and substitute the following:*
3.1 The Date of Commencement of the Work shall be the date fixed in a Notice to Proceed issued by the Owner. The Owner shall issue the Notice to Proceed to the Contractor in writing, no less than seven days prior to the Date of Commencement. Unless otherwise provided elsewhere in the contract documents, and provided the contractor has secured all required insurance and surety bonds, the contractor may commence work immediately after receipt of the Notice to Proceed.
- 2.3** *Delete Section 3.3 and substitute the following:*
3.3 The Contract Time as provided in Section 9(a) of the Bid Form (SE-330) for this Project shall be measured from the Date of Commencement. Contractor agrees that if the Contractor fails to achieve Substantial Completion of the Work within the Contract Time, the Owner shall be entitled to withhold or recover from the Contractor Liquidated Damages in the amounts set forth in Section 9(b) of the Bid Form (SE-330), subject to adjustments of this Contract Time as provided in the Contract Documents.
- 2.4** *In Section 5.1.1, insert the words “and Owner” after the phrase “Payment submitted to the Architect.”*
- 2.5** *Delete Section 5.1.3 and substitute the following:*
5.1.3 The Owner shall make payment of the certified amount to the Contractor not later than 21 days after receipt of the Application for Payment.
- 2.6** *In Section 5.1.6, insert the following after the phrase “Subject to other provisions of the Contract Documents”:*
and subject to Title 12, Chapter 8, Section 550 of the South Carolina Code of Laws, as amended (Withholding Requirements for Payments to Non-Residents).
In the spaces provided in Sub-Sections 1 and 2 for inserting the retainage amount, insert “three and one-half percent (3.5%).”
- 2.7** *In Section 5.1.8, delete the word “follows” and the colon and substitute the following:*
set forth in S.C. Code Ann. § 11-35-3030(4).
- 2.8** *In Section 5.1.9, delete the words “Except with the Owner’s prior approval, the” before the word “ Contractor.”*
- 2.9** *In Section 5.2.2, delete the number 30 and substitute the number 21, delete everything following the words “Certificate for Payment” and place a period at the end of the resulting sentence.*
- 2.10** *Delete the language of Sections 6.1 and 6.2 and substitute the word “Reserved” for the deleted language of each Section.*
- 2.11** *Delete the language of Section 8.2 and substitute the word “Reserved.”*

OSE FORM 00501

STANDARD MODIFICATIONS TO AGREEMENT BETWEEN OWNER AND CONTRACTOR

2.12 In Section 8.3, make the word "Representative" in the title plural, delete everything following the title, and substitute the following:

8.3.1 Owner designates the individual listed below as its Senior Representative ("Owner's Senior Representative"), which individual has the responsibility for and, subject to Section 7.2.1 of the General Conditions, the authority to resolve disputes under Section 15.6 of the General Conditions:

Name: Tom Opal

Title: Assistant Director of USC Facilities Design & Construction

Address: 743 Greene Street, Columbia, SC 29208

Telephone: (803) 777-5500

FAX: n/a

Email: topal@fmc.sc.edu

8.3.2 Owner designates the individual listed below as its Owner's Representative, which individual has the authority and responsibility set forth in Section 2.1.1 of the General Conditions:

Name: Troy Green

Title: Project Manager

Address: 743 Greene Street, Columbia, SC 29208

Telephone: (803) 777-8256

FAX: n/a

Email: green@fmc.sc.edu

2.13 In Section 8.4, make the word "Representative" in the title plural, delete everything following the title, and substitute the following:

8.4.1 Contractor designates the individual listed below as its Senior Representative ("Contractor's Senior Representative"), which individual has the responsibility for and authority to resolve disputes under Section 15.6 of the General Conditions:

Name: TBD

Title: _____

Address: _____

Telephone: _____

FAX: _____

Email: _____

8.4.2 Contractor designates the individual listed below as its Contractor's Representative, which individual has the authority and responsibility set forth in Section 3.1.1 of the General Conditions:

Name: TBD

Title: _____

Address: _____

Telephone: _____

FAX: _____

Email: _____

2.14 Add the following Section 8.6.1:

8.6.1 The Architect's representative:

Name: Steve A. Petersen, PE

Title: ING Consulting, Inc.

Address: 550 11th Street, PO Box 1586, Augusta, GA 30903

Telephone: (706) 774-1020

FAX: (706) 774-0065

Email: spetersen@ingconsultinginc.com

OSE FORM 00501

STANDARD MODIFICATIONS TO AGREEMENT BETWEEN OWNER AND CONTRACTOR

2.15 *In Section 9.1.7, Sub-Section 2, list the following documents in the space provided for listing documents:*

Invitation for Construction Services (SE-310)

Instructions to Bidders (AIA Document A701-1997)

Standard Supplemental Instructions to Bidders (OSE Form 00201)

Contractor's Bid (Completed SE-330)

Notice of Intent to Award (Completed SE-370)

2.16 *In Article 10, delete everything after the first sentence.*

END OF DOCUMENT

AIA Document A201
General Conditions of the Contract for Construction

Original AIA Document on file at:
Office of Facilities, Planning, and Construction
743 Greene Street
Columbia, SC 29208

OSE FORM 00811
STANDARD SUPPLEMENTARY CONDITIONS

AGENCY: USC Aiken Penland Building Mechanical Systems Upgrades

PROJECT NAME: H29-9548

PROJECT NUMBER: University of South Carolina - Aiken, Aiken, SC

1. GENERAL CONDITIONS

The *General Conditions of the Contract for Construction*, AIA Document A201, 2007 Edition, Articles 1 through 15 inclusive, is a part of this Contract and is incorporated as fully as if herein set forth. For brevity, AIA Document A201 is also referred to in the Contract Documents collectively as the "General Conditions."

2. STANDARD SUPPLEMENTARY CONDITIONS

- 2.1** The following supplements modify, delete and/or add to the General Conditions. Where any portion of the General Conditions is modified or any paragraph, Section or clause thereof is modified or deleted by these Supplementary Conditions, the unaltered provisions of the General Conditions shall remain in effect.
- 2.2** Unless otherwise stated, the terms used in these Standard Supplementary Conditions which are defined in the General Conditions have the meanings assigned to them in the General Conditions.

3. MODIFICATIONS TO A201-2007

- 3.1** *Insert the following at the end of Section 1.1.1:*

Any reference in this document to the Agreement between the Owner and Contractor, AIA Document A101, or some abbreviated reference thereof, shall mean the AIA A101, 2007 Edition as modified by OSE Form 00501 – Standard Modification to Agreement between Owner and Contractor. Any reference in this document to the General Conditions of the Contract for Construction, AIA Document A201, or some abbreviated reference thereof, shall mean the AIA A201, 2007 Edition as modified by OSE Form 00811 – Standard Supplementary Conditions.

- 3.2** *Delete the language of Section 1.1.8 and substitute the word "Reserved."*

- 3.3** *Add the following Section 1.1.9:*

1.1.9 NOTICE TO PROCEED

Notice to Proceed is a document issued by the Owner to the Contractor, with a copy to the Architect, directing the Contractor to begin prosecution of the Work in accordance with the requirements of the Contract Documents. The Notice to Proceed shall fix the date on which the Contract Time will commence.

- 3.4** *Insert the following at the end of Section 1.2.1:*

In the event of patent ambiguities within or between parts of the Contract Documents, the contractor shall 1) provide the better quality or greater quantity of Work, or 2) comply with the more stringent requirement, either or both in accordance with the Architect's interpretation.

- 3.5** *Delete Section 1.5.1 and substitute the following:*

1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service 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 a violation of the Architect's or Architect's consultants' reserved rights.

- 3.6** *Delete Section 2.1.1 and substitute the following:*

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 provided in Section 7.1.2. 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 Representative. [Reference § 8.2 of the Agreement.]

- 3.7** *Delete Section 2.1.2 and substitute the following:*

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 post Notice of Project Commencement pursuant to Title 29, Chapter 5, Section 23 of the South Carolina Code of Laws, as amended.

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- 3.8** *Delete Section 2.2.3 and substitute the following:*
- 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. Subject to the Contractor's obligations, including those in Section 3.2, the Contractor shall be entitled to rely on the accuracy of information furnished by the Owner pursuant to this Section but shall exercise proper precautions relating to the safe performance of the Work.
- 3.9** *Replace the period at the end of the last sentence of Section 2.2.4 with a semicolon and insert the following after the inserted semicolon:*
- "however, the Owner does not warrant the accuracy of any such information requested by the Contractor that is not otherwise required of the Owner by the Contract Documents. Neither the Owner nor the Architect shall be required to conduct investigations or to furnish the Contractor with any information concerning subsurface characteristics or other conditions of the area where the Work is to be performed beyond that which is provide in the Contract Documents."
- 3.10** *Delete Section 2.2.5 and substitute the following:*
- 2.2.5** Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor with ten copies of the Contract Documents. The Contractor may make reproductions of the Contract Documents pursuant to Section 1.5.2. All copies of the drawings and specifications, except the Contractor's record set, shall be returned or suitably accounted for to the Owner, on request, upon completion of the Work.
- 3.11** *Add the following Sections 2.2.6 and 2.2.7:*
- 2.2.6** The Owner assumes no responsibility for any conclusions or interpretation made by the Contractor based on information made available by the Owner.
- 2.2.7** The Owner shall obtain, at its own cost, general building and specialty inspection services as required by the Contract Documents. The Contractor shall be responsible for payment of any charges imposed for reinspections.
- 3.12** *Delete Section 2.4 and substitute the following:*
- 2.4** 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, including but not limited to providing necessary resources, 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 Directive 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. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.
- 3.13** *Insert the following at the end of Section 3.2.1:*
- The Contractor acknowledges that it has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including but not limited to (1) conditions bearing upon transportation, disposal, handling, and storage of materials; (2) the availability of labor, water, electric power, and roads; (3) uncertainties of weather, river stages, tides, or similar physical conditions at the site; (4) the conformation and conditions of the ground; and (5) the character of equipment and facilities needed preliminary to and during work performance. The Contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by the Owner, as well as from the drawings and specifications made a part of this contract. Any failure of the Contractor to take the actions described and acknowledged in this paragraph will not relieve the Contractor from responsibility for estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expense to the Owner.
- 3.14** *In the third sentence of Section 3.2.4, insert the word "latent" before the word "errors."*
- 3.15** *In the last sentence of Section 3.3.1, insert the words "by the Owner in writing" after the word "instructed."*
- 3.16** *Delete the third sentence of Section 3.5 and substitute the following sentences:*
- Work, materials, or equipment not conforming to these requirements shall be considered defective. Unless caused by the Contractor or a subcontractor at any tier, 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.

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- 3.17** *Insert the following at the end of Section 3.6:*
The Contractor shall comply with the requirements of Title 12, Chapter 9 of the South Carolina Code of Laws, as amended, regarding withholding tax for nonresidents, employees, contractors and subcontractors.
- 3.18** *In Section 3.7.1, delete the words “the building permit as well as for other” and insert the following sentence at the end of this section:*
Pursuant to Title 10, Chapter 1, Section 180 of the South Carolina Code of Laws, as amended, no local general or specialty building permits are required for state buildings.
- 3.19** *Delete the last sentence of Section 3.7.5 and substitute the following:*
Adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 7.3.3.
- 3.20** *Delete the last sentence of Section 3.8.2.3 and substitute the following:*
The amount of the Change Order shall reflect the difference between actual costs, as documented by invoices, and the allowances under Section 3.8.2.1.
- 3.21** *In Section 3.9.1, insert a comma after the word “superintendent” in the first sentence and insert the following after the inserted comma:*
acceptable to the Owner,
- 3.22** *Delete Section 3.9.2 and substitute the following:*
3.9.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner the name and qualifications of a proposed superintendent. The Owner may reply within 14 days to the Contractor in writing stating (1) whether the Owner has reasonable objection to the proposed superintendent or (2) that the Owner requires additional time to review. Failure of the Owner to reply within the 14-day period shall constitute notice of no reasonable objection.
- 3.23** *After the first sentence in Section 3.9.3, insert the following sentence:*
The Contractor shall notify the Owner, in writing, of any proposed change in the superintendent, including the reason therefore, prior to making such change.
- 3.24** *Delete Section 3.10.3 and substitute the following:*
3.10.3 Additional requirements, if any, for the constructions schedule are as follows:
(Check box if applicable to this Contract)
 The construction schedule shall be in a detailed precedence-style critical path management (CPM) or primavera-type format satisfactory to the Owner and the Architect that shall also (1) provide a graphic representation of all activities and events that will occur during performance of the work; (2) identify each phase of construction and occupancy; and (3) set forth dates that are critical in ensuring the timely and orderly completion of the Work in accordance with the requirements of the Contract Documents (hereinafter referred to as “Milestone Dates”). Upon review and acceptance by the Owner and the Architect of the Milestone Dates, the construction schedule shall be deemed part of the Contract Documents and attached to the Agreement as Exhibit “A.” If not accepted, the construction schedule shall be promptly revised by the Contractor in accordance with the recommendations of the Owner and the Architect and resubmitted for acceptance. The Contractor shall monitor the progress of the Work for conformance with the requirements of the construction schedule and shall promptly advise the Owner of any delays or potential delays. Whenever the approved construction schedule no longer reflects actual conditions and progress of the work or the Contract Time is modified in accordance with the terms of the Contract Documents, the Contractor shall update the accepted construction schedule to reflect such conditions. In the event any progress report indicates any delays, the Contractor shall propose an affirmative plan to correct the delay, including overtime and/or additional labor, if necessary. In no event shall any progress report constitute an adjustment in the Contract Time, any Milestone Date, or the Contract Sum unless any such adjustment is agreed to by the Owner and authorized pursuant to Change Order.
- 3.25** *Add the following Section 3.10.4:*
3.10.4 Owner’s review and acceptance of Contractor’s schedule is not conducted for the purpose of either determining its accuracy and completeness or approving the construction means, methods, techniques, sequences or procedures. The Owner’s approval shall not relieve the Contractor of any obligations. Unless expressly addressed in a Modification, the Owner's approval of a schedule shall not change the Contract Time.

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3.26 *Add the following Section 3.12.5.1:*

3.12.5.1 The fire sprinkler shop drawings shall be prepared by a licensed fire sprinkler contractor and shall accurately reflect actual conditions affecting the required layout of the fire sprinkler system. The fire sprinkler contractor shall certify the accuracy of his shop drawings prior to submitting them for review and approval. The fire sprinkler shop drawings shall be reviewed and approved by the Architect's engineer of record who, upon approving the sprinkler shop drawings will submit them to the State Fire Marshal or other authorities having jurisdiction for review and approval. The Architect's engineer of record will submit a copy of the State Fire Marshal's approval letter to the Contractor, Architect, and OSE. Unless authorized in writing by OSE, neither the Contractor nor subcontractor at any tier shall submit the fire sprinkler shop drawings directly to the State Fire Marshal or other authorities having jurisdiction for approval.

3.27 *In the fourth sentence of Section 3.12.10, after the comma following the words "licensed design professional," insert the following:*

who shall comply with reasonable requirements of the Owner regarding qualifications and insurance and

3.28 *In Section 3.13, insert the section number "3.13.1" before the opening words "The Contractors shall."*

3.29 *Add the following Sections 3.13.2 and 3.13.3:*

3.13.2 Protection of construction materials and equipment stored at the Project site from weather, theft, vandalism, damage, and all other adversity is solely the responsibility of the Contractor. The Contractor shall perform the work in a manner that affords reasonable access, both vehicular and pedestrian, to the site of the Work and all adjacent areas. The Work shall be performed, to the fullest extent reasonably possible, in such a manner that public areas adjacent to the site of the Work shall be free from all debris, building materials, and equipment likely to cause hazardous conditions.

3.13.3 The Contractor and any entity for which the Contractor is responsible shall not erect any sign on the Project site without the prior written consent of the Owner.

3.30 *In the first sentence of Section 3.18.1, after the parenthetical "... (other than the Work itself), ..." and before the word "...but...", insert the following:*

including loss of use resulting therefrom,

3.31 *Delete Section 4.1.1 and substitute the following:*

4.1.1 The Architect is that person or entity identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

3.32 *Insert the following at the end of Section 4.2.1:*

Any reference in the Contract Documents to the Architect taking action or rendering a decision with a "reasonable time" is understood to mean no more than fourteen days, unless otherwise specified in the Contract Documents or otherwise agreed to by the parties.

3.33 *Delete the first sentence of Section 4.2.2 and substitute the following:*

The Architect will visit the site as necessary to fulfill its obligation to the Owner for inspection services, if any, and, at a minimum, to assure conformance with the Architect's design as shown in the Contract Documents and to observe the progress and quality of the various components of the Contractor's Work, and to determine 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.

3.34 *Delete the first sentence of Section 4.2.3 and substitute the following:*

On the basis of the site visits, the Architect will keep the Owner informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) 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.

3.35 *In Section 4.2.5, after the words "evaluations of the" and before the word "Contractor's," insert the following:*

Work completed and correlated with the

3.36 *Delete the first sentence of Section 4.2.11 and substitute the following:*

4.2.11 The Architect will, in the first instance, interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. Upon receipt of such request, the Architect will promptly provide the non-requesting party with a copy of the request.

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3.37 *Insert the following at the end of Section 4.2.12:*

If either party disputes the Architects interpretation or decision, that party may proceed as provided in Article 15. The Architect's interpretations and decisions may be, but need not be, accorded any deference in any review conducted pursuant to law or the Contract Documents.

3.38 *Delete Section 4.2.14 and substitute the following:*

The Architect will review and respond to requests for information about the Contract Documents so as to avoid delay to the construction of the Project. The Architect's response to such requests will be made in writing with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information. Any response to a request for information must be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. Unless issued pursuant to a Modification, supplemental Drawings or Specifications will not involve an adjustment to the Contract Sum or Contract Time.

3.39 *Delete Section 5.2.1 and substitute the following:*

5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, within fourteen days after posting of the Notice of Intent to Award the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (excluding Listed Subcontractors but including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Owner may reply within 14 days to the Contractor in writing stating (1) whether the Owner has reasonable objection to any such proposed person or entity. Failure of the Owner to reply within the 14 day period shall constitute notice of no reasonable objection.

3.40 *Delete Section 5.2.2 and substitute the following:*

5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner has made reasonable and timely objection. The Owner shall not direct the Contractor to contract with any specific individual or entity for supplies or services unless such supplies and services are necessary for completion of the Work and the specified individual or entity is the only source of such supply or services.

3.41 *In the first sentence of Section 5.2.3, delete the words "...or Architect..." in the two places they appear.*

3.42 *Delete the words "...or Architect..." in the in the first sentence of Section 5.2.4 and insert the following sentence at the end of Section 5.2.4:*

The Contractor's request for substitution must be made to the Owner in writing accompanied by supporting information.

3.43 *Add the following Section 5.2.5:*

5.2.5 A Subcontractor identified in the Contractor's Bid in response the specialty subcontractor listing requirements of Section 7 of the Bid Form (SE-330) may only be substituted in accordance with and as permitted by the provisions of Title 11, Chapter 35, Section 3021 of the South Carolina Code of Laws, as amended. A proposed substitute for a Listed Subcontractor shall be subject to the Owner's approval as set forth is Section 5.2.3.

3.44 *Add the following Section 5.2.6:*

5.2.6 The Iran Divestment Act List is a list published by the Board pursuant to Section 11-57-310 that identifies persons engaged in investment activities in Iran. Currently, the list is available at the following URL: <http://procurement.sc.gov/PS/PS-iran-divestment.phtm>(.) Consistent with Section 11-57-330(B), the Contractor shall not contract with any person to perform a part of the Work, if, at the time you enter into the subcontract, that person is on the then-current version of the Iran Divestment Act List.

3.45 *In Section 5.3, delete everything following the heading "SUBCONTRACTUAL RELATIONS" and insert the following Sections 5.3.1, 5.3.2, 5.3.3, and 5.3.4:*

5.3.1 By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, 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 herein or in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract

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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.

5.3.2 Without limitation on the generality of Section 5.3.1, each Subcontract agreement and each Sub-subcontract agreement shall include, and shall be deemed to include, the following Sections of these General Conditions: 3.2, 3.5, 3.18, 5.3, 5.4, 6.2.2, 7.3.3, 7.5, 7.6, 13.1, 13.12, 14.3, 14.4, and 15.1.6.

5.3.3 Each Subcontract Agreement and each Sub-subcontract agreement shall exclude, and shall be deemed to exclude, Sections 13.2.1 and 13.6 and all of Article 15, except Section 15.1.6, of these General Conditions. In the place of these excluded sections of the General Conditions, each Subcontract Agreement and each Sub-subcontract may include Sections 13.2.1 and 13.6 and all of Article 15, except Section 15.1.6, of AIA Document A201-2007, Conditions of the Contract, as originally issued by the American Institute of Architects.

5.3.4 The Contractor shall assure the Owner that all agreements between the Contractor and its Subcontractor incorporate the provisions of Subparagraph 5.3.1 as necessary to preserve and protect the rights of the Owner and the Architect under the Contract Documents with respect to the work to be performed by Subcontractors so that the subcontracting thereof will not prejudice such rights. The Contractor's assurance shall be in the form of an affidavit or in such other form as the Owner may approve. Upon request, the Contractor shall provide the Owner or Architect with copies of any or all subcontracts or purchase orders.

3.46 *Delete the last sentence of Section 5.4.1.*

3.47 *Add the following Sections 5.4.4, 5.4.5 and 5.4.6:*

5.4.4 Each subcontract shall specifically provide that the Owner shall only be responsible to the subcontractor for those obligations of the Contractor that accrue subsequent to the Owner's exercise of any rights under this conditional assignment.

5.4.5 Each subcontract shall specifically provide that the Subcontractor agrees to perform portions of the Work assigned to the Owner in accordance with the Contract Documents.

5.4.6 Nothing in this Section 5.4 shall act to reduce or discharge the Contractor's payment bond surety's obligations to claimants for claims arising prior to the Owner's exercise of any rights under this conditional assignment.

3.48 *Delete the language of Section 6.1.4 and substitute the word "Reserved."*

3.49 *Insert the following at the end of Section 7.1.2:*

If the amount of a Modification exceeds the limits of the Owner's Construction Change Order Certification (reference Section 9.1.7.2 of the Agreement), then the Owner's agreement is not effective, and Work may not proceed, until approved in writing by the Office of State Engineer.

3.50 *Delete Section 7.2.1 and substitute the following:*

7.2.1 A Change Order is a written instrument prepared by the Architect (using State Form SE-480 "Construction Change Order") 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.

3.51 *Add the following Sections 7.2.2, 7.2.3, 7.2.4, and 7.2.5:*

7.2.2 If a Change Order provides for an adjustment to the Contract Sum, the adjustment must be calculated in accordance with Section 7.3.3.

7.2.3 At the Owner's request, the Contractor shall prepare a proposal to perform the work of a proposed Change Order setting forth the amount of the proposed adjustment, if any, in the Contract Sum; and the extent of the proposed adjustment, if any, in the Contract Time. Any proposed adjustment in the Contract sum shall be prepared in accordance with Section 7.2.2. The Owner's request shall include any revisions to the Drawings or Specifications necessary to define any changes in the Work. Within fifteen days of receiving the request, the Contractor shall submit the proposal to the Owner and Architect along with all documentation required by Section 7.6.

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7.2.4 If the Contractor requests a Change Order, the request shall set forth the proposed change in the Work and shall be prepared in accordance with Section 7.2.3. If the Contractor requests a change to the Work that involves a revision to either the Drawings or Specifications, the Contractor shall reimburse the Owner for any expenditure associated with the Architects' review of the proposed revisions, except to the extent the revisions are accepted by execution of a Change Order.

7.2.5 Agreement on any Change Order shall constitute a final settlement of all matters relating to the change in the Work that is the subject of the Change Order, including, but not limited to, any adjustments to the Contract Sum or the Contract Time.

3.52 *Delete 7.3.3 and substitute the following:*

7.3.3 PRICE ADJUSTMENTS

7.3.3.1 If any Modification, including a Construction Change Directive, provides for an adjustment to the Contract Sum, the adjustment shall be based on whichever of the following methods is the most valid approximation of the actual cost to the contractor, with overhead and profit as allowed by Section 7.5:

- .1 Mutual acceptance of a lump sum;
- .2 Unit prices stated in the Contract Documents, except as provided in Section 7.3.4, or subsequently agreed upon;
- .3 Cost attributable to the events or situations under applicable clauses with adjustment of profits or fee, all as specified in the contract, or subsequently agreed upon by the parties, or by some other method as the parties may agree; or
- .4 As provided in Section 7.3.7.

7.3.3.2 Consistent with Section 7.6, costs must be properly itemized and supported by substantiating data sufficient to permit evaluation before commencement of the pertinent performance or as soon after that as practicable. All costs incurred by the Contractor must be justifiably compared with prevailing industry standards. Except as provided in Section 7.5, all adjustments to the Contract Price shall be limited to job specific costs and shall not include indirect costs, overhead, home office overhead, or profit.

3.53 *Delete Section 7.3.7 and substitute the following:*

7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall make an initial determination, consistent with Section 7.3.3, of 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 for overhead and profit as set forth in Section 7.5. In such case, and also under Section 7.3.3.1.3, 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; and
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work.

3.54 *Delete Section 7.3.8 and substitute the following:*

7.3.8 Using the percentages stated in Section 7.5, any adjustment to the Contract Sum for deleted work shall include any overhead and profit attributable to the cost for the deleted Work.

3.55 *Add the following Sections 7.5 and 7.6:*

7.5 AGREED OVERHEAD AND PROFIT RATES

7.5.1 For any adjustment to the Contract Sum for which overhead and profit may be recovered, other than those made pursuant to Unit Prices stated in the Contract Documents, the Contractor agrees to charge and accept, as full payment for overhead and profit, the following percentages of costs attributable to the change in the Work. The percentages cited below shall be considered to include all indirect costs including, but not limited to: field and office managers, supervisors and assistants, incidental job burdens, small tools, and general overhead allocations. The allowable percentages for overhead and profit are as follows:

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- .1 To the Contractor for work performed by the Contractor's own forces, 17% of the Contractor's actual costs.
- .2 To each Subcontractor for work performed by the Subcontractor's own forces, 17% of the subcontractor's actual costs.
- .3 To the Contractor for work performed by a subcontractor, 10% of the subcontractor's actual costs (not including the subcontractor's overhead and profit).

7.6 PRICING DATA AND AUDIT**7.6.1 Cost or Pricing Data.**

Upon request of the Owner or Architect, Contractor shall submit cost or pricing data prior to execution of a Modification which exceeds \$500,000. Contractor shall certify that, to the best of its knowledge and belief, the cost or pricing data submitted is accurate, complete, and current as of a mutually determined specified date prior to the date of pricing the Modification. Contractor's price, including profit, shall be adjusted to exclude any significant sums by which such price was increased because Contractor furnished cost or pricing data that was inaccurate, incomplete, or not current as of the date specified by the parties. Notwithstanding Subparagraph 9.10.4, such adjustments may be made after final payment to the Contractor.

7.6.2 Cost or pricing data means all facts that, as of the date specified by the parties, prudent buyers and sellers would reasonably expect to affect price negotiations significantly. Cost or pricing data are factual, not judgmental; and are verifiable. While they do not indicate the accuracy of the prospective contractor's judgment about estimated future costs or projections, they do include the data forming the basis for that judgment. Cost or pricing data are more than historical accounting data; they are all the facts that can be reasonably expected to contribute to the soundness of estimates of future costs and to the validity of determinations of costs already incurred.

7.6.3 Records Retention.

As used in Section 7.6, the term "records" means any books or records that relate to cost or pricing data that Contractor is required to submit pursuant to Section 7.6.1. Contractor shall maintain records for three years from the date of final payment, or longer if requested by the chief procurement officer. The Owner may audit Contractor's records at reasonable times and places.

3.56 Delete Section 8.2.2 and substitute the following:

8.2.2 The Contractor shall not knowingly commence operations on the site or elsewhere prior to the effective date of surety bonds and 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 surety bonds or insurance.

3.57 Delete Section 8.3.1 and substitute the following:

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 control of the Contractor and any subcontractor at any tier; or by delay authorized by the Owner pending dispute resolution; or by other causes that the Architect determines may justify delay, then to the extent such delay will prevent the Contractor from achieving Substantial Completion within the Contract Time and provided the delay (1) is not caused by the fault or negligence of the Contractor or a subcontractor at any tier and (2) is not due to unusual delay in the delivery of supplies, machinery, equipment, or services when such supplies, machinery, equipment, or services were obtainable from other sources in sufficient time for the Contractor to meet the required delivery, the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

3.58 Insert the following at the end of Section 9.1:

All changes to the Contract Sum shall be adjusted in accordance with Section 7.3.3.

3.59 Delete Section 9.2 and substitute the following:**9.2 SCHEDULE OF VALUES**

9.2.1 The Contractor shall submit to the Architect, within ten days of full execution of the Agreement, 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. As requested by the Architect, the Contractor and each Subcontractor shall prepare a trade payment breakdown for the Work for which each is responsible, such breakdown being submitted on a uniform standardized format approved by the Architect and Owner. The breakdown shall be divided in detail, using convenient units, sufficient to accurately determine the value

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of completed Work during the course of the Project. The Contractor shall update the schedule of values as required by either the Architect or Owner as necessary to reflect:

- .1 the description of Work (listing labor and material separately);
- .2 the total value;
- .3 the percent and value of the Work completed to date;
- .4 the percent and value of previous amounts billed; and
- .5 the current percent completed and amount billed.

9.2.2 Any schedule of values or trade breakdown that fails to include sufficient detail, is unbalanced, or exhibits "front-loading" of the value of the Work shall be rejected. If a schedule of values or trade breakdown is used as the basis for payment and later determined to be inaccurate, sufficient funds shall be withheld from future Applications for Payment to ensure an adequate reserve (exclusive of normal retainage) to complete the Work.

3.60 *Delete Section 9.3.1 and substitute the following:*

Monthly, 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 and any other adjustments provided in Section 5 of the Agreement. If required by the Owner or Architect, the Application for Payment shall be accompanied by a current construction schedule.

3.61 *In Section 9.3.2, add the following words to the end of the second sentence:*

provided such materials or equipment will be subsequently incorporated in the Work

Insert the following at the end of Section 9.3.2:

The Contractor shall 1) protect such materials from diversion, vandalism, theft, destruction, and damage, 2) mark such materials specifically for use on the Project, and 3) segregate such materials from other materials at the storage facility. The Architect and the Owner shall have the right to make inspections of the storage areas at any time.

3.62 *In Section 9.4.2, in the first sentence, after the words "Work has progressed to the point indicated," insert the following:*

in both the Application for Payment and, if required to be submitted by the Contractor, the accompanying current construction schedule

In the last sentence, delete the third item starting with "(3) reviewed copies" and ending with "Contractor's right to payment,"

3.63 *In Section 9.5.1, in the first sentence, delete the word "may" after the opening words "The Architect" and substitute the word "shall."*

In Section 9.5.1, insert the following sentence after the first sentence:

The Architect shall withhold a Certificate of Payment if the Application for Payment is not accompanied by the current construction schedule required by Section 3.10.1.

3.64 *In Section 9.6.2, delete the word "The..." at the beginning of the first sentence and substitute the following:*

Pursuant to Chapter 6 of Title 29 of the South Carolina Code of Laws, as amended, the

3.65 *Delete Section 9.7 and substitute following:*

9.7 FAILURE OF PAYMENT

If the Architect does not issue a Certificate for Payment to the Owner, 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 time established in the Contract Documents the amount certified by the Architect or awarded by a final dispute resolution order, 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, in accordance with the provisions of Section 7.3.3, 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.

3.66 *Insert the following words at the end of the sentence in Section 9.8.1:*

and when all required occupancy permits, if any, have been issued and copies have been delivered to the Owner.

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STANDARD SUPPLEMENTARY CONDITIONS

3.67 *In Section 9.8.2, insert the word “written” after the word “comprehensive” and before the word “list.”*

3.68 *Delete Section 9.8.3 and substitute the following:*

9.8.3.1 Upon receipt of the Contractor’s list, the Architect, with the Owner and any other person the Architect or the Owner choose, will make an inspection on a date and at a time mutually agreeable to the Architect, Owner, and Contractor, to determine whether the Work or designated portion thereof is substantially complete. The Contractor shall furnish access for the inspection and testing as provided in this Contract. The inspection shall include a demonstration by the Contractor that all equipment, systems and operable components of the Work function properly and in accordance with the Contract Documents. 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. If more than one Substantial Completion inspection is required, the Contractor shall reimburse the Owner for all costs of reinspections or, at the Owner’s option, the costs may be deducted from payments due to the Contractor.

9.8.3.2 If the Architect and Owner concur in the Contractor’s assessment that the Work or a portion of the Work is safe to occupy, the Owner and Contractor may arrange for a Certificate of Occupancy Inspection by OSE. The Owner, Architect, and Contractor shall be present at OSE’s inspection. Upon verifying that the Work or a portion of the Work is substantially complete and safe to occupy, OSE will issue, as appropriate, a Full or Partial Certificate of Occupancy.

3.69 *In the second sentence of Section 9.8.5, delete the words “and consent of surety, if any.”*

3.70 *In the first sentence of Section 9.9.1, delete the words “Section 11.3.1.5” and substitute the words “Section 11.3.1.3.”*

3.71 *Delete Section 9.10.1 and substitute the following:*

9.10.1 Unless the parties agree otherwise in the Certificate of Substantial Completion, the Contractor shall achieve Final Completion no later than thirty days after Substantial Completion. 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, with the Owner and any other person the Architect or the Owner choose, will make an inspection on a date and at a time mutually agreeable to the Architect, Owner, and Contractor, 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. If more than one Final Completion inspection is required, the Contractor shall reimburse the Owner for all costs of reinspections or, at the Owner’s option, the costs may be deducted from payments due to the Contractor. If the Contractor does not achieve final completion within thirty days after Substantial Completion or the timeframe agreed to by the parties in the Certificate of Substantial Completion, whichever is greater, the Contractor shall be responsible for any additional Architectural fees resulting from the delay.

3.72 *Delete the first sentence of Section 9.10.2 and substitute the following:*

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 (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, (6) required Training Manuals, (7) equipment Operations and Maintenance Manuals, (8) any certificates of testing, inspection or approval required by the Contract Documents and not previously provided (9) all warranties and guarantees required under or pursuant to the Contract Documents, and (10) one copy of the Documents required by Section 3.11.

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STANDARD SUPPLEMENTARY CONDITIONS

3.73 Delete the first sentence of Section 9.10.3 and substitute the following:

If, after Substantial Completion of the Work, final completion thereof is delayed 60 days 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.

3.74 Delete Section 9.10.5 and substitute the following:

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 specific claims in stated amounts that have been previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

3.75 Add the following Section 9.10.6:

9.10.6 If OSE has not previously issued a Certificate of Occupancy for the entire Project, the Parties shall arrange for a representative of OSE to participate in the Final Completion Inspection. Representatives of the State Fire Marshal's Office and other authorities having jurisdiction may be present at the Final Completion Inspection or otherwise inspect the completed Work and advise the Owner whether the Work meets their respective requirements for the Project.

3.76 Delete Section 10.3.1 and substitute the following:

10.3.1 If the Contractor encounters a hazardous material or substance which was not discoverable as provided in Section 3.2.1 and not required by the Contract Documents, and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons or serious loss to real or personal property resulting from such material or substance 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. Hazardous materials or substances are those hazardous, toxic, or radioactive materials or substances subject to regulations by applicable governmental authorities having jurisdiction, such as, but not limited to, the S.C. Department of Health and Environmental Control, the U.S. Environmental Protection Agency, and the U.S. Nuclear Regulatory Commission.

3.77 Insert the following at the end of Section 10.3.2:

In the absence of agreement, the Architect will make an interim determination regarding any delay or impact on the Contractor's additional costs. 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. Any adjustment in the Contract Sum shall be determined in accordance with Section 7.3.3.

3.78 Delete Section 10.3.3 and substitute the following:

10.3.3 The Work in the affected area shall be resumed immediately following the occurrence of any one of the following events: (a) the Owner causes remedial work to be performed that results in the absence of hazardous materials or substances; (b) the Owner and the Contractor, by written agreement, decide to resume performance of the Work; or (c) the Work may safely and lawfully proceed, as determined by an appropriate governmental authority or as evidenced by a written report to both the Owner and the Contractor, which is prepared by an environmental engineer reasonably satisfactory to both the Owner and the Contractor.

3.79 In Section 10.3.5, delete the word "The" at the beginning of the sentence and substitute the following:

In addition to its obligations under Section 3.18, the

3.80 Delete the language of Section 10.3.6 and substitute the word "Reserved."

3.81 Insert the following at the end of Section 10.4:

The Contractor shall immediately give the Architect notice of the emergency. This initial notice may be oral followed within five days by a written notice setting forth the nature and scope of the emergency. Within fourteen days of the start of the emergency, the Contractor shall give the Architect a written estimate of the cost and probable effect of delay on the progress of the Work.

3.82 Delete 11.1.2 and substitute the following:

11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified below or required by law, whichever coverage is greater. Coverages shall be written on an occurrence basis and 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.

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STANDARD SUPPLEMENTARY CONDITIONS

- (1) COMMERCIAL GENERAL LIABILITY:
- | | |
|--|-------------|
| (a) General Aggregate (per project) | \$1,000,000 |
| (b) Products/Completed Operations | \$1,000,000 |
| (c) Personal and Advertising Injury | \$1,000,000 |
| (d) Each Occurrence | \$1,000,000 |
| (e) Fire Damage (Any one fire) | \$50,000 |
| (f) Medical Expense (Any one person) | \$5,000 |
- (2) BUSINESS AUTO LIABILITY (including All Owned, Non-owned, and Hired Vehicles):
- | | |
|---------------------------------|-------------|
| (a) Combined Single Limit | \$1,000,000 |
|---------------------------------|-------------|
- (3) WORKER'S COMPENSATION:
- | | |
|-------------------------------|----------------------------------|
| (a) State Statutory | |
| (b) Employers Liability | \$100,000 Per Acc. |
| | \$500,000 Disease, Policy Limit |
| | \$100,000 Disease, Each Employee |

In lieu of separate insurance policies for Commercial General Liability, Business Auto Liability, and Employers Liability, the Contractor may provide an umbrella policy meeting or exceeding all coverage requirements set forth in this Section 11.1.2. The umbrella policy limits shall not be less than \$3,000,000.

3.83 *Delete Section 11.1.3 and substitute the following:*

11.1.3 Prior to commencement of the Work, and thereafter upon replacement of each required policy of insurance, Contractor shall provide to the Owner a written endorsement to the Contractor's general liability insurance policy that:

- (i) names the Owner as an additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations;
- (ii) provides that no material alteration, cancellation, non-renewal, or expiration of the coverage contained in such policy shall have effect unless all additional insureds have been given at least ten (10) days prior written notice of cancellation for non-payment of premiums and thirty (30) days prior written notice of cancellation for any other reason; and
- (iii) provides that the Contractor's liability insurance policy shall be primary, with any liability insurance of the Owner as secondary and noncontributory.

Prior to commencement of the Work, and thereafter upon renewal or replacement of each required policy of insurance, Contractor shall provide to the Owner a signed, original certificate of liability insurance (ACORD 25). Consistent with this Section 11.1, the certificate shall identify the types of insurance, state the limits of liability for each type of coverage, name the Owner a Consultants as Certificate Holder, provide that the general aggregate limit applies per project, and provide that coverage is written on an occurrence basis. Both the certificates and the endorsements must be received directly from either the Contractor's insurance agent or the insurance company. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, naming the Owner as an additional insured for claims made under the Contractor's completed operations, and otherwise meeting the above requirements, 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.

3.84 *Delete Section 11.1.4 and substitute the following:*

11.1.4 A failure by the Owner either (i) to demand a certificate of insurance or written endorsement required by Section 11.1, or (ii) to reject a certificate or endorsement on the grounds that it fails to comply with Section 11.1 shall not be considered a waiver of Contractor's obligations to obtain the required insurance.

3.85 *In Section 11.3.1, delete the first sentence and substitute the following:*

Unless otherwise provided in the Contract Documents, the Contractor 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.

3.86 *Delete the language of Section 11.3.1.2 and substitute the word "Reserved."*

3.87 *Delete the language of Section 11.3.1.3 and substitute the word "Reserved."*

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STANDARD SUPPLEMENTARY CONDITIONS

3.88 Delete Section 11.3.2 and substitute the following:

11.3.2 BOILER AND MACHINERY INSURANCE

The Contractor 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 both be named insureds.

3.89 Delete Section 11.3.3 and substitute the following:

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. To the extent any losses are covered and paid for by such insurance, 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.

3.90 Delete Section 11.3.4 and substitute the following:

11.3.4 If the Owner 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 Contractor shall, if possible, include such insurance, and the cost thereof shall be charged to the Owner by appropriate Change Order.

3.91 Delete the language of Section 11.3.5 and substitute the word "Reserved."

3.92 Delete Section 11.3.6 and substitute the following:

11.3.6 Before an exposure to loss may occur, the Contractor shall file with the Owner 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 Owner.

3.93 Delete the first sentence of Section 11.3.7 and substitute the following:

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 the property insurance provided by the Contractor pursuant to this Section 11.3 covers and pays for the damage, except such rights as they have to proceeds of such insurance held by the Contractor as fiduciary.

3.94 Delete the first sentence of Section 11.3.8 and substitute the following:

A loss insured under the Contractor's property insurance shall be adjusted by the Contractor as fiduciary and made payable to the Contractor as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10.

3.95 Delete Section 11.3.9 and substitute the following:

11.3.9 If required in writing by a party in interest, the Contractor as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Contractor's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Contractor shall deposit in a separate account proceeds so received, which the Contractor shall distribute in accordance with such agreement as the parties in interest may reach. 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.

3.96 Delete Section 11.3.10 and substitute the following:

11.3.10 The Contractor 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 Contractor's exercise of this power; if such objection is made, the dispute shall be resolved in the manner provided in the contract between the parties in dispute as the method of binding dispute resolution. The Contractor as fiduciary shall make settlement with insurers or, in the case of a dispute over distribution of insurance proceeds, in accordance with a final order or determination issued by the appropriate authority having jurisdiction over the dispute.

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3.97 *Delete Section 11.4.1 and substitute the following:*

11.4.1 Before commencing any services hereunder, the Contractor shall provide the Owner with Performance and Payment Bonds, each in an amount not less than the Contract Price set forth in Article 4 of the Agreement. The Surety shall have, at a minimum, a "Best Rating" of "A" as stated in the most current publication of "Best's Key Rating Guide, Property-Casualty". In addition, the Surety shall have a minimum "Best Financial Strength Category" of "Class V", and in no case less than five (5) times the contract amount. The Performance Bond shall be written on Form SE-355, "Performance Bond" and the Payment Bond shall be written on Form SE-357, "Labor and Material Payment Bond", and both shall be made payable to the Owner.

3.98 *Delete Section 11.4.2 and substitute the following:*

11.4.2 The Performance and Labor and Material Payment Bonds shall:

- .1 be issued by a surety company licensed to do business in South Carolina;
- .2 be accompanied by a current power of attorney and certified by the attorney-in-fact who executes the bond on the behalf of the surety company; and
- .3 remain in effect for a period not less than one (1) year following the date of Substantial Completion or the time required to resolve any items of incomplete Work and the payment of any disputed amounts, whichever time period is longer.

3.99 *Add the following Sections 11.4.3 and 11.4.4:*

11.4.3 Any bonds required by this Contract shall meet the requirements of the South Carolina Code of Laws and Regulations, as amended.

11.4.4 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.

3.100 *Delete Section 12.1.1 and substitute the following:*

12.1.1 If a portion of the Work is covered contrary to the requirements specifically expressed in the Contract Documents, including inspections of work-in-progress required by all authorities having jurisdiction over the Project, it must, upon demand of the Architect or authority having jurisdiction, be uncovered for observation and be replaced at the Contractor's expense without change in the Contract Time.

3.101 *In Section 12.2.2.1, delete the words "and to make a claim for breach of warranty" at the end of the third sentence.*

3.102 *In Section 12.2.2.3, add the following to the end of the sentence:*

unless otherwise provided in the Contract Documents.

3.103 *Insert the following at the end of Section 12.2.4:*

If, prior to the date of Substantial Completion, the Contractor, a Subcontractor, or anyone for whom either is responsible, uses or damages any portion of the Work, including, without limitation, mechanical, electrical, plumbing, and other building systems, machinery, equipment, or other mechanical device, the Contractor shall cause such item to be restored to "like new" condition at no expense to the Owner.

3.104 *Delete Section 13.1 and substitute the following:*

13.1 GOVERNING LAW

The Contract, any dispute, claim, or controversy relating to the Contract, and all the rights and obligations of the parties shall, in all respects, be interpreted, construed, enforced and governed by and under the laws of the State of South Carolina, except its choice of law rules.

3.105 *Delete Section 13.2, including its Sub-Sections 13.2.1 and 13.2.2, and substitute the following:*

13.2 SUCCESSORS AND ASSIGNS

The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract as a whole, or in part, without written consent of the other and then only in accordance with and as permitted by Regulation 19-445.2180 of the South Carolina Code of Regulations, as amended. 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.

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3.106 *Delete Section 13.3 and substitute the following:*

13.3 WRITTEN NOTICE

Unless otherwise permitted herein, all notices contemplated by the Contract Documents shall be in writing and shall be deemed given:

- .1 upon actual delivery, if delivery is by hand;
- .2 upon receipt by the transmitting party of confirmation or reply, if delivery is by electronic mail, facsimile, telex or telegram;
- .3 upon receipt, if delivery is by the United States mail.

Notice to Contractor shall be to the address provided in Section 8.3.2 of the Agreement. Notice to Owner shall be to the address provided in Section 8.2.2 of the Agreement. Either party may designate a different address for notice by giving notice in accordance with this paragraph.

3.107 *In Section 13.4.1, insert the following at the beginning of the sentence:*

Unless expressly provided otherwise,

3.108 *Add the following Section 13.4.3:*

13.4.3 Notwithstanding Section 9.10.4, the rights and obligations which, by their nature, would continue beyond the termination, cancellation, rejection, or expiration of this contract shall survive such termination, cancellation, rejection, or expiration, including, but not limited to, the rights and obligations created by the following clauses:

- 1.5** Ownership and Use of Drawings, Specifications and Other Instruments of Service;
- 3.5** Warranty
- 3.17** Royalties, Patents and Copyrights
- 3.18** Indemnification
- 7.6** Cost or Pricing Data
- 11.1** Contractor's Liability Insurance
- 11.4** Performance and Payment Bond
- 15.1.6** Claims for Listed Damages
- 15.1.7** Waiver of Claims Against the Architect
- 15.6** Dispute Resolution
- 15.6.5** Service of Process

3.109 *Delete Section 13.6 and substitute the following:*

13.6 INTEREST

Payments due to the Contractor and unpaid under the Contract Documents shall bear interest only if and to the extent allowed by Title 29, Chapter 6, Article 1 of the South Carolina Code of Laws. Amounts due to the Owner shall bear interest at the rate of one percent a month or a pro rata fraction thereof on the unpaid balance as may be due.

3.110 *Delete the language of Section 13.7 and substitute the word "Reserved."*

3.111 *Add the following Sections 13.8 through 13.16:*

13.8 PROCUREMENT OF MATERIALS BY OWNER

The Contractor accepts assignment of all purchase orders and other agreements for procurement of materials and equipment by the Owner that are identified as part of the Contract Documents. The Contractor shall, upon delivery, be responsible for the storage, protection, proper installation, and preservation of such Owner purchased items, if any, as if the Contractor were the original purchaser. The Contract Sum includes, without limitation, all costs and expenses in connection with delivery, storage, insurance, installation, and testing of items covered in any assigned purchase orders or agreements. Unless the Contract Documents specifically provide otherwise, all Contractor warranty of workmanship and correction of the Work obligations under the Contract Documents shall apply to the Contractor's installation of and modifications to any Owner purchased items.

13.9 INTERPRETATION OF BUILDING CODES

As required by Title 10, Chapter 1, Section 180 of the South Carolina Code of Laws, as amended, OSE shall determine the enforcement and interpretation of all building codes and referenced standards on state buildings. The Contractor shall refer any questions, comments, or directives from local officials to the Owner and OSE for resolution.

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13.10 MINORITY BUSINESS ENTERPRISES

Contractor shall notify Owner of each Minority Business Enterprise (MBE) providing labor, materials, equipment, or supplies to the Project under a contract with the Contractor. Contractor's notification shall be via the first monthly status report submitted to the Owner after execution of the contract with the MBE. For each such MBE, the Contractor shall provide the MBE's name, address, and telephone number, the nature of the work to be performed or materials or equipment to be supplied by the MBE, whether the MBE is certified by the South Carolina Office of Small and Minority Business Assistance, and the value of the contract.

13.11 SEVERABILITY

If any provision or any part of a provision of the Contract Documents shall be finally determined to be superseded, invalid, illegal, or otherwise unenforceable pursuant to any applicable Legal Requirements, such determination shall not impair or otherwise affect the validity, legality, or enforceability of the remaining provision or parts of the provision of the Contract Documents, which shall remain in full force and effect as if the unenforceable provision or part were deleted.

13.12 ILLEGAL IMMIGRATION

Contractor certifies and agrees that it will comply with the applicable requirements of Title 8, Chapter 14 of the South Carolina Code of Laws and agrees to provide to the State upon request any documentation required to establish either: (a) that Title 8, Chapter 14 is inapplicable both to Contractor and its subcontractors or sub-subcontractors; or (b) that Contractor and its subcontractors or sub-subcontractors are in compliance with Title 8, Chapter 14. Pursuant to Section 8-14-60, "A person who knowingly makes or files any false, fictitious, or fraudulent document, statement, or report pursuant to this chapter is guilty of a felony and, upon conviction, must be fined within the discretion of the court or imprisoned for not more than five years, or both." Contractor agrees to include in any contracts with its subcontractors language requiring its subcontractors to (a) comply with the applicable requirements of Title 8, Chapter 14, and (b) include in their contracts with the sub-subcontractors language requiring the sub-subcontractors to comply with the applicable requirements of Title 8, Chapter 14. (An overview is available at www.procurement.sc.gov)

13.13 SETOFF

The Owner shall have all of its common law, equitable, and statutory rights of set-off.

13.14 DRUG-FREE WORKPLACE

The Contractor certifies to the Owner that Contractor will provide a Drug-Free Workplace, as required by Title 44, Chapter 107 of the South Carolina Code of Laws, as amended.

13.15 FALSE CLAIMS

According to the S.C. Code of Laws § 16-13-240, "a person who by false pretense or representation obtains the signature of a person to a written instrument or obtains from another person any chattel, money, valuable security, or other property, real or personal, with intent to cheat and defraud a person of that property is guilty" of a crime.

13.16 NON-INDEMNIFICATION:

Any term or condition is void to the extent it requires the State to indemnify anyone. It is unlawful for a person charged with disbursements of state funds appropriated by the General Assembly to exceed the amounts and purposes stated in the appropriations. (§ 11-9-20) It is unlawful for an authorized public officer to enter into a contract for a purpose in which the sum is in excess of the amount appropriated for that purpose. It is unlawful for an authorized public officer to divert or appropriate the funds arising from any tax levied and collected for any one fiscal year to the payment of an indebtedness contracted or incurred for a previous year. (§ 11-1-40)

3.112 Delete Section 14.1.1 and substitute the following:

14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 45 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 substantially all Work to be stopped; or
- .2 An act of government, such as a declaration of national emergency that requires substantially 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 and the Contractor has stopped work in accordance with Section 9.7

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3.113 *Insert the following at the end of Section 14.1.3:*

Any adjustment to the Contract Sum pursuant to this Section shall be made in accordance with the requirements of Article 7.

3.114 *In Section 14.1.4, replace the word "repeatedly" with the word "persistently."*

3.115 *Delete Section 14.2.1 and substitute the following:*

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, or otherwise fails to prosecute the Work, or any separable part of the Work, with the diligence, resources and skill that will ensure its completion within the time specified in the Contract Documents, including any authorized adjustments;
- .2 fails to make payment to Subcontractors for materials or labor in accordance with the Contract Documents and 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.

3.116 *In Section 14.2.2, delete the parenthetical statement ", upon certification by the Initial Decision Maker that sufficient cause exists to justify such action," immediately following the word "Owner" in the first line.*

3.117 *In Section 14.2.4, replace the words "Initial Decision Maker" with the word "Architect"*

3.118 *Add the following Section 14.2.5:*

14.2.5 If, after termination for cause, it is determined that the Owner lacked justification to terminate under Section 14.2.1, or that the Contractor's default was excusable, the rights and obligations of the parties shall be the same as if the termination had been issued for the convenience of the Owner under Section 14.4.

3.119 *Delete the second sentence of Section 14.3.2 and substitute the following:*

Any adjustment to the Contract Sum made pursuant to this section shall be made in accordance with the requirements of Article 7.3.3.

3.120 *Delete Section 14.4.1 and substitute the following:*

14.4.1 The Owner may, at any time, terminate the Contract, in whole or in part for the Owner's convenience and without cause. The Owner shall give written notice of the termination to the Contractor specifying the part of the Contract terminated and when termination becomes effective.

3.121 *Delete Section 14.4.2 and substitute the following:*

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;
- .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; and
- .4 complete the performance of the Work not terminated, if any.

3.122 *Delete Section 14.4.3 and substitute 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, costs incurred by reason of such termination, and any other adjustments otherwise allowed by the Contract. Any adjustment to the Contract Sum made pursuant to this Section 14.4 shall be made in accordance with the requirements of Article 7.3.3.

3.123 *Add the following Sections 14.4.4, 14.4.5, and 14.5:*

14.4.4 Contractor's failure to include an appropriate termination for convenience clause in any subcontract shall not (i) affect the Owner's right to require the termination of a subcontract, or (ii) increase the obligation of the Owner beyond what it would have been if the subcontract had contained an appropriate clause.

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14.4.5 Upon written consent of the Contractor, the Owner may reinstate the terminated portion of this Contract in whole or in part by amending the notice of termination if it has been determined that:

- .1 the termination was due to withdrawal of funding by the General Assembly, Governor, or Budget and Control Board or the need to divert project funds to respond to an emergency as defined by Regulation 19-445.2110(B) of the South Carolina Code of Regulations, as amended;
- .2 funding for the reinstated portion of the work has been restored;
- .3 circumstances clearly indicate a requirement for the terminated work; and
- .4 reinstatement of the terminated work is advantageous to the Owner.

14.5 CANCELLATION AFTER AWARD BUT PRIOR TO PERFORMANCE

Pursuant to Title 11, Chapter 35 and Regulation 19-445.2085 of the South Carolina Code of Laws and Regulations, as amended, this contract may be canceled after award but prior to performance.

3.124 *Insert the following sentence after the second sentence of Section 15.1.1:*

A voucher, invoice, payment application or other routine request for payment that is not in dispute when submitted is not a Claim under this definition.

3.125 *Delete Section 15.1.2 and substitute the following:*

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 Architect. Such notice shall include sufficient information to advise the Architect and other party of the circumstances giving rise to the claim, the specific contractual adjustment or relief requested and the basis of such request. Claims by either party arising prior to the date final payment is due 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 except as stated for adverse weather days in Section 15.1.5.2. By failing to give written notice of a Claim within the time required by this Section, a party expressly waives its claim.

3.126 *Delete Section 15.1.3 and substitute the following:*

15.1.3 CONTINUING CONTRACT PERFORMANCE

Pending final resolution of a Claim, including any administrative review allowed under Section 15.6, 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 issue Certificates for Payment in accordance with the initial decisions and determinations of the Architect.

3.127 *Insert the following at the end of Section 15.1.5.1:*

Claims for an increase in the Contract Time shall be based on one additional calendar day for each full calendar day that the Contractor is prevented from working.

3.128 *Insert the following Sub-Sections at the end of Section 15.1.5.2:*

- .1 Claims for adverse weather shall be based on actual weather conditions at the job site or other place of performance of the Work, as documented in the Contractor's job site log.
- .2 For the purpose of this Contract, a total of five (5) days per calendar month (non-cumulative) shall be anticipated as "adverse weather" at the job site, and such time will not be considered justification for an extension of time. If, in any month, adverse weather develops beyond the five (5) days, the Contractor shall be allowed to claim additional days to compensate for the excess weather delays only to the extent of the impact on the approved construction schedule and days the contractor was already scheduled to work. The remedy for this condition is for an extension of time only and is exclusive of all other rights and remedies available under the Contract Documents or imposed or available by law.
- .3 The Contractor shall submit monthly with their pay application all claims for adverse weather conditions that occurred during the previous month. The Architect shall review each monthly submittal in accordance with Section 15.5 and inform the Contractor and the Owner promptly of its evaluation. Approved days shall be included in the next Change Order issued by the Architect. Adverse weather conditions not claimed within the time limits of this Subparagraph shall be considered to be waived by the Contractor. Claims will not be allowed for adverse weather days that occur after the scheduled (original or adjusted) date of Substantial Completion.

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3.129 *Delete Section 15.1.6 and substitute the following:*

15.1.6 CLAIMS FOR LISTED DAMAGES

Notwithstanding any other provision of the Contract Documents, including Section 1.2.1, but subject to a duty of good faith and fair dealing, the Contractor and Owner waive Claims against each other for listed damages arising out of or relating to this Contract.

15.1.6.1 For the Owner, listed damages are (i) lost revenue and profit, (ii) losses resulting from injury to business or reputation, (iii) additional or escalated overhead and administration expenses, (iv) additional financing costs, (v) costs suffered by a third party unable to commence work, (vi) attorney's fees, (vii) any interest, except to the extent allowed by Section 13.6 (Interest), (viii) lost revenue and profit for lost use of the property, (ix) costs resulting from lost productivity or efficiency.

15.1.6.2 For the Contractor, listed damages are (i) lost revenue and profit, (ii) losses resulting from injury to business or reputation, (iii) additional or escalated overhead and administration expenses, (iv) additional financing costs, (v) attorney's fees, (vi) any interest, except to the extent allowed by Section 13.6 (Interest); (vii) unamortized equipment costs; and, (viii) losses incurred by subcontractors for the types of damages the Contractor has waive as against the Owner. Without limitation, this mutual waiver is applicable to all damages due to either party's termination in accordance with Article 14.

15.1.6.3 Nothing contained in this Section shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents. This mutual waiver is not applicable to amounts due or obligations under Section 3.18 (Indemnification).

3.130 *Add the following Section 15.1.7:*

15.1.7 WAIVER OF CLAIMS AGAINST THE ARCHITECT

Notwithstanding any other provision of the Contract Documents, including Section 1.2.1, but subject to a duty of good faith and fair dealing, the Contractor waives all claims against the Architect and any other design professionals who provide design and/or project management services to the Owner, either directly or as independent contractors or subcontractors to the Architect, for listed damages arising out of or relating to this Contract. The listed damages are (i) lost revenue and profit, (ii) losses resulting from injury to business or reputation, (iii) additional or escalated overhead and administration expenses, (iv) additional financing costs, (v) attorney's fees, (vi) any interest; (vii) unamortized equipment costs; and, (viii) losses incurred by subcontractors for the types of damages the Contractor has waive as against the Owner. This mutual waiver is not applicable to amounts due or obligations under Section 3.18 (Indemnification).

3.131 *Delete the language of Sections 15.2, 15.3, and 15.4, including all Sub-Sections, and substitute the word "Reserved" for the deleted language of each Section and Sub-Section.*

3.132 *Add the following Sections 15.5 and 15.6 with their sub-sections:*

15.5 CLAIM AND DISPUTES - DUTY OF COOPERATION, NOTICE, AND ARCHITECTS INITIAL DECISION

15.5.1 Contractor and Owner are fully committed to working with each other throughout the Project to avoid or minimize claims. To further this goal, Contractor and Owner agree to communicate regularly with each other and the Architect at all times notifying one another as soon as reasonably possible of any issue that if not addressed may cause loss, delay, and/or disruption of the Work. If claims do arise, Contractor and Owner each commit to resolving such claims in an amicable, professional, and expeditious manner to avoid unnecessary losses, delays, and disruptions to the Work.

15.5.2 Claims shall first be referred to the Architect for initial decision. An initial decision shall be required as a condition precedent to resolution pursuant to Section 15.6 of any Claim arising prior to the date of final payment, unless 30 days have passed after the Claim has been referred to the Architect with no decision having been rendered, or after all the Architect's requests for additional supporting data have been answered, whichever is later. The Architect will not address claims between the Contractor and persons or entities other than the Owner.

15.5.3 The Architect will review Claims and within ten days of the receipt of a Claim (1) request additional supporting data from the claimant or a response with supporting data from the other party or (2) render an initial decision in accordance with Section 15.5.5.

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- 15.5.4** If the Architect 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 Architect when the response or supporting data will be furnished or (3) advise the Architect that all supporting data has already been provided. Upon receipt of the response or supporting data, the Architect will render an initial decision in accordance with Section 15.5.5.
- 15.5.5** The Architect will render an initial decision in writing; (1) stating the reasons therefor; and (2) notifying the parties of any change in the Contract Sum or Contract Time or both. The Architect will deliver the initial decision to the parties within two weeks of receipt of any response or supporting data requested pursuant to Section 16.4 or within such longer period as may be mutually agreeable to the parties. If the parties accept the initial decision, the Architect shall prepare a Change Order with appropriate supporting documentation for the review and approval of the parties and the Office of State Engineer. If either the Contractor, Owner, or both, disagree with the initial decision, the Contractor and Owner shall proceed with dispute resolution in accordance with the provisions of Section 15.6.
- 15.5.6** 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.

15.6 DISPUTE RESOLUTION

- 15.6.1** If a claim is not resolved pursuant to Section 15.5 to the satisfaction of either party, both parties shall attempt to resolve the dispute at the field level through discussions between Contractor's Representative and Owner's Representative. If a dispute cannot be resolved through Contractor's Representative and Owner's Representative, then the Contractor's Senior Representative and the Owner's Senior Representative, upon the request of either party, shall meet as soon as conveniently possible, but in no case later than twenty-one days after such a request is made, to attempt to resolve such dispute. Prior to any meetings between the Senior Representatives, the parties will exchange relevant information that will assist the parties in resolving their dispute. The meetings required by this Section are a condition precedent to resolution pursuant to Section 15.6.2.
- 15.6.2** If after meeting in accordance with the provisions of Section 15.6.1, the Senior Representatives determine that the dispute cannot be resolved on terms satisfactory to both the Contractor and the Owner, then either party may submit the dispute by written request to South Carolina's Chief Procurement Officer for Construction (CPOC). Except as otherwise provided in Article 15, all claims, claims, or controversies relating to the Contract shall be resolved exclusively by the appropriate Chief Procurement Officer in accordance with Title 11, Chapter 35, Article 17 of the South Carolina Code of Laws, or in the absence of jurisdiction, only in the Court of Common Pleas for, or in the absence of jurisdiction a federal court located in, Richland County, State of South Carolina. Contractor agrees that any act by the State regarding the Contract is not a waiver of either the State's sovereign immunity or the State's immunity under the Eleventh Amendment of the United State's Constitution.
- 15.6.3** If any party seeks resolution to a dispute pursuant to Section 15.6.2, the parties shall participate in non-binding mediation to resolve the claim. If the claim is governed by Title 11, Chapter 35, Article 17 of the South Carolina Code of Laws as amended and the amount in controversy is \$100,000.00 or less, the CPOC shall appoint a mediator, otherwise, the mediation shall be conducted by an impartial mediator selected by mutual agreement of the parties, or if the parties cannot so agree, a mediator designated by the American Arbitration Association ("AAA") pursuant to its Construction Industry Mediation Rules. The mediation will be governed by and conducted pursuant to a mediation agreement negotiated by the parties or, if the parties cannot so agree, by procedures established by the mediator.
- 15.6.4** Without relieving any party from the other requirements of Sections 15.5 and 15.6, either party may initiate proceedings in the appropriate forum prior to initiating or completing the procedures required by Sections 15.5 and 15.6 if such action is necessary to preserve a claim by avoiding the application of any applicable statutory period of limitation or repose.

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STANDARD SUPPLEMENTARY CONDITIONS

15.6.5 SERVICE OF PROCESS

Contractor consents that any papers, notices, or process necessary or proper for the initiation or continuation of any claims, claims, or controversies relating to the Contract; for any court action in connection therewith; or for the entry of judgment on any award made, may be served on Contractor by certified mail (return receipt requested) addressed to Contractor at the address provided for the Contractor's Senior Representative or by personal service or by any other manner that is permitted by law, in or outside South Carolina. Notice by certified mail is deemed duly given upon deposit in the United States mail.

3.133 Add the following Article 16:

ARTICLE 16 PROJECT-SPECIFIC REQUIREMENTS AND INFORMATION

16.1. Inspection Requirements: *(Indicate the inspection services required by the Contract)*

- Special Inspections are required and are not part of the Contract Sum. *(see section 01400)*
- Building Inspections are required and are not part of the Contract Sum. *(see section 01400)*

The inspections required for this Work are:

(Indicate which services are required and the provider)

- Civil: _____
- Structural: _____
- Mechanical: _____
- Plumbing: _____
- Electrical: _____
- Gas: _____
- Other *(list)*: _____

Remarks: All inspections done by Owner.

16.1.1 Contractor shall schedule and request inspections in an orderly and efficient manner and shall notify the Owner whenever the Contractor schedules an inspection in accordance with the requirements of Section 16.1. Contractor shall be responsible for the cost of inspections scheduled and conducted without the Owner's knowledge and for any increase in the cost of inspections resulting from the inefficient scheduling of inspections.

16.2 List Cash Allowances, if any. *(Refer to attachments as needed. If none, enter NONE)*

None

16.3. Requirements for Record Drawings, if any. *(Refer to attachments as needed. If none, enter NONE)*

See technical specifications.

16.4. Requirements for Shop Drawings and other submittals, if any, including number, procedure for submission, list of materials to be submitted, etc. *(Refer to attachments as needed. If none, enter NONE)*

See technical specifications.

16.5. Requirements for signage, on-site office or trailer, utilities, restrooms, etc., in addition to the Contract, if any. *(Refer to attachments as needed. If none, enter NONE)*

See USC Supplemental General Conditions for Construction

16.6. Requirements for Project Cleanup in addition to the Contract, if any. *(Refer to attachments as needed. If none, enter NONE)*

See USC Supplemental General Conditions for Construction

16.7. List all attachments that modify these General Conditions. *(If none, enter NONE)*

None

SE-355
PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that *(Insert full name or legal title and address of Contractor)*

Name: _____

Address: _____

hereinafter referred to as "Contractor", and *(Insert full name and address of principal place of business of Surety)*

Name: _____

Address: _____

hereinafter called the "surety", are jointly and severally held and firmly bound unto *(Insert full name and address of Agency)*

Name: University of South Carolina

Address: 743 Greene Street

Columbia, SC 29208

hereinafter referred to as "Agency", or its successors or assigns, the sum of _____ (\$ _____), being the sum of the Bond to which payment to be well and truly made, the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Contractor has by written agreement dated _____ entered into a contract with Agency to construct

State Project Name: USCA Penland Mechanical Systems Upgrades

State Project Number: H29-9548

Brief Description of Awarded Work, as found on the SE-330 or SE-332, Bid Form: Upgrades to the mechanical system in the Penland Administration Building located on the USC Aiken campus. Work to include chiller replacement along with related electrical and mechanical components. Miniorty and small business participation is encouraged.

in accordance with Drawings and Specifications prepared by *(Insert full name and address of A-E)*

Name: ING Consulting, Inc.

Address: 550 11th Street, PO Box 1586

Augusta, GA 30903

which agreement is by reference made a part hereof, and is hereinafter referred to as the Contract.

IN WITNESS WHEREOF, Surety and Contractor, intending to be legally bound hereby, subject to the terms stated herein, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent or representative.

DATED this _____ day of _____, **2**
(shall be no earlier than Date of Contract)

BOND NUMBER _____

CONTRACTOR

SURETY

By: _____
(Seal)

By: _____
(Seal)

Print Name: _____

Print Name: _____

Print Title: _____

Print Title: _____
(Attach Power of Attorney)

Witness: _____

Witness: _____

(Additional Signatures, if any, appear on attached page)

SE-355

PERFORMANCE BOND**NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH THAT:**

1. The Contractor and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Agency for the full and faithful performance of the contract, which is incorporated herein by reference.
2. If the Contractor performs the contract, the Surety and the Contractor have no obligation under this Bond, except to participate in conferences as provided in paragraph 3.1.
3. The Surety's obligation under this Bond shall arise after:
 - 3.1 The Agency has notified the Contractor and the Surety at the address described in paragraph 10 below, that the Agency is considering declaring a Contractor Default and has requested and attempted to arrange a conference with the Contractor and the Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. If the Agency, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive the Agency's right, if any, subsequently to declare a Contractor Default; or
 - 3.2 The Agency has declared a Contractor Default and formally terminated the Contractor's right to complete the Contract.
4. The Surety shall, within 15 days after receipt of notice of the Agency's declaration of a Contractor Default, and at the Surety's sole expense, take one of the following actions:
 - 4.1 Arrange for the Contractor, with consent of the Agency, to perform and complete the Contract; or
 - 4.2 Undertake to perform and complete the Contract itself, through its agents or through independent contractors; or
 - 4.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Agency for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by the Agency and the contractor selected with the Agency's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the Bonds issued on the Contract, and pay to the Agency the amount of damages as described in paragraph 7 in excess of the Balance of the Contract Sum incurred by the Agency resulting from the Contractor Default; or
 - 4.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and:
 - 4.4.1 After investigation, determine the amount for which it may be liable to the Agency and, within 60 days of waiving its rights under this paragraph, tender payment thereof to the Agency; or
 - 4.4.2 Deny liability in whole or in part and notify the Agency, citing the reasons therefore.
5. Provided Surety has proceeded under paragraphs 4.1, 4.2, or 4.3, the Agency shall pay the Balance of the Contract Sum to either:
 - 5.1 Surety in accordance with the terms of the Contract; or
 - 5.2 Another contractor selected pursuant to paragraph 4.3 to perform the Contract.
 - 5.3 The balance of the Contract Sum due either the Surety or another contractor shall be reduced by the amount of damages as described in paragraph 7.
6. If the Surety does not proceed as provided in paragraph 4 with reasonable promptness, the Surety shall be deemed to be in default on this Bond 15 days after receipt of written notice from the Agency to the Surety demanding that the Surety perform its obligations under this Bond, and the Agency shall be entitled to enforce any remedy available to the Agency.
 - 6.1 If the Surety proceeds as provided in paragraph 4.4 and the Agency refuses the payment tendered or the Surety has denied liability, in whole or in part, then without further notice the Agency shall be entitled to enforce any remedy available to the Agency.
- 6.2 Any dispute, suit, action or proceeding arising out of or relating to this Bond shall be governed by the Dispute Resolution process defined in the Contract Documents and the laws of the State of South Carolina.
7. After the Agency has terminated the Contractor's right to complete the Contract, and if the Surety elects to act under paragraph 4.1, 4.2, or 4.3 above, then the responsibilities of the Surety to the Agency shall be those of the Contractor under the Contract, and the responsibilities of the Agency to the Surety shall those of the Agency under the Contract. To a limit of the amount of this Bond, but subject to commitment by the Agency of the Balance of the Contract Sum to mitigation of costs and damages on the Contract, the Surety is obligated to the Agency without duplication for:
 - 7.1 The responsibilities of the Contractor for correction of defective Work and completion of the Contract; and
 - 7.2 Additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under paragraph 4; and
 - 7.3 Damages awarded pursuant to the Dispute Resolution Provisions of the Contract. Surety may join in any Dispute Resolution proceeding brought under the Contract and shall be bound by the results thereof; and
 - 7.4 Liquidated Damages, or if no Liquidated Damages are specified in the Contract, actual damages caused by delayed performance or non-performance of the Contractor.
8. The Surety shall not be liable to the Agency or others for obligations of the Contractor that are unrelated to the Contract, and the Balance of the Contract Sum shall not be reduced or set-off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Agency or its heirs, executors, administrators, or successors.
9. The Surety hereby waives notice of any change, including changes of time, to the contract or to related subcontracts, purchase orders and other obligations.
10. Notice to the Surety, the Agency or the Contractor shall be mailed or delivered to the address shown on the signature page.
11. Definitions
 - 11.1 Balance of the Contract Sum: The total amount payable by the Agency to the Contractor under the Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts to be received by the Agency in settlement of insurance or other Claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Contract.
 - 11.2 Contractor Default: Failure of the Contractor, which has neither been remedied nor waived, to perform the Contract or otherwise to comply with the terms of the Contract.

SE-357

LABOR & MATERIAL PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS, that *(Insert full name or legal title and address of Contractor)*

Name: _____

Address: _____

hereinafter referred to as "Contractor", and *(Insert full name and address of principal place of business of Surety)*

Name: _____

Address: _____

hereinafter called the "surety", are jointly and severally held and firmly bound unto *(Insert full name and address of Agency)*

Name: University of South Carolina

Address: 743 Greene Street

Columbia, SC 29208

hereinafter referred to as "Agency", or its successors or assigns, the sum of _____ (\$ _____), being the sum of the Bond to which payment to be well and truly made, the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Contractor has by written agreement dated _____ entered into a contract with Agency to construct

State Project Name: USCA Penland Mechanical Systems Upgrades

State Project Number: H29-9548

Brief Description of Awarded Work, as found on the SE-330 or SE-332, Bid Form: Upgrades to the mechanical system in the Penland Administration Building located on the USC Aiken campus. Work to include chiller replacement along with related electrical and mechanical components. Minority and small business participation is encouraged.

in accordance with Drawings and Specifications prepared by *(Insert full name and address of A-E)*

Name: ING Consulting, Inc.

Address: 550 11th Street, PO Box 1586

Augusta, GA 30903

which agreement is by reference made a part hereof, and is hereinafter referred to as the Contract.

IN WITNESS WHEREOF, Surety and Contractor, intending to be legally bound hereby, subject to the terms stated herein, do each cause this Labor and Material Payment Bond to be duly executed on its behalf by its authorized officer, agent or representative.

DATED this _____ day of _____, 20____
(shall be no earlier than Date of Contract)

BOND NUMBER _____

CONTRACTOR

SURETY

By: _____
(Seal)

By: _____
(Seal)

Print Name: _____

Print Name: _____

Print Title: _____

Print Title: _____
(Attach Power of Attorney)

Witness: _____

Witness: _____

(Additional Signatures, if any, appear on attached page)

LABOR AND MATERIAL PAYMENT BOND**NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH THAT:**

1. The Contractor and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Agency to pay for all labor, materials and equipment required for use in the performance of the Contract, which is incorporated herein by reference.
 2. With respect to the Agency, this obligation shall be null and void if the Contractor:
 - 2.1 Promptly makes payment, directly or indirectly, for all sums due Claimants; and
 - 2.2 Defends, indemnifies and holds harmless the Agency from all claims, demands, liens or suits by any person or entity who furnished labor, materials or equipment for use in the performance of the Contract.
 3. With respect to Claimants, this obligation shall be null and void if the Contractor promptly makes payment, directly or indirectly, for all sums due.
 4. With respect to Claimants, and subject to the provisions of Title 29, Chapter 5 and the provisions of §11-35-3030(2)(c) of the SC Code of Laws, as amended, the Surety's obligation under this Bond shall arise as follows:
 - 4.1 Every person who has furnished labor, material or rental equipment to the Contractor or its subcontractors for the work specified in the Contract, and who has not been paid in full therefore before the expiration of a period of ninety (90) days after the date on which the last of the labor was done or performed by him or material or rental equipment was furnished or supplied by him for which such claim is made, shall have the right to sue on the payment bond for the amount, or the balance thereof, unpaid at the time of institution of such suit and to prosecute such action for the sum or sums justly due him.
 - 4.2 A remote claimant shall have a right of action on the payment bond upon giving written notice by certified or registered mail to the Contractor within ninety (90) days from the date on which such person did or performed the last of the labor or furnished or supplied the last of the material or rental equipment upon which such claim is made.
 - 4.3 Every suit instituted upon a payment bond shall be brought in a court of competent jurisdiction for the county or circuit in which the construction contract was to be performed, but no such suit shall be commenced after the expiration of one year after the day on which the last of the labor was performed or material or rental equipment was supplied by the person bringing suit.
 5. When the Claimant has satisfied the conditions of paragraph 4, the Surety shall promptly and at the Surety's expense take the following actions:
 - 5.1 Send an answer to the Claimant, with a copy to the Agency, within sixty (60) days after receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.
 - 5.2 Pay or arrange for payment of any undisputed amounts.
 - 5.3 The Surety's failure to discharge its obligations under this paragraph 5 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a claim. However, if the Surety fails to discharge its obligations under this paragraph 5, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs to recover any sums found to be due and owing to the Claimant.
 6. Amounts owed by the Agency to the Contractor under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any Performance Bond. By the Contractor furnishing and the Agency accepting this Bond, they agree that all funds earned by the contractor in the performance of the Contract are dedicated to satisfy obligations of the Contractor and the Surety under this Bond, subject to the Agency's prior right to use the funds for the completion of the Work.
 7. The Surety shall not be liable to the Agency, Claimants or others for obligations of the Contractor that are unrelated to the Contract. The Agency shall not be liable for payment of any costs or expenses of any claimant under this bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.
 8. The Surety hereby waives notice of any change, including changes of time, to the Contract or to related Subcontracts, purchase orders and other obligations.
 9. Notice to the Surety, the Agency or the Contractor shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, the Agency or the contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.
 10. By the Contractor furnishing and the Agency accepting this Bond, they agree that this Bond has been furnished to comply with the statutory requirements of the South Carolina Code of Laws, as amended, and further, that any provision in this Bond conflicting with said statutory requirements shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory Bond and not as a common law bond.
 11. Upon request of any person or entity appearing to be a potential beneficiary of this bond, the Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.
 12. Any dispute, suit, action or proceeding arising out of or relating to this Bond shall be governed by the laws of the State of South Carolina.
- 13. DEFINITIONS**
- 13.1 Claimant: An individual or entity having a direct contract with the Contractor or with a Subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Contract, architectural and engineering services required for performance of the Work of the Contractor and the Contractor's Subcontractors, and all other items for which a mechanic's lien might otherwise be asserted.
 - 13.2 Remote Claimant: A person having a direct contractual relationship with a subcontractor of the Contractor or subcontractor, but no contractual relationship expressed or implied with the Contractor.
 - 13.3 Contract: The agreement between the Agency and the Contractor identified on the signature page, including all Contract Documents and changes thereto.

SE-380

CHANGE ORDER NO.: _____

CHANGE ORDER TO CONSTRUCTION CONTRACT

AGENCY: University of South Carolina

PROJECT NAME: USC Aiken Penland Mechanical Systems Upgrades

PROJECT NUMBER: H29-9548

CONTRACTOR: _____ CONTRACT DATE: _____

This Contract is changed as follows: *(Insert description of change in space provided below)*

ADJUSTMENTS IN THE CONTRACT SUM:

1. Original Contract Sum:		\$
2. Change in Contract Sum by previously approved Change Orders:	\$	
3. Contract Sum prior to this Change Order		\$ 0.00
4. Amount of this Change Order:	\$	
5. New Contract Sum, including this Change Order:		\$ 0.00

ADJUSTMENTS IN THE CONTRACT TIME:

1. Original Substantial Completion Date:	
2. Sum of previously approved increases and decreases in Days:	Days
3. Change in Days for this Change Order	Days
4. New Substantial Completion Date:	

CONTRACTOR ACCEPTANCE:

BY: _____ Date: _____
(Signature of Representative)

Print Name: _____

ARCHITECT RECOMMENDATION FOR ACCEPTANCE:

BY: _____ Date: _____
(Signature of Representative)

Print Name: _____

AGENCY ACCEPTANCE AND CERTIFICATION:

BY: _____ Date: _____
(Signature of Representative)

Print Name: _____

- Change is within Agency Construction Procurement Certification of: \$ _____
- Change is not within Agency Construction Procurement Certification of: \$ _____

Office of the State Engineer Authorization for change exceeding Agency Construction Procurement Certification:

AUTHORIZED BY: _____ DATE: _____
(OSE Project Manager)

USC SUPPLEMENTAL GENERAL CONDITIONS
FOR CONSTRUCTION PROJECTS

WORK AREAS

1. The Contractor shall maintain the job site in a safe manner at all times. This includes (but is not limited to) the provision and/or maintenance of lighting, fencing, barricades around obstructions, and safety and directional signage.
2. Contractor's employees shall take all reasonable means not to interrupt the flow of student traffic in building corridors, lobbies, stairs and exterior walks. All necessary and reasonable safety precautions shall be taken to prevent injury to building occupants while transporting materials and equipment through the work area. Providing safe, accessible, plywood-shielded pedestrian ways around construction may be required if a suitable alternative route is not available.
3. At the beginning of the project, the USC Project Manager will establish the Contractor's lay-down area. This area will also be used for the Contractor's work vehicles. The lay-down area will be clearly identified to the contractor by the Project Manager, with a sketch or drawing provided to USC Parking Services. In turn, Parking Services will mark off this area with a sign containing the project name, Project Manager's name, Contractor name and contact number, and end date. Where this area is subject to foot traffic, protective barriers will be provided as specified by the Project Manager. The area will be maintained in a neat and orderly fashion.
4. Work vehicles parked in the lay down area (or designated parking areas) will be clearly marked and display a USC-furnished placard for identification. No personal vehicles will be allowed in this area, or in any areas surrounding the construction site. Personal vehicles must be parked in the perimeter parking lots or garages. Temporary parking permits can be obtained at the Contractor's expense at the USC Parking Office located in the Pendleton Street parking garage. Refer to the CAMPUS VEHICLE EXPECTATIONS (below) for additional information.
5. Contractor is responsible for removal of all debris from the site, and is required to provide the necessary dumpsters which will be emptied on a regular basis. Construction waste must not be placed in University dumpsters. The construction site must be thoroughly cleaned with all trash picked up and properly disposed of on a daily basis and the site must be left in a safe and sanitary condition each day. The University will inspect job sites regularly and will fine any contractor found to be in violation of this requirement an amount of up to \$1,000 per violation.
6. The Contractor shall be responsible for erosion and sediment control measures where ground disturbances are made.

PROJECT FENCING

7. All construction projects with exterior impacts shall have construction fencing at the perimeter. Fencing shall be 6' chain link with black or green privacy fabric (80-90% blockage). For fence panels with footed stands, sandbag weights shall be placed on the inside of the fence. Ripped sandbags shall be replaced immediately.
8. For projects with long fencing runs and/or high profile locations, decorative USC banners shall be used on top of privacy fabric; banners should be used at a ratio of one banner for every five fence panels. USC Project Manager will make arrangements for banner delivery for Contractor to hang.
9. The use of plastic safety fencing is discouraged and shall only be used on a temporary basis (less than four weeks) where absolutely necessary. Safety fencing shall be a neon yellow-green, high-

visibility fencing equal to 'Kryptonight' by Tenax. Safety fencing shall be erected and maintained in a neat and orderly fashion throughout the project.

10. Vehicles and all other equipment shall be contained within a fenced area if they are on site for more than 3 consecutive calendar days.

BEHAVIOR

11. Fraternalization between Contractor's employees and USC students, faculty or staff is strictly prohibited.
12. USC will not tolerate rude, abusive or degrading behavior on the job site. Heckling and cat-calling directed toward students, faculty or staff or any other person on USC property is strictly prohibited. Any contractor whose employees violate this requirement will be assessed a fine of up to \$500 per violation.
13. Contractor's employees must adhere to the University's policy of maintaining a drug-free and tobacco-free campus.

HAZARDOUS MATERIALS & SAFETY COMPLIANCE

14. A USC Permit to Work must be signed prior to any work being performed by the general contractor or sub-contractor(s).
15. The contractor will comply with all regulations set forth by OSHA and SCDHEC. Contractor must also adhere to USC's internal policies and procedures (available by request). Upon request, the contractor will submit all Safety Programs and Certificates of Insurance to the University for review.
16. Contractor must notify the University immediately upon the discovery of suspect material which may contain asbestos or other such hazardous materials. These materials must not be disturbed until approved by the USC Project Manager.
17. In the event of an OSHA inspection, the Contractor shall immediately call the Facilities Call Center, 803-777-4217, and report that an OSHA inspector is on site. An employee from USC's Safety Unit will arrive to assist in the inspection.

LANDSCAPE & TREE PROTECTION

18. In conjunction with the construction documents, the USC Arborist shall direct methods to minimize damage to campus trees. Tree protection fencing is required to protect existing trees and other landscape features to be affected by a construction project. The location of this fence will be evaluated for each situation with the USC Arborist, Landscape Architect and Project Manager. Tree protection fencing may be required along access routes as well as within the project area itself. Fence locations may have to be reset throughout the course of the project.
19. The tree protection fence shall be 6' high chain link fence with 80-90% privacy screening unless otherwise approved by USC Arborist and/or Landscape Architect. If the tree protection fence is completely within a screened jobsite fence perimeter, privacy fabric is not required. In-ground fence posts are preferred in most situations for greater protection. If utility or pavement conflicts are present, fence panels in footed stands are acceptable. See attached detail for typical tree protection fencing.
20. No entry, vehicle parking, or materials storage will be allowed inside the tree protection zone. A 4"

layer of mulch shall be placed over the tree protection area to maintain moisture in the root zone.

21. Where it is necessary to cross walks, tree root zones (i.e., under canopy) or lawns the following protective measures shall be taken:
 - a. For single loads up to 9,000 lbs., a 3/4" minimum plywood base shall be placed over 4" of mulch.
 - b. For single loads over 9,000 lbs., two layers of 3/4" plywood shall be placed over 4" of mulch.
 - c. Plywood sheets shall be replaced as they deteriorate or delaminate with exposure.
 - d. For projects requiring heavier loads, a construction entry road consisting of 10' X 16' oak logging mats on 12" coarse, chipped, hardwood base. Mulch and logging mats shall be supplemented throughout the project to keep matting structurally functional.
22. Damage to any trees during construction shall be assessed by the USC Arborist, who will stipulate what action will be taken for remediation of damage. The cost of any and all remediation will be assumed by the contractor at no additional cost to the project. Compensation for damages may be assessed up to \$500 per caliper inch of tree (up to 8") and \$500 per inch of diameter at breast height (for trees over 8").
23. Damage to trunks and limbs, as well as disturbance of the root zone under the dripline of tree, including compaction of soil, cutting or filling, or storage of materials, shall qualify as damage and subject to remediation.
24. Any damage to existing pavements or landscaping (including lawn areas and irrigation) will be remediated before final payment is made.

TEMPORARY FACILITIES

25. Contractor will be responsible for providing its own temporary toilet facilities, unless prior arrangements are made with the USC Project Manager.
26. Use of USC communications facilities (telephones, computers, etc.) by the Contractor is prohibited, unless prior arrangements are made with the USC Project Manager.

CAMPUS KEYS

27. Contractor must sign a Contractor Key Receipt/Return form before any keys are issued. Keys must be returned immediately upon the completion of the work. The Contractor will bear the cost of any re-keying necessary due to the loss of or failure to return keys.

WELDING

28. A welding (hot work) permit must be issued by the University Fire Marshall before any welding can begin inside a building. The USC Project Manager will coordinate.

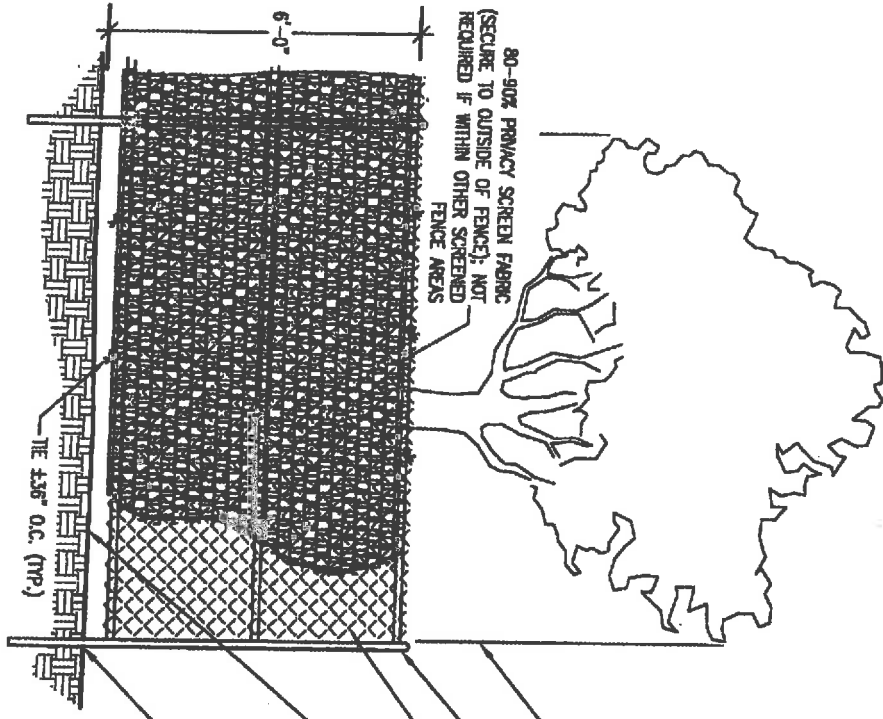
PROJECT EVALUATION & CLOSE-OUT

29. For all projects over \$100,000, including IDCs, a Contractor Performance Evaluation (SE 397) will be reviewed with the GC at the beginning of the project and a copy given to the GC. At the end of the project the form will be completed by the USC Project Manager and a Construction Performance rating will be established.
30. Contractor must provide all O&M manuals, as-built drawings, and training of USC personnel on new equipment, controls, etc. prior to Substantial Completion. Final payment will not be made until

this is completed.

CAMPUS VEHICLE EXPECTATIONS

31. Personal vehicles must be parked in the perimeter parking lots or garages. Temporary parking permits can be obtained at the Contractor's expense at the USC Parking Office located in the Pendleton Street parking garage.
32. All motorized vehicle traffic on USC walkways and landscape areas must be approved by the USC Project Manager and Parking Division, have a USC parking placard, and be parked within the approved laydown area. Violators may be subject to ticketing, towing and fines.
33. All motorized vehicles that leak or drip liquids are prohibited from traveling or parking on walks or landscaped areas.
34. Drivers of equipment or motor vehicles that damage university hardscape or landscape will be held responsible for damages and restoration expense.
35. All vehicles parked on landscape, hardscape, or in the process of service delivery, must display adequate safety devices, i.e. flashing lights, cones, signage, etc.
36. All drivers of equipment and vehicles shall be respectful of University landscape, equipment, structures, fixtures and signage.
37. All incidents of property damage shall be reported to Parking Services or the Work Management Center.



TREE PROTECTION FENCING (IN-GROUND) WITH SCREENING

- 80-90% PRIVACY SCREEN FABRIC (SECURE TO OUTSIDE OF FENCE); NOT REQUIRED IF WITHIN OTHER SCREENED FENCE AREAS
- 6'-0"
- TREE CANOPY DRIPLINE; SEE NOTE #2.
- 2" O.D. GALV. FENCEPOST
- CHAIN LINK FENCE PANEL
- PROVIDE 4' HARDWOOD MULCH AT TREE PROTECTION AREA UPON RECOMMENDATION OF USC ARBORIST
- FENCE POSTS TO BE SET INTO GROUND; MARK POST LOCATIONS FOR REVIEW AND APPROVAL BY USC ARBORIST PRIOR TO INSTALLATION. SEE NOTE #4.

NOTES:

1. PROVIDE PROTECTION FENCING FOR ALL TREES WITHIN AREA OF DISTURBANCE AND CONSTRUCTION ACCESS.
2. PROTECTION FENCING SHALL BE IN PLACE PRIOR TO BEGINNING CONSTRUCTION.
3. PROTECTION FENCING TO BE PLACED AT THE OUTSIDE OF THE CANOPY DRIPLINE, OR AT A DISTANCE OF ONE FOOT PER ONE INCH OF TREE DIAMETER, MEASURED AT BREAST HEIGHT, WHICHEVER IS LARGER, UNLESS OTHERWISE INDICATED ON LANDSCAPE PLAN OR APPROVED BY UNIVERSITY ARBORIST.
4. IN-GROUND POSTS ARE STANDARD. IF EXISTING ROOTS, UTILITIES OR PAVEMENT PRECLUDE USE OF IN-GROUND POSTS, FOOTED STANDS ARE ACCEPTABLE. SAND BAGS SHALL BE PLACED ON THE INSIDE OF FENCE.
5. DAMAGE TO ANY TREES DURING CONSTRUCTION SHALL BE ASSESSED BY UNIVERSITY ARBORIST AND THE UNIVERSITY ARBORIST SHALL STIPULATE WHAT ACTION WILL BE TAKEN FOR REMEDIATION OF DAMAGE. THE COST OF ANY AND ALL REMEDIATION WILL BE ASSUMED BY CONTRACTOR AT NO ADDITIONAL COST TO THE PROJECT.
6. DISTURBANCE OF ROOT ZONE UNDER DRIPLINE OF TREE, INCLUDING COMPACTION OF SOIL, CUTTING OR FILLING OR STORAGE OF MATERIALS SHALL QUALIFY AS DAMAGE AND SUBJECT TO REMEDIATION.

NO SCALE REVISED 8.28.14

Project Name: USC Aiken Penland Mechanical Systems Upgrades

Project Number: H29-9548

University of South Carolina

CONTRACTOR'S ONE YEAR GUARANTEE

STATE OF _____

COUNTY OF _____

WE _____
as Contractor on the above-named project, do hereby guarantee that all work executed under the requirements of the Contract Documents shall be free from defects due to faulty materials and /or workmanship for a period of one (1) year from date of acceptance of the work by the Owner and/or Architect/Engineer; and hereby agree to remedy defects due to faulty materials and/or workmanship, and pay for any damage resulting wherefrom, at no cost to the Owner, provided; however, that the following are excluded from this guarantee;

Defects or failures resulting from abuse by Owner.

Damage caused by fire, tornado, hail, hurricane, acts of God, wars, riots, or civil commotion.

[Name of Contracting Firm]

*By _____

Title _____

*Must be executed by an office of the Contracting Firm.

SWORN TO before me this _____ day of _____, 2____ (seal)

_____ State

My commission expires _____

Technical Specifications

DIVISION 15 – MECHANICAL
SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Sleeves.
4. Grout.
5. Equipment installation requirements common to equipment sections.
6. Painting and finishing.
7. Concrete bases.
8. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within cooling tower enclosures.
- F. The following are industry abbreviations for plastic materials:
1. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
1. EPDM: Ethylene-propylene-diene terpolymer rubber.
 2. NBR: Acrylonitrile-butadiene rubber.

1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified at no additional cost to owner. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.6 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 JOINING MATERIALS

- A. Refer to individual Division 15 piping Sections for special joining materials not listed below.
- B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- C. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAgl, silver alloy for refrigerant piping, unless otherwise indicated.

2.3 TRANSITION FITTINGS

- A. Plastic-to-Metal Transition Fittings: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Available Manufacturers:
 - a. Eslon Thermoplastics.

2.4 SLEEVES

- A. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

2.5 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.
- B. 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 Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.

- K. Sleeves are not required for core-drilled holes.
- L. Verify final equipment locations for roughing-in.
- M. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment. Grooved connections may also be used. Install in location such that heat exchanger heads can be removed for maintenance without disturbing additional pipe beyond the joints.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. 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.
- D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

- A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
- B. See Section 15080, *Mechanical Insulation*, for additional painting requirements.

3.6 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions, according to seismic codes at Project, and according to the Project Drawings.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. Drill and epoxy slab for placement of anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 3. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 4. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 5. Use 3000-psi, 28-day compressive-strength concrete and reinforcement if not otherwise noted.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Field Welding: Comply with AWS D1.1.

3.8 GROUTING

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Place grout on concrete bases and provide smooth bearing surface for equipment.
- E. Place grout around anchors.
- F. Cure placed grout.

END OF SECTION 15050

DIVISION 15 - MECHANICAL
SECTION 15058 - COMMON MOTOR REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 500 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.

USC-Aiken Project #H29-9548
Penland Building Mechanical System Upgrades

- C. Service Factor: 1.15.
- D. Rotor: Random-wound, squirrel cage.
- E. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- F. Temperature Rise: Class B.
- G. Insulation: Class F
- H. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- I. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 15058

DIVISION 15 - MECHANICAL
SECTION 15060 – HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Steel pipe hangers and supports.
 2. Trapeze pipe hangers.
 3. Metal framing systems.
 4. Thermal-hanger shield inserts.
 5. Fastener systems.
 6. Equipment supports.
 7. Strut framing system.
 8. Vibration isolation pad.

1.2 DEFINITIONS

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.4 SUBMITTALS

- A. Product Data: For the following:
1. Steel pipe hangers and supports.
 2. Thermal-hanger shield inserts.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
1. Trapeze pipe hangers. Include Product Data for components.
 2. Metal framing systems. Include Product Data for components.
 3. Equipment supports.
- C. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:

1. AAA Technology & Specialties Co., Inc.
2. Bergen-Power Pipe Supports.
3. B-Line Systems, Inc.; a division of Cooper Industries.
4. Carpenter & Paterson, Inc.
5. Empire Industries, Inc.
6. ERICO/Michigan Hanger Co.
7. Globe Pipe Hanger Products, Inc.
8. Grinnell Corp.
9. GS Metals Corp.
10. MIFAB
11. National Pipe Hanger Corporation.
12. PHD Manufacturing, Inc.
13. PHS Industries, Inc.
14. Piping Technology & Products, Inc.
15. Tolco Inc.

- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

1. For supports installed outdoors: hot dipped galvanized.

- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Manufacturers:
 - 1. Carpenter & Paterson, Inc.
 - 2. ERICO/Michigan Hanger Co.
 - 3. PHS Industries, Inc.
 - 4. Pipe Shields, Inc.
 - 5. Rilco Manufacturing Company, Inc.
 - 6. Value Engineered Products, Inc.
- C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with vapor barrier.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Empire Industries, Inc.
 - c. Hilti, Inc.
 - d. ITW Ramset/Red Head.
 - e. MKT Fastening, LLC.
 - f. Powers Fasteners.

2.6 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.7 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

2.8 STRUT FRAMING SYSTEM

- A. Where indicated on the drawings and noted herein, provide strut framing system from Uni-Strut, B-Line or equal.
- B. All strut framing installed outdoors shall be hot-dipped galvanized and shall have galvanize repair paint applied to any defects in the finish.

2.9 VIBRATION ISOLATION PAD

- A. Provide pad, sized for pump bases (may be constructed of multiple pads if not available in that size) equal to Mason Industries Super W Pad, constructed of Natural Rubber or Bridge-bearing Neoprene.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- B. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- C. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- D. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
 - 2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
 - 3. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
 - 4. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
 - 5. Adjustable Roller Hangers (MSS Type 43): For suspension of CHW & HW hydronic piping, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur. MSS Type 39 Saddle required.
 - 6. Adjustable Roller Hangers (MSS Type 43): For suspension of CHW & HW hydronic piping, NPS 1/2 to NPS 2, from single rod if horizontal movement caused by expansion and contraction might occur. MSS Type 40 Saddle required.
- E. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
- F. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
- G. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
 2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 4. C-Clamps (MSS Type 23): For structural shapes.
 5. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- H. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
1. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
- I. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 2. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- J. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
- K. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- L. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- M. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
- ### 3.2 HANGER AND SUPPORT INSTALLATION
- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

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- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger and shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.
- M. Insulated Piping: Comply with the following:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Insert Material: Length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 15060

DIVISION 15 - MECHANICAL
SECTION 15075 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following mechanical identification materials and their installation:

1. Equipment nameplates.
2. Equipment markers.
3. Equipment signs.
4. Pipe markers.
5. Valve tags.
6. Engraved Corrosion Resistant Metallic Sign.

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.

1. Data:
 - a. Manufacturer, product name, model number, and serial number.
 - b. Capacity, operating and power characteristics, and essential data.
 - c. Labels of tested compliances.
2. Location: Accessible and visible.
3. Fasteners: As required to mount on equipment.

B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.

1. Terminology: Match schedules as closely as possible.
2. Data:
 - a. Name and plan number.
 - b. Equipment service.
 - c. Design capacity.

- d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
- C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
 1. Data: Instructions for operation of equipment and for safety procedures.
 2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
 3. Thickness: 1/8 inch, unless otherwise indicated.
 4. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.2 PIPING IDENTIFICATION DEVICES

- A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
 1. Colors: Comply with ASU STANDARDS, unless otherwise indicated.
 2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
 3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
 4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
 5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.
- B. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.
- C. Plastic Tape: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, self-adhesive back.
 1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
 2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

2.3 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme. Provide 5/32-inch hole for fastener.
 1. Material: 0.032-inch- thick brass.
 2. Valve-Tag Fasteners: Beaded chain; or S-hook.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Division 15 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
1. Fuel-burning units, including boilers, water heaters, furnaces, heaters, stills, and absorption units.
 2. Pumps, compressors, chillers, condensers, and similar motor-driven units.
 3. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
- B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
 3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
 - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
 - b. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
 - c. Pumps, compressors, chillers, condensers, and similar motor-driven units.
 - d. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
 - e. Tanks and pressure vessels.
 - f. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

3.3 PIPING IDENTIFICATION

- A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
1. Pipes with OD, Including Insulation, Less Than 6 Inches: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, 1-1/2 inches wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.
 2. Pipes with OD, Including Insulation, 6 Inches and Larger: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 1-1/2 inches wide, lapped at least 3 inches at both ends of pipe marker, and covering full circumference of pipe.

- B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as furred wall chase and plenums; and exterior nonconcealed locations as follows:
1. Near each valve and control device.
 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 5. Near major equipment items and other points of origination and termination.
 6. Spaced at maximum intervals of 25 feet along each run.

3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems.
1. Except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units.

3.5 ADJUSTING AND CLEANING

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.
- B. Clean faces of mechanical identification devices.

3.6 ENGRAVED CORROSION RESISTANT METALLIC SIGN

- A. Provide sign at cooling tower fan CT-2, disconnect in cooling tower enclosure stating the following:
1. DO NOT OPEN DISCONNECT UNDER LOAD, EXCEPT IN EMERGENCY SITUATION. DOING SO WILL LIKELY CAUSE FAILURE OF VFD. ENSURE VFD IS DE-ENERGIZED PRIOR TO OPENING TO PREVENT DAMAGE.
- B. Sign shall be constructed of corrosion resistant metal, such as aluminum or stainless steel and shall be engraved with letters at least 1/2" tall.
- C. Securely fasten sign to front cover of disconnect.

END OF SECTION 15075

DIVISION 15 - MECHANICAL
SECTION 15080 – MECHANICAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes mechanical insulation for equipment, and pipe, including the following:

1. Insulation Materials:
 - a. Flexible elastomeric.
 - b. Mineral fiber.
2. Adhesives.
3. Mastics.
4. Sealants.
5. Factory-applied jackets.
6. Field-applied fabric-reinforcing mesh.
7. Field-applied jackets.
8. Tapes.
9. Securements.
10. Corner angles.

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 INSULATION MATERIALS

- A. Refer to Part 3 schedule articles for requirements about where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- D. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 1. Available Products:
 - a. Aeroflex USA Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
- E. Mineral-Fiber, Preformed Pipe Insulation:
 1. Available Products:
 - a. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Johns Manville; Micro-Lok.
 - c. Knauf Insulation; 1000 Pipe Insulation.
 - d. Manson Insulation Inc.; Alley-K.
 - e. Owens Corning; Fiberglas Pipe Insulation.
 2. Type I, 850° F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Cellular-Glass and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300° F.
 1. Available Products:
 - a. Childers Products, Division of ITW; CP-96.
 - b. Foster Products Corporation, H. B. Fuller Company; 81-33.
- C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 1. Available Products:
 - a. Aeroflex USA Inc.; Aero seal.

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- b. Armacell LCC; 520 Adhesive.
 - c. Foster Products Corporation, H. B. Fuller Company; 85-75.
 - d. RBX Corporation; Rubatex Contact Adhesive.
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- 1. Available Products:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
- E. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
- 1. Available Products:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
- F. PVC Jacket Adhesive: Compatible with PVC jacket.
- 1. Available Products:
 - a. Dow Chemical Company (The); 739, Dow Silicone.
 - b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Red Devil, Inc.; Celulon Ultra Clear.
 - e. Speedline Corporation; Speedline Vinyl Adhesive.

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates: Comply with MIL-C-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
- 1. Available Products:
 - a. Childers Products, Division of ITW; CP-35.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
 - c. ITW TACC, Division of Illinois Tool Works; CB-50.
 - d. Marathon Industries, Inc.; 590.
 - e. Mon-Eco Industries, Inc.; 55-40.
 - f. Vimasco Corporation; 749.
 - 2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180° F.

4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Available Joint Sealants Products:
 - a. Childers Products, Division of ITW; CP-76.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-45.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Pittsburgh Corning Corporation; Pittseal 444.
 - f. Vimasco Corporation; 750.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300° F.
5. Color: White or gray.

B. FSK and Metal Jacket Flashing Sealants:

1. Available Products:
 - a. Childers Products, Division of ITW; CP-76-8.
 - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Vimasco Corporation; 750.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250° F.
5. Color: Aluminum.

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Available Products:
 - a. Childers Products, Division of ITW; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250° F.
5. Color: White.

2.6 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with Kraft-paper backing.

- C. PVC Fitting Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled.
1. Available Products:
 - 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: By system. See details in Section 3.10.
 4. Factory-fabricated fitting if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, and mechanical joints.

2.7 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.
1. Width: 3 inches.
 2. Thickness: 11.5 mils.
 3. Adhesion: 90 ounces force/inch in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch in width.
 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and UL listed.
1. Width: 3 inches.
 2. Thickness: 6.5 mils.
 3. Adhesion: 90 ounces force/inch in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch in width.
 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.8 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.
- B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
1. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

- C. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- D. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

2.9 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application. No item to be insulated shall be below dew point temperature at time of insulation installation.

3.2 COMMON INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation with tightly butted joints free of voids and gaps. Vapor barriers shall be continuous. Before installing jacket material, install vapor-barrier system.
- C. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- D. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- E. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- F. Install multiple layers of insulation with longitudinal and end seams staggered.
- G. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- H. Keep insulation materials dry during application and finishing.
- I. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- J. Install insulation with least number of joints practical.
- K. Hangers and Anchors: Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- L. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- M. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- N. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- O. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- P. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- Q. For above ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Manholes.
 5. Handholes.
 6. Cleanouts.

3.3 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Firestopping and fire-resistive joint sealers shall be used.

3.4 PIPE INSULATION INSTALLATION

- A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Secure single-layer insulation with bands at 12-inch intervals and tighten bands without deforming insulation materials.
- C. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with 0.062-inch wire spaced at 12-inch intervals. Secure outer layer with bands at 12-inch intervals.
- D. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
- E. Cover segmented insulated surfaces with a layer of insulating cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
- F. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
- G. Label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- H. Insulation Installation on Straight Pipes and Tubes:
 - 1. Secure each layer of preformed insulation to pipe with wire or bands and tighten bands without deforming insulation materials. Orient longitudinal joints between half sections in 3 and 9 o'clock positions on the pipe.
 - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - 3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.
 - 4. For insulation with factory-applied jackets with vapor barriers, do not staple longitudinal tabs but secure tabs with additional adhesive or tape as recommended by insulation material manufacturer and seal with vapor-barrier mastic.
 - 5. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- I. Insulation Installation on Pipe Flanges:
 - 1. Install preformed pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of same insulation material and thickness as pipe insulation.
 - 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
 - 5. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

J. Insulation Installation on Pipe Fittings and Elbows:

1. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
2. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

K. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
5. Install insulation to flanges as specified for flange insulation application.

L. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

M. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

N. Special Installation Requirements for Flexible Elastomeric and Polyolefin Insulation:

1. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

2. Insulation Installation on Pipe Flanges:
 - a. Install pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 - d. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
3. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install mitered sections of pipe insulation.
 - b. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.5 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
 1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.
- B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.6 FINISHES

- A. Color: Factory applied color per Owner's Piping Color Schedule.

3.7 EQUIPMENT INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
- B. Insulate indoor equipment in paragraphs below that is not factory insulated.
- C. Chilled-water primary pumps' insulation shall be the following:
 1. Elastomeric Insulation removable for maintenance.

3.8 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.9 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. All Pipe Sizes: Insulation shall be the following:
 - a. Mineral Fiber Pipe and fitting insulation: 1 inch thick.
 - b. ASJ Jacket

B. Domestic Hot Water:

1. All Pipe Sizes: Insulation shall be the following:
 - a. Mineral Fiber Pipe and fitting insulation: 2 inch thick.
 - b. ASJ Jacket

C. Condensate and Equipment Drain Water below 60° F:

1. All Pipe Sizes: Insulation shall be the following:
 - a. Elastomeric and jacketed: 1 inch thick.

D. Chilled Water, above 40° F (including pump flexible connectors):

1. NPS 8 and Smaller: Insulation shall be the following:
 - a. Mineral Fiber Pipe and fitting insulation: 2 inch thick.
 - b. A continuous exterior vapor barrier shall be installed and seams taped with approved materials.
 - c. PVC jacketing shall be installed.
 - d. All penetrations of the ASJ and exposed ends of insulation shall be sealed with vapor barrier mastic

3.10 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. New insulated piping:
1. PVC, Color-Coded by system.
 - a. 30 mils thick applied to fittings

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- b. Chilled Water Supply – Color: Dark Blue
- c. Chilled Water Return – Color: Light Blue

END OF SECTION 15080

DIVISION 15 - MECHANICAL
SECTION 15112 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bronze ball valves.
2. Iron, single-flange butterfly valves.
3. Iron, grooved-end butterfly valves.
4. Bronze swing check valves.
5. Iron, center-guided check valves.
6. Bronze gate valves.
7. Iron gate valves.
8. Chainwheels.
9. Mud valves.

B. Related Sections:

1. Division 15 HVAC piping Sections for specialty valves applicable to those Sections only.
2. Division 15 Section "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.

1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.1 for power piping valves.
 - 3. ASME B31.9 for building services piping valves.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set angle, gate, and globe valves closed to prevent rattling.
 - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 5. Set butterfly valves closed or slightly open.
 - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to HVAC valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
 - 2. Handwheel: For valves other than quarter-turn types.
 - 3. Handlever: For quarter-turn valves NPS 6 and smaller.
 - 4. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. Gate Valves: With non-rising stem.

2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Crane Co.; Crane Valve Group; Crane Valves.
 - d. Hammond Valve.
 - e. Lance Valves; a division of Advanced Thermal Systems, Inc.
 - f. Legend Valve.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Red-White Valve Corporation.
 - j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.3 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 150 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
 - b. Bray Controls; a division of Bray International.
 - c. Conbraco Industries, Inc.; Apollo Valves.

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- d. Cooper Cameron Valves; a division of Cooper Cameron Corp.
- e. Crane Co.; Crane Valve Group; Jenkins Valves.
- f. Crane Co.; Crane Valve Group; Stockham Division.
- g. DeZurik Water Controls.
- h. Hammond Valve.
- i. Kitz Corporation.
- j. Milwaukee Valve Company.
- k. NIBCO INC.
- l. Norriseal; a Dover Corporation company.
- m. Red-White Valve Corporation.
- n. Spence Strainers International; a division of CIRCOR International.
- o. Tyco Valves & Controls; a unit of Tyco Flow Control.
- p. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 150 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Aluminum bronze.

2.4 IRON, GROOVED-END BUTTERFLY VALVES

A. 175 CWP, Iron, Grooved-End Butterfly Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kennedy Valve; a division of McWane, Inc.
 - b. Shurjoint Piping Products.
 - c. Tyco Fire Products LP; Grinnell Mechanical Products.
 - d. Victaulic Company.

2. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 175 psig.
- c. Body Material: Coated, ductile iron.
- d. Stem: Two-piece stainless steel.
- e. Disc: Coated, ductile iron.
- f. Seal: EPDM.

2.5 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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- a. American Valve, Inc.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Crane Co.; Crane Valve Group; Jenkins Valves.
- d. Crane Co.; Crane Valve Group; Stockham Division.
- e. Hammond Valve.
- f. Kitz Corporation.
- g. Milwaukee Valve Company.
- h. NIBCO INC.
- i. Powell Valves.
- j. Red-White Valve Corporation.
- k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- l. Zy-Tech Global Industries, Inc.

2. Description:

- a. Standard: MSS SP-80, Type 3.
- b. CWP Rating: 200 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: Bronze.

2.6 IRON, CENTER-GUIDED CHECK VALVES

A. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. APCO Willamette Valve and Primer Corporation.
- b. Crispin Valve.
- c. DFT Inc.
- d. Flo Fab Inc.
- e. Hammond Valve.
- f. Milwaukee Valve Company.
- g. NIBCO INC.
- h. Spence Strainers International; a division of CIRCOR International.
- i. Sure Flow Equipment Inc.
- j. Val-Matic Valve & Manufacturing Corp.

2. Description:

- a. Standard: MSS SP-125.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
- c. NPS 14 to NPS 24, CWP Rating: 150 psig.
- d. Body Material: ASTM A 126, gray iron.
- e. Style: Compact wafer.
- f. Seat: EPDM.

2.7 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Division.
 - e. Hammond Valve.
 - f. Kitz Corporation.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Powell Valves.
 - j. Red-White Valve Corporation.
 - k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - l. Zy-Tech Global Industries, Inc.

2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron, bronze, or aluminum.

2.8 IRON GATE VALVES

A. Class 125, NRS, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Flo Fab Inc.
 - e. Hammond Valve.
 - f. Kitz Corporation.
 - g. Legend Valve.
 - h. Milwaukee Valve Company.
 - i. NIBCO INC.
 - j. Powell Valves.
 - k. Red-White Valve Corporation.
 - l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - m. Zy-Tech Global Industries, Inc.

2. Description:
 - a. Standard: MSS SP-70, Type I.
 - b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
 - c. NPS 14 to NPS 24, CWP Rating: 150 psig.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.

- e. Ends: Flanged.
- f. Trim: Bronze.
- g. Disc: Solid wedge.
- h. Packing and Gasket: Asbestos free.

2.9 CHAINWHEELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Babbitt Steam Specialty Co.
 - 2. Roto Hammer Industries.
 - 3. Trumbull Industries.
- B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
 - 1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
 - 2. Attachment: For connection to butterfly valve stems.
 - 3. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve.
 - 4. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

2.10 MUD VALVES

- A. The Mud Valve shall be of the heavy duty flanged type designed to provide a positive seal under both seating and unseating head conditions. the valve shall be non-rising stem style.
- B. The frame, yoke and gate shall be sturdily proportioned for strength and rigidity and be of cast iron conforming to ASTM specifications A-126 Class B.
- C. The stem and stem nut shall be bronze. The stem shall be machined with accurately cut modified acme threads.
- D. The seat ring shall be bronze with a tapered, accurately machined seating face. The plug seat shall be a seamless molded ring of Buna-N tapered to accurately mate with the seat ring to form a positive seal.
- E. Mud valves shall be F-3075 non-rising stem design as furnished by Clow Valve Company, or Equal.
- F. Provide extended operator, operator support, and handwheel as noted on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.

- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install chainwheels on operators for butterfly and gate valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.
- F. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Center-Guided Check Valves: In horizontal or vertical position, between flanges.
 - 3. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, butterfly, or gate valves.
 - 2. Pump-Discharge Triple Duty Valves:
 - a. See Section 15181, *Hydronic Piping*.
 - 3. Chiller balancing valves:
 - a. See Section 15181, *Hydronic Piping*.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends.
 - 2. For Steel Piping, NPS 2 and Smaller: Threaded ends.

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3. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
4. For Steel Piping, NPS 5 and Larger: Flanged ends.
5. For Grooved-End Steel Piping: Valve ends may be grooved.

3.5 CHILLED-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Ball Valves: Two piece, full port, bronze with bronze trim.
2. Bronze Swing Check Valves: Class 125, bronze disc.
3. Bronze Gate Valves: Class 125, NRS, bronze.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12: 200 CWP, EPDM seat, aluminum-bronze disc.
3. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 12: 175 CWP.
4. Iron Gate Valves: Class 125, NRS.

3.6 CONDENSER-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, full port, bronze with bronze trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.
4. Bronze Gate Valves: Class 125, NRS.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12: 200 CWP, EPDM seat, aluminum-bronze disc.
3. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 12: 175 CWP.
4. Iron, Center-Guided Check Valves, NPS 2-1/2 to NPS 24: Class 125, resilient seat.
5. Iron Gate Valves: Class 125, NRS.

END OF SECTION 15112

DIVISION 15 - MECHANICAL
SECTION 15122 - METERS AND GAGES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following meters and gages for mechanical systems:

1. Thermometers.
2. Gages.

B. Related Sections include the following:

1. Section 15181, Hydronic Piping

1.2 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.3 SUBMITTALS

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

B. Shop Drawings: Schedule for thermometers, gages, and test plugs indicating manufacturer's number, scale range, and location for each.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

B. Available Manufacturers:

1. AMETEK, Inc.; U.S. Gauge Div.
2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
3. Ernst Gage Co.
4. Marsh Bellofram.
5. Miljoco Corp.
6. NANMAC Corporation.
7. Noshok, Inc.

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8. Palmer - Wahl Instruments Inc.
9. REO TEMP Instrument Corporation.
10. Tel-Tru Manufacturing Company.
11. Trerice, H. O. Co.
12. Weiss Instruments, Inc.
13. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
14. WIKA Instrument Corporation.
15. Winters Instruments.

2.2 THERMOMETERS

A. General

1. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

B. Scale Ranges: Temperature ranges for services:

1. Chilled Water: 0 to 100° F, with 2° scale divisions.
2. Condenser Water: 0 to 150° F, with 3° scale divisions.

2.3 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS

A. Case: Die-cast aluminum in baked-epoxy enamel, ASTM E1, spring secured, 9 inches long.

B. Tube: Red or blue reading, organic-liquid filled, with magnifying lens.

C. Tube Background: Satin-faced, non-reflective aluminum with permanently etched scale markings.

D. Window: Glass.

E. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

F. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.

G. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range

2.4 THERMOWELLS

A. Manufacturers: Same as manufacturer of thermometer being used.

B. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

C. Material:

1. Brass, for use with copper piping.
2. Stainless Steel, for use in steel piping.

- D. Extension-Neck Length: Nominal thickness of 2 inches, but not less than thickness of insulation.
- E. Insertion length: To extend 2 inches into pipe, but not more than one-third of pipe diameter.
- F. Cap: Threaded, with chain permanently fastened to socket.
- G. Heat-Transfer Fluid: Oil or graphite.

2.5 PRESSURE GAGES

- A. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.
 - 1. Case: Dry, unless Liquid-filled type is indicated, drawn steel or cast aluminum, 4-1/2-inch diameter. Stainless steel case shall be provided for outdoor installations.
 - 2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
 - 3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
 - 4. Movement: Mechanical, with link to pressure element and connection to pointer.
 - 5. Dial: Satin-faced, non-reflective aluminum with permanently etched scale markings.
 - 6. Pointer: Red metal.
 - 7. Window: Glass.
 - 8. Ring: Metal.
 - 9. Accuracy: Grade C, plus or minus 3 percent of middle half scale.
 - 10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
 - 11. Range for Fluids under Pressure: Two times operating pressure.
- B. Pressure-Gage Fittings:
 - 1. Valves: NPS 1/4 brass or stainless-steel needle type.
 - 2. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install meters, gages, and accessories according to manufacturer's written instructions for applications where used.

3.2 THERMOMETER APPLICATIONS

- A. Install thermometers and adjust vertical and tilted positions.
- B. Install liquid-in-glass thermometers in the following locations:
 - 1. Chiller #2:
 - a. Chilled water inlet and outlet.
 - b. Condenser water inlet and outlet.
 - c. Where shown on drawings.

3.3 GAGE APPLICATIONS

- A. Install liquid-filled-case-type pressure gages at the following locations:
 - 1. Chilled water pumps:
 - a. Suction diffuser inlet.
 - b. Pump Suction.
 - c. Pump Discharge.
 - 2. Cooling tower pumps:
 - a. Pump Discharge.
 - 3. Where shown on drawings.

3.4 INSTALLATIONS

- A. Install direct-mounting thermometers and adjust vertical and tilted positions.
- B. Install thermowells with socket extending a minimum of 2 inches into fluid but not more than one-third of diameter of pipe and in vertical position in piping tees where thermometers are indicated.
- C. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.
- D. Install needle-valve and snubber fitting in piping for each pressure gage for fluids (except steam).

3.5 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.
- B. Ground equipment according to Division 16 Section "Grounding and Bonding."

3.6 ADJUSTING

- A. Calibrate meters according to manufacturer's written instructions, after installation.
- B. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION 15122

DIVISION 15 - MECHANICAL
SECTION 15181 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. This Section includes piping, special-duty valves, and hydronic specialties for chilled-water cooling and condenser water systems.
- B. Related Sections include the following:
1. List below only products, construction, and equipment that the reader might expect to find in this Section but are specified elsewhere.
 2. Division 15 Section "Basic Mechanical Materials and Methods" for general piping materials and installation requirements.
 3. Division 15 Section "Hangers and Supports" for pipe supports, product descriptions, and installation requirements. Hanger and support spacing is specified in this Section.
 4. Division 15 Section "General-Duty Valves for HVAC Piping" for general-duty gate, globe, ball, butterfly, and check valves.
 5. Division 15 Section "Meters and Gages" for thermometers and pressure gages.
 6. Retain first subparagraph below if Specification in Division 15 Section "Basic Mechanical Materials and Methods" is insufficient for this Project.
 7. Division 15 Section "Mechanical Identification" for labeling and identifying hydronic piping.
 8. Division 15 Section "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.
 9. Division 15 Section "HVAC Instrumentation and Controls" for temperature-control valves and sensors.
 10. Division 15 Section "HVAC Water Treatment" for water treatment requirements.

1.3 SUBMITTALS

- A. Product Data: For each type of special-duty valve indicated. Include flow and pressure drop curves based on manufacturer's testing for diverting fittings, calibrated balancing valves, and automatic flow-control valves.
- B. Shop Drawings: Detail fabrication of pipe anchors, hangers, special pipe support assemblies, alignment guides, expansion joints and loops, and their attachment to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
- C. Welding Certificates: Copies of certificates for welding procedures and personnel.
- D. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:
1. Test procedures used.
 2. Test results that comply with requirements.

3. Failed test results and corrective action taken to achieve requirements.
- E. Maintenance Data: For hydronic specialties and special-duty valves to include in maintenance manuals specified in Division 1.
- 1.4 QUALITY ASSURANCE
- A. Welding: Qualify processes and operators according to the ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- 1.5 COORDINATION
- A. Coordinate layout and installation of hydronic piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.
- B. Coordinate pipe fitting pressure classes with products specified in related Sections.
- C. Coordinate size and location of concrete bases. Drill and epoxy anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods." Additional instructions are shown on drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

2.2 PIPING MATERIALS

A. Copper Tube And Fittings

1. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
2. Wrought-Copper Fittings: ASME B16.22.
3. Wrought-Copper Unions: ASME B16.22.
4. Solder Filler Metals: ASTM B 32, 95-5 tin antimony.
5. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (silver).

B. Steel Pipe And Fittings

1. Steel Pipe, NPS 2-1/2 through NPS 12: ASTM A 53, Type E (electric-resistance welded), Grade B, Schedule 40, black steel, plain ends.
2. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.
3. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.
 - b. End Connections: Butt welding.
 - c. Facings: Raised face.

4. Grooved Mechanical-Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47, Grade 32510 malleable iron; ASTM A 53, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders designed to accept grooved end couplings.
5. Grooved Mechanical-Joint Couplings: Ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
6. Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150-psig minimum working pressure and 250 deg F maximum operating temperature. Connectors shall have flanged or threaded-end connections to match equipment connected and shall be capable of 3/4-inch misalignment.
7. Welding Materials: Comply with Section II, Part C, of the ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.
8. Gasket Material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures.

2.3 VALVES

A. Gate, check, ball, and butterfly valves are specified in Division 15 Section "Valves."

B. Circuit Setter Valves

1. Valves shall have pre-set balance feature: Valves shall be designed to allow installing contractor to pre-set balance points for proportional system balance prior to system start-up in accordance with the project schedules.
2. Valves 1/2" to 3" pipe size, NPT
 - a. Valve Design and Construction:
 - 1) Valves shall be of bronze body/brass ball construction with glass and carbon filled TFE seat rings.
 - 2) Valves shall have differential pressure read-out ports across valve seat area. Read-out ports shall be fitted with internal EPT insert and check valve.
 - 3) Valve bodies shall have 1/4" NPT tapped drain/purge port.
 - 4) Valves shall have memory stop feature to allow valve to be closed for service and then reopened to set point without disturbing balance position.
 - 5) All valves shall have calibrated nameplate to assure specific valve setting.
 - 6) Valves shall be leak-tight at full rated working pressure.
 - b. Design Pressure and Temperature:
 - 1) 300 psig at 250° F.
3. Valves 4" to 12" pipe size, Flanged or Grooved
 - a. Valve Design and Construction:
 - 1) Valves shall be heavy-duty cast iron (flanged models) or ductile iron (grooved models) construction with 125 ANSI flanged connections or standard cut groove connections respectively. Connections shall be designed for use up to 175 psi working pressure.
 - 2) Valves shall be fitted with a bronze seat, replaceable bronze disc with EPDM seal insert, and stainless steel stem.

- 3) Valves shall have memory stop feature to allow valve to be closed for service and then reopened to setpoint without disturbing balance position.
 - 4) All valves shall have calibrated nameplate to assure specific valve settings.
 - 5) Valves shall be leak-tight at full rated working pressure.
- b. Design Pressure and Temperature:
- 1) 175 psig at 250° F.
4. Manufacturers:
- a. ITT Bell & Gossett
 - b. Armstrong
 - c. Taco
- C. Triple Duty Valves
1. Provide straight pattern single valves designed to perform the functions of a center guided non-slam check valve, shutoff valve and calibrated balancing valve.
 2. The valves shall be of heavy-duty cast iron (flanged valves) or ductile iron (grooved valves) construction.
 - a. Flanged valves shall have 125 psi ANSI flanged connections suitable for 175 psi working pressure for operating temperatures up to 250° F.
 - b. Grooved valves shall have standard cut groove connections suitable for working pressures up to 300 psi for operating temperatures up to 250° F.
 3. The valve shall be fitted with a bronze seat, replaceable bronze disc with EPDM seat insert, stainless steel stem, and chatter preventing stainless steel spring.
 4. The valve design shall permit repacking under full system pressure.
 5. Cv rating shall be provided at every 10% increment opening for the valve.
 6. Manufacturer shall supply the Cv rating for read-out of flow determination and system pressure drop.
 7. The valve shall be equipped with brass readout valves (with integral check valve) to facilitate taking differential pressure readings across the orifice for accurate system balance.
 8. Manufacturers:
 - a. ITT Bell & Gossett
 - b. Armstrong
 - c. Taco

2.4 HYDRONIC SPECIALTIES

- A. Bypass Chemical Feeder.
- B. Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150-psig minimum working pressure and 250 deg F maximum operating temperature. Connectors shall have flanged- or threaded-end connections to match equipment connected and shall be capable of 3/4-inch misalignment.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Chilled-water piping, aboveground, NPS 2 and smaller, shall be the following:
 - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.
- B. Chilled-water piping, aboveground, NPS 2-1/2 and larger, shall be of the following:
 - 1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded joints.
- C. Condenser-water piping, aboveground, NPS 2 and smaller, shall be the following:
 - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.
- D. Condenser-water piping, aboveground, NPS 2-1/2 and larger, shall be of the following:
 - 1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded joints.
- E. Makeup-water piping installed aboveground shall be the following:
 - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.

3.2 VALVE APPLICATIONS

- A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.
- B. Install shutoff-duty valves at each branch connection to return main.
- C. Install calibrated-orifice, balancing valves in the return pipes of chiller.
- D. Install triple duty valves at each chilled water pump discharge
- E. Install check valves at each condenser water pump discharge and elsewhere as required to control flow direction.

3.3 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated piping locations and arrangements were used to size pipe and calculate friction loss, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

- D. Install piping to permit valve servicing.
- E. Install piping free of sags and bends.
- F. Install fittings for changes in direction and branch connections.
- G. Install piping to allow application of insulation.
- H. Select system components with pressure rating equal to or greater than system operating pressure.
- I. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- J. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- K. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- L. Install valves according to Division 15 Section "Valves."
- M. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- N. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- O. Install strainers on inlet side of each chilled water pump (see Division 15 Section "Hydronic Pumps" for Suction Diffusers with integral strainers). Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger.
- P. Identify piping as specified in Division 15 Section "Mechanical Identification."

3.4 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor devices are specified in Division 15 Section "Hangers and Supports." Comply with the following requirements for maximum spacing of supports.

3.5 PIPE JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

- G. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. PVC Pressure Piping: Join ASTM D 1785 schedule number, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule number PVC pipe and socket fittings according to ASTM D 2855.
- H. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.

3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Circuit Setter Valves:

- 1. Install the following minimum lengths of unrestricted straight pipe adjacent to the valves:
 - a. Valves 1/2" to 3":
 - 1) Three pipe diameters upstream and one pipe diameter downstream.
 - b. Valves 4" to 12":
 - 1) Five pipe diameters upstream and two pipe diameters downstream.

3.7 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

- 1. Leave joints, including welds, un-insulated and exposed for examination during test.
- 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
- 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
- 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
- 5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- 6. Tests need only be performed on new piping installed by this project.

B. Perform the following tests on hydronic piping:

- 1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
- 2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
- 3. Isolate expansion tanks and determine that hydronic system is full of water.
- 4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."

5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure, if required.
4. Inspect air vents at high points of system and bleed air completely.
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as chillers and cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

3.8 ADJUSTING

- A. Mark calibrated nameplates of triple duty valves and circuit setters after hydronic system balancing has been completed, to permanently indicate final balanced position.

3.9 CLEANING

- A. Flush hydronic piping systems with clean water. Remove and clean or replace strainer screens. After cleaning and flushing hydronic piping systems, but before balancing, remove disposable fine-mesh strainers in pump suction diffusers.

END OF SECTION 15181

DIVISION 15 - MECHANICAL
SECTION 15185 - HYDRONIC PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Base-mounted, end-suction centrifugal pumps.
2. Pump Suction Diffusers.

1.3 DEFINITIONS

- A. Buna-N: Nitrile rubber.
- B. EPT: Ethylene propylene terpolymer.

1.4 SUBMITTALS

- A. Product Data: For each type of pump. Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.
- B. Shop Drawings: For each pump.
 1. Show pump layout and connections.
 2. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.
 3. Include diagrams for power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For pumps to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Equipment provider shall be responsible for providing certified equipment start-up. New pump start-up shall be for the purpose of determining pump alignment, lubrication, voltage, and amperage readings. All proper electrical connections, pump's balance, discharge and suction gauge readings, and adjustment of head, if required. A copy of the start-up report shall be made and sent to both the contractor and to the Engineer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the site in such a manner as to protect the materials from shipping and handling damage. Provide materials on factory provided shipping skids and lifting lugs if required for handling. Materials potentially damaged by the elements should be packaged in such a manner that they can withstand short-term exposure to the elements during transportation.
- B. Store materials in clean, dry place and protect from weather and construction traffic. Handle carefully to avoid damage.
- C. Use all means necessary to protect equipment before, during, and after installation.
- D. All scratched, dented, and otherwise damaged units shall be repaired or replaced as directed by the Engineer.

PART 2 - PRODUCTS

2.1 BASE-MOUNTED, END-SUCTION, CENTRIFUGAL PUMPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Armstrong Pumps, Inc.
 - 2. TACO Incorporated.
 - 3. Approved equal prior to bid.
- C. Performance:
 - 1. Pumps shall meet types, sizes, capacities, and characteristics as scheduled on the drawings.
 - 2. Pumps shall be provided with connection sizes equal to those scheduled. Pump connections shall not be downsized.
 - 3. Pumps shall not be provided at efficiencies less than those scheduled.
- D. Description: Factory-assembled and -tested, centrifugal, impeller-between-bearings, separately coupled, double-suction pump as defined in HI 1.1-1.2 and HI 1.3; designed for base mounting, with pump and motor shafts horizontal.
 - 1. The pumps shall be base mounted, single stage, end suction, in cast iron bronze fitted construction specifically designed for quiet operation. Suitable for standard operations at 300° F and 175 PSIG working pressure. Working pressures shall not be de-rated at temperatures up to 300° F.
 - 2. Pump and motors shall be factory aligned, and shall be realigned after installation by the manufacturer's representative.
 - 3. Each pump shall be hydrostatically tested and painted with one coat of high quality factory approved paint and name-plated before shipment from the factory.
 - 4. Pumps shall be provided with stainless steel drip pan on the base
- E. Pump Construction:
 - 1. Casing: Pump volute shall be of a cast iron ASTM A159 material (35,000 psi) design with an integrally cast pump discharge and an integrally cast pump suction. Flanges shall be extra heavy-duty design and will be of 250# thickness while capable of being drilled for 125# ANSI flat face

- use. Volute shall have integrally cast support feet, gauge ports at nozzles, and vent and drain ports. Pumps shall be provided with internal bronze casing wear rings
2. Impeller: Impeller shall be of the enclosed end suction type made of low zinc silicon brass, both hydraulically and dynamically balanced to ISO 1940-1:2003 balance grade G6.3 and keyed to the shaft.
 3. Pump Shaft: The impeller shaft shall be of solid 1045 steel with 304 SS sleeves covering the wetted area of the shaft.
 4. Seal: Pump shall be equipped with internally flushed unitized mechanical seal assemblies, mounted on 304SS sleeves, installed in enlarged tapered seal chambers. Application of an internally flushed mechanical seal shall be adequate for seal flushing without requiring external flushing lines. Mechanical seal assemblies shall be unitized, single spring, EPR elastomer bellows with drive ring, Carbon face rotating against a stationary Silicon Carbide face allowing for fast and easy installation and replacement. Seals shall be capable of being inspected and easily repaired.
 5. Pump Bearings: heavy-duty single row permanently lubricated ball bearings, with provision for purging or flushing if desired. Polyurea grease, capable of handling both high and low temperatures and that is resistant to washout and condensation shall be provided. The bearings shall be capable of absorbing both radial and thrust loads and maintaining the rotating element in proper axial alignment. Bearings shall be capable of being inspected and repaired by removal of only a bearing bracket.
- F. Shaft Coupling: Coupling capable of absorbing torsional vibration and of operating in variable speed applications, shall be employed between the pump and motor. A Spacer Coupler shall be provided, and allow for removal of pump's wetted end without disturbing pump volute or movement of the pump's motor and electrical connections.
- G. Coupling Guard: An ANSI B15.1 and OSHA 1910.219 compliant coupling guard shall shield the coupler during operation. Coupler guard shall be dual designed and contain viewing windows for inspection of the coupling. No more than .25 inch opening in the guard around the rotating assembly shall be visible..
- H. Mounting Frame: Base plate shall be welded structural steel fully enclosed at sides and ends, with securely welded cross members. The minimum base plate stiffness shall conform to ANSI/HI 1.3-2000, section 1.3.5.3 for Horizontal Base Plate Design standards.
- I. Motor: Motors shall be non-overloading at any point on the pump curve and shall meet NEMA specifications and conform to the standards outlined in EPACKT 92.
1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 15 Section "Common Motor Requirements for HVAC Equipment."
 - a. Enclosure: Open, dripproof.

2.2 PUMP SPECIALTY FITTINGS

A. Suction Diffuser:

1. Straight pattern.
2. 175-psig pressure rating, cast or ductile-iron body and end cap, pump-inlet fitting.
3. Disposable 16-mesh bronze startup strainer and bronze permanent strainer with 3/16" diameter openings. Permanent strainer shall be designed to withstand pressure differential equal to pump shutoff head and shall have a free area equal to five times the cross sectional area of the pump suction opening.

4. Bronze or stainless-steel straightening vanes that run the full length of the diffuser. Vane length shall be no less than 2-1/2 times the pump connection diameter.
 5. Drain plug.
 6. Factory-fabricated support.
 7. Diffuser manufacturer shall be responsible for any reduction in pump performance or damage due to high pressure drops, internal failures of components or harmonic oscillations caused by the diffuser.
- B. Triple-Duty Valve:
1. See Division 15 Section, *Hydronic Piping*.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PUMP INSTALLATION

- A. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories.
- B. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
- C. Equipment Mounting: Install base-mounted pumps on cast-in-place concrete equipment bases. Comply with requirements for equipment bases specified in Division 15 Section *Basic Mechanical Materials and Methods*, and as shown on Drawings.
 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
- D. Equipment Mounting: Install base-mounted pumps on cast-in-place concrete equipment base(s) using elastomeric pads. Comply with requirements for equipment bases specified in Division 15 Section *Basic Mechanical Materials and Methods*, and as shown on Drawings. Comply with requirements for vibration isolation devices specified in Division 15 Section *Hangers and Supports*.

3.3 ALIGNMENT

- A. Engage a factory-authorized service representative to perform alignment service.
- B. Comply with requirements in Hydronics Institute standards for alignment of pump and motor shaft. Add shims to the motor feet and bolt motor to base frame. Do not use grout between motor feet and base frame.

- C. Comply with pump and coupling manufacturers' written instructions.
- D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with non-shrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.4 CONNECTIONS

- A. Comply with requirements for piping specified in Division 15 Section *Hydronic Piping*. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to pump, allow space for service and maintenance.
- C. Connect piping to pumps. Install valves that are size as noted on the drawings.
- D. Install suction and discharge pipe sizes equal to or greater than those shown on drawings.
- E. Install triple-duty valve on discharge side of pumps.
- F. Install suction diffuser and shutoff valve on suction side of pumps.
- G. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.
- H. Install pressure gages as shown on drawings.
- I. Install check valve and gate or ball valve on each condensate pump unit discharge.
- J. Ground equipment according to Division 16.
- K. Connect wiring according to Division 16.

3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Check piping connections for tightness.
 - 3. Clean strainers on suction piping.
 - 4. Perform the following startup checks for each pump before starting:
 - a. Verify bearing lubrication.
 - b. Verify that pump is free to rotate by hand. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
 - c. Verify that pump is rotating in the correct direction.
 - 5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
 - 6. Start motor.
 - 7. Open discharge valve slowly.

END OF SECTION 15185

DIVISION 15 - MECHANICAL
SECTION 15189 - HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following chilled water-treatment systems (see cooling tower cleaning note on drawings for all other water chemistry requirements):
1. Chemical treatment test equipment.
 2. HVAC water-treatment chemicals.

1.3 DEFINITIONS

- A. TDS: Total dissolved solids.

1.4 PERFORMANCE REQUIREMENTS

- A. Water quality for Chilled Water systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.
- B. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.
- C. Chilled water system, shall have the following water qualities:
1. pH: Maintain a value within 9.0 to 10.5.
 2. "P" Alkalinity: Maintain a value within 100 to 500 ppm.
 3. Boron: Maintain a value within 100 to 200 ppm.
 4. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
 5. Soluble Copper: Maintain a maximum value of 0.20 ppm.
 6. TDS: Maintain a maximum value of 10 ppm.
 7. Ammonia: Maintain a maximum value of 20 ppm.
 8. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.

1.5 SUBMITTALS

- A. **Product Data:** Include rated capacities, operating characteristics, furnished specialties, and accessories for the following products:
 - 1. Chemical test equipment.
 - 2. Chemical material safety data sheets.
- B. **Other Informational Submittals:**
 - 1. **Water-Treatment Program:** Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in the "Performance Requirements" Article above.
 - 2. **Water Analysis:** Illustrate water quality available at Project site.

1.6 QUALITY ASSURANCE

- A. **Water-Treatment Service Provider Qualifications:** Contractor shall have a Certified Water Technologist (CWT) on staff. A copy of this certification shall be submitted with the bid. HVAC water-treatment service provider capable of analyzing water qualities, and applying water treatment as specified in this Section.

1.7 MAINTENANCE SERVICE

- A. **Scope of Maintenance Service:** Provide chemicals and service program to maintain water conditions required above to inhibit corrosion, scale formation, and biological growth for chilled-water piping and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion, and shall include the following:
 - 1. Initial water analysis and HVAC water-treatment recommendations.
 - 2. Startup assistance for Contractor to flush the systems, clean with detergents, and initially fill systems with required chemical treatment prior to operation.
 - 3. Periodic field service and consultation.
 - 4. Customer report charts and log sheets.
 - 5. Laboratory technical analysis.
 - 6. Analyses and reports of all chemical items concerning safety and compliance with government regulations.

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. Ampion Corp.
 - 2. Anderson Chemical Co, Inc.
 - 3. Aqua-Chem, Inc.; Cleaver-Brooks Div.
 - 4. Barclay Chemical Co.; Water Management, Inc.
 - 5. Boland Trane Services
 - 6. GE Betz.

7. GE Osmonics.
8. H-O-H Chemicals, Inc.
9. Metro Group. Inc. (The); Metropolitan Refining Div.
10. ONDEO Nalco Company.
11. Watcon, Inc.

2.2 CHEMICAL TREATMENT TEST EQUIPMENT

- A. Test Kit: Manufacturer-recommended equipment and chemicals in a wall-mounting cabinet for testing pH, TDS, inhibitor, chloride, alkalinity, and hardness.

2.3 CHEMICALS

- A. Chemicals shall be as recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment, and that can attain water quality specified in Part 1 "Performance Requirements" Article.

PART 3 - EXECUTION

3.1 WATER ANALYSIS

- A. Perform an analysis of supply water to determine quality of water available at Project site.

3.2 INSTALLATION

- A. Install water testing equipment on wall near water chemical application equipment.
- B. Bypass Feeders: See Division 15 Section, *Hydronic Piping*:
 1. Install a gate or full-port ball isolation valves on inlet, outlet, and drain below feeder inlet.
 2. Install a swing check on inlet after the isolation valve.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Connect wiring according to Division 16 Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 1. Manufacturer's Field Service: Engage a factory-authorized service representative to assist in testing.

B. Tests and Inspections:

1. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
2. Test chilled water system water.
3. Add chemicals to correct any deficiencies in water chemistry.
4. Maintain chilled water system chemistry within specified allowances.

C. Comply with ASTM D 3370 and with the following standards:

1. Silica: ASTM D 859.
2. Acidity and Alkalinity: ASTM D 1067.
3. Iron: ASTM D 1068.
4. Water Hardness: ASTM D 1126.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to test water and maintain HVAC water chemistry.

END OF SECTION 15189

DIVISION 15 - MECHANICAL
SECTION 15269 - VARIABLE FREQUENCY CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section includes separately enclosed, pre-assembled, combination VFCs, rated 600 V and less, for speed control of three-phase, squirrel-cage induction motors.
- B. Related Sections:
 - 1. Division 15 Section "Common Motor Requirements"
 - 2. Division 15 Section "Mechanical Identification"
 - 3. Division 15 Section "Hydronic Pumps"

1.3 DEFINITIONS

- A. BAS: Building automation system.
- B. CE: Conformance Europeene (European Compliance).
- C. CPT: Control power transformer.
- D. EMI: Electromagnetic interference.
- E. IGBT: Insulated-gate bipolar transistor.
- F. LAN: Local area network.
- G. LED: Light-emitting diode.
- H. MCP: Motor-circuit protector.
- I. NC: Normally closed.
- J. NO: Normally open.
- K. OCPD: Overcurrent protective device.
- L. PCC: Point of common coupling.
- M. PID: Control action, proportional plus integral plus derivative.

- N. PWM: Pulse-width modulated.
- O. RFI: Radio-frequency interference.
- P. TDD: Total demand (harmonic current) distortion.
- Q. THD(V): Total harmonic voltage demand.
- R. VFC: Variable-frequency motor controller.

1.4 ACTION SUBMITTALS

- A. **Product Data:** For each type and rating of VFC indicated. Include features, performance, electrical ratings, operating characteristics, shipping and operating weights, and furnished specialties and accessories.
- B. **Shop Drawings:** For each VFC indicated. Include dimensioned plans, elevations, and sections; and conduit entry locations and sizes, mounting arrangements, and details, including required clearances and service space around equipment.
 - 1. **Show tabulations of installed devices, equipment features, and ratings. Include the following:**
 - a. Each installed unit's type and details.
 - b. Factory-installed devices.
 - c. Enclosure types and details.
 - d. Nameplate legends.
 - e. Short-circuit current (withstand) rating of enclosed unit.
 - f. Features, characteristics, ratings, and factory settings of each VFC and installed devices.
 - 2. **Schematic and Connection Wiring Diagrams:** For power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

- A. **Operation and Maintenance Data:** For VFCs to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting thermal-magnetic circuit breaker and MCP trip settings.
 - 2. Manufacturer's written instructions for setting field-adjustable overload relays.
 - 3. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
 - 4. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.

1.6 QUALITY ASSURANCE

- A. **Electrical Components, Devices, and Accessories:** Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. **Comply with NFPA 70.**

1.7 DELIVERY, STORAGE, AND HANDLING

- A. If stored in space that is not permanently enclosed and air conditioned, remove loose packing and flammable materials from inside controllers and install temporary electric heating, with at least 250 W per controller.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation, capable of driving full load without derating, under the following conditions unless otherwise indicated:
1. Ambient Temperature: Not less than 14 deg F and not exceeding 104 deg F.
 2. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F
 3. Humidity: Less than 95 percent (noncondensing).
 4. Altitude: Not exceeding 3300 feet.
- B. Product Selection for Restricted Space: VFCs shall be of similar width and depth to those scaled from the drawings. Maintain clearances between VFCs and from other adjacent equipment per the manufacturer's instructions and the N.E.C. Provide Slim-Line units.

1.9 COORDINATION

- A. Coordinate features of motors, load characteristics, installed units, and accessory devices to be compatible with the following:
1. Torque, speed, and horsepower requirements of the load.
 2. Ratings and characteristics of supply circuit and required control sequence.
 3. Ambient and environmental conditions of installation location.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace VFCs that fail in materials or workmanship within specified warranty period.
1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ABB.
 2. Danfoss Inc.; Danfoss Drives Div.
 3. Yaskawa America, Inc.
 4. Approved equal prior to bid.
- B. General Requirements for VFCs: Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508C.

- C. Application: variable torque.
- D. VFC Description: Variable-frequency power converter (rectifier, dc bus, and IGBT, PWM inverter) factory packaged in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.
 - 1. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."
 - 2. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.
- E. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.
- F. Output Rating: Three-phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range; maximum voltage equals input voltage.
- G. Unit Operating Requirements:
 - 1. Input AC Voltage Tolerance: Plus 10 and minus 10 percent of VFC input voltage rating.
 - 2. Input AC Voltage Unbalance: Not exceeding 3 percent.
 - 3. Input Frequency Tolerance: Plus or minus 3 percent of VFC frequency rating.
 - 4. Minimum Efficiency: 97 percent at 60 Hz, full load.
 - 5. Minimum Displacement Primary-Side Power Factor: 96 percent under any load or speed condition.
 - 6. Minimum Short-Circuit Current (Withstand) Rating: 22 kA.
 - 7. Ambient Temperature Rating: Not less than 14 deg F and not exceeding 104 deg F.
 - 8. Ambient Storage Temperature Rating: Not less than minus 4 deg F and not exceeding 140 deg F
 - 9. Humidity Rating: Less than 95 percent (noncondensing).
 - 10. Altitude Rating: Not exceeding 3300 feet.
 - 11. Overload Capability: 1.1 times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
 - 12. Starting Torque: Minimum 100 percent of rated torque from 3 to 60 Hz.
 - 13. Speed Regulation: Plus or minus 5 percent.
 - 14. Output Carrier Frequency: Selectable; 0.5 to 15 kHz.
 - 15. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.
- H. Inverter Logic: Microprocessor based, 16 bit, isolated from all power circuits.
- I. Isolated Control Interface: Allows VFCs to follow remote-control signal over a minimum 40:1 speed range.
 - 1. Signal: Electrical.
- J. Internal Adjustability Capabilities:
 - 1. Minimum Speed: 5 to 25 percent of maximum rpm.
 - 2. Maximum Speed: 80 to 100 percent of maximum rpm.
 - 3. Acceleration: 0.1 to 999.9 seconds.
 - 4. Deceleration: 0.1 to 999.9 seconds.
 - 5. Current Limit: 30 to minimum of 150 percent of maximum rating.
- K. Self-Protection and Reliability Features:

1. Input transient protection by means of surge suppressors to provide three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
 2. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
 3. Under- and overvoltage trips.
 4. Inverter overcurrent trips.
 5. VFC and Motor Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFCs and motor thermal characteristics, and for providing VFC overtemperature and motor overload alarm and trip; settings selectable via the keypad; NRTL approved.
 6. Critical frequency rejection, with three selectable, adjustable deadbands.
 7. Instantaneous line-to-line and line-to-ground overcurrent trips.
 8. Loss-of-phase protection.
 9. Reverse-phase protection.
 10. Short-circuit protection.
 11. Motor overtemperature fault.
- L. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.
- M. Bidirectional Autospeed Search: Capable of starting VFC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.
- N. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
- O. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
- P. Integral Input Disconnecting Means and OCPD: NEMA AB 1, instantaneous-trip circuit breaker with pad-lockable, door-mounted handle mechanism.
1. Disconnect Rating: Not less than 115 percent of NFPA 70 motor full-load current rating or VFC input current rating, whichever is larger.
 2. Auxiliary Contacts: NO/NC, arranged to activate before switch blades open.
 3. Auxiliary contacts "a" and "b" arranged to activate with circuit-breaker handle.
 4. NC alarm contact that operates only when circuit breaker has tripped.

2.2 CONTROLS AND INDICATION

- A. Status Lights: Door-mounted LED indicators displaying the following conditions:
1. Power on.
 2. Run.
 3. Overvoltage.
 4. Line fault.
 5. Overcurrent.
 6. External fault.
- B. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.

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1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.
 2. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service.
 - a. Control Authority: Supports at least four conditions: Off, local manual control at VFC, local automatic control at VFC, and automatic control through a remote source.
- C. Historical Logging Information and Displays:
1. Running log of total power versus time.
 2. Total run time.
 3. Fault log, maintaining last four faults with time and date stamp for each.
- D. Indicating Devices: Digital display mounted flush in VFC door and connected to display VFC parameters including, but not limited to:
1. Output frequency (Hz).
 2. Motor speed (rpm).
 3. Motor status (running, stop, fault).
 4. Motor current (amperes).
 5. Motor torque (percent).
 6. Fault or alarming status (code).
 7. PID feedback signal (percent).
 8. DC-link voltage (V dc).
 9. Set point frequency (Hz).
 10. Motor output voltage (V ac).
- E. Control Signal Interfaces:
1. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BAS or other control systems:
 - a. 0- to 10-V dc.
 - b. 4- to 20-mA dc.
 - c. Potentiometer using up/down digital inputs.
 - d. Fixed frequencies using digital inputs.
 2. Output Signal Interface: A minimum of one programmable analog output signal(s) (0- to 10-V dc 4- to 20-mA dc), which can be configured for any of the following:
 - a. Output frequency (Hz).
 - b. Output current (load).
 - c. DC-link voltage (V dc).
 - d. Motor torque (percent).
 - e. Motor speed (rpm).
 - f. Set point frequency (Hz).
- F. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display VFC status and alarms. Allows VFC to be used with an external system within a multidrop LAN configuration; settings retained within VFC's nonvolatile memory.
1. Network Communications Ports: Ethernet and RS-422/485.

2. Embedded BAS Protocols for Network Communications: ASHRAE 135 BACnet Johnson Metasys N2; protocols accessible via the communications ports.

2.3 BYPASS SYSTEMS

- A. Bypass Operation: Safely transfers motor between power converter output and bypass circuit, manually, automatically, or both. Selector switches set modes and indicator lights indicate mode selected. Unit is capable of stable operation (starting, stopping, and running) with motor completely disconnected from power converter.
- B. Bypass Mode: Manual operation only; requires local operator selection at VFC. Transfer between power converter and bypass contactor and retransfer shall only be allowed with the motor at zero speed.
- C. Bypass Controller: Two-contactor-style bypass allows motor operation via the power converter or the bypass controller; with input isolating switch and barrier arranged to isolate the power converter and permit safe troubleshooting and testing, both energized and de-energized, while motor is operating in bypass mode.
 1. Bypass Contactor: Load-break, IEC-rated contactor.
 2. Output Isolating Contactor: Non-load-break, IEC-rated contactor.
 3. Isolating Switch: Non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-energized, while motor is operating in bypass mode; pad-lockable, door-mounted handle mechanism.
- D. Bypass Contactor Configuration: Full-voltage (across-the-line) type.
 1. NORMAL/BYPASS selector switch.
 2. HAND/OFF/AUTO selector switch.
 3. NORMAL/TEST Selector Switch: Allows testing and adjusting of VFC while the motor is running in the bypass mode.
 4. Contactor Coils: Pressure-encapsulated type.
 - a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
 - b. Power Contacts: Totally enclosed, double break, and silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
 5. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate all integral devices and remotely located pilot, indicating, and control devices.
 6. Overload Relays: NEMA ICS 2.

2.4 OPTIONAL FEATURES

- A. Communication Port: RS-232 port, USB 2.0 port, or equivalent connection capable of connecting a printer.

2.5 ENCLOSURES

- A. VFC Enclosures: NEMA 250, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 1.

2.6 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect VFCs according to requirements in NEMA ICS 61800-2.
 1. Test each VFC while connected to its specified motor.
 2. Verification of Performance: Rate VFCs according to operation of functions and features specified.
- B. VFCs will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, surfaces, and substrates to receive VFCs, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance.
- B. Examine VFC before installation. Reject VFCs that are wet, moisture damaged, or mold damaged.
- C. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFC installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Coordinate layout and installation of VFCs with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Wall-Mounting Controllers: Install VFCs on walls with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished floor unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Division 16 Section "Hangers and Supports for Electrical Systems."
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in each fusible-switch VFC.
- E. Install fuses in control circuits if not factory installed. Comply with requirements in Division 16 Section "Fuses."
- F. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

- G. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.
- H. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify VFCs, components, and control wiring. Comply with requirements for identification specified in Division 15 Section "Mechanical Identification."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each VFC with engraved nameplate.
 - 3. Label each enclosure-mounted control and pilot device.
- B. Operating Instructions: Frame printed operating instructions for VFCs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of VFC units.

3.4 CONTROL WIRING INSTALLATION

- A. Install wiring between VFCs and remote devices and facility's central-control system. Comply with requirements in Division 16 Sections.
- B. Bundle, train, and support wiring in enclosures.
- C. Connect selector switches and other automatic control devices where applicable.
 - 1. Connect selector switches to bypass only those manual- and automatic control devices that have no safety functions when switches are in manual-control position.
 - 2. Connect selector switches with control circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each VFC element, bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.

E. Tests and Inspections:

1. Inspect VFC, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
2. Test insulation resistance for each VFC element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at VFC locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Engineer before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. VFCs will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies the VFC and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.7 ADJUSTING

A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to six times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Engineer before increasing settings.

D. Set the taps on reduced-voltage autotransformer controllers.

E. Set field-adjustable circuit-breaker trip ranges

F. Set field-adjustable pressure switches.

3.8 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until controllers are ready to be energized and placed into service.
- B. Replace VFCs whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, reprogram, and maintain VFCs.

END OF SECTION 15269

DIVISION 15 - MECHANICAL

SECTION 15626 - WATER COOLED CHILLERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Packaged, air-cooled chillers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1.3 INFORMATIONAL SUBMITTALS

- A. Certificates: For certification required in "Quality Assurance" Article.
- B. Startup service reports.
- C. Warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. ARI Certification: Certify chiller according to ARI 550 certification program(s).
- B. ARI Rating: Rate chiller performance according to requirements in ARI 550/590.
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1
- D. ASME Compliance: Fabricate and label chiller to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, and include an ASME U-stamp and nameplate certifying compliance.
- E. Comply with NFPA 70.

- F. Comply with requirements of UL and UL Canada and include label by a qualified testing agency showing compliance.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chillers that fail in materials or workmanship within specified warranty period.
 - 1. Extended warranties include, but are not limited to, the following:
 - a. Complete compressor and drive assembly.
 - b. Parts and labor.
 - 2. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PACKAGED, AIR-COOLED CHILLERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Trane
 - 2. YORK International Corporation.
 - 3. Approved equal prior to bid.
- B. Description: Factory-assembled and run-tested chiller complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, evaporator, condenser coils, condenser fans and motors, electrical power, controls, and accessories.
- C. Fabricate base, frame, and attachment to chiller components strong enough to resist chiller movement during a seismic event when chiller base is anchored to field support structure.
- D. Cabinet:
 - 1. Base: Galvanized-steel base extending the perimeter of chiller. Secure frame, compressors, and evaporator to base to provide a single-piece unit.
 - 2. Frame: Rigid galvanized-steel frame secured to base and designed to support cabinet, condenser, control panel, and other chiller components not directly supported by base.
 - 3. Casing: Galvanized steel.
 - 4. Finish: Coat base, frame, and casing with a corrosion-resistant coating capable of withstanding a 1000-hour salt-spray test according to ASTM B 117.
- E. Service: Easily accessible for inspection and service.
- F. Capacity Control: Variable speed.
 - 1. Maintain stable operation throughout range of operation. Configure to achieve most energy-efficient operation possible.
 - 2. Operating Range: From 100 to 10 percent of design capacity.

G. Vibration Control:

1. Vibration Balance: Balance chiller compressors and drive assemblies to provide a precision balance that is free of noticeable vibration over the entire operating range.
 - a. Overspeed Test: 25 percent above design operating speed.
2. Isolation: Mount individual compressors on vibration isolators.

H. Refrigerant Circuits:

1. Refrigerant: Type as indicated on Drawings.
2. Refrigerant Type: R-134a or any HFC. Classified as Safety Group A1 according to ASHRAE 34.
3. Refrigerant Compatibility: Chiller parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
4. Refrigerant Circuit: Each shall include a thermal- or electronic-expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
5. Pressure Relief Device:
 - a. Comply with requirements in ASHRAE 15 and in applicable portions of ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - b. ASME-rated, spring-loaded pressure relief valve; single- or multiple-reseating type.

I. Evaporator:

1. Description: Shell-and-tube design.
 - a. Direct-expansion (DX) type with fluid flowing through the shell, and refrigerant flowing through the tubes within the shell.
 - b. Flooded type with fluid flowing through tubes and refrigerant flowing around tubes within the shell.
2. Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Shell Material: Carbon steel.
4. Shell Heads: Removable carbon-steel heads located at one end of the tube bundle. Hinged 150psig marine water box at the other end.
5. Fluid Nozzles: Terminated with mechanical-coupling or flanged end connections for connection to field piping.
6. Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
7. Heater: Factory-installed and -wired electric heater with integral controls designed to protect the evaporator to minus 20 deg F.

J. Electrical Power:

1. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point, field-power connection to chiller.
 2. Wiring shall be numbered and color-coded to match wiring diagram.
 3. Install factory wiring outside of an enclosure in a raceway.
 4. Field-power interface shall be to NEMA KS 1, heavy-duty, nonfused disconnect switch.
 - a. Disconnect means shall be interlocked with door operation.
 5. Provide each motor with overcurrent protection.
 6. Overload relay sized according to UL 1995 or an integral component of chiller control microprocessor.
 7. Phase-Failure and Undervoltage Relays: Solid-state sensing with adjustable settings.
 8. Control Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.
 - a. Power unit-mounted controls where indicated.
 9. Control Relays: Auxiliary and adjustable time-delay relays.
- K. Controls:
1. Microprocessor based interfaced with existing campus Building Management System.
 2. Enclosure: Share enclosure with electrical power devices or provide a separate enclosure.
 3. Operator Interface: Multiple-character digital or graphic display with dynamic update of information and with keypad or touch-sensitive display located on front of control enclosure.
 4. Manually Reset Safety Controls: The following conditions shall shut down chiller and require manual reset:
 - a. Low evaporator pressure or high condenser pressure.
 - b. Low chilled-water temperature.
 - c. Refrigerant high pressure.
 - d. High or low oil pressure.
 - e. High oil temperature.
 - f. Loss of chilled-water flow.
 - g. Control device failure.
 5. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: view only; view and operate; and view, operate, and service.
 6. Control Authority: At least four conditions: Off, local manual control at chiller, local automatic control at chiller, and automatic control through a remote source.
 7. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display chiller status and alarms.
 - a. Hardwired Points:
 - 1) Monitoring: On-off status, common trouble alarm, electrical power consumption (kilowatt-hours)

- 2) Control: On-off operation, chilled-water, discharge temperature set-point adjustment, electrical power demand limit.
 - b. [ASHRAE 135 (BACnet)] communication interface with the BAS shall enable the BAS operator to remotely control and monitor the chiller from an operator workstation. Control features and monitoring points displayed locally at chiller control panel shall be available through the BAS.
- L. Insulation:
1. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 2. Thickness: 1-1/2 inches.
 3. Factory-applied insulation over cold surfaces of chiller components.
 - a. Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.
 4. Apply protective coating to exposed surfaces of insulation to protect insulation from weather.
- M. Accessories:
1. Factory-furnished, chilled-water flow switches for field installation.
 2. Individual compressor suction and discharge pressure gages with shutoff valves for each refrigerant circuit.
 3. Factory-furnished neoprene or spring isolators for field installation.

2.2 SOURCE QUALITY CONTROL

- A. Perform functional tests of chillers before shipping.
- B. Factory test and inspect evaporator according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 3 - EXECUTION

3.1 CHILLER INSTALLATION

- A. Install chillers on support structure indicated.
- B. Equipment Mounting: Install chiller using elastomeric pads.
 1. Minimum Deflection: 1/2 inch
- C. Maintain manufacturer's recommended clearances for service and maintenance.
- D. Charge chiller with refrigerant and fill with oil if not factory installed.

- E. Install separate devices furnished by manufacturer and not factory installed.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Section 15181 "Hydronic Piping" Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to chiller to allow service and maintenance.
- C. Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer, flexible connector, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, and drain connection with valve. Make connections to chiller with a flange or mechanical coupling.
- D. Connect each chiller drain connection with a union and hose end connection. Provide a shutoff valve at each connection.

3.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Verify that refrigerant charge is sufficient and chiller has been leak tested.
 - 3. Verify that pumps are installed and functional.
 - 4. Verify that thermometers and gages are installed.
 - 5. Operate chiller for run-in period.
 - 6. Check bearing lubrication and oil levels.
 - 7. Verify proper motor rotation.
 - 8. Verify static deflection of vibration isolators, including deflection during chiller startup and shutdown.
 - 9. Verify and record performance of fluid flow and low-temperature interlocks for evaporator and condenser.
 - 10. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
- B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assembly, installation, and connection.
- C. Prepare test and inspection startup reports.

END OF SECTION 15626

DIVISION 15 - MECHANICAL
SECTION 15900 - HVAC INSTRUMENTATION AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. This Section includes control equipment for HVAC systems and components, including interfacing with VFD and chiller.
- B. Control items to be provided include the following:
 - 1. Electronic Sensors
 - 2. Status Sensors
- C. Related Sections include the following:
 - 1. Division 15 Section "Mechanical Identification" for identifying newly installed control system panels, if any.
 - 2. Division 15 Section "Mechanical Insulation" for coordination between sensors and insulated piping and equipment.
 - 3. Division 15 Section "Meters and Gages" for measuring equipment that relates to this Section and thermowells to be installed in new piping.
 - 4. Division 15 Section "Hydronic Pumps" for equipment controlled by this Section.

1.3 DEFINITIONS

- A. BACNET: Building Control Communication Protocol. Also known as ASHRAE 135
- B. BMS: Building Management System
- C. CCMS: Campus-wide Central Control and Management System
- D. DDC: Direct digital control.
- E. FEC: Field Equipment Controller.
- F. I/O: Input/output.
- G. MS/TP: Master slave/token passing.
- H. NAE: Network Automation Engine.
- I. PID: Proportional plus integral plus derivative.
- J. RTD: Resistance temperature detector.

- K. VFD: Variable frequency drive.

1.4 SYSTEM PERFORMANCE

- A. Comply with the following performance requirements:
 - 1. 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.
 - b. Water Flow: Response of the flow sensor.
 - c. Pressure Differential: Plus or minus 1 psid.

1.5 ACTION SUBMITTALS

- A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, 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 interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, and control panels.
 - 2. 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 fans affected by CO2 control, pumps, 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 valves including flow characteristics.
 - 7. DDC System Hardware:
 - a. Wiring diagrams for control units with termination numbers.
 - b. Schematic diagrams and floor plans for field sensors and control hardware.
 - 8. Controlled Systems:
 - a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
 - b. Written description of sequence of operation including schematic diagram.
 - c. Points list.

1.6 INFORMATIONAL SUBMITTALS

- A. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135.

- B. Field quality-control test reports.

1.7 CLOSEOUT SUBMITTALS

- A. 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 1 Section "Operation and Maintenance Data," include the following:
 - 1. Interconnection wiring diagrams with identified and numbered system components and devices.
 - 2. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
 - 3. Calibration records and list of set points.
- B. Software and Firmware Operational Documentation: Include the following:
 - 1. Device address list.
 - 2. Printout of software application and graphic screens added by this project.

1.8 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, and marked for intended use.
- B. Comply with ASHRAE 135 for DDC system components.
- C. The CMMS shall be complete in all respects and shall be provided, installed and commissioned by the CMMS equipment manufacturer. Equipment manufacturer shall be responsible for and warrant the proper installation and operation of the CMMS and control system equipment.

1.9 COORDINATION

- A. Coordinate location of control sensors.
- B. Coordinate electrical branch circuits for control units.
- C. Coordinate equipment with Electrical Power Monitoring and Control to achieve compatibility of communication interfaces.
- D. Coordinate equipment with Panelboards to achieve compatibility with starter coils and annunciation devices.

1.10 Work Included and Interface Requirements

- A. Installation of control components and modification of the BMS
 - 1. The CMMS contractor shall provide all necessary hardware and software to integrate the new control system components with the existing BMS. Integration means the ability to monitor, override, change setpoints, and provide real-time bi-directional dynamic data exchange between the new control system and the existing BMS hardware and software.

PRODUCTS

1.11 ACCEPTABLE MANUFACTURER AND CONTRACTOR

- A. The following CMMS Contractor and Manufacturer is solely approved to provide and install the CMMS for this project due to having provided the existing building control system and their ability to modify its programming to suit this project requirements.
1. Emcor Services Integrated Solutions - Andover

1.12 CONTROL SYSTEM

- A. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems.
1. The work of this Section shall consist of only that necessary to extend the existing CMMS to provide the control functions herein specified. Existing controllers, wiring and components shall be reused to the maximum extent possible, unless noted otherwise on the Drawings.

1.13 ELECTRONIC SENSORS

- A. Description: Vibration and corrosion resistant; for immersion mounting as required.
- B. Thermistor Temperature Sensors and Transmitters:
1. Accuracy: Plus or minus 0.5 deg F at calibration point.
 2. Wire: Twisted, shielded-pair cable.
 3. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.
- C. RTDs and Transmitters:
1. Accuracy: Plus or minus 0.2 percent at calibration point.
 2. Wire: Twisted, shielded-pair cable.
 3. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
- D. Pressure Transmitters/Transducers:
1. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.
 2. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and tested to 300-psig; linear output 4 to 20 mA.
 3. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.

1.14 STATUS SENSORS

- A. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig, piped across pump.

- B. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.
- C. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.

PART 2 - EXECUTION

2.1 INSTALLATION

- A. Install software in control units. Implement all features of programs to specified requirements and as appropriate to sequence of operation.
- B. Connect and configure equipment and software to achieve sequence of operation specified.
- C. Install labels and nameplates to identify control components according to Division 15 Section "Mechanical Identification."
- D. Install hydronic instrument wells, valves, and other accessories according to Division 15 Section "Hydronic Piping."
- E. Install new differential pressure sensor in existing chilled water piping tap located on the second floor of the Patron's Partners building. This sensor will be used to control the variable frequency drives on the secondary pumps.

2.2 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. CCMS Wiring
 - 1. All conduit, wiring, accessories and wiring connections required for the installation of the Building Management System, as herein specified, shall be provided by the CCMS Contractor. All wiring shall comply with the requirements of applicable portions of Division 16 and all local and national electric codes, unless specified otherwise in this section.
 - 2. All CCMS wiring materials and installation methods shall comply with CCMS manufacturer recommendations.
 - 3. The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the CCMS Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the CCMS Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.
 - 4. Class 2 Wiring
 - a. All Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.
 - b. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.
 - 5. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.
 - 6. Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.

B. CCMS Raceway

1. All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size 1/2”.
2. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Engineer.
3. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.
4. Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit shall be UL listed.

C. Penetrations

1. Provide fire stopping for all penetrations used by dedicated CCMS conduits and raceways.
2. All openings in fire proofed or fire stopped components shall be closed by using approved fire resistive sealant.
3. All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway. Where wiring passes entirely through an occupied space to another space or level, enclosed raceway shall not be used, wiring shall be installed in conduit in a concealed location.
4. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.

D. CCMS Identification Standards

1. Node Identification. All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location.

E. CCMS Panel Installation

1. The CCMS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.
2. The CCMS contractor shall be responsible for coordinating panel locations with other trades and electrical and mechanical contractors.

F. Input Devices

1. All Input devices shall be installed per the manufacturer recommendation
2. Locate components of the CCMS in accessible local control panels wherever possible.

G. HVAC Input Devices – General

1. All Input devices shall be installed per the manufacturer recommendation
2. Locate components of the CCMS in accessible local control panels wherever possible.
3. The mechanical contractor shall install all in-line devices such as temperature wells, pressure taps, etc.
4. Water Differential Pressure Sensors
 - a. Differential pressure transmitters shall be supplied with tee fittings and shut-off valves in the high and low sensing pick-up lines.
 - b. The transmitters shall be installed in an accessible location wherever possible.
 - c. Air bleed units, bypass valves and compression fittings shall be provided.

H. HVAC Output Devices

1. All output devices shall be installed per the manufacturers recommendation. The mechanical contractor shall install all in-line devices such as control valves, pressure wells, etc.

2.3 COMMISSIONING

- A. Fully commission all aspects of the Building Management System work.
- B. Acceptance Check Sheet
 1. Prepare a check sheet that includes all points for all functions of the CCMS as added by this project.
 2. Submit the check sheet to the Engineer for approval
 3. The Engineer will use the check sheet as the basis for acceptance with the CCMS Contractor.
- C. Promptly rectify all listed deficiencies and submit to the Engineer that this has been done.

2.4 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 each point through its full operating range to verify that safety and operating control set points are as required.
 4. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
 5. Test each system for compliance with sequence of operation.
 6. 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 instrument tubing for proper fittings, slope, material, and support.
 5. Check temperature instruments and material and length of sensing elements.
 6. Check control valves. Verify that they are in correct direction.
 7. Check DDC system as follows:
 - a. Verify that wires at control panels are tagged with their service designation and approved tagging system.
 - b. Verify that spare I/O capacity has been provided.
 - c. Verify that DDC controllers are protected from power supply surges.
- D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

2.5 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 without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
10. Provide diagnostic and test instruments for calibration and adjustment of system.
11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature set points.

2.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls.

END OF SECTION 15900

DIVISION 15 - MECHANICAL
SECTION 15940 - SEQUENCE OF OPERATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. This Section includes control sequences for HVAC systems, subsystems, and equipment.
- B. Related Sections include the following:
 - 1. Division 15 Section "HVAC Instrumentation and Controls" for control equipment and devices and for submittal requirements.

1.3 DEFINITIONS

- A. DDC: Direct digital control.
- B. VFD: Variable frequency drive.

1.4 CENTRAL REFRIGERATION PLANT SEQUENCES

- A. Chillers:
 - 1. Chiller - CH-1:
 - a. Chiller CH-1 is the main chiller for the system and will be operated continuously when cooling is called for.
 - b. Chiller shall operate continuously modulating its capacity via onboard control system.
 - c. Chiller shall not start until the following requirements are met:
 - 1) Primary chilled water pump PCP-1 is operating.
 - 2) Proof of flow switch in Chiller CH-1 chilled water piping.
- B. Chilled water pumps:
 - 1. Secondary Pumps PCP-1:
 - a. This pump shall operate any time there is a call for cooling within the building. It shall have its speed controlled by the associated VFD.
 - b. When chilled water is required in the building, control system shall command the VFD to start this pump. Once system flow is initiated, control system shall take the input from the chilled water system differential pressure transmitter in the mechanical penthouse and convert it into a control signal for the VFD to vary the pumps operating speed to maintain this differential pressure constant. Differential pressure set point shall be adjustable.

- C. Operator Station Display: Indicate the following on operator workstation display terminal:
1. DDC system graphic.
 2. DDC system status, on-off.
 3. Outdoor-air temperature.
 4. Cooling (software) demand indication.
 5. Time and time schedule.
 6. Chilled-water Primary pump(s) on-off status.
 7. Chilled-water temperature control-point adjustment.
 8. Chiller(s) on-off status.
 9. Chiller(s) on-off indication.
 10. Chiller "failure-to-start" indication.
 11. Chiller chilled-water supply and return temperature.
- D. AHU Chilled Water Coil:
1. AHU-1, 3 and 4:
 - a. Modulate two-way chilled water control valve to maintain discharge air temperature setpoint.
 2. AHU-2
 - a. Modulate three-way chilled water control valve to maintain discharge air temperature setpoint.

PRODUCTS (Not Applicable)

PART 2 - EXECUTION (Not Applicable)

END OF SECTION 15940

DIVISION 15 - MECHANICAL
SECTION 15950 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Balancing Hydronic Piping Systems:
 - a. Variable-flow hydronic systems.
 - b. Motors
 - c. Chillers

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 SUBMITTALS

- A. Certified TAB reports.
- B. Sample report forms.
- C. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.

1.5 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.

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1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.
 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician.
- B. Certify TAB field data reports and perform the following:
1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard TAB contractor's forms approved by Engineer.
- D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."
- 1.6 PROJECT CONDITIONS
- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- 1.7 COORDINATION
- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine 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, 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.

2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. Compare results with the design data and installed conditions.
- F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- G. Examine test reports specified in individual system and equipment Sections.
- H. Examine HVAC equipment and 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 with indicated perforations.
- J. Examine chillers for correct piping connections.
- K. Examine system pumps to ensure absence of entrained air in the suction piping.
- L. Examine operating safety interlocks and controls on HVAC equipment.
- M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
 1. Permanent electrical-power wiring is complete.
 2. Hydronic systems are filled, clean, and free of air.
 3. Automatic temperature-control systems are operational.
 4. Equipment access doors are securely closed.
 5. Isolating and balancing valves are open and control valves are operational.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
- B. Cut insulation, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 1. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 15 Section "HVAC Insulation."
- C. Mark equipment and balancing devices, including valve position indicators and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data, and number in sequence starting at pump to system at wall penetration for chilled water and at cooling tower sump for condenser water system.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
 - 1. Open all manual valves for maximum flow.
 - 2. Check makeup water-station pressure gage for adequate pressure for highest vent.
 - 3. Check flow-control valves for specified sequence of operation, and set at indicated flow.
 - 4. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
 - 5. Set system controls so automatic valves are wide open to heat exchangers.
 - 6. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
 - 7. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.5 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:
 - 1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Engineer and comply with requirements in Division 15 Section "Hydronic Pumps."
 - 2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
 - a. Monitor motor performance during procedures and do not operate motors in overload conditions.
 - 3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
 - 4. Report flow rates that are not within plus or minus 10 percent of design.
- B. Set calibrated balancing valves, if installed, at calculated presettings.
- C. Measure flow at all stations and adjust, where necessary, to obtain first balance.
 - 1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

- D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- E. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
 - 1. Determine the balancing station with the highest percentage over indicated flow.
 - 2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
 - 3. Record settings and mark balancing devices.
- F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- G. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.
- H. Check settings and operation of each safety valve. Record settings.
- I. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals by lowering space cooling setpoints in the building automation system and proceed as specified above for hydronic systems, except that only balancing of the secondary pump shall be performed.

3.6 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer's name, model number, and serial number.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Efficiency rating.
 - 5. Nameplate and measured voltage, each phase.
 - 6. Nameplate and measured amperage, each phase.
 - 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.7 PROCEDURES FOR CHILLERS

- A. Balance water flow through each evaporator to within specified tolerances of indicated flow with associated pumps operating. Measure and record the following data with each chiller operating at design conditions:
 - 1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
 - 2. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.
 - 3. Power factor if factory-installed instrumentation is furnished for measuring kilowatts.
 - 4. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatts.
 - 5. Capacity: Calculate in tons of cooling.

3.8 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
 2. Air Outlets and Inlets: Plus or minus 10 percent.
 3. Cooling-Water Flow Rate: Plus or minus 10 percent.
 4. Condenser-Water Flow Rate: Plus or minus 10 percent.

3.9 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
1. Pump curves.
 2. Manufacturers' test data.
 3. Field test reports prepared by system and equipment installers.
 4. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
 2. Name and address of the TAB contractor.
 3. Project name.
 4. Project location.
 5. Engineer's name and address.
 6. Contractor's name and address.
 7. Report date.
 8. Signature of TAB supervisor who certifies the report.
 9. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 10. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 11. Nomenclature sheets for each item of equipment.
 12. Notes to explain why certain final data in the body of reports vary from indicated values.
 13. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Settings for supply-air, static-pressure controller.

- g. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Water flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Balancing stations.
 6. Position of balancing devices.
 7. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 8. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.
- E. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
1. Unit Data:
 - a. Unit identification.
 - b. Service.
 - c. Make and size.
 - d. Model number and serial number.
 - e. Water flow rate in gpm.
 - f. Water pressure differential in feet of head or psig.
 - g. Pump rpm.
 - h. Impeller diameter in inches.
 - i. Motor make and frame size.
 - j. Motor horsepower and rpm.
 - k. Voltage at each connection.
 - l. Amperage for each phase.
 - m. Full-load amperage and service factor.
 2. Test Data (Indicated and Actual Values):
 - a. Static head in feet of head or psig.
 - b. Pump shutoff pressure in feet of head or psig.
 - c. Actual impeller size in inches.
 - d. Full-open flow rate in gpm.
 - e. Full-open pressure in feet of head or psig.
 - f. Final discharge pressure in feet of head or psig.
 - g. Final suction pressure in feet of head or psig.

- h. Final total pressure in feet of head or psig.
- i. Final water flow rate in gpm.
- j. Voltage at each connection.
- k. Amperage for each phase.

F. Instrument Calibration Reports:

1. Report Data:

- a. Instrument type and make.
- b. Serial number.
- c. Application.
- d. Dates of use.
- e. Dates of calibration.

3.10 INSPECTIONS

A. Initial Inspection:

- 1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
- 2. Check the following for each system:
 - a. Verify that balancing devices are marked with final balance position.
 - b. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

- 1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final observation be made by Engineer.
- 2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Engineer and Owner.
- 3. Engineer and/or Owner shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
- 4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
- 5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

- 1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.

D. Prepare test and inspection reports.

END OF SECTION 15950

DIVISION 16 – ELECTRICAL
SECTION 16000 – GENERAL

PART 1 – GENERAL

1.1 CONTRACT DOCUMENTS:

- A. All work of Section 16 shall comply with the requirements of:
 - 1. General Conditions
 - 2. Supplementary General Conditions
 - 3. General Requirements
 - 4. Specifications
 - 5. Drawings
 - 6. Modifications incorporated in the documents before their execution.

1.2 WORK INCLUDED

- A. This Division of the specifications (16000) covers the complete interior and exterior electrical system for all work shown on the drawings as specified herein providing all material, labor and equipment required for the installation of the electrical systems complete and in operating condition.
- B. Include in the electrical work all the necessary supervision and the issuing of all coordinating information to any other trades who are supplying work to accommodate the electrical installations.

1.3 DRAWINGS

- A. The drawings for electrical work utilize symbols and schematic diagrams which have no dimensional significance. The work shall therefore, be installed to fulfill the diagrammatic intent expressed on the electrical drawings.
- B. Review architectural drawings for door swings, cabinets, counters, moldings and built-in equipment, conditions indicated on architectural drawings shall govern. Prior to rough-in of receptacles and systems outlets, refer to architectural casework drawings for rough-in coordination.
- C. Coordinate electrical work with the architectural details, floor plans, elevations, structural and mechanical drawings. Provide fittings, junction boxes and accessories to meet conditions.
- D. Do not scale drawings. Dimensions for layout of equipment, or spaces shall be obtained from architectural, structural or mechanical drawings unless specifically indicated on the electrical drawings.
- E. Discrepancies shown on different drawings, between drawings and specifications or between drawings and field conditions shall be promptly brought to the attention of the Architect.
- F. Provide as used on the drawings and in the specifications shall mean, furnish, install, connect, adjust and test.
- G. The drawings and specifications are complimentary and any work or material shown in one and omitted in the other, or described in the one and not shown in the other, or which may be implied by both or either, shall be furnished as though shown on both, in order to give a complete and first class installation.

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1.4 SITE INVESTIGATION

- A. Potential Contractors shall visit the project site prior to bid date to satisfy themselves as to the existing conditions and distances which may effect the cost of the project. Where work under this project requires extension, relocation, re-connecting or modifications to existing equipment or systems, the existing equipment or systems, shall be restored to their original condition, with the exception of the work under this contract, before the completion of this project.

1.5 SHOP DRAWINGS

- A. Submit for approval by the Architect all materials and equipment to be incorporated in the electrical work.
- B. Submit only shop drawings which comply with the contract documents. Shop drawings shall be checked and corrected by the Contractor before they are submitted to the Architect. Shop drawings that are not corrected by the Contractor shall be returned for correction without detailed notations by the Architect as to the necessary corrections.
- C. Mark each individual submittal item to show specification section which pertains to the item.
- D. Submit information as required under SUBMITTALS, for each of the individual electrical sections of the specifications.
- E. Data submitted shall contain all information required to indicate compliance with equipment specified.
- F. Submit field information drawings to explain fully all procedures involved in erecting, mounting and connecting all items of equipment which differ from that specified.
- G. When Shop Drawings are reviewed, some errors may be detected but others may be overlooked. This does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings, the requirements of the Drawings and Specifications shall be followed and are not waived or superseded in any way by the Shop Drawing review.

1.6 RECORD DRAWINGS:

- A. One complete set of electrical drawings shall be reserved for as-built drawings. Any approved deviation from the contract drawings shall be recorded on these drawings. Drawings shall be checked monthly for completeness.
- B. Completed as-built drawings shall be presented to the Architect prior to final inspection.

1.7 MAINTENANCE AND OPERATING INSTRUCTIONS:

- A. Provide at the time of final inspection three sets of maintenance and operating instruction for:
 - 1. Fuses
 - 2. Disconnect Switches
- B. Furnish a qualified and accredited factory trained technician to train personnel designated by the Owner in the proper operation and maintenance of specialized equipment.

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- C. The issuing of operating instructions shall include the submission of the name, address, and telephone number of the manufacturer's representative and service company for each item of equipment so that service and spare parts can be readily obtained.

1.8 CODES AND PERMITS:

- A. All electrical work shall meet or exceed the latest requirements of the following codes and/or other authorities exercising jurisdiction over the electrical construction work and the project.
 - 1. The National Electrical Code (NFPA 70) - 2014 Edition
 - 2. The National Electrical Safety Code (ANSI C-2)
 - 3. The Life Safety Code (NFPA 101) - 2012 Edition
 - 4. The International Building Code - 2012 Edition
 - 5. Regulations of the local utility company with respect to metering and service entrance.
 - 6. Municipal and State ordinances governing electrical work.
- B. All required permits and inspection certificates shall be obtained, and made available at the completion of the work. Permits, inspections, and certification fees shall be paid for as a part of the electrical work.

1.9 DEVIATIONS:

- A. No deviations from the plans and specifications shall be made without the full knowledge and consent of the Architect or his authorized representative.
- B. Should the Contractor find at any time during progress of the work that, in his judgment, existing conditions make desirable a modification in requirements covering any particular item or items, he shall report such items promptly to the Architect for his decision and instruction.

1.10 COOPERATION:

- A. This Contractor shall schedule his work and in every way possible cooperate with all other Contractors on the job to avoid delays, interferences, and unnecessary work. He shall notify them of all openings, hangers, excavations, etc., so that proper provisions shall be made for his work. This shall not relieve him of the cost of cutting, when such is required.
- B. This Contractor shall do all cutting and excavating necessary for the complete installation of his work, but he shall not cut the work of any other Contractor without first consulting the Architect. He shall repair any work damaged by him or his workmen, employing the services of the Contractor whose work is damaged. Saw cut existing slab as required for routing conduits and floor boxes noted to be installed in existing floors. Restore to original finish.
- C. This Contractor shall by all means coordinate the location of ceiling lighting fixtures, both recessed and surface mounted, with the Ceiling Contractor so that proper hangers and supports shall be provided.
- D. Any conflict between electrical and other trades shall be reported before construction starts. No extra charges will be approved for work resulting from failure to coordinate with other trades.

1.11 INSTALLATION:

- A. Raceways, fixtures, devices, and other electrical equipment shall be installed in a neat and workmanlike manner and in accordance with recognized good practice for a first class installation.

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- B. The Architect or his representative shall have the authority to reject any workmanship not complying with the contract documents.
- C. The Electrical Contractor shall personally or through an authorized licensed and competent electrician, constantly supervise the work from beginning to complete and final inspection.
- D. Electrical equipment shall be installed in accordance with manufacturer's recommendations.
- E. Locations of proposed raceway, riser, location of structural elements, location and size of chases method and type of construction of floors, walls, partitions, etc., shall be verified before construction starts.
- F. Consult owner and utility companies for underground lines before any underground work is started. Contractors shall be responsible for any damage.
- G. All empty conduits shall have a pull string installed. All flush recessed boxes shall have black plates installed.

1.12 MATERIALS:

- A. Materials specified by manufacturer's name shall be used unless approval of other manufacturers are listed in addenda to these specifications. Request for prior approval shall be submitted by mail only. Facsimile will not be acceptable.
- B. Drawings indicating proposed layout of space, all equipment to be installed therein and clearance between equipment shall be submitted, where substitution of materials alter space requirements on the drawings.
- C. Material Standards: All materials shall be new and shall conform to the standards where such have been established for the particular material in question. Publications and Standards of the organization listed below are applicable to materials specified herein.
 - 1. American Society for Testing and Materials (ASTM)
 - 2. Underwriter's Laboratories, Inc. (UL)
 - 3. National Electrical Manufacturer Association (NEMA)
 - 4. Insulated Cable Engineers Association (ICEA)
 - 5. Institute of Electrical and Electronic Engineers (IEEE)
 - 6. National Fire Protection Association (NFPA)
 - 7. American National Standards Institute (ANSI)
- D. Material of the same type shall be the product of one manufacturer.
- E. Materials not readily available from local sources shall be ordered immediately upon approval.
- F. The Architect shall have authority to reject any materials, or equipment, not complying with these specifications and have the Contractor replace materials so rejected immediately upon notification of rejection.
- G. Any material or equipment so rejected shall be removed from the job within 24 hours of such rejection, otherwise the Architect may have same removed at the Contractor's expense.

1.13 EQUIPMENT CONNECTIONS:

- A. All equipment requiring electrical power connections shall be connected under this Division of these specifications.

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- B. Where electrical connections to equipment require specific locations, such locations shall be obtained from shop drawings.
- C. Drawings for location of conduit stub-up boxes mounted in wall or floor to serve specific equipment, shall not be scaled.
- D. Electrical circuits to equipment furnished under other sections of these specifications are based on design loads. If actual equipment furnished has loads other than design loads electrical circuits and protective devices shall be revised to be compatible with equipment furnished at no additional cost to the Owner. Any revisions must have prior approval by the Architect. Before submitting shop drawings, Electrical Sub-Contractor shall along with the Mechanical and Plumbing Sub-Contractor review voltage and load requirements for mechanical and plumbing equipment to determine the compatibility between what is being furnished and what is shown in the contract drawings. The Electrical Sub-Contractor shall along with his submittals submit a statement that he has reviewed all shop drawings including review with the Mechanical and Plumbing Sub-Contractors.
- E. Where equipment is indicated to be served thru conduit stub-up, conduit shall be stubbed up not less than four inches above floor where transition shall be made to sealite flexible conduit for connection to equipment.
- F. The Contractor's attention is invited to other Divisions of these specifications, where equipment requiring electrical service or electrically related work is specified to become fully aware of the scope of work required for electrical service or related work.
- G. Where electricity utilizing equipment is supplied separate from the electrical work, and is energized, controlled or otherwise made operative by electrical work, the testing to provide the proper functional performance of such wiring systems shall be conducted by the trade responsible for the equipment. The electrical work shall, however, include cooperation in such testing and the making available of any necessary testing or adjustments to the electrical equipment.
- H. Heating, air conditioning, and ventilating equipment is specified to be furnished and installed under other sections of these specifications. The controls, likewise are specified to be furnished thereunder. All necessary wiring, wiring troughs and circuit breakers for power for this equipment shall be furnished and installed under this section of the specifications, in accordance with the plans and/or diagrams furnished with the equipment, or shown on these plans. Starters furnished by the Mechanical Contractor shall be installed under this Division of the specifications. Power wiring to auxiliary equipment on a piece of equipment remote from its main terminal box and interlocking of apparatus shall be accomplished under Heating Ventilating Equipment section of the specifications. Conduit and outlets for control wiring shall be furnished and installed under Division 15 of these specifications. Control conductors for mechanical equipment shall not be installed in same conduit with power conductors.
- I. Contractor is to note that location of disconnect switches shown are schematic in nature. Exact location of disconnect switch and mounting height shall be coordinated with field conditions and equipment shop drawings. Locate disconnect as required to maintain clearances required by National Electrical Code.

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1.15 PRODUCT DELIVERY, STORAGE, HANDLING, & PROTECTION

- A. Inspect materials upon arrival at Project and verify conformance to Contract Documents. Prevent unloading of unsatisfactory material. Handle materials in accordance with manufacturer's applicable standards and suppliers recommendations, and in a manner to prevent damage to materials. Store packaged materials in original undamaged condition with manufacturer's labels and seals intact. Containers which are broken, opened, damaged, or watermarked are unacceptable and shall be removed from the premises.
- B. All material, except items specifically designed to be installed outdoors such as pad mounted transformers or stand-by generators, shall be stored in an enclosed, dry building or trailer. Areas for general storage shall be provided by the Contractor. Provide temperature and/or humidity control where applicable. No material for interior installation, including conductors, shall be stored other than in an enclosed weather tight structure. Equipment stored other than as specified above shall be removed from the premises.
- C. Equipment and materials shall not be installed until such time as the environmental conditions of the job site are suitable to protect the equipment or materials. Conditions shall be those for which the equipment or materials are designed to be installed. Equipment and materials shall be protected from water, direct sunlight, cold or heat. Equipment or materials damaged or which are subjected to these elements are unacceptable and shall be removed from the premises and replaced.

1.16 CLEANING AND PAINTING

- A. Remove oil, dirt, grease and foreign materials from all raceways, fittings, boxes, panelboard trims and cabinets to provide a clean surface for painting. Touch-up scratched or marred surfaces of lighting fixtures, panelboard and cabinet trims, motor control center, switchboard or equipment enclosures with paint furnished by the equipment manufacturers specifically for that purpose.
- B. Do not paint trim covers for flush mounted panelboards, telephone cabinets, pull boxes, junction boxes and control cabinet unless required by the Architect. Remove trim covers before painting. Under no conditions shall locks, latches or exposed trim clamps be painted.
- C. Unless indicated on the drawings or specified herein to the contrary, all painting shall be done under the PAINTING Section of these Specifications.
- D. Where plywood backboards are used to mount equipment provided under Division 16, paint backboards with two coats of light grey semi-gloss paint. Plywood shall be 3/4" fire rated plywood. Paint shall be fire retardant paint.

1.17 GUARANTEE:

- A. All systems and component parts shall be guaranteed for two (2) years from the date of final acceptance of the complete project. Defects found during this guaranteed period shall be promptly corrected at no additional cost to the Owner.

END OF SECTION 16000

DIVISION 16 - ELECTRICAL
SECTION 16015 - FUSES

PART 1 – GENERAL

1.1 SUBMITTALS

- A. Shop drawings shall be submitted and shall consist of manufacturer's published literature and technical data sufficient for the engineer to determine whether system function will be adversely affected, whether proposed fuses meet this specification, and whether they are equal in quality.

1.2 MANUFACTURERS

- A. Acceptable manufacturers are:
1. Littelfuse
 2. Cefco
 3. Gould - Shawmut

1.3 EQUIPMENT/MATERIAL

- A. All fuses rated 600 volts or less and used for main, feeder, or branch circuit protection with 200,000 ampere interrupting rating and shall be so labeled. Fuse classes and sizes indicated on the drawings have been selected to provide a fully coordinated selective protection system. To maintain this design, all fuses provided shall be furnished by the same manufacturer. Should equipment provided require a different U.L. Class or fuse size, the engineer shall be furnished with sufficient data to ascertain that system function will not be adversely affected.
- B. Current-Limiting Fuses 600 Amperes or Less
All fuses 600 amperes and below shall be true dual-element time delay fuses with separate spring-loaded thermal overload elements in all ampere ratings. All ampere ratings shall be designed to open at 400 degrees Fahrenheit or less when subjected to a non-load oven test. To eliminate induction heating, all fuse ferrules and end caps shall be non-ferrous and shall be bronze or another alloy not subject to stress cracking.
- C. Spare Fuses
At the time of final acceptance, the contractor shall furnish the owner's representative, not less than three (3) spare fuses of each size and type installed.

END OF SECTION 16015

DIVISION 16 – ELECTRICAL
SECTION 16020 - RACEWAYS

PART 1 – GENERAL

1.1 SUBMITTALS

- A. Submit manufacturer's literature for each type of conduit or tubing and fittings used in the project.

1.2 MANUFACTURERS

- A. Acceptable manufacturers of rigid steel and electrical metallic tubing conduit are:
1. Allied Tube and Conduit Co.
 2. Wheatland Tube Co.
 3. Triangle
 4. L.T.V.
 5. American Brass
 6. E.T.P.
 7. Robroy
 8. PYTCO
 9. RYMCO
- B. Acceptable manufacturer's of polyvinyl chloride (PVC) conduit are:
1. Certainteed
 2. Georgia Pipe
 3. Carlon
 4. Can-Tex
 5. Queen City
- C. Acceptable manufacturer's of conduit fittings, bushings, and locknuts are:
1. O-Z/Gedney
 2. Thomas and Belts
 3. Raco

1.3 MATERIALS

- A. All metallic conduit and electric metallic tubing shall be steel, of standard pipe dimensions, smooth inside and out, and shall be galvanized. Where the word "conduit" is used hereinafter it shall mean either rigid steel conduit, electric metallic tubing, flexible steel conduit, liquid tight flexible steel conduit or schedule 40 plastic conduit. Intermediate grade conduit is not acceptable.
- B. Galvanized rigid steel conduit shall be used in all areas where it will be exposed to physical damage. Schedule 40 plastic conduit shall be used underground and in slab-on-grade. In no case shall plastic conduit be exposed; switch to rigid steel conduit when turning up exposed. All other conduit, unless otherwise specified or called for on the plans, may be galvanized electric metallic tubing. Any exposed conduit on exterior of the building shall be galvanized rigid steel only.
- C. Plastic conduit shall be made from virgin polyvinyl chloride C-300 compound. Conduit and fittings shall carry a UL label. Fitting and cement shall be produced by the same manufacturer as the conduit to assure system integrity.
- D. All conduit shall be concealed in building construction except as noted or shown otherwise. In areas with no finished ceiling and where conduit is run exposed all runs down to switches, receptacles, etc. shall when possible be concealed in wall. It is the intent of these specifications that all conduit will be concealed whenever possible. Where outlets are required to be installed on existing walls in a finished space, raceway and outlet box shall be wiremold surface metal raceway.

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- E. EMT fittings shall be compression or and made of steel for sizes two inches or smaller, steel set screw type fittings may be used on sizes 2 1/2" or larger. Connectors and couplings shall be rain tight and shall have a nylon insulated throat. All fittings shall be "UL" approved. Die cast, and indenter type fittings are not acceptable. Fittings for flexible steel conduits and liquid tight flexible conduit shall be steel and have nylon insulated throat.
- F. Rigid steel conduit and EMT shall be not less than 1/2 inch trade size, schedule 40 plastic conduit shall not be less than 3/4" trade size and not less than required by the NEC or indicated. Conduit runs with more than 5 #12 conductors shall not be less than 3/4".
- G. Conduit and EMT systems indicated on the drawings for communication and signaling systems are for typical systems. Install conduit and EMT systems for the system being installed.
- H. Connect individual recessed lighting fixtures to the conduit or EMT system with "maximum 6'-0" flexible, galvanized steel conduit. Use flexible galvanized, steel metal conduit for final connection to all rotating equipment and transformers. The flexible conduits shall be long enough to permit the full range of required movements without strain and to prevent the transmission of vibration. Do not utilize flexible conduit to loop between fixtures and devices.
- I. Galvanized rigid steel conduit couplings and connections:
 - 1. Install standard, conduit-threaded fittings.
 - 2. Ream the ends of conduits after cutting and threading them.
 - 3. For connection to sheet metal boxes, cabinets and other sheet metal enclosures, install locknuts on the inside and outside of the enclosure for each connection. See Section 16110 of these specifications.
- J. EMT couplings and connectors:
 - 1. Ream the ends of EMT after cutting them.
 - 2. Install the following threadless type fittings:
 - a. Connectors: steel compression type with insulated throat or steel tap-on type with insulated throat.
 - b. Couplings: steel compression or tap-on type.
- K. Installation of plastic conduit:
 - 1. Shall be installed in complete accordance with manufacturer's recommendations.
 - 2. Shall be a minimum of 2'-0" below finished grade when not covered by concrete.
 - 3. Shall have properly sized bond wire installed with all circuits.
 - 4. Bends and turns shall be kept to a bare minimum.
 - 5. Extreme care shall be taken to avoid crushing or cracking conduit. "DO NOT" run vehicles over exposed conduit under any conditions.
 - 6. All conduit and fittings shall be solvent welded.
 - 7. Plastic conduit maybe turned up in masonry walls only. PVC conduit shall be allowed to be routed concealed in masonry walls to a maximum height of 48" A.F.F.
 - 8. Do not install conduit in slab. All conduit shall be installed a minimum of 6" below slab. Conduits shall not be bunched together. Maintain 1" clearance between conduits.
 - 9. Plastic conduit shall not be bent with a propane torch or open flame. Contractor shall utilize a heat gun, heat blanket, or hot box. Plastic conduit bent with such shall not be scorched or marred.
- L. Insulated bushings:
 - 1. Install nylon insulated bushings on the end of all rigid conduit.
 - 2. The insulating material shall be designed for rugged, long service.
 - 3. Bushings which consist of only insulating material will not be accepted.
 - 4. Fittings which incorporate insulated bushings will be considered for approval in lieu of fittings with separate bushings.

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- M. All couplings and connections in location where water or other liquid or vapor might contact the conduit and EMT shall also be watertight.
- N. Close empty conduit and EMT as complete runs before pulling in the cables and wires.
- O. Install exposed conduit and EMT parallel to or at right angles with the lines of the building. Locate them so they will not obstruct headroom or walkways or cause tripping.
- P. Avoid bends or offsets where practicable:
 - 1. Do not install more bends, offsets or equivalent in any conduit or EMT run than permitted by the NEC.
 - 2. Make bends with standard conduit bending machines.
 - 3. Conduit hickies may be used for making slight offsets and for straightening conduits stubbed out of concrete.
 - 4. Conduit or EMT bent with a pipe tee or vise will not be accepted.
 - 5. Do not install crushed or deformed conduits or EMT.
- Q. Install conduit or EMT clamps:
 - 1. At intervals as required by the NEC.
 - 2. Above suspended ceilings, metal supports may be installed as permitted by the NEC, except that conduit cannot be supported or secured to the T-bar grid or from the wire supporting the T-bar grid.
 - 3. Trapeze, split ring, band or clevis hanger may be installed as permitted by the NEC. Trapeze hangers shall be structural metal channels, angle irons or preformed metal channel shapes with the conduit and EMT runs held on specific center by U bolts, clips or clamps. Do not support conduit from ceiling suspension wire or from other conduit.
 - 4. Chain, wire or perforated strap supports will not be acceptable. Nor are they acceptable as a means of securing the conduit.
 - 5. Fasten the clamps and other supports as follows:
 - a. For new masonry or concrete structures, install threaded metal inserts prior to pouring the concrete.
 - b. For existing solid masonry or reinforced concrete structures:
 - 1) Install expansion anchors and bolts or approved power-set fasteners.
 - 2) Expansion anchors and bolts shall be not less than 1/4 inch diameter and shall extend not less than 3 inches into the concrete or masonry.
 - 3) Power-set fasteners shall be not less than 1/4-inch diameter and shall extend not less than 1-1/4-inch into the concrete.
 - c. For hollow masonry install toggle bolts. Bolts supported only by plaster will not be accepted.
 - d. For metal structures install machine screws.
 - e. Attachments to wood plug, rawl plug, soft metal insert or wood blocking will not be permitted.
- R. For vertical runs of conduit of EMT:
 - 1. Install supports for conduit, EMT, cables and wires at intervals as required by the NEC and as indicated on the drawings.
 - 2. Conduit and EMT supports shall be supported by framing for the floors.
- S. Conduits and EMT shall be kept 6" away from parallel runs of steam or hot water pipes.
- T. Clogged raceways shall be entirely free of obstructions or shall be replaced.
- U. Rigid steel conduit installed underground and in concrete shall be wrapped with Scotchwrap #50 corrosion protection tape.
- V. All empty conduits shall have nylon pull cord installed to provide for installation of cables, conductors or wiring. All empty conduits stubbed out below grade shall have be capped and

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provided with a concrete marker. All spare conduits stubbed up through slab shall have a cap installed to prevent debris from entering conduit.

- W. Do not combine conduit homeruns. Each homerun shall be separately routed directly to panel unless specifically noted otherwise.

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- X. Install service conduit and all panel feeder conduits as follows:
 - 1. All underground entrances shall have metallic sleeves through building foundation walls and extend to undisturbed ground to avoid shear, and shall be full weight, threaded hot-dipped galvanized rigid steel conduit.
 - 2. All 90 degree bends to be rigid metallic conduit, with a radius of not less than 10 times the diameter of the conduit.
 - 3. Maintain a minimum cover of 24 inches below final grade for conduits.
- Y. Do not install conduit in cavity between concrete block and brick. Conduit shall not be stubbed up into this cavity or routed horizontally in cavity.
- Z. All underground conduit installed outside of the building footprint shall have yellow 4" wide warning type reading "caution-electrical lines below" installed in trench above conduit warning type 12" grade.

END OF SECTION 16020

DIVISION 16 – ELECTRICAL
SECTION 16030 – CONDUCTORS

PART 1 – GENERAL

1.1 SUBMITTALS

- A. Shop drawings shall be submitted and shall consist of manufacturer's published literature.

1.2 MANUFACTURERS

- A. Acceptable manufacturers are:

1. General
2. Okonite
3. Senator
4. Triangle
5. Pirelli
6. Cyprus Rome
7. Essex
8. Carol
9. Southwire
10. American
11. Cerro
12. CME
13. Colonial Wire

- B. All wiring shall be manufactured in the United States.

1.3 MATERIALS

- A. Ratings and sizes:

1. Shall be not less than indicated on the drawings and not less than required by the NEC.
2. Minimum size shall be No. 12 AWG copper provided the maximum voltage drops in the control circuits will not adversely affect the operation of the controls.
3. Conductor sizes indicated on the drawings are for copper conductors.

- B. Conductors and ground wires:

1. Shall be copper.
2. Size No. 8 AWG and larger shall be stranded.
3. Size No. 10 AWG and smaller shall be solid.

- C. Conductor insulation:

1. Conductor insulation shall be the NEC type THHN.

- D. Wire shall be factory color coded in size No. 10 and smaller. Color shall be by integral pigmentation with a separate color for each phase, neutral and grounding conductor. Color code per phase shall be continuous throughout the project.

- E. Manufacturer's name and other pertinent information shall be marked or molded clearly on the overall jacket's outside surface or incorporated on marker tapes within the cables and wires at reasonable intervals along the cables and wires.

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- F. Cables and wires indicated on the drawings for communication and signaling systems are for typical systems. Install cables and wires for the system being installed.
- G. All wiring shall be in conduit unless specifically noted otherwise.
- H. Every coil of wire shall be in the original wrapping and shall bear the Underwriters' Label of approval.
- I. Where wires are left for connection to any fixture or an apparatus, spare wire or cables shall be provided at the ends for connections. Fixture connections at the outlet box shall be made with insulated wire connectors.
- J. Outer jackets shall be color coded as follows:
 - 1. Three phase or single phase circuits, 120/208 volts:
 - a. Phase A - Black
 - b. Phase B - Red
 - c. Phase C - Blue
 - d. Neutral - White
 - e. Insulated ground wire - Green

Note: Where dedicated neutrals are used for receptacle circuits. Outer jacket shall be white with appropriate colored tracer (i.e. white with red tracer, white with blue tracer, white with black tracer).

- K. Wiring for signal circuits shall conform to the recommendations of manufacturers of the signal system being installed so the system shall have optimum performance and maximum service continuity. Communication and signaling circuit wiring where run in conduit below grade or in a damp location shall be listed for use in a damp or wet location. Communication and signaling conductors not in conduit shall be rated for plenum use.
- L. No circuit wiring shall be smaller than number 12. Where the homerun exceeds 100'-0" in length, number 10 (minimum) wire shall be used even though all such circuits are not indicated on the plans.

When installing THHN extra care must be exercised so as not to damage nylon jacket. When nylon jacket is damaged wiring shall be removed from service, and replaced with new conductors.

END OF SECTION 16030

DIVISION 16 – ELECTRICAL
SECTION 16070 – DISCONNECT SWITCHES

PART 1 – GENERAL

1.1 SUBMITTALS

- A. Shop drawings shall be submitted and shall consist of manufacturer's published literature.

1.2 MANUFACTURERS

- A. Acceptable manufacturers are:
1. Square "D" Company
 2. G. E.
 3. Siemens
 4. Cutler Hammer

1.3 EQUIPMENT

- A. Disconnect switches shall be provided for all motors and strip heaters located out of sight of motor controller, and where specifically indicated on the drawings. Disconnect switches shall disconnect all ungrounded conductors. When exposed to weather, enclosure shall be NEMA - 3R. Switches shall be installed to be fully accessible in accordance with Article 110-26 of the National Electrical Code.
- B. All disconnects shall be heavy duty type and shall be equipped with factory installed equipment ground kit bonded to the can for grounding purposes.
- C. For single phase motors, a single - or double-pole toggle switch, rated only for alternating current, will be acceptable for capacities less than 30 amperes, provided the ampere rating of the switch is at least 125 percent of the motor rating. Enclosed safety switches shall be horsepower rated in conformance with Table III of Fed. Spec. W-D-865. Switches shall disconnect all ungrounded conductors.
- D. Each disconnect serving ground mounted exterior A/C units shall be equipped with a padlock (Master 3206) all keyed alike.
- E. All disconnects shall be equipped with provisions to lock the handle in the OFF position.
- F. All disconnects shall be fusible type, fused in accordance with the name plate data on the unit. Disconnects serving water heaters or resistance heat strips shall be fused at 125% of the full load amps of the unit.
- G. Install fuses so that ampere rating can be read without having to remove fuses.
- H. All fuses shall be as noted in Section 16015.
- I. Disconnects shall be identified as required under Section 16120.
- J. Maintain 3'-0" clearance in front of disconnect having voltage rating of 250 volts and 4'-0" clearance in front of disconnect having voltage rating of 480 volts. Do not locate disconnect over other electrical equipment (i.e.: transformers). See 16000-1.14-I.

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END OF SECTION 16070

DIVISION 16 – ELECTRICAL
SECTION 16100 – PULL BOXES AND JUNCTION BOXES AND FITTINGS

PART 1 – GENERAL

1.1 PULL BOXES AND JUNCTION BOXES AND FITTINGS

- A. Boxes shall be provided in the raceway systems wherever required for the pulling of wires and the making of connections.
- B. Pull boxes of not less than the minimum size required by the National Electrical Code Article 370 shall be constructed of code-gauge galvanized sheet steel. Boxes shall be furnished with screw-fastened covers. Covers on flush wall mounted boxes in well appointed areas (offices, reception, classrooms, media center, etc) shall be minimum 1/16 302 stainless steel. Boxes located on the exterior of the building shall be watertight. Covers shall be secured with tamper proof screws.
- C. Boxes shall be securely and rigidly fastened to the surface of which they are mounted or shall be supported from structural member of the building either directly or by using a substantial and approved metal rod or brace.
- D. All boxes shall be so installed that the wiring contained in them can be rendered accessible without removing part of the building.
- E. Where several circuits pass through a common pull box, the circuits shall be tagged to indicate clearly their electrical characteristics, circuit number and designation.
- F. All junction boxes larger than 4" x 4" flush mounted in wall shall have overlapping cover plate to cover rough-in openings.

END OF SECTION 16100

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DIVISION 16 – ELECTRICAL
SECTION 16120 – EQUIPMENT IDENTIFICATION

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Submit sample of laminated plastic identification plate with lettering.

1.2 MATERIALS

- A. Laminated plastic plates with 3/16" high white letter etched on black background.
- B. Plates shall be permanently mounted utilizing pop rivets or a permanent mastic/epoxy.
- C. Painted, stenciled or indented tape identification is not acceptable.

1.3 ITEM IDENTIFICATION

- A. All electrical apparatus such as wiring troughs, panelboards, individual circuit breakers, transformers and disconnect switches shall have laminated plastic identification plates. Identification shall match labeling shown on plans.
- B. A "steel" circuit directory frame permanently attached at factory (not glued), and a directory card with a plastic covering shall be provided on the inside of each panel door. The directory shall be typed to identify the load fed by each circuit and the areas served. Spaces or room numbers shown on the drawings are not necessarily the final numbers to be assigned to these areas. The Contractors shall before completion of the project obtain from the Architect final space or room numbers so that it can be typed onto directory.
- C. Circuit breakers and disconnects shall identify the equipment served and circuit and panel from which it is served.
- D. On all panelboards the exterior identification plate shall match that on the drawings and the panel and circuit number serving the panel shall be designated within the panel.

END OF SECTION 16120

DIVISION 16 – ELECTRICAL
SECTION 16220 – CONSTRUCTION REVIEWS INSPECTION AND TESTING

PART 1 – GENERAL

1.1 GENERAL

- A. Comply with Division 1 - General Requirements.

1.2 CONSTRUCTION REVIEWS

- A. The Architect or his representative shall observe and review the installation of all electrical systems shown on the drawings and as specified herein.
- B. Before covering or concealing any conduit below grade or slab, in wall or above ceiling, the contractor shall notify the Architect so that he can review the installation.

1.3 CONTRACTOR'S FINAL INSPECTION

- A. At the time of the Contractor's final inspection, all systems shall be checked and tested for proper installation and operation by the Contractor in the presence of the Architect or his representative.
- B. The Contractor shall furnish the personnel, tools and equipment required to inspect and test all systems.
- C. Following is a list of items that the contractor must demonstrate to the Architect or his representative as complying with the plans and specifications. Please note that this list does not necessarily represent all items to be covered in the final inspection, but should give the Contractor an idea of what is to be reviewed.
 - 1. Demonstrate that all panels have breakers as specified, ground bar, copper bus, typed directory for circuit identification and that they are free of trash.
 - 2. Demonstrate that all conduits are supported as required by the National Electrical Code.
 - 3. Demonstrate that all devices are properly secured to boxes, that device plates are properly aligned and are not being used to secure device.
 - 4. Demonstrate that all disconnects requiring fuses are fused with the proper size and type, and that all disconnects are properly identified.

END OF SECTION 16220

