University of South Carolina Beaufort

HH Gateway Campus Chiller Replacement

Project No. H36-I316

Project Manual

Essex Consulting Group, Inc.
3125 Medlock Bridge Road
Norcross, GA 30071
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TECHNICAL SPECIFICATIONS

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SE-310
INVITATION FOR CONSTRUCTION SERVICES

PROJECT NAME: USC Beaufort HH Gateway Campus Chiller Replacement

PROJECT NUMBER: H36-I316

PROJECT LOCATION: Bluffton, 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: $ 500K - $515K

DESCRIPTION OF PROJECT: Installation of a new 450-ton, magnetic-bearing, centrifugal chiller, cooling tower, condenser water pump, chilled water pump, and associated piping and equipment on the South Campus for the University of South Carolina Beaufort. Project includes connecting to existing chilled water and condenser water pipes and changes to the existing control system to incorporate the new chiller, cooling, tower, and pumps. Small and minority business participation is strongly encouraged.

BIDDING DOCUMENTS/PLANS MAY BE OBTAINED FROM: http://purchasing.sc.edu - Bidders are responsible for obtaining all updates to bidding documents from the USC Purchasing website.

PLAN DEPOSIT AMOUNT: $ $0.00 **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:
N/A

All questions & correspondence concerning this Invitation shall be addressed to the A/E.

A/E NAME: Essex Consulting Group, Inc.

A/E CONTACT: Lance Barron

A/E ADDRESS: **Street/PO Box**: 3125 Medlock Bridge Road

City: Norcross **State:** GA **ZIP**: 30071-

EMAIL: lbarron@essexco.com

TELEPHONE: 404-365-9482 **FAX:** 404-365-8163

AGENCY: University of South Carolina

AGENCY PROJECT COORDINATOR: Juaquana Brookins

ADDRESS: **Street/PO Box**: 1300 Pickens Street

City: Columbia **State: SC** **ZIP:** 29208-

EMAIL: jbrookin@mailbox.sc.edu

TELEPHONE: 803.777.3596 **FAX:**

PRE-BID CONFERENCE: Yes ☒ No ☐ **MANDATORY ATTENDANCE:** Yes ☐ No ☒

PRE-BID DATE: 10/19/2017 **TIME:** 10:00 a.m. **PLACE:** USCB, Facilicties Building, Rm 100, 65 West Campus Dr, Bluffton, SC 29902

BID CLOSING DATE: 10/31/2017 **TIME:** 2:00 p.m. **PLACE:** 1300 Pickens Street, Columbia SC 29208

BID DELIVERY ADDRESSES:

HAND-DELIVERY:
Attn: Juaquana Brookins
USC 1300 Pickens Street
Columbia, SC 29208

MAIL SERVICE:
Attn: Juaquana Brookins
USC 1300 Pickens Street
Columbia, SC 29208

IS PROJECT WITHIN AGENCY CONSTRUCTION CERTIFICATION? ***(Agency MUST check one)*** Yes ☒ No ☐

APPROVED BY: _____ **DATE:** _____
(OSE Project Manager)

South Carolina Division of Procurement Services, Office of the State Engineer Version of AIA® Document A701™ – 1997

Instructions to Bidders

This version of AIA Document A701™–1997 is modified by the South Carolina Division of Procurement Services, Office of the State Engineer ("SCOSE"). Publication of this version of AIA Document A701–1997 does not imply the American Institute of Architects' endorsement of any modification by SCOSE. A comparative version of AIA Document A701–1997 showing additions and deletions by SCOSE is available for review on the SCOSE Web site.

Cite this document as "AIA Document A701™– 1997, Instructions to Bidders — SCOSE Version," or "AIA Document A701™–1997 — SCOSE Version."

South Carolina Division of Procurement Services, Office of the State Engineer Version of AIA® Document A701™ – 1997

Instructions to Bidders

for the following PROJECT:
(Name and location or address)
HHI Chiller Replacement
USCB Maintenance Bldg 25 West Campus Dr, Bluffton, SC 29909
Project Number: H36-I316

THE OWNER:
(Name, legal status and address)
University of South Carolina Beaufort
One University Boulevard
Bluffton, SC 29909

The Owner is a Governmental Body of the State of South Carolina as defined by Title 11, Chapter 35 of the South Carolina Code of Laws, as amended.

THE ARCHITECT:
(Name, legal status and address)
Essex Consulting Group, Inc.
3125 Medlock Bridge Road
Norcross, GA 30071

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

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ARTICLE 1 DEFINITIONS

§ 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, Supplementary Instructions to Bidders, the Bid Form, the Notice of Intent to Award, 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 and 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 AIA Document A101™–2007 Standard Form of Agreement Between Owner and Contractor, SCOSE edition. Any reference in this document to the General Conditions of the Contract for Construction, AIA Document A201, or some abbreviated reference thereof, shall mean AIA Document A201™–2007 General Conditions of the Contract for Construction, SCOSE edition.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, AIA Document A201, or in other Contract Documents are applicable to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect prior to the execution of the Contract which modify or interpret the Bidding Documents by additions, deletions, clarifications or corrections.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents as the base, to which Work may be added or from which Work may be deleted for sums stated in Alternate Bids.

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from the amount of the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment or services or a portion of the Work as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment or labor for a portion of the Work.

ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 The Bidder by submitting a Bid represents that:

§ 2.1.1 The Bidder has read and understands the Bidding Documents and Contract Documents, to the extent that such documentation relates to the Work for which the Bid is submitted, and for other portions of the Project, if any, being bid concurrently or presently under construction. 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.

§ 2.1.2 The Bid is made in compliance with the Bidding Documents.

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

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

§ 2.1.5 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.

§ 2.1.5.1 By submitting a 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:
  - .1 those prices;
  - .2 the intention to submit a bid; or
  - .3 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.

§ 2.1.5.2 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 Section 2.1.5.1 of this certification; or
- .2 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 Section 2.1.5.1 of this certification [As used in this subdivision, the term "principals" means the person(s) in the bidder's organization responsible for determining the prices offered in this bid];
- .3 As an authorized agent, does certify that the principals referenced in Section 2.1.5.2.2 of this certification have not participated, and will not participate, in any action contrary to Section 2.1.5.1 of this certification; and
- .4 As an agent, has not personally participated, and will not participate, in any action contrary to Section 2.1.5.1 of this certification.

§ 2.1.5.3 If the bidder deletes or modifies Section 2.1.5.1.2 of this certification, the bidder must furnish with its offer a signed statement setting forth in detail the circumstances of the disclosure.

§ 2.1.6 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.

§ 2.1.7 CERTIFICATION REGARDING DEBARMENT AND OTHER RESPONSIBILITY MATTERS

§ 2.1.7.1 By submitting a Bid, Bidder certifies, to the best of its knowledge and belief, that:

- .1 Bidder and/or any of its Principals-
  - .1 Are not presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any state or federal agency;
  - .2 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
  - .3 Are not presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in Section 2.1.7.1.1.2 of this provision.
- .2 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.

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.3 "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).

§ 2.1.7.2 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.

§ 2.1.7.3 If Bidder is unable to certify the representations stated in Section 2.1.7.1, 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.

§ 2.1.7.4 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 Section 2.1.7.1 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.

§ 2.1.7.5 The certification in Section 2.1.7.1 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.

§ 2.1.8 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 the 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, the 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.

§ 2.1.9 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.

§ 2.1.9.1 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.

§ 2.1.9.2 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.***

§ 2.1.9.3 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.

§ 2.1.10 IRAN DIVESTMENT ACT CERTIFICATION

§ 2.1.10.1 The Iran Divestment Act List is a list published by the State Fiscal Accountability Authority pursuant to Section 11-57-310 that identifies persons engaged in investment activities in Iran. Currently, the list is available at the

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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.

§ 2.1.10.2 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.

§ 2.1.10.3 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.

§ 2.1.11 OPEN TRADE REPRESENTATION (JUN 2015)
By submitting an Offer, the Offeror represents that Offeror is not currently engaged in the boycott of a person or an entity based in or doing business with a jurisdiction with whom South Carolina can enjoy open trade, as defined in SC Code Section 11-35-5300. [02-2A083-1]

ARTICLE 3 BIDDING DOCUMENTS
§ 3.1 COPIES
§ 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 (10) 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.

§ 3.1.2 Bidders shall use complete sets of Bidding Documents in preparing Bids; neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

§ 3.1.3 The Owner has made copies of the Bidding Documents available on the above terms for the purpose of obtaining Bids on the Work. No license or grant of use is conferred by issuance of copies of the Bidding Documents.

§ 3.1.4 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.

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

§ 3.2.2 Bidders requiring clarification or interpretation of the Bidding Documents shall make a written request which shall reach the Architect at least ten (10) days prior to the date for receipt of Bids.

§ 3.2.3 Interpretations, corrections and changes of the Bidding Documents will be made by written Addendum. Interpretations, corrections and changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon them. 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.

§ 3.3 SUBSTITUTIONS
§ 3.3.1 The materials, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution. 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.

§ 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 (10) 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.

§ 3.3.3 If the Architect approves a proposed substitution prior to receipt of Bids, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.

§ 3.3.4 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

§ 3.4 ADDENDA

§ 3.4.1 Addenda will be transmitted to all who are known by the issuing office to have received a complete set of Bidding Documents.

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

§ 3.4.3 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.

§ 3.4.4 Each Bidder shall ascertain prior to submitting a Bid that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

§ 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, the 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.

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 PREPARATION OF BIDS

§ 4.1.1 Bids shall be submitted on the SE-330 Bid Form included with the Bidding Documents.

§ 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.

§ 4.1.3 Sums shall be expressed in figures.

§ 4.1.4 Interlineations, alterations and erasures must be initialed by the signer of the Bid. 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.

§ 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."

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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.

§ 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.

§ 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.

§ 4.2 BID SECURITY

§ 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.

§ 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.

§ 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.

§ 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.

§ 4.3 SUBMISSION OF BIDS

§ 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 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.

§ 4.3.2 Bids shall be deposited at the designated location prior to the time and date for receipt of Bids. Bids received after the time and date for receipt of Bids will be returned unopened.

§ 4.3.3 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.3.4 Oral, telephonic, telegraphic, facsimile or other electronically transmitted bids will not be considered.

§ 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.

§ 4.4 MODIFICATION OR WITHDRAWAL OF BID

§ 4.4.1 A Bid may not be modified, withdrawn or canceled by the Bidder during the stipulated time period following the time and date designated for the receipt of Bids, and each Bidder so agrees in submitting a Bid.

§ 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.

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

§ 4.4.4 Bid security, if required, shall be in an amount sufficient for the Bid as resubmitted.

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 OPENING OF BIDS

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

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

§ 5.1.3 The 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 the Owner determines to award the Project, the 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, the Owner will open and consider the Bid.

§ 5.2 REJECTION OF BIDS

§ 5.2.1 The Owner shall have the right to reject any or all Bids. A Bid not accompanied by a required bid security or by other data required by the Bidding Documents, or a Bid which is in any way incomplete or irregular is subject to rejection.

§ 5.2.2 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.

§ 5.3 ACCEPTANCE OF BID (AWARD)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest qualified Bidder provided the Bid has been submitted in accordance with the requirements of the Bidding Documents and does not exceed the funds available. The Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's own best interests.

§ 5.3.2 The Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the low Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

§ 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.

§ 6.2 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 E (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].

§ 6.3 SUBMITTALS

§ 6.3.1 The Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, after notification of selection for the award of a Contract, furnish to the Owner through the Architect in writing:

.1 a designation of the Work to be performed with the Bidder's own forces;

.2 names of the manufacturers, products, and the suppliers of principal items or systems of materials and equipment proposed for the Work; and

.3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 BOND REQUIREMENTS

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Bonds may be secured through the Bidder's usual sources.

§ 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.

§ 7.2 TIME OF DELIVERY CONTRACT, CERTIFICATES OF INSURANCE AND FORM OF BONDS

§ 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 (7) days thereafter. The Bidder shall deliver the required bonds and certificate of insurance to the Owner not later than three (3) 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.

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

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

ARTICLE 8 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

Unless otherwise required in the Bidding Documents, the Agreement for the Work will be written on AIA Document A101-2007, Standard Form of Agreement Between Owner and Contractor, SCOSE edition.

ARTICLE 9 MISCELLANEOUS

§ 9.1 NONRESIDENT TAXPAYER REGISTRATION AFFIDAVIT INCOME TAX WITHHOLDING IMPORTANT TAX NOTICE - NONRESIDENTS ONLY

§ 9.1.1 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.

§ 9.1.2 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

§ 9.1.3 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).

§ 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

§ 9.3.1 For every document the Bidder submits in response to or with regard to this solicitation or request, the Bidder must separately mark with the word "CONFIDENTIAL" every page, or portion thereof, that the 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.

§ 9.3.2 For every document the Bidder submits in response to or with regard to this solicitation or request, the Bidder must separately mark with the words "TRADE SECRET" every page, or portion thereof, that the Bidder contends contains a trade secret as that term is defined by Section 39-8-20 of the Trade Secrets Act.

§ 9.3.3 For every document the Bidder submits in response to or with regard to this solicitation or request, the Bidder must separately mark with the word "PROTECTED" every page, or portion thereof, that theBidder contends is protected by Section 11-35-1810.

§ 9.3.4 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.

§ 9.3.5 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.

§ 9.3.6 In determining whether to release documents, the State will detrimentally rely on the Bidders' marking of documents, as required by these bidding instructions, as being either "Confidential" or "Trade Secret" or "PROTECTED".

§ 9.3.7 By submitting a response, the 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

The SE-370, Notice of Intent to Award, will be posted at the following location:
Room or Area of Posting: Lobby
Building Where Posted: Facilities Building
Address of Building: 1300 Pickens Street, Columbia SC 29208
WEB site address (if applicable): 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

§ 9.5.1 Any prospective bidder, offeror, contractor, or subcontractor who is aggrieved in connection with the solicitation of a contract shall protest within fifteen (15) 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 (10) 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.

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

.1 by email to protest-ose@mmo.sc.gov,
.2 by facsimile at 803-737-0639, or
.3 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.

§ 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

§ 9.8.1 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

AIA® Document A310™ – 2010

Bid Bond

CONTRACTOR:
(Name, legal status and address)
000
000

SURETY:
(Name, legal status and principal place of business)
000
000

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

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

OWNER:
(Name, legal status and address)
University of South Carolina Beaufort
One University Boulevard, Bluffton, SC 29909

BOND AMOUNT:

PROJECT:
(Name, location or address, and Project number, if any)
HHI Chiller Replacement
Project Number: H36-I316
USCB Maintenance Bldg, 25 West Campus Drive, Bluffton, SC 29909

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

Signed and sealed this day of

(Witness)	*(Principal)* *(Seal)*
	(Title)
(Witness)	*(Surety)* *(Seal)*
	(Title)

Init.
/

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 Beaufort

(Owner's Name)

FOR: PROJECT NAME: USC Beaufort HH Gateway Campus Chiller Replacemen

PROJECT NUMBER: H36-I316

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)*****:** Installation of a new 450-ton, magnetic-bearing, centrifugal chiller, cooling tower, condenser water pump, chilled water pump, and associated piping and equipment on the South Campus for the University of South Carolina Beaufort. Project includes connecting to existing chilled water and condenser water pipes and changes to the existing control system to incorporate the new chiller, cooling, tower, and pumps.

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

(Bidder to insert Base Bid Amount on line above)

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§ 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.	Rem/Dis of asbestos mat. for shingles	SF	$	$
2.	Rem/Dis of asbestos mat.for builtup/bitumen	SF	$	$
3.	Rem/Dis of asbestos mat. for roof membrane	SF	$	$
4.			$	$
5.			$	$
6.			$	$

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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** *(Completed by Owner)*	**SUBCONTRACTOR'S PRIME CONTRACTOR'S NAME** *(Must be completed by Bidder)*	**SUBCONTRACTOR'S PRIME CONTRACTOR'S SC LICENSE NUMBER** *(Requested, but not Required)*
BASE BID		
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.

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LUMP SUM BID FORM

INSTRUCTIONS FOR SUBCONTRACTOR LISTING

1. Section 7 of the Bid Form sets forth an Owner developed list of contractor/subcontractor specialties by contractor license category and/or subcategory for which bidder is required to identify the entity (subcontractor(s) and/or himself) Bidder will use to perform the work of each listed specialty..
   a. **Column A**: The Owner fills out this column, which identifies the contractor/subcontractor specialties for which the bidder must list either a subcontractor or himself as the entity that will perform this work. Subcontractor specialties are identified by contractor license categories or subcategories listed in Title 40 of the South Carolina Code of laws. Abbreviations of classifications to be listed after the specialty can be found at: http://www.llr.state.sc.us/POL/Contractors/PDFFiles/CLBClassificationAbbreviations.pdf . If the owner has not identified a specialty, the bidder does not list a subcontractor.
   b. **Columns B and C:** In these columns, the Bidder identifies the subcontractors it will use for the work of each specialty listed by the Owner in Column A. Bidder must identify only the subcontractor(s) who will perform the work and no others. Bidders should make sure that their identification of each subcontractor is clear and unambiguous. A listing that could be any number of different entities may be cause for rejection of the bid as non-responsive. For example, a listing of M&M without more may be problematic if there are multiple different licensed contractors in South Carolina whose names start with M&M.
2. **Subcontractor Defined:** 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 pursuant to a contract with the prime contractor. Bidder should not identify sub-subcontractors in the spaces provided on the bid form but only those entities with which bidder will contract directly. Likewise, do not identify 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).
3. **Subcontractor Qualifications:** Bidder must only list subcontractors who possess a South Carolina Contractor's license with the license classification and/or subclassification identified by the Owner in the first column on the left. The subcontractor license must also be within the appropriate license group for the work of the specialty. If Bidder lists a subcontractor who is not qualified to perform the work, the Bidder will be rejected as non-responsible.
4. **Use of Own forces:** If under the terms of the Bidding Documents, Bidder is qualified to perform the work of a listed specialty 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 specialty.
5. **Use of Multiple Subcontractors:**
   a. If Bidder intends to use multiple subcontractors to perform the work of a single specialty 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 specialty listing and to use one or more subcontractors to perform the remaining work for that specialty listing, bidder must insert his own name and the name of each subcontractor, preferably separating the name of each with the word **"and"**. Bidder must use each entity listed for the work of a single specialty listing in the performance of that work.
   b. **Optional Listing Prohibited:** Bidder may not list multiple subcontractors for a specialty listing, in a form that provides the Bidder the option, after bid opening or award, to choose to use one or more but not all the listed subcontractors to perform the work for which they are listed. A listing, which on its face requires subsequent explanation to determine whether it is an optional listing, is non-responsive. If bidder intends to use multiple entities to perform the work for a single specialty 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 specialty. Agency 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 Agency may reasonably interpret as an optional listing.
6. If Bidder is awarded the contract, bidder must, except with the approval of the Agency for good cause shown, use the listed entities to perform the work for which they are listed.
7. 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 except for one or more of the reasons allowed by the SC Code of Laws.
8. Bidder's failure to identify an entity (subcontractor or himself) to perform the work of a subcontractor specialty listed in the first column on the left will render the Bid non-responsive.

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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 $ **300.00** 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: _____

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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: _____

South Carolina Division of Procurement Services, Office of the State Engineer Version of AIA® Document A101™ – 2007

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

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

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

The Owner is a Governmental Body of the State of South Carolina as defined by Title 11, Chapter 35 of the South Carolina Code of Laws, as amended.

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

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

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

The Owner and Contractor agree as follows.

This version of AIA Document A101–2007 is modified by the South Carolina Division of Procurement Services, Office of the State Engineer. Publication of this version of AIA Document A101 does not imply the American Institute of Architects' endorsement of any modification by South Carolina Division of Procurement Services, Office of the State Engineer. A comparative version of AIA Document A101–2007 showing additions and deletions by the South Carolina Division of Procurement Services, Office of the State Engineer is available for review on South Carolina state Web site.

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

TABLE OF ARTICLES

ARTICLE 1 THE CONTRACT DOCUMENTS

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

§ 1.2 Any reference in this document to the Agreement between the Owner and Contractor, AIA Document A101, or some abbreviated reference thereof, shall mean AIA Document A101™-2007 Standard Form of Agreement Between Owner and Contractor, SCOSE edition. Any reference in this document to the General Conditions of the Contract for Construction, AIA Document A201, or some abbreviated reference thereof, shall mean AIA Document A201™-2007 General Conditions of the Contract for Construction, SCOSE edition.

ARTICLE 2 THE WORK OF THIS CONTRACT

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

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The Date of Commencement of the Work shall be the date 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 (7) 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.

§ 3.2 The Contract Time as provided in Section 9(a) of the Bid Form for this Project shall be measured from the Date of Commencement. The 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, subject to adjustments of this Contract Time as provided in the Contract Documents.

§ 3.3 The Contractor shall achieve Substantial Completion of the entire Work not later than
( ) days from the date of commencement, or as follows:
(Insert number of calendar days. Alternatively, a calendar date may be used when coordinated with the date of commencement. If appropriate, insert requirements for earlier Substantial Completion of certain portions of the Work.)

Portion of Work	Substantial Completion Date

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

ARTICLE 4 CONTRACT SUM

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

§ 4.2 The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:
(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

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

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.4 Allowances included in the Contract Sum, if any:
(Identify allowance and state exclusions, if any, from the allowance price.)

Item	Price

ARTICLE 5 PAYMENTS

§ 5.1 PROGRESS PAYMENTS

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

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

§ 5.1.3 The Owner shall make payment of the certified amount to the Contractor not later than twenty-one (21) days after receipt of the Application for Payment.

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

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

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

.1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of three and one-half percent (3.5%). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as provided in Section 7.3.9 of AIA Document A201™–2007, General Conditions of the Contract for Construction;

.2 Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), less retainage of three and one-half percent (3.5%);

.3 Subtract the aggregate of previous payments made by the Owner; and

.4 Subtract amounts, if any, for which the Architect has withheld or nullified a Certificate for Payment as provided in Section 9.5 of AIA Document A201–2007.

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

.1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work, retainage applicable to such work and unsettled claims; and
(Section 9.8.5 of AIA Document A201–2007 requires release of applicable retainage upon Substantial Completion of Work with consent of surety, if any.)

.2 Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 9.10.3 of AIA Document A201–2007.

§ 5.1.8 Reduction or limitation of retainage, if any, shall be as set forth in S.C. Code Ann. § 11-35-3030(4).
(If it is intended, prior to Substantial Completion of the entire Work, to reduce or limit the retainage resulting from the percentages inserted in Sections 5.1.6.1 and 5.1.6.2 above, and this is not explained elsewhere in the Contract Documents, insert here provisions for such reduction or limitation.)

§ 5.1.9 The Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 FINAL PAYMENT

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

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

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

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than twenty-one (21) days after the issuance of the Architect's final Certificate for Payment.

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Reserved

ARTICLE 7 TERMINATION OR SUSPENSION

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

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

ARTICLE 8 MISCELLANEOUS PROVISIONS

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

§ 8.2 Reserved

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

§ 8.3.1 The 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:
Title:
Address:
Telephone: **FAX:**
Email:

§ 8.3.2 The 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:
Title:
Address:
Telephone: **FAX:**
Email:

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

§ 8.4.1 The 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:
Title:
Address:
Telephone: **FAX:**
Email:

§ 8.4.2 The 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:
Title:
Address:
Telephone: **FAX:**
Email:

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

§ 8.6 Other provisions:

§ 8.6.1 The Architect's representative:

Name:
Title:
Address:
Telephone: **FAX:**
Email:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

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

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

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

§ 9.1.3 The Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

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

Section	Title	Date	Pages

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

Number	Title	Date

§ 9.1.6 The Addenda, if any:

Number	Title	Date

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

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

.1 AIA Document E201™–2007, Digital Data Protocol Exhibit, if completed by the parties, or the following:

.2 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201–2007 provides that bidding requirements such as advertisement or invitation to bid, Instructions to Bidders, sample forms and the Contractor's bid are not part of the Contract Documents unless enumerated in this Agreement. They should be listed here only if intended to be part of the Contract Documents.)

SE-310, Invitation for Construction Services

Instructions to Bidders (AIA Document A701-1997)

Contractor's Bid (Completed Bid Form)

SE-370, Notice of Intent to Award

Certificate of Procurement Authority issued by the State Fiscal Accountability Authority

ARTICLE 10 INSURANCE AND BONDS

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

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

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

South Carolina Division of Procurement Services, Office of the State Engineer Version of AIA® Document A201™ – 2007

General Conditions of the Contract for Construction

This version of AIA Document A201™–2007 is modified by the South Carolina Division of Procurement Services, Office of the State Engineer ("SCOSE"). Publication of this version of AIA Document A201–2007 does not imply the American Institute of Architects' endorsement of any modification by SCOSE. A comparative version of AIA Document A201–2007 showing additions and deletions by SCOSE is available for review on the SCOSE Web site.

Cite this document as "AIA Document A201™–2007, General Conditions of the Contract for Construction—SCOSE Version," or "AIA Document A201™–2007 — SCOSE Version."

South Carolina Division of Procurement Services, Office of the State Engineer Version of AIA® Document A201™ – 2007

General Conditions of the Contract for Construction

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

HHI Chiller Replacement

USCB Maintenance Bldg 25 West Campus Dr, Bluffton, SC 29909

THE OWNER:
(Name, legal status and address)

University of South Carolina Beaufort

One University Boulevard

Bluffton, SC 29909

The Owner is a Governmental Body of the State of South Carolina as defined by Title 11, Chapter 35 of the South Carolina Code of Laws, as amended.

THE ARCHITECT:
(Name, legal status and address)

Essex Consulting Group, Inc.

3125 Medlock Bridge Road

Norcross, GA 30071

This version of AIA Document A201–2007 is modified by the South Carolina Division of Procurement, Office of the State Engineer. Publication of this version of AIA Document A201 does not imply the American Institute of Architects' endorsement of any modification by South Carolina Division of Procurement, Office of the State Engineer. A comparative version of AIA Document A201–2007 showing additions and deletions by the South Carolina Division of Procurement, Office of the State Engineer is available for review on the State of South Carolina Web site.

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

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 BASIC DEFINITIONS

§ 1.1.1 THE CONTRACT DOCUMENTS

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

Any reference in this document to the Agreement between the Owner and Contractor, AIA Document A101, or some abbreviated reference thereof, shall mean AIA Document A101™–2007 Standard Form of Agreement Between Owner and Contractor, SCOSE edition. Any reference in this document to the General Conditions of the Contract for Construction, AIA Document A201, or some abbreviated reference thereof, shall mean AIA Document A201™–2007 General Conditions of the Contract for Construction, SCOSE edition.

§ 1.1.2 THE CONTRACT

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

§ 1.1.3 THE WORK

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

§ 1.1.4 THE PROJECT

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

§ 1.1.5 THE DRAWINGS

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

§ 1.1.6 THE SPECIFICATIONS

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

§ 1.1.7 INSTRUMENTS OF SERVICE

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

§ 1.1.8 NOTICE TO PROCEED

The 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.

§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

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

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

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

§ 1.3 CAPITALIZATION

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

§ 1.4 INTERPRETATION

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

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

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service 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.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants.

§ 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

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

ARTICLE 2 OWNER

§ 2.1 GENERAL

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization, except as 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 § 8.3 of the Agreement.]

§ 2.1.2 The Owner shall furnish to the Contractor within fifteen (15) 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.

§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due. The Owner shall furnish such evidence as a condition precedent to commencement or continuation of the Work or the portion of the Work affected by a material change. After the Owner furnishes the evidence, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

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

§ 2.2.3 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. 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.

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

§ 2.2.5 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one electronic copy (.pdf format) of the Contract Documents. The Contractor may make reproductions of the Contract Documents pursuant to Section 1.5.2.

§ 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.

§ 2.3 OWNER'S RIGHT TO STOP THE WORK

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

§ 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect, 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.

ARTICLE 3 CONTRACTOR

§ 3.1 GENERAL

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

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

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

§ 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

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

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

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

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

§ 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

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

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

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

§ 3.4 LABOR AND MATERIALS

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

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

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

§ 3.5 WARRANTY

The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements 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. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.6 TAXES

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect. The Contractor shall comply with the requirements of Title 12, Chapter 8 of the South Carolina Code of Laws, as amended, regarding withholding tax for nonresidents, employees, contractors and subcontractors.

§ 3.7 PERMITS, FEES, NOTICES AND COMPLIANCE WITH LAWS

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

negotiations concluded. 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.

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

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

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

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

§ 3.8 ALLOWANCES

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

§ 3.8.2 Unless otherwise provided in the Contract Documents,

.1 Allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;

.2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and

.3 Whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect the difference between actual costs, as documented by invoices, and the allowances under Section 3.8.2.1.

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

§ 3.9 SUPERINTENDENT

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

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner the name and qualifications of a proposed superintendent. The Owner may reply within 14 days to the Contractor in

writing stating whether the Owner has reasonable objection to the proposed superintendent. Failure of the Owner to reply within the 14 day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall notify the Owner, in writing, of any proposed change in the superintendent, including the reason therefore, prior to making such change. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

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

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

§ 3.10.3 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 Contactor 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.

§ 3.10.4 The Owner's review and acceptance of the 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.

§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE

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

§ 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

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

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

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

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

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

§ 3.12.5.1 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 for review and approval. A copy of the shop drawings will also be sent to OSE for information. 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 for approval.

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

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

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

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

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, who shall comply with reasonable requirements of the Owner regarding qualifications and insurance and whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

§ 3.13 USE OF SITE

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

§ 3.13.2 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.

§ 3.14 CUTTING AND PATCHING

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

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

§ 3.15 CLEANING UP

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

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

§ 3.16 ACCESS TO WORK
The Contractor shall provide the Owner and Architect access to the Work in preparation and progress wherever located.

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

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

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

ARTICLE 4 ARCHITECT
§ 4.1 GENERAL
§ 4.1.1 The Architect is that person or entity identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

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

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

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

§ 4.2.2 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. However, the Architect will not be required to make exhaustive or

continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner 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. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

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

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

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

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

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

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

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

§ 4.2.11 The Architect will, 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. The Architect's response to such requests will be made in writing with reasonable promptness.

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

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

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents 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.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 DEFINITIONS

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

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

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

§ 5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, 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 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.

§ 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.

§ 5.2.3 If the Owner has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner has no reasonable objection. If the proposed but rejected Subcontractor was

reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person or entity previously selected if the Owner makes reasonable objection to such substitution. The Contractor's request for substitution must be made to the Owner in writing accompanied by supporting information.

§ 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.

§ 5.2.6 The Iran Divestment Act List is a list published by the State Fiscal Accountability Authority 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.

§ 5.3 SUBCONTRACTUAL RELATIONS

§ 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 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 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.

§ 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

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

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

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

§ 5.4.3 Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

§ 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.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

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

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

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

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

§ 6.1.4 Reserved.

§ 6.2 MUTUAL RESPONSIBILITY

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

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable

for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

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

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

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

§ 6.3 OWNER'S RIGHT TO CLEAN UP

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

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 GENERAL

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

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

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

§ 7.2 CHANGE ORDERS

§ 7.2.1 A Change Order is a written instrument prepared by the Architect (using Form SE-380 "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.

§ 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.

§ 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.

§ 7.3 CONSTRUCTION CHANGE DIRECTIVES

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

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

§ 7.3.3 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.

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

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

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

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall 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;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work.

§ 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.

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

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

§ 7.4 MINOR CHANGES IN THE WORK

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

§ 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:

.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.

ARTICLE 8 TIME

§ 8.1 DEFINITIONS

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

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

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

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

§ 8.2 PROGRESS AND COMPLETION

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

§ 8.2.2 The Contractor shall not knowingly 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.

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

§ 8.3 DELAYS AND EXTENSIONS OF TIME

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the 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.

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

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

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 CONTRACT SUM

The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents. All changes to the Contract Sum shall be adjusted in accordance with Section 7.3.3.

§ 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 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.

§ 9.3 APPLICATIONS FOR PAYMENT

§ 9.3.1 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.

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

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

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

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

§ 9.4 CERTIFICATES FOR PAYMENT

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

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

§ 9.5 DECISIONS TO WITHHOLD CERTIFICATION

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

.1 defective Work not remedied;

.2 third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;

.3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;

.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

.5 damage to the Owner or a separate contractor;

.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or

.7 repeated failure to carry out the Work in accordance with the Contract Documents.

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

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

§ 9.6 PROGRESS PAYMENTS

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

§ 9.6.2 Pursuant to Chapter 6 of Title 29 of the South Carolina Code of Laws, as amended, the Contractor shall pay each Subcontractor no later than seven days after receipt of payment from the Owner the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

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

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

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

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

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

§ 9.7 FAILURE OF PAYMENT

If the Architect does not issue a Certificate for Payment 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 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.

§ 9.8 SUBSTANTIAL COMPLETION

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use and when all required occupancy permits, if any, have been issued and copies have been delivered to the Owner.

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

§ 9.8.3 Upon receipt of the Contractor's list, the Architect, 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 re-inspections or, at the Owner's option, the costs may be deducted from payments due to the Contractor.

§ 9.8.3.1 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.

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

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

§ 9.9 PARTIAL OCCUPANCY OR USE

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

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

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

§ 9.10 FINAL COMPLETION AND FINAL PAYMENT

§ 9.10.1 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 re-inspections 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.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment (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.

§ 9.10.3 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. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

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

.1 liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;

.2 failure of the Work to comply with the requirements of the Contract Documents; or

.3 terms of special warranties required by the Contract Documents.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those 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.

§ 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.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 SAFETY PRECAUTIONS AND PROGRAMS

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

§ 10.2 SAFETY OF PERSONS AND PROPERTY

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

.1 employees on the Work and other persons who may be affected thereby;

.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and

.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

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

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

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

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

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

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

§ 10.2.8 INJURY OR DAMAGE TO PERSON OR PROPERTY

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

§ 10.3 HAZARDOUS MATERIALS

§ 10.3.1 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.

§ 10.3.2 Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or

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who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up. 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.

§ 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.

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

§ 10.3.5 In addition to its obligations under Section 3.18, the Contractor shall indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 Reserved.

§ 10.4 EMERGENCIES

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

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 CONTRACTOR'S LIABILITY INSURANCE

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

.1 Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;

.2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;

.3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;

.4 Claims for damages insured by usual personal injury liability coverage;

.5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;

.6 Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;

.7 Claims for bodily injury or property damage arising out of completed operations; and

.8 Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified 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.

.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) Damage to Rented Premises (ea occurrence) $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.

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

.1 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;

.2 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

.3 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, the 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.

§ 11.1.4 A failure by the Owner to either (i) demand a certificate of insurance or written endorsement required by Section 11.1, or (ii) 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.

§ 11.2 OWNER'S LIABILITY INSURANCE

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

§ 11.3 PROPERTY INSURANCE

§ 11.3.1 Unless otherwise provided 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. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

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

§ 11.3.1.2 Reserved.

§ 11.3.1.3 Reserved.

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

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

§ 11.3.2 BOILER AND MACHINERY INSURANCE

The 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 be named insureds.

§ 11.3.3 LOSS OF USE INSURANCE

The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. 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.

§ 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.

§ 11.3.5 Reserved.

§ 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.

§ 11.3.7 WAIVERS OF SUBROGATION

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

§ 11.3.8 A loss insured under the 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. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the 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.

§ 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.

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

§ 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 written on Form SE-357, "Labor and Material Payment Bond", and both shall be made payable to the Owner.

§ 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.

§ 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.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 UNCOVERING OF WORK

§ 12.1.1 If a portion of the Work is covered contrary to the 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.

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

§ 12.2 CORRECTION OF WORK

§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

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

§ 12.2.2 AFTER SUBSTANTIAL COMPLETION

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

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

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

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

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

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

§ 12.3 ACCEPTANCE OF NONCONFORMING WORK

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

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 GOVERNING LAW

The Contract, 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.

§ 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.

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

§ 13.4 RIGHTS AND REMEDIES

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

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

§ 13.4.3 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

§ 13.5 TESTS AND INSPECTIONS

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

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

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's services and expenses shall be at the Contractor's expense.

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

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

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

§ 13.6 INTEREST

Payments due 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.

§ 13.7 Reserved

§ 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 Caroline 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.

§ 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)

§ 13.17 OPEN TRADE (JUN 2015)

During the contract term, including any renewals or extensions, Contractor will not engage in the boycott of a person or an entity based in or doing business with a jurisdiction with whom South Carolina can enjoy open trade, as defined in SC Code Section 11-35-5300. [07-7A053-1]

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 TERMINATION BY THE CONTRACTOR

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 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

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

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, including reasonable overhead and profit, costs incurred by reason of such termination, and damages. Any adjustment to the Contract Sum pursuant to this Section shall be made in accordance with the requirements of Article 7.

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

§ 14.2 TERMINATION BY THE OWNER FOR CAUSE

§ 14.2.1 The Owner may terminate the Contract if the Contractor

.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials, 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.

§ 14.2.2 When any of the above reasons exist, the Owner may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

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

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

§ 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.

§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

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

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Any adjustment to the Contract Sum made pursuant to this section shall be made in accordance with the requirements of Article 7.3.3. No adjustment shall be made to the extent

.1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

§ 14.4.1 The Owner may, at any time, terminate the Contract 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.

§ 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.**

§ 14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, 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.

§ 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.

§ 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 State Fiscal Accountability Authority 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.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 CLAIMS

§ 15.1.1 DEFINITION

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

§ 15.1.2 NOTICE OF CLAIMS

Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the 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.

§ 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.

§ 15.1.4 CLAIMS FOR ADDITIONAL COST

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

§ 15.1.5 CLAIMS FOR ADDITIONAL TIME

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

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

.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.

§ 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).

§ 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).

§ 15.2 Reserved.

§ 15.3 Reserved.

§ 15.4 Reserved.

§ 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.

§ 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.

§ 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.

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:

§ 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, or enter NONE)*

NONE

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

Section 01 77 00 Closeout Requirements of the 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, or enter NONE)*

Section 01 77 00 Closeout Requirements of the 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, or enter NONE)*

NONE

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

NONE

§ 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: 1300 Pickens 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: HHI Chiller Replacement

State Project Number: H36-I316

Brief Description of Awarded Work, as found on the SE-330 or SE-332, Bid Form: Installation of a new 450-ton, magnetic-bearing, centrifugal chiller, cooling tower, condenser water pump, chilled water pump, and associated piping and equipment on the South Campus for the University of South Carolina Beaufort. Project includes connecting to existing chilled water and condenser water pipes and changes to the existing control system to incorporate the new chiller, cooling, tower, and pumps. Small and minority business participation is strongly encouraged.

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

Name: Essex Consulting Group, Inc.

Address: 3125 Medlock Bridge Road

Norcross, GA 30071

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 si 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: 1300 Pickens 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: HHI Chiller Replacement

State Project Number: H36-I316

Brief Description of Awarded Work, as found on the SE-330 or SE-332, Bid Form: Installation of a new 450-ton, magnetic-bearing, centrifugal chiller, cooling tower, condenser water pump, chilled water pump, and associated piping and equipment on the South Campus for the University of South Carolina Beaufort. Project includes connecting to existing chilled water and condenser water pipes and changes to the existing control system to incorporate the new chiller, cooling, tower, and pumps. Small and minority business participation is strongly encouraged.

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

Name: Essex Consulting Group, Inc.

Address: 3125 Medlock Bridge Road

Norcross, GA 30071

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 & Material Payment 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-357
LABOR & 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 o ne 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 Beaufort HH Gateway Campus Chiller Replacement

PROJECT NUMBER: H36-I316

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: _____

A/E 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 Contract Change Order Certification of: **$** _____ **Yes** ☐ **No** ☐

Office of the State Engineer Authorization for change exceeding Agency Construction Contract Change Order Certification:

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

SUBMIT THE FOLLOWING TO OSE

1. SE-380, fully completed and signed by the Contractor, A/E and Agency;
2. Detailed back-up information from the Contractor/Subcontractor(s) that justifies the costs and schedule changes shown.
3. If any item exceeds Agency certification, OSE will authorize the SE-380 and return to Agency.

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. Fraternization 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.

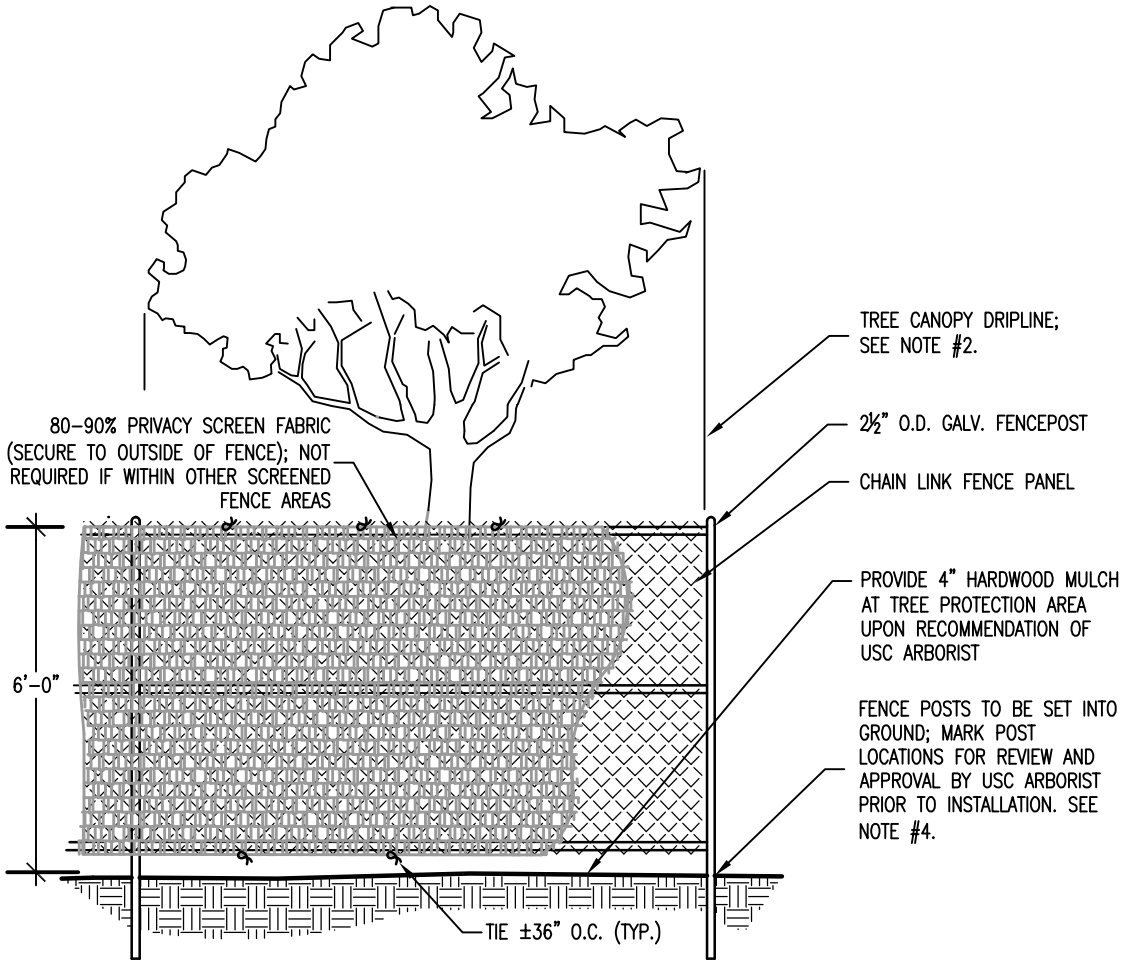
33. All motorized vehicles that leak or drip liquids are prohibited from traveling or parking on walks or landscaped areas.

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.



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 ADDITONAL 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.

TREE PROTECTION FENCING (IN–GROUND) WITH SCREENING

NO SCALE REVISED 8.28.14

Project Name: USC Beaufort HH Gateway Campus Chiller Replacement
Project Number: H36-I316

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 _____

SECTION 01 10 00

SUMMARY OF WORK

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
1. Work covered by the Contract Documents.
2. Type of the Contract.
3. Work phases.
4. Work under other contracts.
5. Products ordered in advance.
6. Owner furnished products.
7. Use of premises.
8. Owner's occupancy requirements.
9. Work restrictions.
10. Specification formats and conventions.

1.03 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: University of South Carolina at Beaufort.
1. Project Location: Hilton Head Gateway Campus, Bluffton, South Carolina.
2. Building included:
Maintenance Building, 65 West Campus Drive, Bluffton, SC

B. Owner:
University of South Carolina Beaufort
1300 Pickens Street
Columbia, SC 29208
Tel: 803-777-9824
Fax: 803-777-8739
Contact: Mr. Lee Miller, lee.miller@sc.edu

C. Engineer: Essex Consulting Group
4611 Hardscrabble Road, Suite 109-230
Columbia, South Carolina 29229
Tel: 803-873-9910
Fax: 803-873-9913
Cell: 678-428-3329
Contact: Lance Barron, lbarron@essexco.com

E. End User:

University of South Carolina Beaufort
Hilton Head Gateway Campus
One University Parkway
Bluffton, South Carolina 29909
Contact: Mr. Mike Parrott, mparrott@uscb.edu

F. Construction Manager: Duties to be performed by General Contractor.

G. Program Manager: Duties to be performed by Owner.

H. The Contract Documents include: Documents issued under the title block of Essex including the Project manual which includes Project Specifications and Drawings, all dated June __, 2017.
1. Drawings and Specifications were prepared by and the work covered therein are the responsibility of the following:
a. Essex Consulting Group, Inc.

I. The work consists of the following:
1. The work includes:
a. Installation of a new chiller, cooling tower, chilled water pumps and condenser water pumps in the central plant of the Maintenance Building.
b. All associated plumbing as indicated.
c. All electrical work as indicated.
d. All concrete and inertia base work as indicated.
e. All changes to the cooling tower structural steel as indicated.
f. All controls work as indicated.

1.04 TYPE OF CONTRACT
A. Project will be constructed under a single prime contract.

1.05 WORK PHASES
A. The Work shall be conducted in one phase delivered Summer/Fall 2017.

1.06 WORK UNDER OTHER CONTRACTS

A. General: Cooperate fully with Owner's separate contractors or consultants, if any, so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.
B. Preceding Work: None.
C. Concurrent Work:
1. None anticipated.
D. Future Work: None anticipated.
E. Concurrent and/or Future Work: None anticipated other than that Work described under paragraph C.

1.07 PRODUCTS ORDERED OR PURCHASED IN ADVANCE

A. None.

1.08 FURNISHED PRODUCTS OR SYSTEMS

A. None.

1.09 USE OF PREMISES

A. General: Contractor shall have full use of premises for construction operations, including use of Project site, during construction period. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

B. Use of Site: Limit use of premises to areas within the property limits indicated.

1. Limits: Materials lay down and storage and employee parking shall be as mutually agreed between Owner and Contractor.

2. Owner Occupancy: Allow for Owner occupancy of Project site and operation of existing chiller, cooling tower, and pumps.

3. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances.

b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.10 END USER’S OCCUPANCY REQUIREMENTS

A. End User’s Occupancy of buildings during Construction: The End User and its employees and vendors shall occupy the Maintenance Building during the Work, provided such occupancy does not interfere with completion of the Work as mutually agreed between Owner and Contractor. Such occupancy shall not constitute acceptance of the total Work.

1.11 WORK RESTRICTIONS

A. On-Site Work Hours: GC to coordinate with USCB.

B. Nonsmoking Building: Smoking is not permitted within the building or within 10 feet of entrances, operable windows, or outdoor air intakes.

1.12 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "MasterFormat" numbering system.

1. Section Identification: The Specifications use Section numbers and titles to help Cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.

2. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.

B. Specification Content: The Specifications use certain conventions for the style of

language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

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

PART 2 _ PRODUCTS (Not Used)

PART 3 _ EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This section shall not be interpreted to relieve Contractor of his sole responsibility for supervision and coordination of all construction procedures as provided herein and in Contract Conditions.
B. Contractor requirements:
    1. Be responsible for supervising and directing Work, using his best skill and attention.
    2. Be solely responsible for all construction means, methods, techniques, sequences and procedures, and coordination of all portions of Work under Contract.
    3. Be responsible for acts and omissions of his employees, subcontractors and their agents, and employees.
C. Contractor shall not be relieved from his obligation to perform Work complying with Contract Documents, either by activities of Owner or Engineer in his administrations of Contract or by inspections, tests, or approvals required to substantiate Contract compliance.
D. Provisions of this section are considered minimal for orderly and expeditious prosecution of Work.
E. Related Sections:
    1. Section 013300: Submittal Procedures.
    2. Section 014523: Testing and Inspection Services.
    3. Section 016000: Product Requirements.
    4. Section 017400: Cleaning and Waste Management.
    5. Section 017700: Closeout Procedures.

1.03 ORDERING PRODUCTS

A. Before ordering materials, equipment, custom or standard fabricated items, verify the following provisions:
    1. Each item complies with Contract Documents.
    2. Each properly relates to Work already completed.
    3. Shop drawings or other submittals confirm "1." and "2." above.
    4. Orders are placed and delivery dates are established allowing orderly execution of Work on schedule and not allowing untimely delivery of critically sensitive products before Project site conditions are satisfactory to receive them.

1.04 COORDINATION AMONG TRADES

A. Initiate coordinating procedures at Project meetings before Work in field begins. Resolve scheduling, sequencing, interferences, and priorities of oncoming simultaneous Work among interested parties to achieve specified results, and to advance planned progress of Project.
B. Continue coordinating procedures by actively controlling Project conditions as follows:
    1. Verify products of all trades are stored in orderly fashion under conditions complying with manufacturer's instructions or specific requirements of relevant specification section whichever requirement is more stringent at planned locations.
    2. Verify compliance of environmental conditions before, during, and after execution of Work, with manufacturer's instructions and specific requirements of relevant sections of these specifications.
    3. Verify adherence to specified tolerances as Work progresses.
    4. Inspect job conditions before one trade follows another in compliance with these specifications:
        a. Plan joint inspections involving interested parties.
        b. Schedule inspections one week in advance, with notices sent to interested parties.
        d. Engineer will confine his observations to only limited areas; Contractor shall be responsible for continuing similar inspections to all areas involved.
        e. Review of job conditions, in part or in whole, by Engineer in no way relieves Contractor of his obligation to provide various stages of Work as well as finished Work complying with Contract Documents.
        f. Allowing Work to proceed over unsatisfactory conditions preventing execution of new specified Work is prohibited.
C. Continue coordinating efforts as Work progresses, verifying parties comply with decisions as agreed under Paragraphs A. and B. above. Make adjustments in planned procedures as changing job conditions require to achieve results specified to best advance progress of Work. Immediately advise all parties involved of required changes in construction schedule and planned procedure.

1.05 COORDINATION WITH RELATED WORK

A. Require all trades to cooperate with related Work as well as with those sections enumerated in Article 1.02 above.
B. Contractor and his Subcontractors: Coordinate Work with separate contract work by Owner, if applicable, and with prior occupancy provisions required by Owner.

1.06 TRAFFIC MAINTENANCE AND CIRCULATION

A. General:
    1. Maintain circulation of traffic, both pedestrian and vehicular, and access to all parts of site by fire-fighting apparatus during construction.

2. Access to site is from public streets. Confine parking and vehicle access as directed by Owner to accommodate operation of existing occupants.
3. Obtain offsite parking required for construction.
4. Access to occupied areas will be restricted during construction unless prior approval is obtained from Owner.

PART 2 PRODUCTS _ NOT USED

PART 3 EXECUTION _ NOT USED

END OF SECTION 01 31 00

SECTION 01 31 19

PROJECT MEETINGS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 RELATED REQUIREMENTS:

A. Section 01 33 00: Submittal Procedures.

B. Pre-installation conferences: Individual Specifications Sections.

1.03 PRE'CONSTRUCTION MEETING:

A. The Owner will schedule a pre-construction conference in a timely manner.

B. Attendance:
1. Owner or his appointed representative.
2. Engineer (and his professional consultants he deems appropriate).
3. Contractor and his superintendent.
4. Others required by the Owner and the Engineer.

C. Agenda:

1. Submittal of executed bonds and insurance certificates.
2. Distribution of Contract Documents.
3. Submittal of:
    a. List of subcontractors.
    b. List of products.
    c. Schedule of values.
    d. Progress schedule.
4. Designation of responsible personnel.
5. Procedures and processing of:
    a. Field decisions.
    b. Submittals.
    c. Substitutions.
    d. Applications for payment.
    e. Proposal requests.
    f. Change orders.
    g. Contract closeout procedures.
6. Scheduling.

1.04 PROJECT MEETINGS:

A. Schedule and administer biweekly progress meetings, called meetings, and pre-installation meetings throughout the progress of the Work.
   1. Make physical arrangements for meetings.
   2. Prepare agenda for meetings.
   3. Distribute written notice of each meeting seven days in advance of meeting date.
   4. Preside at meetings.
   5. Record the minutes.
   6. Reproduce and distribute copies of minutes within three days after each meeting. Provide one copy to all participants in the meeting, and all parties affected by decisions made at the meeting. Furnish three copies to the Engineer.

B. Location of the meetings: To be determined in coordination with Owner's representative.

C. Attendance:
   1. Owner or his appointed representative.
   2. Engineer (and his professional consultants he deems appropriate).
   3. Contractor.
   4. Contractor's job superintendent.
   5. Subcontractors as appropriate to the agenda.
   6. Suppliers as appropriate to the agenda.
   7. Others.
   8. Representatives of contractors, subcontracts and suppliers attending the meetings shall be qualified and authorized to act on behalf of the entity each represents.

D. Minimum Agenda:
   1. Approval of minutes of previous meeting.
   2. Review of work in progress.
   3. Field observations, problems and decisions.
   4. Identification of problems which impede planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Review of off-site fabrication and delivery schedules.
   7. Maintenance of progress schedule.
   8. Corrective measures to regain projected schedules.
   9. Planned progress during succeeding work period.
   10. Coordination of projected schedules.
   11. Maintenance of quality and work standards.
   12. Effect of proposed changes on progress schedule and coordination.
   13. Project safety.
   14. Site Cleanup.
   15. Other business relating to the work.

PART 2 PRODUCTS _ NOT USED

PART 3 EXECUTION _ NOT USED

END OF SECTION 01 31 19

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. General Provisions:
1. Provisions in this section are mandatory procedures for preparing and submitting samples, shop drawings, and product data.
2. Job delays occasioned by requirement of resubmission of samples, shop drawings and product data not in accord with Contract Documents are Contractor's responsibility, and will not be considered valid justification for extension of time.

1.03 PREPARATION

A. Samples:
1. Prepare samples in sizes, shapes, and finishes in accord with provisions of individual specification sections.
2. Samples furnished under this section are not to be confused with full size, on the site "Mock-Ups" that may be called for in some specification sections.
3. Number of samples submitted: Number required by Contractor, plus one which will be retained by Engineer unless otherwise indicated.
4. Samples requiring color selection: Not applicable in this Contract.

B. Shop Drawings:
1. Conform to the following requirements:
a. Number sheets consecutively.
b. Indicate working and erection dimensions and relationships to adjacent work.
c. Indicate:
1) Arrangements and sectional views, as applicable.
2) Material, gauges, thicknesses, finishes and characteristics.
3) Anchoring and fastening details: include information for making connections to adjacent work.
d. Indicate working and erection dimensions and relationships to adjacent work. Concurrent submittals of different aspects of work may be required by Owner’s representative as deemed necessary to demonstrate Contractor's ability to understand these relationships and coordinate Work.
e. Provide 6 in. by 6 in. clean space in the lower right hand area for entry of the Contractor's, Owner’s representative, and Engineer's stamps.

f. Cross reference drawing details and specification paragraphs applicable to submitted data.

2. Submit copies of shop drawings. Provide number of copies as follows:
    a. Number required by Contractor for coordination and execution of Work.
    b. One copy for Owner's file.
    c. One copy for Engineer.

C. Product Data:

1. Include product manufacturer's standard printed material, dated, with product description and installation instructions indicated: delete data not required for this Project or mark "Void" as applicable.
2. Number of copies submitted: Number required by Contractor plus two which will be retained by Owner's representative and Engineer.
3. Quality control submittals: Submit from manufacturers for each product indicating materials supplied or installed are asbestos free.

1.04 REVIEW

A. Contractor's:
1. Review submittals and stamp with approval action stamp containing Contractor's name, word "Approved", signed initials of approving agent, date of approval action, review notes, comments, and corrections required prior to submission to Owner's representative.
2. By so noting, Contractor indicates that he has reviewed and approves materials, equipment, quantities, and dimensions represented by particular submittal.
3. Contractor represents by submitting samples, shop drawings, and product data that he has complied with provisions specified above.
4. Submissions made without Contractor's approval indicated thereon will be returned without being reviewed for compliance with this requirement.
5. Date each submittal: indicate name of Project, Engineer, Contractor, Sub-Contractor, as applicable, description or name of equipment, material, or product and identify Work use location.
6. Accompany submittal with transmittal letter containing project name, Contractor's name, number of samples or drawings, titles, and other pertinent data. Outline deviations, if any, in submittals from requirements of Contract Documents.

B. Owner's Representative:
1. Review submittals with reasonable promptness to cause no delay in Work.
2. Review is only for conformance with design concept of project and information in Contract Documents. Review of separate item shall not indicate approval of an assembly in which item functions.
3. Owner's representative will return submittals to Contractor for distribution.

C. Engineer's shop drawing stamp contains the following information:

SUBMITTAL REVIEW

APPROVAL IS ONLY FOR GENERAL CONFORMANCE WITH THE DESIGN CONCEPT OF THE PROJECT AND THE INFORMATION GIVEN IN THE CONTRACT DOCU_ MENTS. CONTRACTOR IS RESPONSIBLE FOR DIMEN_ SIONS TO BE CONFIRMED AND CORRELATED AT THE JOB SITE; INFORMATION THAT PERTAINS SOLELY TO THE FABRICATION PROCESS OR TO THE MEANS AND METHOD OF CONSTRUCTION; COORDINATION OF THE WORK OF ALL TRADES; AND PERFORMING ALL WORK IN A SAFE AND SATISFACTORY MANNER. THIS APPROVAL DOES NOT MODIFY CONTRACTOR'S DUTY TO COMPLY WITH THE CONTRACT DOCUMENTS.

APPROVED ☐

APPROVED AS NOTED ☐

REVISE AND RESUBMIT ☐

REJECTED ☐

NOT REQUIRED FOR REVIEW ☐

ESSEX CONSULTING GROUP, INC.

NORCROSS, GA 30071/Columbia, SC 29229

Date_____ By_____

1.05 RESUBMISSION

A. Make corrections and changes indicated for unapproved submissions: resubmit in same manner as specified above until Owner's representative approval is obtained.

B. Direct specific attention to revisions other than corrections requested by Owner's representative on previous submissions, if any, in resubmission transmittal.

PART 2 PRODUCTS _ NOT USED

PART 3 EXECUTION _ NOT USED

END OF SECTION 01 33 00

SECTION 01 45 23

TESTING AND INSPECTON SERVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Contractor shall employ and pay for services of independent testing laboratory to perform specified services and testing.

B. Related Requirements:
1. Conditions of the Contract: Inspections and testing required by laws, ordinances, rules, regulations, orders or approvals of public authorities.

1.03 TESTING LABORATORY

A. Qualifications:
1. Meet "Recommended Requirements for Independent Laboratory Qualification" published by American Council of Independent Laboratories.
2. Meeting basic requirements of ASTM E329'00b, "Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction."
3. Authorized to operate in State in which Project located.
4. Submit copy of Inspection Report of Facilities made by Materials Reference Laboratory of National Institute of Standards and Technology (NIST) during most recent tour of inspection, with memorandum of remedies of deficiencies reported by inspection.
5. Testing equipment, calibrate at reasonable intervals by devices of accuracy traceable to either:
    a. National Institute of Standards and Technology.
    b. Accepted values of natural physical constants.

B. Duties:
1. Cooperate with Owner’s representative and Contractor: provide qualified personnel after due notice.
2. Perform necessary inspections, sampling, and testing of materials and methods of construction.
    a. Comply with specified standards.
    b. Ascertain compliance of materials with requirements of Contract Documents.

3. Promptly notify Owner’s representative and Contractor in writing of observed

irregularities or deficiencies of work or products.

4. Promptly submit five copies of written report of each test and inspection to Owner's representative Include on each report:
    a. Date issued.
    b. Project title and number.
    c. Testing laboratory name, address, and telephone number.
    d. Name and signature of laboratory inspector.
    e. Date and time of sampling or inspection.
    f. Record of temperature and weather conditions.
    g. Date of test.
    h. Identification of product and specification section.
    i. Location of sample or test in Project.
    j. Type of inspection or test.
    k. Results of tests and compliance with Contract Documents.
    l. Interpretation of test results, when requested by Owner's representative.
5. Perform additional tests required by Owner's representative.

C. Limitations: Laboratory is not authorized to:
1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Approve or accept any portion of Work.
3. Perform duties of Contractor.

1.04 CONTRACTOR

A. Responsibilities:
1. Cooperate with laboratory personnel; provide access to Work, and manufacturers operations.
2. Secure and deliver to laboratory adequate quantities of representative samples of materials proposed requiring testing.
3. Provide laboratory preliminary design mix proposed for concrete and other materials mix requiring control by Testing Laboratory.
4. Furnish required copies of products test reports.
5. Furnish incidental labor and facilities:
    a. To provide access to Work to be tested.
    b. To obtain and handle samples at Project site or at source of product to be tested.
    c. To facilitate inspections and tests.
    d. For storage and curing of test samples.
6. Notify laboratory sufficiently in advance of operations to allow laboratory assignment of personnel and scheduling of tests.

PART 2 PRODUCTS _ NOT USED

PART 3 EXECUTION _ NOT USED

END OF SECTION 01 45 23

SECTION 01 50 00

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 FACILITIES

A. Temporary Lighting:

1. Provide adequate lighting levels to complete work as construction progresses or as required by local code.
2. Extend and maintain lighting and related systems required by construction progress.

B. Temporary Ventilation:

1. Provide adequate ventilation for work to progress and meet Manufacturers' requirements.
2. Provide ventilation to prevent accumulation of dust, fumes, or gases, cure materials, and disperse humidity, as required.

C. Scaffolding:

1. Type: Designed and installed by each contractor or subcontractor for his own use for work during construction. Conform to special requirements of respective trades that use scaffolding and applicable rules and regulations of local building codes.
2. Erect scaffolding independent of building walls; arrange to avoid interference with other trades.
3. Remove scaffolding when no longer required.

D. Barriers:

1. Provide barriers to prevent unauthorized entry to construction areas and protect existing facilities and adjacent properties from construction damage.
2. Provide protection to plant life designated to remain; replace damaged plant life with same type and size as damaged plant life.
3. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.
4. Fencing: Coordinate any requirement for site fencing with Owner’s representative.

E. Access Roads:

1. Maintain circulation of traffic, both pedestrian and vehicular, and access to all parts of site by fire-fighting apparatus during construction.
3. Extend and relocate as construction activities progress; provide detours necessary for unimpeded traffic flow.
4. Provide and maintain access to fire hydrants, free of obstructions.
5. Provide means of removing mud from vehicle wheels before entering streets, if required.

F. Progress Cleaning: See Section 017400: Cleaning and Waste Management.

G. Removal:

1. Remove temporary facilities, including connections and debris resulting from temporary installation at construction activities completion, or at time of permanent utility connections, as applicable.
2. Clean and repair damage caused by installation or use of temporary facilities.

PART 2 PRODUCTS _ NOT USED

PART 3 EXECUTION _ NOT USED

END OF SECTION 01 50 00

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Products are specified by reference standards, by manufacturer's name and model number, or trade name.
   1. When specified only by reference standard, Contract may select any product meeting this standard by any manufacturer.
   2. When several products or manufacturers are specified as being equally acceptable, Contractor has option of choosing among those named.
   3. When proprietary products are specified, substitutions will be allowed only by substitution provisions specified.
   4. Any coordination, redesign of the drawings of the Contract Documents will be considered additional service for the Engineer to be paid for by the Contractor.

B. If it is desired to use products different from those indicated in Contract Documents, make written application by party requesting substitution as described. Burden of proving equality of proposed substitutions rests on party making request for substitution.

1.03 PROCEDURE

A. General:
   1. Make requests for substitution on a timely basis as single submittal. Base Contract Sum on products and systems specified in Contract Documents only.
   2. Engineer will consider reports from independent testing laboratories, verified experience records from previous users, and other printed or written information valid in the circumstances.
   3. Indicate in what respects proposed materials or products differ from those specified.
   4. Any coordination, redesign of drawings of the Contract Documents will be considered Additional Services for the Engineer to be paid for by the Contractor.

B. Include on Requests for Substitution:
   1. Technical data.
   2. Manufacturer's dated product data describing installation, use, and care, as applicable, of proposed substitution.
   3. Complete cost data, indicate: material cost, installed cost, and savings, if any, resulting from proposed substitution.

4. Statement from proposed manufacturers indicating products, materials, or assemblies in substitution do not contain asbestos or polychlorinated biphenyl (PCB) in any form.

C. Determination as to acceptability of proposed substitutions will be based on data submitted only.

D. Appropriate modification will be issued on a timely basis after submittal, if proposed substitution is approved by Owner's representative, Contractor shall be responsible for furnishing materials and products in accord with Contract Documents, unless requests for substitutions are received and approved as described above.

1.04 TIME SUBSTITUTION

A. In event specified items cannot be delivered to Project and incorporated into Work at such times and in such quantities as to cause no delay, Contractor may request substitution in manner described above. Should accepted substitution provide cost savings, Contract price will be adjusted by Change Order with Owner receiving benefit of net savings. No increase in Contract price will be allowed on substitutions made after 30 day substitution period.
B. Inability to obtain specified items due to Contractor's failure to place timely orders will not be considered reason for authorizing substitutions.

PART 2 PRODUCTS _ NOT USED

PART 3 EXECUTION _ NOT USED

END OF SECTION 01 60 00

SECTION 01 65 00

PRODUCT DELIVERY REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Requirements of this section are general in nature. Refer to individual specification sections for additional, specific requirements.

B. Packing and shipping:
1. Deliver manufactured products to Project site in manufacturer's original packaging with labels and seals intact and legible; indicate manufacturer and product name, description, mixing and application instructions, and fire-resistive classifications, as applicable.
2. Inspect materials upon delivery to ensure proper material, color, type and quantity.
3. Deliver materials to be stored outside on ground on pallets where practical.

C. Acceptance at site:
1. Unload materials; check for damage.
2. Open, punctured, or opened damaged containers or wet materials will not be accepted.
3. Damaged materials determined by visual inspection will not be accepted.
4. Remove rejected materials from site immediately.

D. Storage and protection:
1. General:
a. Store materials and equipment in dry area, under cover, off ground at least 6"; protect from freezing and excessive heat, except for materials not subject to damage or deterioration by contact with ambient environmental conditions.
b. Observe manufacturer's recommendations for positioning, separation and ventilation.
c. Store in manufacturer's protective packaging or original containers with labels and installation instructions intact.
d. Remove wet, damaged, or deteriorated materials.
2. Prevent corrosion, soiling, breakage of materials, or contact with deleterious materials.
3. Store and handle products subject to spillage in areas where spills will not deface finished surfaces or other work.
4. Cover materials stored outside, not under cover with non-staining waterproof breathable tarps until used. Recover unused materials during nonworking hours.

5. Flammable or hazardous materials:
    a. Store minimum quantities in protected areas.
    b. Provide appropriate type fire extinguishers near storage areas.
    c. Observe manufacturer's precautions and applicable ordinances and regulations.
6. Comply with each manufacturer's instructions and recommendations for product storage and handling.

E. Handling:
1. Handle materials and equipment to prevent damage, deterioration, or contamination.
2. Installation of physically damaged or stained materials prior to material installation is prohibited.

F. Inspection and installation:
1. Comply with manufacturer's product data in aspects of basic material usage, installation, and substrate preparation, except where more stringent requirements
are indicated.
2. Inspect substrates prior to installation of applied materials. Correct unacceptable conditions prior to proceeding with work.
3. Be responsible for verifying and obtaining proper substrate conditions, tolerances, and material alignments to receive applied or attached materials and construction.
4. Provide substrates sound, clean, dry, and free of imperfections or conditions detrimental to reception of applied materials.
5. Align material to give smooth, uniform surface planes within specified tolerances and straight, plumb surfaces.
6. Provide finished surfaces clean, uniform, and free of damage, soiling, or defects in material and finish.
7. Finished surfaces: Match color and texture of samples provided by or approved by Engineer.
8. Protection:
    a. Protect finished surfaces from damage and soiling during application, drying or curing.
    b. Provide temporary protective coverings or barriers until Date of Substantial Completion unless otherwise indicated.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION 01 65 00

SECTION 01 73 29

CUTTING AND PATCHING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 REQUIREMENTS:

A. Contractor shall be responsible for cutting, fitting and patching required to complete Work and to:
    1. Make its parts fit together properly.
    2. Uncover work to provide for installation of ill-timed work.
    3. Remove and replace defective work.
    4. Remove and replace work not conforming to Contract Documents.
    5. Remove samples of installed work as required for testing.
    6. Provide routine penetrations of non-structural surfaces for installation of piping and electrical conduit.

1.03 RELATED REQUIREMENTS

None.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 013300: Submittal Procedures.

B. Submit a written request to Owner and Engineer well in advance of executing cutting or alteration which affects:
    1. Work of Owner or separate contractor.
    2. Structural value of integrity of any element of Project.
    3. Integrity of weather exposed or moisture resistant elements.
    4. Efficiency, operational life, maintenance or safety of operational elements.
    5. Visual qualities of sight and exposed elements.

C. Request shall include:
    1. Identification of Project and description of affected work.
    2. Necessity for cutting or alteration.
    3. Effect on work of Owner or separate contractor, or on structural or weatherproof integrity of Project.
    4. Alternatives to cutting and patching.
    5. Cost proposal, when applicable.
    6. Written permission of separate contractor whose work will be affected.
    7. Description of proposed work including:
        a. Scope of cutting, patching, alteration, or excavation.
        b. Products proposed to be used.

c. Extent of refinishing to be included.

D. Should conditions of Work or schedule indicate a change of products from original installation, Contractor shall submit request for substitution as specified in Section 016000 – Product Requirements.

E. Submit written notice to Engineer designating date and time work will be uncovered.

PART 2 PRODUCTS

2.01 MATERIALS:

A. Comply with specifications and standards for each specific product involved.

B. Where specifications and standards have not been provided, provide materials and fabrication consistent with quality of Project and intended for commercial construction.

C. Provide new materials for cutting and patching unless otherwise indicated.

PART 3 EXECUTION

3.01 INSPECTION

A. Inspect existing conditions of Project, including elements subject to damage or to movement during cutting and patching.

B. After uncovering work, inspect conditions affecting installation of products, or performance of work.

C. Report unsatisfactory or questionable conditions to Owner in writing; do not proceed with work until Owner has provided further instructions.

3.02 PREPARATION

A. Provide adequate temporary support as necessary to assure structural value or integrity of affected portion of Work.

B. Protect other portions of Project from damage.

3.03 PERFORMANCE

A. Execute cutting to avoid damage to other work and by methods which will provide proper surfaces to receive installation of repairs.
   1. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

B. Employ same installer or fabricator to perform cutting and patching work as employed for new construction for:
   1. Weather and exposed or moisture resistant elements.

2. Sight and exposed finished surfaces.

C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

D. Restore work which has been cut or removed; install new products to provide completed Work in accordance with requirements of Contract Documents.

E. Fit work tight to pipes, sleeves, ducts, conduit and penetrations through surfaces.

F. Refinish entire surfaces as necessary to provide even finish to match adjacent finishes:

1. For continuous surfaces, refinish to nearest intersection.
2. For an assembly, refinish entire unit.

G. At penetrations of fire rated wall, ceiling or floor construction completely seal voids with fire rated material, full thickness of construction element.

H. Inspect existing conditions and completely fill gaps, openings and any abandoned elements to provide a secure facility including potential insect and rodent infestations.

END OF SECTION 01 73 29

SECTION 01 74 00

CLEANING AND WASTE MANAGEMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Safety Requirements:
1. Store volatile and toxic waste in covered metal containers. Remove from Project site daily. Dispose of properly.
2. Provide adequate ventilation during use of volatile or toxic substances.
3. Prohibited practices:
    a. Allowing volatile or toxic wastes to accumulate on Project site.
    b. Burning or burying of waste materials or rubbish on Project site.
    c. Disposal of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains, on pavements, in gutters or downspouts, or on Project site in any manner.
    d. Disposal of waste or cleaning materials on Project site.
4. Clean up accidentally spilled materials as quickly as possible.
5. If asbestos-containing materials are identified, removal and disposal shall be in accordance with South Carolina DHEC and EPA regulations.

B. Clean-up During Construction:
1. Execute cleaning procedures to ensure building, project site, and adjacent properties are maintained free from debris and rubbish.
2. Wet down materials subject to blowing. Throwing waste materials from heights is prohibited.
3. Provide covered, on-site containers for waste collection. Place waste materials and rubbish in containers in an expeditious manner to prevent accumulation. Remove waste from Project site when containers become full.
4. Legally dispose of waste materials, rubbish, volatile materials, and cleaning materials off Project site.
5. Clean and maintain interior spaces during and following installation of. Protect finishes and clean surfaces from contamination during cleaning operations.
6. Accumulation of debris contributing to survival or spread of rodents, roaches, or other pests are prohibited.
    a. Remove debris containing food scraps on daily basis.
    b. Contractor shall be responsible for securing services of pest exterminator at no additional cost.
7. Disposal of materials in waterways is prohibited.

8. Graffiti or other similar distasteful comments or illustrations authored on any building materials used on Project are prohibited. Monitor Project for violations of this criteria, and, if found, take appropriate action immediately to cover or replace defaced materials as necessary.

C. Final Cleaning:

1. Clean floor surfaces just prior to Date of Substantial Completion. Perform general and specific cleaning prior to request for Project or portion thereof to be inspected or Substantial Completion.
2. Remove dust, debris, oils, stains, fingerprints, and labels from exposed interior and exterior finish surfaces, including glazing materials.
3. Replace, patch, and touch up marred surfaces to match adjacent finishes. Replace materials which cannot be repaired or patched.
4. Clean disturbed areas of Project site of debris:
    a. Broom clean paved surfaces. Remove oil and similar deleterious substances in manner not to damage substrates.
    b. Remove debris from grassed and landscaped areas and disturbed areas.
5. Thoroughly clean plumbing fixtures used by Contractors or Subcontractors.

PART 2 PRODUCTS _ NOT USED

PART 3 EXECUTION _ NOT USED

END OF SECTION 01 74 00

SECTION 01 77 00

CLOSEOUT REQUIREMENTS

PART 1 _ GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
    1. Inspection procedures.
    2. Project Record Documents.
    3. Operation and maintenance manual.
    4. Warranties.
    5. Instruction/training of Owner's personnel.
    6. Final cleaning.
B. Related Sections include the following:
    1. Section 017400 Cleaning and Waste Management.

1.03 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
    1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
    2. Advise Owner of pending insurance changeover requirements.
    3. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases, if any.
    4. Complete testing of systems.
    5. Terminate and remove temporary facilities (unless otherwise approved) from Project site, along with mockups, construction tools, and similar elements.
    6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
    7. Complete final cleaning requirements, including touchup painting.
    8. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Owner’s Representative that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.04 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
   1. Submit a final Application for Payment.
   2. Submit certified copy of Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Contractor. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
   3. Submit asbestos waste disposal landfill receipts, if asbestos materials were removed and disposed of.
   3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   4. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
   5. Complete training and instruct Owner's designated personnel in operation, adjustment, and maintenance of equipment and systems.
   6. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, property surveys, and similar final record information.
   7. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
   8. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
   1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.05 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1.06 PROJECT RECORD DOCUMENTS

A. General: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Engineer's and Owner's reference during normal working hours.

B. Record documents are to be provided to Owner prior to final completion including but are not limited to the following:

1. As-built drawings and specifications indicating all changes to the contract documents (including sprinkler and fire alarm).
2. Operating and maintenance manuals.
3. Manufacturer's installation instructions.
4. Warranties.
5. Copies of all approved submittals and samples.
6. List of all trades, vendors and suppliers with contact information.

C. Record Drawings: Maintain and submit two sets of blue or black line white prints of Contract Drawings and Shop Drawings.

1. Mark Record Prints to show the actual "As-Built" information where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
    a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
    b. Accurately record information in an understandable drawing technique.
    c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
    d. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross reference on Contract Drawings.
2. Mark record sets with contrasting color pen or pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
3. Mark important additional information that was either shown schematically or omitted from original Drawings.
4. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.
5. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.

D. Maintain three complete copies of the Project Manual, including addenda. Bound into each Project Manual, one copy of other written construction documents such as change orders, addenda, supplemental drawings, RFI's, and other modifications issued in printed form during construction. Mark these documents to indicate variations in actual work

performed in comparison with the text of the specifications and modifications. Give particular attention to substitutions and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation. Note related record drawing information and product data.

E. Maintain one copy of each product data submittal. Note related change orders and markup of record drawings and specification. Mark these documents to show variations in actual work performed in comparison with the information submitted. Include variations in products delivered to the site and from the manufacturer's installation instructions and recommendations.

F. Miscellaneous Record Submittals: Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference. Maintain one copy of each sample submittal. Include multiple samples showing full color range when inherent to product.

1.07 OPERATION AND MAINTENANCE MANUALS

A. Assemble a complete set of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as described herein.

B. Organize operation and maintenance data into suitable sets of manageable size. Bind properly indexed data by the CSI Division Format in individual, heavy duty, 3-inch, 3-ring, vinyl covered binders, with pocket folders for folded sheet information. Identify contents and building name on front and spine of each binder.

C. Include the following types of information:
   1. Emergency instruction.
   2. Spare parts list.
   3. Copies of warranties.
   4. Inspection procedures.
   5. Shop drawings and product data.
   6. Record of finishes used.
   7. Manufacturer's installation instructions.
   8. Names of installers and local service representatives.

D. Three sets of manuals will be provided to Owner. These manuals must be reviewed and approved by the design team prior to final acceptance.

1.08 WARRANTIES

A. Organize warranties with proper indexing and labeling and bind into a single heavy duty, three ring, vinyl covered binder. Identify contents and building name on front and spine of binder.

B. Include permit, inspection reports, and certificates from applicable government agencies that construction has been inspected as required by laws or ordinances and that the buildings and/or components are approved for occupancy or use.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

1.09 ELECTRONIC CLOSE OUT DOCUMENTS

A. Compile all close out documents, record drawings, submittals, and manuals. Record on electronic format, CD/DVD, for Owner's record. Number of copies to be determined; provide not less than six (6) CD/DVD's. Disc shall be distributed following approval of hard copies.

PART 2 _ PRODUCTS _ NOT USED

PART 3 _ EXECUTION

3.01 DEMONSTRATION AND TRAINING

A. Arrange for each manufacturer, or their approved agent, of systems or equipment that requires regular maintenance to meet with Owner's personnel to provide instruction in proper operation and maintenance. A minimum of ten days' notice must be provided for the meeting.

B. Program Structure: Include a detailed review of the following items:
   1. Maintenance manuals.
   2. Record documents.
   3. Spare parts and materials.
   4. Identification systems.
   5. Hazards.
   6. Cleaning.
   7. Warranties and bonds.
   8. Maintenance agreements and similar continuing commitments.

C. As part of the instruction for operating equipment, demonstrate the following procedures:
   1. Safety procedures.
   2. Troubleshooting.

3.02 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Refer to Section 017400 Cleaning and Waste Management.

END OF SECTION 01 77 00

SECTION 01 78 00

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Requirements:
   1. Compile specified warranties and bonds.
   2. Compile specified service and maintenance contracts.
   3. Co-execute submittals when specified.
   4. Review submittals to verify compliance with Contract Documents.
   5. Submit to Engineer for review and transmittal to Owner.

B. Related sections:
   1. Section 017700: Closeout Procedures.
   2. Each respective specification section.
   3. Respective section of specifications specifying product: Provisions of Warranties and Bonds, Duration.

1.03 SUBMITTALS:

A. Requirements:
   1. Assemble warranties, bonds, and service and maintenance contracts, and subcontractors.
   2. Number or original signed copies required: Two each.
   3. Table of contents: Type neatly in orderly sequence. Provide complete information for each item.
      a. Product, equipment, or work item.
      b. Firm name, principal name, address, and telephone number.
      c. Scope.
      d. Beginning date for warranty, bond, or service maintenance contract.
      e. Duration of warranty, bond, or service maintenance contract.
      f. Provide information for Owner's personnel:
         1) Proper procedure in case of failure.
         2) Instances which might affect the validity of warranty or bond.
      g. Contractor, name of responsible principal, address, and telephone number.

B. Form:

1. Prepare in duplicate packets.
2. Format:
    a. Size: 8 ½" by 11": punch sheets for standard three ring binder. Fold larger sheets to fit into binders.
    b. Binders: Commercial quality, three ring, with durable and cleanable plastic covers.
    c. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS". List:
        1) Type of Project.
        2) Name of Contractor.

C. Time:

1. Submit documents within ten days after inspection and acceptance from equipment or component parts supplier, installer, or manufacturer put into service during construction progress.
2. Make submittals within ten days after Date of Substantial Completion, prior to final request for payment.
3. Items of work, where acceptance is delayed materially beyond Date of Substantial Completion: Provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

D. Submit warranties, bond, service, and maintenance contracts specified in respective specifications sections.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION 01 78 00

SECTION 23 05 10
GENERAL MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Definitions
B. Regulatory Requirements indicating applicable Codes, Ordinances, and Regulations.
C. Performance Requirements.
D. Submittal Procedures Supplementing Section 01 3000.
E. Operating and Maintenance Manuals.
F. Quality Assurance Requirements and Installer Qualifications.
G. General Product Delivery and Storage.

1.2 RELATED SECTIONS

A. Section 01 2300 - Alternates.
B. Section 01 3300 - Submittal Procedures, for submittal procedures.
C. Section 01 7700 - Closeout Procedures, for additional submittal and warranty requirements.
D. Section 03 3000 - Cast-in-Place Concrete.
E. Section 07 8413 - Penetration Firestopping.
F. Section 07 9200 - Joint Sealants.
G. Section 09 9113 - Exterior Painting.
H. Section 09 9123 - Interior Painting.

1.3 ALTERNATIVES

A. Refer to Section 01 2300 - Alternatives, for product alternatives affecting this Division.

1.4 DEFINITIONS

A. Manufacturer's Representatives: Wherever MANUFACTURER'S REPRESENTATIVE is referred to in this division, said representative shall be regularly employed by the manufacturer to perform similar activities to those called for herein, which indicates his competence in that field of work.
B. Concealed: Where the word concealed is used in this Division, it shall mean items above ceilings, in attics, in crawl spaces, in chases, in tunnels, in cabinet work, and under counters or equipment so as to be not visible from an elevation of 5 feet at a horizontal distance of 10 feet.
C. Finished Spaces or Areas: Where finished spaces or areas are referred to in this Division, it shall mean all spaces except concealed spaces, mechanical rooms, or boiler rooms unless otherwise noted.
D. Provide: Furnish and install.
E. Control and Interlock Wiring: All wiring, both line voltage and low voltage, other than power wiring from an electrical distribution panel, through the primary control device, to the item of equipment.
F. Primary Control Device: That ONE device for any item of equipment which interrupts power flow during normal operation. Where magnetic starters are provided, they are the primary control. For items not switched by starters, the primary control device will be that ONE thermostat, time clock, manual switch, aquastat, P.E. switch, or relay performing the primary switching.

G. Diagrammatic: A drawing that shows arrangement and relations (as of parts).i.e.: A diagrammatic drawing uses symbols rather than pictorial representation of pipes, ducts, conduit and other items shown and is not necessarily to scale. Arrangement, location, and sizes shown are firm.

H. Readily Accessible: Items requiring maintenance shall be available for close approach for maintenance or use in a space, through an access door from floor elevation, or above a lay-in ceiling though an access point by maintenance staff safely standing on a ladder no taller than the ceiling.

I. Noted, Indicated or Shown: Where the terms "Noted", "Indicated" or "Shown" are used in these specifications, the words "in the specifications or on the plans" shall be inferred.

J. Detail: Where reference is made to a Detail, the Detail shall be on the plans unless otherwise noted.

K. Specifications: Where reference is made to these specifications, it shall be inferred in this Division of specifications.

L. Notification by the Contractor, and Instructions to the Contractor: Where reference is made in these specifications to notification by or instructions given to the Contractor, it shall be inferred that the Engineer shall be the instructor or shall be notified, as the case exists.

M. Division or Section Reference: Where reference is made to another Division or Section within this Division, refer to specifications table of contents for Division, Section, or Page Number.

N. Flow Diagram: A single-line, two-dimension, non-scaled drawing depicting arrangement and sequence of equipment, valves, controls, thermometers, gauges, and other specialty devices in a pipe or duct system.

1.5 REGULATORY REQUIREMENTS

A. Where requirements of these specifications exceed specified codes and ordinances, conform to these specifications.

B. Materials and equipment included in Underwriters Label Service shall bear that label. Electrical equipment shall be U.L. approved as installed.

C. Jurisdiction: Where codes or guides refer jurisdiction to local governing code officials, such official in this procedure shall be the Beaufort County Building Codes Department.

D. Permits and Codes: Refer to the General Conditions.

E. Fire Prevention Precautions in Cutting and Welding Areas: Conform to Article 2605 Fire Prevention Precautions, International Fire Code, 2015 Edition, with all South Carolina Amendments, for all work involving cutting and welding.

F. HVAC: Conform to the International Mechanical Code, 2015 Edition with all South Carolina Amendments.

G. Energy: Conform to the International Energy Code, 2009 Edition (January 1, 2013).

H. All Work: Conform to South Carolina adopted codes and standards for fire and life safety.

I. Electrical: Refer to Division 26. Conform to the National Electrical Code, NFPA 70, 2014 Edition.

J. Building Code: International Building Code, 2015 Edition with all South Carolina Amendments.

1.6 PERFORMANCE REQUIREMENTS

A. Requirements specified herein are minimum. All equipment, when installed, shall perform equal to or exceed specified requirements.

1.7 SUBMITTALS

A. Refer to Section 01 3000 - Administrative Requirements, for general submittal procedures.

B. Quality Assurance Qualifications:

1. Testing and Balancing Agency Qualifications.

C. Supplementing Division 1 Administrative Requirements; the Contractor shall:
   1. Assemble the submittal data in complete sets in hard back three-ring binders, separated by trade, and bound with numbered index sheets and tabs by Specification Sections. Submittal data shall be submitted at one time unless unavailable data such as control submittal would delay project progress. Data shall include capacities, complete installation instructions, dimensional data and electrical data, BHP, motor HP, operating weights and load distribution at mounting points.
   2. Identify all submittals by a cover sheet showing project name, specification section, drawing or detail number, room number, date, revision date, contractor and subcontractor's organization and project manager with phone number, the model, style and size of item being submitted with manufacturers' representative, salesman (or a preparer who can answer questions), and Preparer's phone number.
   3. Prepare a master list of submittals proposed to be submitted on the project. This list shall be updated for each submission and shall be the first sheet(s) of the submission in the quantity that is submitted for review. The information and general format of the master list shall contain a Specification Section, Section Title, Item Description, Item Status and any comment.
   4. Review the submittal data and check to ensure compliance with specifications prior to submitting.
      a. The Contractor agrees that submittals of equipment and material and shop drawings of equipment and material layouts required under provisions of these specifications and processed by the Engineer are not Change Orders. The purpose of submittals is to demonstrate that the Contractor understands the design concept of the project by indicating the equipment and materials he intends to furnish and install, and by detailing the installation he intends to achieve.
      b. The Contractor shall conform to the requirements of the Contract Documents unless a change order is issued. The Contractor shall identify on each submittal that the
      submittal contains no deviations, or the Contractor shall identify any proposed deviations.
      c. Any submittal or shop drawing not conforming to the Contract Documents without this identification and notification shall be assumed to be marked "Revise and Resubmit" (the contractor acknowledges this by the submission), and the Contractor shall promptly resubmit said submittal so as to be in full compliance with the Contract Documents.
      d. Failure of the Contractor to provide this information during the shop drawing phase shall make the Contractor responsible for all changes to achieve compliance with the Contract Documents without additional compensation.
   5. Provide a Letter from the HVAC Contractor stating that they have checked all submittals for compliance with specifications.
   6. Product Data:
      a. Provide data specific to the product proposed indicating capacity data, all standard and optional features to be supplied and all accessories and options available for that product.
      b. Manufacturers' standard drawings shall be modified by deletions or additions to show only items applicable to this project.

D. Deliver submittals to the Engineer at the business address.

E. Digital Delivery of Submittals:
   1. Submittal data may be posted to an FTP site when agreed upon by the Engineer and the Owner during the preconstruction phase. The Contractor will be provided with a project folder and a password.
   2. Prepare the submittals as described above. Take steps to reduce submittal file size.

3. Do not scan in color or high resolution unless required for clarity.
4. Optimize any scans to help control file size.
5. Ensure any reproductions are legible.
6. Organize Submittal files individually by specification section with file name format as Follows; "*CSISection# - Section Title* - any further identifier required such as *control drawings*"
7. Send an email to the HVAC Engineer and Owner identified during the preconstruction phase.
8. Identify the submittal using the official project title, specification section and submitted item. i.e. Project No. G-xxx, Addition to Administrative Building-Section 230548-Vibration and Seismic Controls. Include drawing or detail number, room number, date, revision date(s), contractor and subcontractor's organization as applicable
9. Include the project manager's and manufacturers' representatives, salesman's (or a preparer who can answer questions) contact information, email and phone number.
10. Identify the submittal in the email subject line using the same information listed above.
11. Provide a submittal index.
12. Ensure any submittal posted to an FTP site has the same identification.
13. Essex will not process or react to submittals which are not properly transmitted, indexed, and identified.

F. Shop Drawings:
   1. General: Furnish shop drawings of each of the following systems:
      a. HVAC Piping - Building
      b. Equipment Rooms
         1) HVAC Equipment and Piping
   2. Format and Content:
      a. Shop drawings shall be complete and shall accurately show all items of equipment and material. The number of drawings, and the views contained therein, shall be as
      needed to show the actual and final routing, construction, and final assembly of each system.
      b. All drawings shall be electronically produced in a format identified during the preconstruction meeting. Free-hand drawings are not acceptable.
      c. All lettering shall be legible without use or aid of magnifying device. Title-block lettering shall be minimum 1/8".
      d. Drawings shall be printed (or plotted) at either 24" high by 36" wide, or the same size as the Contract Drawings for the same trade, whichever is greater. Each drawing sheet shall be formatted the same as the Contract documents (i.e., border width, title block, etc.). With the exception of Isometric drawings, all other drawings shall be drawn in two-dimension and at the same scale as the Contract Drawing of the same area, or as follows, whichever is the larger scale:
      e. Scale of drawings shall be as follows:
         1) Floor Plans 1/8" per foot
         2) Roof Plans 1/8" per foot
         3) Elevations 1/4" per foot
         4) Details 1/4" per foot
         5) Equipment Room Layouts 1/4" per foot
         6) Isometrics No scale
         7) Riser Diagrams 1/4" per foot
         8) Equipment Room Pad Layout 1/4" per foot
      f. Three-dimensional views may be produced and used to provide supplemental information to that which is given on two dimensional drawings. Three-dimensional drawings shall be drawn from a 30-deg. perspective.
      g. Each individual shop drawing sheet shall contain a single format (two-

dimensional or three-dimensional).

h. In addition to the information called for in the Contract Documents, provide all additional data and notations needed to show conformance with Contract Documents (i.e., water flow).

i. For all drawings drawn in two-dimensions, all characteristics of the equipment, systems and components, shall be drawn to scale to designate actual size. Use of dimensions alone to designate width, height, length, or depth is not acceptable. Drawings shall not require that they be "scale" to determine sizes or location.

j. In the event either the project as a whole, or the specific area covered by a particular drawing, does not contain columns, floors and/or walls to which dimension reference can be made in the location of items, alternate fixed points of reference may be used.

k. Shop Drawings drawn at the same scale as the contract Drawings, shall incorporate the same floor plan or ceiling plan areas, and shall be arranged and be "broken" along the same lines as the Contract Drawings.

l. Piping systems which have the following maximum width on one side shall be drawn in the following manner:
   1) Drawing Scale
   2) 1/4" per ft. =>4" Double-line
   3) 1/4" per ft. <4" Single-line

3. Piping Shop Drawings:
   a. Background shall be the Central Plant or cooling tower pad.
   b. Show flanges, fittings, equipment, locations and sizes of access panels, required maintenance, removal and safe working clearances, elevations, net size (size of system less thermal or acoustical coverings), dimension from finished floor and/or overhead structure, horizontal dimension from centerline of columns, grade, percent of slope and/or rate of change, direction of flow, changes in size, changes in external covering, system material, construction classification, system name or symbol, unique situations, equipment designation.
   c. Show floor plan location of all space control and sensing devices (thermostats, humidistats, CO2 sensors) complete with the designation of the piece of equipment or component which device controls. Lines drawn between the sensing device to the controlled equipment or component, to designate their interaction, are not acceptable.
   d. Piping shall be drawn utilizing the symbols and designations of the controls standards, providing those standards are in general compliance with Industry Standards (i.e. ASHRAE, ANSI, etc.). Provide piping symbol legend on shop drawing.
   e. Each piece of equipment or manufactured product shall bear the same designation as indicated on the contract documents.
4. Equipment Room Shop Drawings:
   a. Background shall be redrawn scaled versions of the Architectural Floor Plan showing all partitions, openings, and structural features.
   b. Show actual size and location of equipment in both plan and vertical section, laid out on center line of equipment shown.
   c. Equipment and equipment pads shall be drawn to scale and dimensioned. Dimensions shall conform to actual manufacturer's dimensions for product used.
   d. Show dimensions of equipment placing relative to partitions, columns, beams, and underside of structural deck.
   e. Show and dimension all service clearances, access door swings, vertical clearances.
   f. Show all piping, ducts, and equipment to provide full information for coordination.
   g. Show electrical panels to scale including control panels and disconnect switches.

G. Tabulation of Power Wiring Requirements: Within 30 Days of the Notice to Proceed, provide a Tabulation of Power Wiring Requirements of all proposed equipment, including horsepower, amps, voltage, phase, and kiloWatts tabulated on a separate sheet. A copy of the tabulation shall be transmitted independently to the Owner, the Engineer and to all affected trades. (Refer to Electrical Drawings for electrical provisions for equipment.)

H. Piping Pressure Tests - Submit the following:
   1. Hydrostatic Testing Records: The Mechanical Contractor shall maintain an updated log of pressure tests available to the Owner and the Engineer at all times. The Mechanical Contractor shall submit a final log to the Owner for record.
   2. Submit affidavit of pressure test compliance to the Owner and Engineer.

I. Warranty: Submit the HVAC installer's warranty letter addressed to the Owner stating the correct project name and number, if applicable, the warranty period and ensure that form has the correct date of the Substantial Completion.

1.8 OPERATING AND MAINTENANCE MANUALS

A. Operating and Maintenance Manuals shall be prepared by the Contractor for all equipment and be submitted for review a minimum of prior to the request for Substantial Completion.

B. Digital delivery of Operating and Maintenance Manuals:
   1. Operating and Maintenance Manuals may be delivered digitally and posted to an FTP site when agreed upon by the Engineer and the Owner during the preconstruction phase. The Contractor will be provided with a project folder and password.
   2. Prepare the Operating and Maintenance Manuals as described above. Take steps to reduce submittal file size. [EDIT]
   3. Do not scan in color or high resolution unless required for clarity.
   4. Ensure any reproductions are legible.
   5. Send an email to submittal@nbpengineers.com with a copy to the HVAC Engineer and the Architectural Engineer identified during the preconstruction phase.
   6. Identify the manuals in the email subject line using the official project title, specification section and submitted item. I.E. Project No. G-xxx, Addition to Administrative Building.
   7. Table of Contents (Index) sheets shall be included in the order listed with identifications typed in capital letters.
   8. Ensure the manuals posted to the FTP site has the same identification.
   9. NBP Engineers will not process or react to manuals which are not properly transmitted, indexed, and identified.

C. Each Manual shall contain the following information, data and drawings:
   1. Copies of submittals (with Engineer's review comments and stamp), equipment and materials.
   2. Manufacturer's installation, operating and maintenance instructions for each item of equipment with moving parts including recommended frequency of inspections and maintenance for one year of facility operation.
   3. Manufacturer's list of renewal parts for each item of equipment with recommended stock items and quantities indicated.
   4. Control diagrams, electrical interlock diagrams, and control valve lists.
   5. Manual shall include all setup procedures, calibration settings, setup parameters, and final settings for all equipment, drives, instrumentation, etc.
   6. Electronic files on CD of as-built shop drawings showing layouts and construction details.
   7. Copies of Test and Balance Reports including list of instruments and description of methods employed.

1.9 QUALITY ASSURANCE

A. HVAC Installer Qualifications:
   1. Wherever the word "company" or "firm" is used in these subparagraphs, it shall mean

the contractor/subcontractor of record for the installations used for proficiency qualification.

2. Refer to the individual sections within this division for additional installer qualification requirements.
3. The Contractor expressly warrants that the company performing the installation of the air conditioning systems has demonstrated proficiency in the installation, start-up and adjustment of such systems by the successful performance of work of the nature specified herein on at least three commercial or institutional buildings, each containing minimum of 250 tons capacity or greater with ducted air distribution and chilled water, PTAC or wall hung units excluded.
4. The Contractor further warrants that the aforesaid subcontractor, if any, has trained personnel, instruments, tools, and equipment to perform the installation, start-up, instruction and maintenance service specified.
5. The Contractor also warrants that the aforesaid installer, if any, has been in business performing services of the nature specified herein for at least five years.

B. Testing and Balancing Qualifications:
1. The Contractor expressly warrants that the company performing the HVAC Testing and Balancing of the mechanical systems has demonstrated proficiency in the testing, balancing, start-up and adjustment of such systems by the successful performance of work of the nature specified herein on at least Twenty (20) commercial or institutional buildings, each containing minimum of 250 tons capacity or greater with ducted air distribution and chilled water, incremental units excluded. The contractor further warrants that the proposed subcontractor has trained personnel, instruments, tools, and equipment to perform the testing and balancing specified. The contractor also warrants that the aforesaid installer has been in business performing services of the nature specified herein for at least five years.
2. The Mechanical Contractor further warrants that the aforesaid subcontractor has trained personnel, instruments, tools, and equipment to perform the testing and balancing specified.
3. The Mechanical Contractor also warrants that the aforesaid installer has been in business performing services of the nature specified herein for at least five (5) years.
4. Test and Balance Agency Affidavit:
   a. THIS IS TO CERTIFY pursuant to the General Conditions that [insert name of firm], Testing and Balancing subcontractor of the undersigned, has demonstrated proficiency in the testing, balancing, start-up and adjustment of such systems by the successful performance of work of the nature specified herein on at least Twenty (20) commercial or institutional buildings.
   b. List at least twenty showing name and address of each: (1) - (20)
   c. List at least three show name and address of Laboratory HVAC Projects: (1) - (3)
   d. Provide a complete set of the Test and Balance report forms to be used for the project, with a complete listing of all equipment to be tested, adjusted and balanced; and provide a listing of all air flow, water flow, system capacity and efficiency measurements to be performed.
   e. THE CERTIFICATIONS of the affiant are not mere declarations but are in consideration of and in fulfillment of express contractual requirements established in the bidding documents for construction of Project No._.
      THIS AFFIDAVIT applies to Project No._____. This_____day of__, 2017.
      1) NAME OF COMPANY:
      2) By:
      3) Title:
      CERTIFICATE OF NOTARY PUBLIC Sworn and subscribed to before me, an officer authorized to administer oaths. This___day of_____, 2017.
      _ ,Notary Public My commission expires on:

_____.

C. Activity Log Book
   1. A Log Notebook of tear-out sheet type, with consecutively numbered pages shall be maintained on site by the Project Superintendent providing a continuous record of tests, equipment start-up, system cleaning, system start-up/check out for the length of the project.
   2. Notebook entries shall include data; description of test/clean-up/check out; sub-contractor involved; personnel involved; and results.
   3. Mechanical Contractor shall turn over original notebook and two (2) first generation copies to Engineer at Substantial Completion.

1.10 PRODUCT DELIVERY, STORAGE, AND PROTECTION

A. Accept all products on site in factory-fabricated protective containers. Inspect for damage.

B. Store products in a clean dry place and protect from weather and construction traffic.

C. Handle products carefully to avoid damage to components, enclosures, and finish.

D. After placement, protect products from damage during construction, by all trade contractors.

E. Protect equipment nameplates and labels from damage, being painted, scarring, etc.

1.11 WARRANTY

A. Refer to Section 01 7000 - Contract Closeout, for additional warranty requirements.

B. Submit manufacturers' warranties prior to final inspection. Refer to the General Conditions.

C. Correct any defective Work within a one year period after Date of Substantial Completion. Provide HVAC Installer's warranty letter dated the date of the Substantial Completion

D. Where warranties beyond the Contractor's one-year warranty are specified, the additional warranty time shall start on the same date as the Contractor's warranty.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

A. Hazardous Materials:
   1. Engineer's Responsibility: Plans and specifications have been prepared by the Engineer for the Owner without the Engineer having conducted investigation as to the presence of asbestos or hazardous waste on the project. Not being a part of this contract, the Engineer has not charged any fees and has not and will not advise the Owner with regard to the detection and/or removal of asbestos or hazardous waste. The Owner is aware that asbestos or hazardous waste could be present and will make all decisions with regard to its removal. The removal of all hazardous materials and encapsulation of remaining surfaces is the sole responsibility of the Owner.
   2. If the Contractor observes the existence of a friable, asbestos-containing material which must be disturbed during the course of his work, the Contractor shall promptly notify the Owner and the Engineer. The Owner shall make all arrangements regarding testing and removal or encapsulation and disposal of asbestos-containing material if present. The Contractor shall not perform any work pertinent to the friable, asbestos-containing material prior to receipt of special instructions from the Owner.

B. Refer to the specifications and Architectural and Structural drawings for additional requirements pertaining to work under this discipline. Notify the Engineer for clarification in the event of conflict.

C. All materials of systems installation exposed in hollow spaces that are used as ducts or plenums shall have a flame spread rating of 25 or less and a smoke development rating of 50 or less.

3.2 PREPARATION

A. Drawings are diagrammatic and show the general proximity of the equipment, ducts, and pipes, etc., are not to be scaled, and do not include all required changes in direction or offsets necessary in coordinating the installation of various materials either between trades or within the same trade. All dimensions shall be verified at the building. Prefabrication and/or installation of work from drawings shall be at the Contractor's risk.

B. Space Conditions:
   1. All equipment intended for installation in the Central Plant shall fit into the available spaces in the building and must be introduced into the building so as not to cause damage to the structure. Equipment larger than access to equipment spaces shall be disassembled into sub-assemblies for installation.
   2. Where deviations from the plans are required in order to conform to the space limitations, such changes shall be made at no additional cost to the Owner and shall be subject to approval.
   3. All equipment requiring service shall be made accessible. Coordinate piping and ductwork installation to avoid conflict with other trades.

3.3 HVAC DEMOLITION

A. No HVAC demolition is anticipated. If the Mechanical Contractor identifies material that requires demolition in order to complete this project, conduct no demolition until the Owner and the Engineer provide written approval.

B. Any existing material removed from the facility shall be the property of the Contractor, unless otherwise required by the Owner, and shall be removed from the facility as required by the Contract provisions concerning trash removal.

C. Material and equipment which have been removed shall not be used in the new work, except as required by the Owner.

D. Where the Contract Documents, including Change Orders, indicate an equipment item to be removed. Remove all associated material including hangers, supports, wiring, controls conduit, etc. Do not leave abandoned items.

E. Dispose of any material to be discarded in accordance with all laws and regulations.

3.4 EXISTING HVAC SYSTEMS

A. The existing mechanical equipment and systems shall remain "as-is". Perform all work necessary to properly tie in new work with existing conditions and to adapt existing conditions to conform to the changes in the building and systems.

B. Remove exposed and accessible piping, ductwork, and other materials rendered useless due to changes or modifications. Cap outlets in piping using grooved-pipe fittings where applicable. Repair insulation damaged during construction.

C. Sleeves left open by removal of piping shall be cut flush with the finished slab or wall, filled with non-shrinking cement grout and/or fire rated foam flush with both sides of slab or wall to maintain slab or wall fire rating and finished to match the space finishes.

D. Where existing piping and/or equipment is shown on the Drawings to be reused or connected to, its identity, size, flow direction and location shall be verified prior to performing any work. Notify the Engineer of any discrepancies.

E. Prior to connecting new equipment to existing piping (chilled water supply and return and condenser water supply and return), the Mechanical Contractor shall flush and drain the existing pipes to remove any sediment or other material that might have a deleterious effect on pumps, chillers, valves or cooling towers. Final flushing shall be witnessed by the Owner and/or Engineer.

3.5 INSTALLATION

A. Indoor Air Quality Environment: Portions of the existing Facilities Building will be in use and occupied during construction. The Contractor shall schedule work and provide

temporary ventilation and/or isolation to insure that fumes from welding, other construction tasks, and out-gassing from construction materials do not migrate to occupied areas.

B. Clearance above and in front of electrical switchgear, electrical power panels or control panels shall be maintained by mechanical systems so that no mechanical pipes, vents, or equipment is routed above or across the space directly above this equipment in conformance with the National Electrical Code.

C. All equipment shall be installed in accordance with manufacturers' published installation instructions shipped with the equipment. In the event there is a discrepancy between these Specifications or Drawings and the manufacturers' instructions, no work shall be performed until additional instructions are received.

D. Install and connect all equipment and appurtenances as specified, indicated, or required in accordance with the manufacturers' instructions and recommendations. Furnish and install complete auxiliary piping, water seals, valves, electrical connections, and similar items, recommended by the manufacturer or as required for proper operation.

E. Equipment, valves, and other items installed under this division requiring service shall be installed to be readily accessible. Refer to definitions in this section.

F. Coordinate with the Owner and monitor the progress of the work so that other trades do not obstruct items requiring access for service.

G. After final balancing, equipment with belt drives shall have their belts operating in the mid-80% position of the adjustable sheave.

H. Provide equipment belt and coupling guards shielding the perimeter and face of all new belt drives, shafts and couplings. Provide openings opposite drive and driven shafts to permit use of revolution counter. Guards for fans shall be supported from the fan and mounting base, independent of the floor or housekeeping pad.

I. Concrete Work: Refer to section 23 05 48 for concrete bases and other supports required for HVAC equipment and systems. Coordinate with the Contractor.

J. Equipment and pipe support upper attachments shall be 3" x 3" x 1/4" steel angles, minimum, spanning structural members unless noted otherwise. Provide inserts and bolts for supporting pipes and equipment from structural members.

K. Continuity of Building Services:
   1. Conform to staging as described under Division 01.
   2. Sequence equipment installation and schedule work to ensure that systems of existing buildings are not interrupted when they are required for normal usage of the existing buildings.
   3. Schedule work so existing buildings' systems will not be interrupted when they are required for normal usage of the existing buildings.
   4. Perform work to provide minimum inconvenience to the Owner and as approved by the Engineer. No allowance will be made for lack of knowledge of existing conditions.

3.6 SPACE CONDITIONING DURING CONSTRUCTION

A. Coordinate with the Contractor regarding the limits of space conditions specified or requested by other trade sections.

B. Prepare a construction schedule and determine to what extent the project's HVAC system can be operated within the restrictions listed below to help maintain those conditions.

C. The building's HVAC system shall be kept clean during the entire construction process. Protect equipment, motor, ducts, pipes from dirt and debris.

D. Filters during construction:
   1. Provide and maintain filters on any air handling equipment and terminal units

used for space conditioning during construction.
2. Provide and maintain filters on all return air grilles when air handling equipment or terminal units are used for space conditioning during construction.
3. Provide filters with a minimum MERV rating of 8.

E. Heating Terminal units such as unit heaters, cabinet heaters and finned radiation may be used for temporary heat during construction. Clean to new condition.

3.7 PIPING PRESSURE TESTS

A. General:
1. Provide 48-hour notification to the Engineer in advance of any test.
2. Complete tests prior to insulating.
3. Leaks shall be repaired, defective materials replaced, and system shall be retested.
4. Strike all joints in copper and steel piping under a pressure test.
5. Conduct tests prior to connecting to equipment or isolate equipment from system.
6. No water pressure test shall be conducted in freezing weather where subject to freezing.
7. Tests shall be maintained at conditions specified until approved but, in no event, for less than a minimum duration of eight hours minimum, unless otherwise noted.
8. Hydrostatic pressure tests shall maintain pressure without change, except that due to temperature change.

B. Chilled Water: Hydrostatic test: 150 PSIG.

C. Cooling Tower/Condenser Water Piping: Hydrostatic test: 150 PSIG.

3.8 EQUIPMENT BASES AND HOUSEKEEPING PADS

A. Provide housekeeping and equipment bases as shown or listed below. Rough up slab under bases before pouring concrete.

B. Materials: Refer to Section 03 30 00 - Cast-in-Place Concrete. Omit test cylinders for concrete poured under this section.

C. Bases/Pads shall be rectangular with vertical sides 4-inches from centerline of anchor bolts or 2 inches from edges of equipment supports, whichever provides the larger dimension, side of equipment or base edge, unless otherwise noted. Refer to Section 03 05 48 Vibration and Seismic Controls for HVAC Equipment and Piping.

D. Height:
1. Chiller on Grade: 4-inches or as shown on plans.
2. Pumps on Grade: 12-inch concrete base.
3. Housekeeping Pads for Other Equipment: 4-inches or as shown on plans.

E. Chamfer: 3/4-inch on edges and corners.

F. Reinforcing: #3 bars 12 inches on center each way or as otherwise directed in Section 03 05 48 Vibration and Seismic Controls for HVAC Equipment and Piping. (Base/Pad over 6 inch thickness.)

G. Reinforcing: 6"x 6" 10/10 WWF at mid-depth of slab. (4 inch thick pads.) Or as otherwise directed in Section 03 05 48 Vibration and Seismic Controls for HVAC Equipment and Piping

3.9 EQUIPMENT BACKBOARDS

A. General: Provide wood backboards for installation of surface mounted control panels, enclosed motor controllers, variable frequency controllers, and where shown.

B. Type: 3/4-inch-thick, grade 1, fire-retardant-treated plywood supported by 3/4" x 3/4" x 1/8" aluminum angle frame attached to wall with 1/4-inch toggle bolts for hollow masonry, expansion shields for solid masonry.

C. Finish: Frame and board with two coats of light-gray, enamel paint.

3.10 COMMISSIONING

A. The project Commissioning Authority (CxA) will manage the commissioning process for

select equipment and systems. The commissioning process will begin during the design phase and continue through the first year warranty period. The commissioning process shall encompass and coordinate the functions of system documentation, equipment startup, control system calibration, test adjust and balance, performance testing and training. The intent of commissioning is to verify and document that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by the installing contractors; verify and document proper functional performance of equipment and systems; verify that O&M documentation submitted is complete and accurate; verify that the Owner's operations personnel are adequately trained.

B. Commissioning Tests: Provide assistance to the Commissioning Authority for scheduling and witnessing of testing. Review the Prefunctional and Functional test procedures to ensure feasibility, safety, and equipment protection.

3.11 STARTING EQUIPMENT AND SYSTEMS

A. Start no equipment or systems unless all Prefunctional checklist forms, company start-up checklists, and/or manufacturers' start-up checklists for all equipment installed under Division 23 have been completed. Successful start-up and documentation shall be completed prior to start of any TAB fieldwork for that equipment. Provide copies of the factory service technician start-up reports.

B. Adjust equipment for proper operation within manufacturers' published tolerances.

C. Demonstrate proper operation of systems and equipment to the Owner's designated representative.

3.12 DEMONSTRATION, TRAINING AND INSTRUCTIONS

A. Frame sequence of operation under glass and mount on a wall in mechanical room.

B. Instruct operating personnel designated by the Owner in operation and maintenance of system prior to request for final inspection. Provide signed statement certifying instructions have been received.

C. A manufacturer's service representative shall provide the instructions for each piece of equipment on a system when specified in other Sections of this Division. A manufacturer's sales representative is not acceptable. The instructor shall not be a sales person, but shall have service experience on a continuing basis and be knowledgeable about the subject equipment.

D. The Mechanical Contractor shall give notice to the Engineer not less than 30 days of the anticipated date of instruction to allow planning by the Owner.

E. The Mechanical Contractor shall request the instruction date within not less than 15 days of the desired date for coordination with the Owner. Operating manuals for the equipment/systems on which instructions are being given shall be in the possession of the operating personnel not less than 15 days prior to the date of instruction.

F. The Mechanical Contractor shall give an orientation session to operating personnel for achieving familiarity, not instructions, of the systems approximately five days prior to the instruction date. The Mechanical Contractor's representative giving instruction shall be knowledgeable in the equipment/systems to allow quality video recordings for the Owner.

G. The Mechanical Contractor shall develop not less than three copies of the instructions with an index for easy retrieval of information.

H. Refer to Section 01 9113 - General Commissioning Requirements for additional Mechanical Training procedures and requirements.

I. Equipment and Systems Included in the Training Plan:
   1. Variable Speed Drives
   2. Chiller

3. Pumps
4. Cooling Tower
5. HVAC Instrumentation & Direct Digital Control System.

3.13 CLEANING AND PROTECTION

A. All materials, equipment, and the Central Plant shall be cleaned prior to Substantial Completion.

B. Wash down and scrub clean all Central Plant floors, walls, equipment bases and equipment.

C. Paint equipment where finish has been damaged requiring retouching of finish to match factory finish.

D. Chipped or scraped paint shall be retouched to match original finish.

E. Clean and polish all equipment nameplates. All nameplate information shall be legible.

F. All dents and sags in equipment casings shall be straightened.

G. All insulation, equipment, pipe, pipe fittings, and appurtenances shall be free of dust, rust, and stains prior to Substantial Completion.

3.14 FINISHING EQUIPMENT AND MATERIAL

A. Paint shop-primed equipment.

B. Paint exposed bare steel piping in accordance with ANSI 13.1 Standard for the following color schedule:
   1. Safety Vent Piping: Yellow
   2. Blowdown and Equipment Drain Piping: Yellow

C. Paint all piping and equipment hangers, brackets, collars and supports, unless otherwise indicated.

D. All ferrous fasteners and hanger supports not having a corrosion resistant plated finish shall be painted to prevent rust.

E. Paint all exposed, un-insulated ferrous metals, flat black.

F. Paint miscellaneous ferrous metals such as nipples and fittings on chilled water piping at drains, vents, and instrument tappings before insulation.

G. Paint all exterior un-insulated ferrous metals at cooling tower and tower piping with aluminum paint.

END OF SECTION

SECTION 23 05 13
MOTORS FOR HVAC EQUIPMENT

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Single phase electric motors.

B. Three phase electric motors.

1.2 RELATED REQUIREMENTS

A. SECTION 23 05 10 General Mechanical Requirements

B. SECTION 23 05 14 VSD

C. Other sections specifying motor-driven equipment in Division 23.

1.3 SUMMARY

A. Provide all labor, materials, transportation and equipment to complete the furnishing, installation, assembly, set up, connection, and testing of the motors work indicated on the drawings and specified herein. Notwithstanding any detailed information in this Section, provide a complete, working system.

1.4 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; American Bearing Manufacturers Association, Inc.; 2015.

B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; Institute of Electrical and Electronic Engineers; 2004.

C. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2014.

D. NEMA MG 201 – Safety Standard and Guide for Selection, Installation, and Use of Electric Motors and Generators; 2014.

E. NFPA 70 - National Electrical Code, 2014 Edition; National Fire Protection Association.

1.5 SUBMITTALS

A. In accordance with Section GENERAL MECHANICAL REQUIREMENTS, make the required submittals and as listed below.

B. Shop Drawings:

1. Submit the following:
2. Include electrical ratings, dimensions, mounting details, materials, horsepower, RPM, enclosure, starting characteristics, torque characteristics, code letter, full load and locked rotor current, service factor, and lubrication method.

C. Manuals:

1. Submit simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets and application data.

D. Certifications:

1. Two weeks prior to final inspection, unless otherwise noted, submit two copies of the following certification each to the Owner's Representative and to the Engineer:

a. Certification that the motors have been properly applied, installed, adjusted, lubricated, and tested.

1.6 QUALITY ASSURANCE

A. Conform to NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.8 WARRANTY

A. See Section 23 05 10 - General Mechanical Requirements, for additional warranty requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Baldor, Century, Lincoln, Marathon, Magnetec, Toshiba

2.2 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service:
1. Motors 1/2 HP and Smaller: 115 volts, single phase, 60 Hz.
2. Motors 1/2 HP and larger: three phase 60 Hz.
   a. 460 volt motors on 480 volt systems.
3. Refer to Electrical drawings for voltage and phase required.

B. Overload Protection: Single phase motors shall be furnished with built-in automatic reset overload protection.

C. Efficiency: Motors 1 HP and larger shall be premium efficiency motors and have minimum full load efficiencies not less than listed in the Energy Code. Motors provided as an integral part of motor driven equipment shall also meet this requirement.

D. Brake Horsepower: All motors shall have rated horsepower at least 10 percent above the indicated brake horsepower of equipment including belt losses and inlet vane losses.

E. Horsepower ratings shall be adequate for operating the connected loads continuously in the prevailing ambient temperatures in areas where the motors are installed, without exceeding the NEMA standard temperature rises for the motor insulation.

F. Motor designs, as indicated by the NEMA code letters, shall be coordinated with the connected loads to assure adequate starting and running torque.

G. Construction:
1. Open, drip-proof type except where specifically noted otherwise.
2. Design for continuous operation in 104°F environment.
3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
4. All copper windings and leads.
5. Motors for belt driven equipment and base mounted pumps shall have cast iron yoke and bearing housings.

H. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number,

service factor, power factor, efficiency.

I. Motors serviced by Variable Frequency Controllers:
1. Motors shall be Definite Purpose Inverter-Fed Motors complying with NEMA MG 1-Part 31. Stator laminations shall be vacuum-pressure impregnated with varnish for reduction of audible motor noise.
2. Motors shall be equipped with factory installed grounding rings to electrically ground the motor shaft to prevent eddy current damage to bearings, AEGIS-SCR.

J. Wiring Terminations:
1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

K. Additional requirements for specific motors, as indicated in other sections, shall also apply.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions, the NEC, NEMA, and as shown on the drawings, and as required by other sections of these specifications.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

3.2 FIELD TESTS

A. Megger all motors after installation, before start-up. All shall test free from grounds.

END OF SECTION 23 05 13

SECTION 23 05 14
VARIABLE FREQUENCY CONTROLLERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Variable frequency controllers

1.2 RELATED SECTIONS

A. Section 23 05 10 - General Mechanical Requirements
B. Section 23 05 13 - Motors for HVAC Equipment.
C. Section 23 05 53 - Identification HVAC Piping and Equipment.
D. Section 23 09 94 - HVAC Sequence of Operation.
E. Section 23 08 00 - HVAC Commissioning Requirements.

1.3 REFERENCES

A. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems; 2014.
B. NEMA ICS 7 - Industrial Control and Systems: Adjustable Speed Drives; National Electrical Manufacturers Association, 2014.
C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum), National Electrical Manufacturers Association, 2014.
D. IEEE 519 - IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power Systems; Institute of Electrical and Electronic Engineers; 2014.
E. NFPA 70 - National Electrical Code 2014 Edition.

1.4 SUBMITTALS

A. Refer to Section 23 05 10 - General HVAC Requirements, for submittal procedures.
B. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.
C. Provide programming manual for drive. Manual shall be tabbed for items indicated in item B above.
D. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown, conduit entrance locations and requirements, and nameplate legends.
E. Rating: Submittal shall specifically indicate that drive size submitted is rated for horsepower being served with drive at 104°F and minimum of 4,000-Hz switching frequency. Drives rated at lower frequencies are not acceptable.
F. Test Reports: Indicate field test and inspection procedures and test results.
G. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
H. Manufacturer's Field Reports: Indicate start-up inspection findings.
I. Operation Data: NEMA ICS 7.1. Include instructions for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions.
J. Maintenance Data: NEMA ICS 7.1. Include routine preventive maintenance schedule.
K. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in the Owner's name and registered with manufacturer.

L. Certificate: Provide Manufacturer's Certificate complying with the requirements of the General Conditions.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by UL (Underwriters' Laboratories) as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure, and finish.

1.7 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide a three-year warranty to include materials and labor.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Layout Basis: ABB ACH550, with bypass.

B. Other Acceptable Manufacturers: Eaton HVX-9000; Square D E-Flex; Dan Foss VLT 6000; AC Technology QC3000; Yaskawa E7; Johnson Controls.

2.2 DESCRIPTION

A. Variable Frequency Controllers: Enclosed controllers suitable for operating the indicated loads, in conformance with requirements of NEMA ICS 7. Select unspecified features and options in accordance with NEMA ICS 3.1.
   1. Employ microprocessor-based inverter logic isolated from power circuits.
   2. Employ pulse-width-modulated inverter system providing a carrier frequency adjustable from 4,000 Hz to 8,000 Hz.
   3. Design shall be capable of withstanding a 10,000-volt spike, 50 joules of power, and input voltage variations of 480V to 528V without tripping.
   4. Design for ability to operate controller with motor disconnected from output.
   5. Design to attempt five automatic restarts following fault condition before locking out and requiring manual restart.

B. Enclosures: NEMA 250, Type 1, suitable for equipment application in places restricted to persons employed on the premises.

C. Finish: Manufacturer's standard enamel.

2.3 OPERATING REQUIREMENTS

A. Rated Input Voltage: 480 volts, three phase, 60 Hertz.

B. Motor Nameplate Voltage: 460 volts, three phase, 60 Hertz.

C. Displacement Power Factor: Between 1.0 and 0.95, lagging, over entire range of operating speed and load.

D. Operating Ambient: -10°F to 122°F.

E. Minimum Efficiency at Full Load: 95 percent.

F. Volts Per Hertz Adjustment: Plus or minus 10 percent.

G. Current Limit Adjustment: 60 to 110 percent of rated.

H. Acceleration Rate Adjustment: .5 to 360 seconds.

I. Deceleration Rate Adjustment: 1 to 360 seconds.

J. Input Signal: 4 to 20 mA DC.

2.4 COMPONENTS

A. Display: Provide integral digital display to indicate output voltage, output frequency, and output current.

B. Status Indicators: Separate indicators for overcurrent, overvoltage, ground fault, overtemperature, and input power ON.

C. Furnish HAND-OFF-AUTOMATIC selector switch and manual speed control.

D. Include undervoltage release.

E. Control Power Source: Integral control transformer.

F. Door Interlocks: Furnish mechanical means to prevent opening of equipment with power connected, or to disconnect power if door is opened; include means for defeating interlock by qualified persons.

G. Safety Interlocks: Furnish terminals for remote contact to inhibit starting under both manual and automatic mode.

H. Control Interlocks:
1. Furnish terminals for remote contact to allow starting in automatic mode.
2. Furnish BACNET communication device(s) to interface VFD with the BAS.
3. Provide auxiliary outputs to comply with the sequence of operation specified in Section 23 0994. Furnish programmable analog outputs(two minimum) and programmable digital outputs(three minimum).

I. Manual Bypass: Bypass shall be integral to the variable speed drive and manufactured by same firm that manufactures drive. Furnish contactor, motor running overload protection, and short circuit protection for full voltage, non-reversing operation of the motor. By-pass shall be two contactor type (does not allow maintenance on inverter while motor is operating).

J. Emergency Stop: Use dynamic brakes for emergency stop function.

K. Disconnecting Means: Include integral circuit breaker on the line side of each controller.

L. Wiring Terminations: Match conductor materials and sizes indicated.

M. Unit shall be capable of "plug-in" fan replacement with the drive in operation without requiring the removal of components or opening the drive enclosure.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surface is suitable for controller installation.

3.2 INSTALLATION

A. Install in accordance with NEMA ICS 7.1 and manufacturer's instructions.

B. Tighten accessible connections and mechanical fasteners after placing controller.

C. Variable frequency controllers shall not be installed within the air stream of an air handling unit or outside air energy recovery unit.

D. Select and install overload heater elements in motor controllers to match installed motor characteristics.

E. Provide engraved plastic nameplates; refer to Section 23 0553 - Mechanical Identification, for product requirements and location.

F. Include neatly typed label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place in clear plastic holder.

3.3 MANUFACTURER'S FIELD SERVICES

A. Provide services of factory trained representative for minimum of one day to prepare and start the controllers, calibrate the controls and inspect the installation.

B. Provide services of factory trained representative for minimum of one day to instruct the Owner on operation and maintenance.

C. Provide start-up certificate in the format prescribed by the General Conditions.

3.4 ADJUSTING

A. Make final adjustments to installed controller to assure proper operation of load system. Obtain performance requirements from installer of driven loads.

3.5 COMMISSIONING TESTS

A. Provide assistance to the Commissioning Authority (CxA) for scheduling and witnessing of testing.

B. Review the Prefuctional and Functional test procedures to ensure feasibility, safety, and equipment protection.

3.6 SCHEDULE

A. Provide variable frequency controllers for HVAC equipment where specified or indicated on the drawings and described in HVAC Sequences of Operation.

END OF SECTION

SECTION 23 05 15
ENCLOSED MOTOR CONTROLLERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Combination magnetic motor controllers and disconnects

1.2 RELATED SECTIONS

A. SECTION 23 05 10 General Mechanical Requirements

B. Section 23 05 53 - Mechanical Identification: Engraved nameplates

1.3 REFERENCES

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2015.

B. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated Not More Than 2000 Volts AC or 750 Volts DC; National Electrical Manufacturers Association ; 2000 (R2005).

C. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; National Electrical Manufacturers Association; 2017.

D. NEMA ICS 6 - Industrial Control and Systems: Enclosures; National Electrical Manufacturers Association; 1993 (R2006).

E. UL 489 Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures, 2016. (Formerly NEMA AB 1)

F. NFPA 70 - National Electrical Code 2014 Edition.

1.4 SUBMITTALS

A. Refer to Section 23 05 10 - General HVAC Requirements, for submittal procedures.

B. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Maintenance Data: Replacement parts list for controllers.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB, Allen Bradley, Cutler Hammer, Furnas, General Electric, Siemens, Square-D.

2.2 AUTOMATIC CONTROLLERS

A. Magnetic Motor Controllers: NEMA ICS 2, AC general-purpose Class A magnetic controller for induction motors rated in horsepower.

B. Starters shall be NEMA type starters. IEC type starters are not allowed.

C. Coil Operating Voltage: 120 volts, 60 Hertz.

D. Overload Relays: NEMA ICS 2; bimetal.

E. Enclosures:
   1. Enclosures: NEMA ICS 6, Type 1 indoors.

2.3 ACCESSORIES

A. Refer to HVAC Sequence of Operation for auxiliary contacts and where pushbuttons and remote pushbutton stations are required.

B. Auxiliary Contacts: NEMA ICS 2, 2 field convertible contacts in addition to seal-in contact.

C. Pilot Device Contacts: NEMA ICS 5, Form Z, rated A150.

D. Indicating Lights: Transformer, LED type.

E. Selector Switches:
   1. Rotary type Hand-Off-Automatic. Provide unless noted otherwise.

F. Control Power Transformers: 120-volt secondary, 145 VA minimum, in each motor starter. Provide fused primary, secondary, and bond unfused leg of secondary to enclosure.

2.4 DISCONNECTS

A. Combination Controllers: Combine motor controllers with disconnects in common enclosure. Obtain IEC Class 2 coordinated component protection.

B. Thermal Magnetic Circuit Breakers: UL 489, with integral thermal and instantaneous magnetic trip in each pole.

PART 3 EXECUTION

3.1 INSTALLATION

A. All three-phase motors furnished under this Division not fed from a starter in a motor control center or Variable Frequency Controller shall be provided with combination starter and circuit breaker unless otherwise noted.

B. Install enclosed controllers where indicated, in accordance with NECA Standard of Installation.

C. Install enclosed controllers plumb.

D. Height: 5 ft. to operating handle.

E. Install with minimum of four anchors.

F. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch off wall.

G. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

H. Select and install overload heater elements in motor controllers to match installed motor characteristics.

I. Provide engraved plastic nameplates; refer to Section 23 0553 for product requirements and location.

J. Neatly type label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, voltage/phase rating, panel and circuit number. Place label in clear plastic holder.

END OF SECTION

SECTION 23 05 19
METERS AND GAGES FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Balancing Flow meters.

B. Pressure gages and pressure gage taps.

C. Thermometers and thermometer wells.

D. Test Plugs.

1.2 RELATED REQUIREMENTS

A. SECTION 23 05 10 General Mechanical Requirements

B. Section 23 09 13 - INSTRUMENTATION AND CONTROL DEVICES FOR HVAC.

C. Section 23 09 23 - DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

D. Section 23 21 13 - HYDRONIC PIPING.

1.3 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; The American Society of Mechanical Engineers; 2013.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014.

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014.

1.4 SUBMITTALS

A. Refer to Section 23 05 10 - General HVAC Requirements, for submittal procedures.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

1.5 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.1 BALANCING FLOW METERS

A. Annular element flow stations:
   1. Manufacturers: Onicon, Greyline, Omega.
   2. Measuring Station: electromagnetic insertion flow meter than can be installed through one-inch ball valve. Wetted parts of 316 stainless steel. Produces analog output.
   3. Pressure rating: 275 psi.
   4. Maximum temperature: 150°F.
   5. Accuracy: plus or minus one percent.

2.2 PRESSURE GAGES

A. Manufacturers:
   1. Trerice Model 500X.
   2. Other acceptable manufacturers offering equivalent products: Marsh 103, Palmer Wahl 40SPDLH, Weksler BM1, Weiss AG-1.

B. Pressure Gages: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
   1. Case: Cast aluminum with phosphor bronze bourdon tube, Stem(flangeless) mounting.
   2. Size: 4-1/2-inch diameter.

3. Mid-Scale Accuracy: One percent.
4. Hydronic Water Scale: Feet-H2O in 2 ft. graduations. Scale range shall be so pump suction pressure is above lower 10% and pump discharge is below upper 10% of scale range.

2.3 PRESSURE GAGE TAPPINGS

A. Ball Valve: 1/4 inch, 400 psig WOG, Bronze two piece body, standard port, chrome plated brass ball, reinforced teflon seats and stuffing box ring, blow-out proof stem design, adjustable packing gland, zinc coated steel lever handle with vinyl hand grip, threaded ends.

B. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections, as manufactured by Trerice, Model 872, Duro, Marsh, Weksler, Weiss.

C. Syphon: Steel, Schedule 40, ¼-inch angle or straight pattern.

2.4 STEM TYPE THERMOMETERS

A. Manufacturers:
1. Trerice Model AX9.
2. Other acceptable manufacturers offering equivalent products: Palmer Wahl 9FLA, Weksler A7.

B. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
1. Size: 7-inch scale.
2. Window: Clear Lexan.
3. Stem: 3/4 inch NPT brass.
4. Accuracy: 2 percent, per ASTM E 77.
5. Calibration: Degrees F.

2.5 DIAL THERMOMETERS

A. Manufacturers:
1. Trerice Model V80341.
2. Other acceptable manufacturers offering equivalent products: Ashcroft 6140TW, Palmer 50B, Weksler 12B25-A11.

B. Thermometers: Dial type vapor or liquid actuated; ASTM E 1; drawn steel with enamel finish case, with brass or copper bulb, copper or bronze braided capillary, white with black markings and black pointer, glass lens.
1. Size: 4-1/2-inch diameter dial.
2. Lens: Clear Lexan.
3. Length of Capillary: Minimum 5 feet.
4. Accuracy: 2 percent.
5. Calibration: Degrees F.

2.6 THERMOMETER SUPPORTS

A. Pipe Socket Well:
1. Brass or stainless steel separable socket wells for thermometer stems and control sensors.
2. Provide cap and chain where not used to mount permanent instrument or control sensor.
3. Provide lagging extension when mounted on insulated pipe.

B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.7 TEST PLUGS

A. Manufacturers:
1. FDI Model Super Seal.

2. Other acceptable manufacturers offering equivalent products: Peterson Equipment Co. "Pete's Plug II, Sisco, Trerice, Texas Fairfax.

B. Test Plug: ¼-inch or ½-inch brass fitting and cap for receiving 1/8-inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200°F. Provide extra-long shaft when mounted on insulated pipe.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install flow meters in pipe lines indicated on Drawings with the manufacturer's required straight length of pipe entering and leaving meter.

C. Pump Differential Pressure Stations:
1. Provide one pressure gage per base mounted pump, installing taps before strainer (Suction Diffuser) and on suction and discharge of pump.
2. Pipe to pressure gage mounting with copper or brass tubing.
3. Provide a test port at each tap location such that piping is straight through and can be cleared with a rod inserted through the port and the tap. Use a tee fitting to route to the pressure gage with isolation valves as required to isolate each pressure tap location.
4. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), hard drawn, using the following fittings:
   a. Fittings: Solder type ASME B16.18 cast/bronze/brass or ASME B16.22 wrought copper fittings, unless otherwise noted.

D. Provide two pressure gages per pump, installing taps on suction and discharge of pump. Pipe to gage.

E. Install pressure gages on hydronic systems with pulsation dampers. Provide ball valve to isolate each gage connection to system. Extend nipples to allow clearance from insulation.

F. Differential pressure transducer piping manifold:
1. Tap tubing from side of pipe mains, not top or bottom. Tubing shall be copper or brass.
2. Provide manifold unions across the supply and return mains with isolation valves.
3. Provide a pressure gage across the supply and return mains in parallel with the pressure transducer.
4. Provide test ports across the transducer and a blowdown on each side of the transducer.
5. Install manifold at 5'-0" AFF.
6. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), hard drawn, using the following fittings:
   a. Fittings: Solder type ASME B16.18 cast/bronze/brass or ASME B16.22 wrought copper fittings, unless otherwise noted.

G. Install pressure tappings on piping where specified or shown on flow diagrams and details. Provide valve to isolate each tapping connection to system. Extend nipples to clear insulation.

H. Install sockets for all thermometers and control sensors. Provide spare sockets with cap and chain as shown on flow diagrams and details.

I. Mount sockets in ¾-inch NPT pipe openings. Install vertical to 45 degrees off vertical. Use lateral-o-let on vertical pipe.

J. Fill sockets with SAE 10W oil for conduction.

K. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2-inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

L. Coil and conceal excess capillary on remote element instruments.

M. Provide instruments with scale ranges selected according to service with largest appropriate scale.

N. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

O. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

P. Locate test plugs adjacent to thermometers, temperature wells, pressure gages, coil connections, and where shown on flow diagrams and details. Install in ½-inch pipe opening(minimum), with bushing.

Q. Install test plugs vertical to horizontal. Do not install pointing down.

3.2 SCHEDULE

A. Balancing Flow Meters, Location:
   1. Provide annular flow stations where specified and as shown on Drawings and Flow Diagrams.

B. Pressure Gages, Location and Scale Range:
   1. Provide pressure gages where specified and as shown on flow diagrams and details.

C. Stem Type Thermometers, Location and Scale Range:
   1. Provide thermometers where specified and as shown on flow diagrams and details.
   2. Chilled Water, 0 to 100°F in one degree divisions.
   3. Condenser Water, 0 to 160°F in two degree divisions.
   4. Low Temperature Heating Water, 30 to 230°F in two degree divisions.

D. Dial Thermometers, Location and Scale Range:
   1. Supply Air of each Air Handling Unit, 0 to 100°F.

END OF SECTION

SECTION 23 05 33
HEAT TRACING FOR HVAC PIPING

PART 1 GENERAL

SECTION INCLUDES

A. Self-regulating parallel resistance electric heating cable.

1.2 RELATED REQUIREMENTS

A. Section 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT.

B. Section 23 07 19 - HVAC PIPING INSULATION.

C. Section 23 21 13 - HYDRONIC PIPING.

D. Section 23 21 14 - HYDRONIC SPECIALTIES.

E. Section 26 27 17 - Equipment Wiring.

1.3 REFERENCE STANDARDS

A. IEEE 515.1 - IEEE Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications; 2012.

B. NFPA 70 - National Electrical Code; 2014.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

B. Coordinate the work with other trades to provide ground fault protection for electric heat tracing circuits as required by NFPA 70.

1.5 SUBMITTALS

A. Refer to Section 23 05 10 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide data for electric heat tracing.

C. Shop Drawings: Indicate electric heat tracing layout, electrical terminations and controls.

D. Manufacturer's Installation Instructions: Indicate installation instructions and recommendations.

E. Field Quality Control Submittals: Indicate test reports and inspection reports.

F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions of equipment and controls, maintenance and repair data, and parts listings.

1.6 QUALITY ASSURANCE

A. Acceptable Installers: Familiar with the installation of heat-trace cabling and equipment, subject to compliance with the requirements of the Contract Documents.

1.7 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide two-year manufacturer warranty for cables, connection kits, and accessories.

PART 2 PRODUCTS

2.1 SELF-REGULATING PARALLEL RESISTANCE ELECTRIC HEATING CABLE

A. Manufacturers:
   1. Chromalox, Inc ; SRL-8: www.chromalox.com.
   2. Pentair : www.pentairthermal.com.
   3. Thermon Manufacturing Company : www.thermon.com.

B. Provide products listed, classified, and labeled by UL (Underwriters Laboratories).

C. Factory Rating and Testing: Comply with IEEE 515.1.

D. Heating Element:
   1. Provide pair of parallel No. 16 tinned or nickel coated stranded copper bus wires embedded in cross linked conductive polymer core with varying heat output in response to temperature along its length.
   2. Terminations: Waterproof, factory assembled, non-heating leads with connector at one end and water-tight seal at opposite end.
   3. Capable of crossing over itself without overheating.

E. Insulated Jacket: Flame retardant polyolefin.

F. Cable Cover: Provide tinned copper and polyolefin outer jacket with UV inhibitor.

G. Maximum Power-On Operating Temperature: 150 degrees F.

H. Maximum Power-Off Exposure Temperature: 185 degrees F.

I. Setpoint: 40°F.

J. Electrical Characteristics:
   1. 8 Watts/lineal ft.
   2. 120 volts, single phase, 60 Hz.

2.2 OUTER JACKET MARKINGS

A. Name of manufacturer, trademark, or other recognized symbol of identification.

B. Catalog number, reference number, or model.

C. Month and year of manufacture, date coding, applicable serial number, or equivalent.

D. Agency listing or approval.

2.3 CONNECTION KITS

A. Provide power connection, splice/tee, and end seal kits compatible with the heating cable and without requiring cutting of the cable core to expose bus wires.

B. Furnish with NEMA 4X rating for prevention of corrosion and water ingress.

C. All components UV stabilized.

2.4 ACCESSORIES

A. Provide Accessories As Indicated or As Required for Complete Installation, Including but Not Limited To:
   1. High temperature, glass filament tape for attachment of heating cable to metal piping.
   2. Aluminum self-adhesive tape for attachment of heating cable to plastic piping.
   3. Heat-conductive putty.
   4. Cable ties.
   5. Silicone end seals and splice kits.
   6. Installation clips.
   7. Warning labels for attachment to exterior of piping insulation. Refer to Section 23 0553.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping and equipment are ready to receive work.

B. Verify field measurements are as shown on drawings.

C. Verify required power is available, in proper location, and ready for use.

3.2 PREPARATION

A. Clean all surfaces prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer.

3.3 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Comply with installation requirements of IEEE 515.1 and NFPA 70, Article 427.

C. Apply heating cable linearly on pipe with fiberglass tape only after piping has successfully completed any required pressure testing.

D. Fasten heating cable to pipe with cable ties 12-inch on center. Install with manufacturer's power connectors, splice kits and end seals.

E. Comply with all national and local code requirements.

F. Identification:
   1. After thermal insulation installation, apply external pipeline decals to indicate presence of the thermal insulation cladding at intervals not to exceed 20 ft. including cladding over each valve or other equipment that may require maintenance.

3.4 FIELD QUALITY CONTROL

A. Field Testing and Inspections:
   1. Commission system in accordance with installation and operation manual.
   2. Inspect for sources of water entry and proper sealing.
   3. Inspect weather barrier to confirm that no sharp edges are contacting the trace heating.
   4. Minimum Acceptable Insulation Resistance: 20 megohms or greater at a test voltage of 2500 VDC for polymer insulated trace heaters.
   5. Test heating cable integrity with megohmmeter at the following intervals:
      a. Before installing the cable.
      b. After cable has been installed onto the piping.
      c. After installing the connection kits.
      d. After the installation of thermal insulation onto the piping.
   6. Measure voltage and current at each unit.
   7. Submit written test report showing values measured on each test for each cable.

3.5 CLOSEOUT ACTIVITIES

A. Demonstrate operation of heating cable controls.

3.6 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 23 05 41
NOISE CONTROL FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

Noise criteria, for HVAC equipment work.

1.2 RELATED WORK

A. Section 23 05 10, General Mechanical Requirements: General mechanical requirements and items, which are common to more than one section of Division 23.

B. Section 23 05 93, Testing, Adjusting, And Balancing For HVAC: requirements for sound tests.

1.3 QUALITY ASSURANCE

A. Refer to article, Quality Assurance in specification Section 23 05 11, General Mechanical Requirements.

B. Noise Criteria:

1. Noise levels in indoor environments for all eight octave bands due to equipment shall not exceed following NC levels:

TYPE OF ROOM	NC
Conference Rooms	35
Corridors	40
Kitchens	50
Laundries	50
Lobbies, Waiting Areas	40
Locker Rooms	50
Offices, large open (3 or more occupants)	40
Offices, small private (2 or fewer occupants)	35

2. For equipment which has no sound power ratings scheduled on the plans, the contractor shall select equipment such that the foregoing noise criteria, local ordinance noise levels, and OSHA requirements are not exceeded. Selection procedure shall be in accordance with the 2013 ASHRAE Fundamentals Handbook, Chapter 8, Sound and Vibration.
3. An allowance, not to exceed 5db, may be added to the measured value to compensate for the variation of the room attenuating effect between room test condition prior to occupancy and design condition after occupancy which may include the addition of sound absorbing material, such as, furniture. This allowance may not be taken after occupancy. The room attenuating effect is defined as the difference between sound power level emitted to room and sound pressure level in room.
4. In absence of specified measurement requirements, measure equipment noise levels three feet from equipment and at an elevation of maximum noise generation.

C. Allowable Vibration Tolerances for Rotating, Non-reciprocating Equipment: Not to exceed a self-excited vibration maximum velocity of 5 mm per second (0.20 inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal and axial directions or measured at equipment mounting feet if bearings are concealed. Measurements for internally isolated fans and motors may be made at the mounting feet.

1.4 SUBMITTALS

A. Submit in accordance with specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:
1. Vibration isolators:
   a. Floor mountings
   b. Hangers
2. Bases.

C. Isolator manufacturer shall furnish with submittal load calculations for selection of isolators, including supplemental bases, based on lowest operating speed of equipment supported.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):
2013 Fundamentals Handbook, Chapter 8, Sound and Vibration

C. American Society for Testing and Materials (ASTM):
A123/A123M-02 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A307-04 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
D2240-05 - Standard Test Method for Rubber Property - Durometer Hardness

D. Manufacturers Standardization (MSS):
SP-58-02 - Pipe Hangers and Supports-Materials, Design and Manufacture

E. Occupational Safety and Health Administration (OSHA):
29 CFR 1910.95 - Occupational Noise Exposure

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Type of isolator, base, and minimum static deflection shall be as required for each specific equipment application as recommended by isolator or equipment manufacturer but subject to minimum requirements indicated herein and in the schedule on the drawings.

B. Elastometric Isolators shall comply with ASTM D2240 and be oil resistant neoprene with a maximum stiffness of 60 durometer and have a straight-line deflection curve.

C. Uniform Loading: Select and locate isolators to produce uniform loading and deflection even when equipment weight is not evenly distributed.

D. Color code isolators by type and size for easy identification of capacity.

2.2 VIBRATION ISOLATORS

A. Floor Mountings:

1. Double Deflection Neoprene (Type N): Shall include neoprene covered steel support plated (top and bottom), friction pads, and necessary bolt holes.

2.3 BASES

A. Integral Structural Steel Base (Type B): Design base with isolator brackets to reduce mounting height of equipment which require a complete supplementary rigid base. To assure adequate stiffness, height of members shall be a minimum of 1/12 of longest base dimension, but not less than 100 mm (four inches).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Vibration Isolation:

1. No metal-to-metal contact will be permitted between fixed and floating parts.
2. Connections to Equipment: Allow for deflections equal to or greater than equipment deflections. Electrical, drain, piping connections, and other items made to rotating or reciprocating equipment (pumps, compressors, etc.) which rests on vibration isolators, shall be isolated from building structure for first three hangers or supports.
3. Common Foundation: Mount each electric motor on same foundation as driven machine. Hold driving motor and driven machine in positive rigid alignment with provision for adjusting motor alignment and belt tension. Bases shall be level throughout length and width. Provide shims to facilitate pipe connections, leveling, and bolting.
4. Provide heat shields where elastomers are subject to temperatures over l00°F).
5. Extend bases for pipe elbow supports at discharge and suction connections at pumps. Pipe elbow supports shall not short circuit pump vibration to structure.
6. Non-rotating equipment shall be mounted on isolation units having the same static deflection as the isolation hangers or support of the pipe connected to the equipment.

B. Inspection and Adjustments: Check for noise transmission through connections, piping, ductwork, foundations, and walls. Adjust, repair, or replace isolators as required to reduce noise transmissions to specified levels.

3.2 ADJUSTING

A. Adjust vibration isolators after piping systems are filled and equipment is at operating weight.

END OF SECTION

SELECTION GUIDE FOR VIBRATION ISOLATORS

EQUIPMENT		ON			20FT FLOOR			30FT FLOOR			40FT FLOOR			50FT FLOOR		
		BASE	ISOL	MIN	BASE	ISOL	MIN	BASE	ISOL	MIN	BASE	ISOL	MIN	BASE	ISOL	MIN
PUMPS																
BASE MOUNTED	UP TO 10	---	---	---	I	SS	1.0	I	SS	1.0	I	SS	1.7	I	SS	1.7
	15 HP TH	I	SS	1.0	I	SS	1.0	I	SS	1.7	I	SS	1.7	I	SS	1.7
	50-125 HP	I	SS	1.0	I	SS	1.0	I	SS	1.7	I	SS	2.5	I	SS	2.5
	150 HP	I	SS	1.0	I	SS	1.7	9	SS	2.5	I	SS	2.5	I	SS	3.5
CENTRIFUGAL BLOWERS																
UP TO 50 HP:																
UP TO 200 RPM		B	N	0.3	B	SS	2.5	B	S	2.5	B	S	3.5	B	S	3.5
201 - 300 RPM		B	N	0.3	B	SS	1.7	B	S	2.5	B	S	2.5	B	S	3.5
301 - 500 RPM		B	N	0.3	B	SS	1.7	B	S	1.7	B	S	2.5	B	S	3.5
501 RPM &		B	N	0.3	B	SS	1.0	B	S	1.0	B	S	1.7	B	S	2.5

EQUIPMENT	ON			20FT FLOOR			30FT FLOOR			40FT FLOOR			50FT FLOOR		
	BASE	ISOL	MIN	BASE	ISOL	MIN	BASE	ISOL	MIN	BASE	ISOL	MIN	BASE	ISOL	MIN
AIR HANDLING UNIT PACKAGES															
SUSPENDED:															
UP THRU 5 HP	---	---	---	---	H	1.0	---	H	1.0	---	H	1.0	---	H	1.0
7-1/2 HP & OVER:															
UP TO 500 RPM	---	---	---	---	H, T	1.7	---	H, T	1.7	---	H, T	1.7	---	H, T	1.7
501 RPM & OVER	---	---	---	---	H, T	1.0	---	H, T	1.0	---	H,TH	1.7	---	H,TH	1.7
FLOOR MOUNTED:															
UP THRU 5 HP	---	DS	---	---	SS	1.0	---	SS	1.0	---	SS	1.0	---	SS	1.0
7-1/2 HP & OVER:															
UP TO 500 RPM	---	DS	---	R	SS,	1.7	R	SS,	1.7	R	SS,	1.7	R	SS,	1.7
501 RPM & OVER	---	DS	---	---	SS,	1.0	---	SS,	1.0	R	SS,	1.7	R	SS,	1.7

NOTES:

1. For suspended floors lighter than 100 mm (4 inch) thick concrete, select deflection requirements from next higherspan.
2. Direct bolt fire pumps to concrete base. Provide pads (D) for domestic water booster pump package.

SECTION 23 05 48

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Equipment support bases.

B. Vibration isolators.

1.2 REFERENCE STANDARDS

A. ASHRAE – 2015 ASHRAE Handbook - HVAC Applications; Chapter 38, Testing, Adjusting, and Balancing

B. 2015 South Carolina Building Code

C. American Society of Civil Engineers 7-10

D. VISCMA (The Vibration Isolation and Seismic Control Manufacturer's Association) Testing and Rating Standards for Vibration Components that comply with Building Code and ASHRAE requirements.

1.3 SUMMARY

A. Provide all labor, materials, transportation and equipment to complete the furnishing, installation, assembly, set up, and testing of the Vibration and Motion Control work indicated on the drawings and specified herein. Notwithstanding any detailed information in this Section, provide complete, working systems.

B. Provide complete, all means of support, suspension, attachment, fastening, bracing, and restraint (hereinafter "support") of the Work of this Section. Provide engineering of such support by parties licensed to perform work of this type in the Project jurisdiction.

C. Provide including, but not limited to:

1. Isolation of mechanical equipment including but not limited to chillers, pumps, fans, air handling units, including bases.
2. Isolation for ductwork and piping (including but not limited to heating water and chilled water, and including all piping connected to vibration isolated equipment).
3. Supervision and inspection of installation of vibration isolation to equipment.
4. See contents of this Section for specific specifications and schedules of vibration isolators, frames and static deflections.

1.4 SUBMITTALS

A. Descriptive Data - Submit the Following:

1. An itemized list showing the items of equipment, piping, and other equipment to have vibration isolated, the vibration isolator type and model number selected, isolator loading and deflection, coil diameter and number of coils in springs, and references to specific shop drawings showing frame construction where specified. Include Vibration Rating Data for each vibration-rated isolator or restraint component.
2. Provide manufacturer's product literature documenting compliance with Part 2 Products. Catalog cuts and data sheets on specific vibration isolators to be utilized showing compliance with the specifications and schedules herein. Include load versus deflection curves.
3. Written approval of the frame design to be used, obtained from the equipment manufacturer.
4. Written instructions from the vibration isolation manufacturer as to the proper installation and adjustment of vibration isolation devices, including hangers and bases; alternatively the equipment may be installed by the vibration isolation manufacturer.

B. Shop Drawings:

1. Provide schedule of vibration isolator type with location and load on each.

2. Fully dimensioned fabrication drawings and installation details for vibration isolation bases, member sizes, attachments to isolators, and supported equipment.
3. Detailed submittal drawings of vibration restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors. Include ratings for loads.
4. Include auxiliary motor slide bases and rails, base weights, inertia bases, concrete weights, equipment static loads, centers of gravity, support points, vibration isolators, and detailed layout of isolator location and orientation with static and dynamic load on each isolator.
5. Include selections from prescriptive design tables that indicate compliance with the 2015 South Carolina Building Code and the vibration isolator manufacturer's requirements.
6. Clearly indicate the load and capacity assumptions selected. Include copies of any calculations.

C. See Section 23 0510 - General Mechanical Requirements for submittal procedures.

D. Manufacturer's Instructions: Indicate installation instructions with special procedures and setting dimensions.

1.5 QUALITY ASSURANCE

A. Product Suppliers: All vibration isolation devices, equipment bases and frames for equipment and piping furnished under all Division 23 sections shall be designed and furnished by one isolator manufacturer and no single vibrating element shall be isolated by the products of more than one isolator manufacturer.

B. Supervision: The installation of all vibration isolation units, and associated hangers and bases shall be under the direct supervision of the vibration isolation manufacturer's representative.

C. Verification: Examine related Work and surfaces before starting Work of this Section. Do not proceed with the Work until conditions which will prevent proper provision of this Work have been corrected. Beginning the Work of this Section without reporting unsuitable conditions to the Owner’s Representative and the Engineer constitutes acceptance of such conditions by Contractor. Perform any required removal, repair, or replacement of this Work caused by unsuitable conditions at no additional cost to the Owner.

D. Coordination: Comply with Division 1. Coordinate with Finish Systems, Piping Systems and Equipment, Heating, Ventilating and Air Conditioning and Electrical Sections for installation of Vibration Isolation. Coordinate with Concrete trade for equipment inertial bases. Coordinate Work of this Section with all other Work.

E. Perform design and installation in accordance with applicable codes.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Kinetics Noise Control, Inc. is the basis of design.

B. Other acceptable manufacturers with prior approval include:

1. Korfund Dynamics
2. Mason Industries
3. Vibration Eliminator Company, Inc.
4. Vibration Mounting and Control
5. Vibro-Acoustics

2.2 PERFORMANCE REQUIREMENTS

A. General:

1. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.
2. Steel springs to function without undue stress or overloading.
3. All equipment mounted on vibration isolated bases to have minimum operating clearance of 2 inches between the base and floor or support beneath unless noted otherwise.

2.3 VIBRATION ISOLATORS

A. Non-Seismic Type:

1. Open Spring Isolators:
   a. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
   b. Spring Mounts: Provide with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
   c. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
   d. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs.
2. Restrained Closed Spring Isolators:
   a. Type : Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
   b. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
   c. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance and limit stops.
   d. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs.
3. Spring Hangers:
   a. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
   b. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators.
   c. Misalignment: Capable of 20 degree hanger rod misalignment.
4. Neoprene Rubber Mount or Hanger: Molded rubber designed for 0.4 inch deflection with threaded insert.
5. Neoprene Pad Isolators:
   a. Rubber or neoprene waffle pads.
      1) Hardness: 30 durometer.
      2) Thickness: Minimum 1/2 inch.
      3) Maximum Loading: 50 psi.
      4) Rib Height: Maximum 0.7 times width.
   b. Configuration: 1/2 inch thick waffle pads bonded each side of 1/4 inch thick steel plate.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

A. Install in accordance with manufacturer's instructions.

B. Bases:
1. All bases shall be placed in position and supported temporarily by blocks or shims prior to the installation of the equipment, isolators and restraints.
2. Isolators shall be installed after all equipment is installed without changing equipment elevations.
3. Adjust equipment level.
4. Remove all debris from beneath the equipment and verify that there are no short circuits of the isolators or the isolation system.

C. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

D. Support piping connections to equipment mounted on isolators using isolators or resilient hangers for scheduled distance.
   1. Up to 4 Inches Pipe Size: First three points of support.
   2. 5 to 8 Inches Pipe Size: First four points of support.

E. Vibration isolation hangers shall be positioned as close as possible to the structure without coming in contact with any object (including the structure).
   1. Hanger rods shall not contact any object which would short circuit the isolator.

3.2 SCHEDULE

A. Equipment Isolation Schedule.
   1. Base Mounted Pumps mounted on concrete inertia pads.
      a. Isolator Type: Restrained Closed Spring Isolators
      b. Isolator Deflection: 0.5 inches.
   2. Cooling Tower mounted on structural steel frame above grade. Fans and motors are factory isolated
      a. No additional isolation required.

END OF SECTION 23 05 48

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe Markers.

D. Valve Tags.

1.2 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2015.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2013.

1.3 SUBMITTALS

A. Refer to Section 23 05 10 - General HVAC Requirements, for submittal procedures.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved white letters on black contrasting background.

B. Size: ½-inch high letters unless otherwise noted.

2.2 EQUIPMENT TAGS

A. Manufacturers: Brimar, Kolbi, Seton.

B. Plastic Tags: Laminated three-layer plastic with engraved white letters on black contrasting background. Tag size minimum 1-1/2-inch diameter.

C. Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.3 PIPE MARKERS

A. Match markers on existing chilled water and condenser water pipes, else use manufacturers in 2.3 B.

B. Manufacturers: Brimar, Kolbi Industries Style A thru E (5-inch and smaller) else Style F thru H, Marking Services Inc., Seton Identification Products - Setmark.

C. Color: Conform to ASME A13.1.

D. Pipe Markers for Indoor Use: Seton Setmark; media indicator with direction-of-flow arrows on calendared vinyl sheet; snap-around type for pipe sizes to 5-7/8 inches diameter, strap around type with nylon ties for pipe sizes 6-inch diameter and larger.

E. Pipe Markers for Outdoor Use: Seton Weather-Code; media indicator and detachable direction-of-flow arrows on weather-resistant pressure-sensitive vinyl sheet; service temperature -40 to 175 degrees F.

2.4 VALVE TAGS

A. Manufacturers: Brimar, Kolbi, Marking Services Inc., Seton.

B. Valve Tags: Polished Brass 1-1/2 inches in diameter; Media and identification number imprinted with black color fill on tag, not less than 3/16 inch high.
   1. Tag shapes shall be round.

2. Valve tag number scheme shall run consecutively regardless of service with no duplication of numbers throughout the project following the largest number used in existing tag series.
3. Coordinate valve tag numbers with existing valve tag system.

C. Valve Tag Securing Devices: Number 6 brass bead chain; provide one securing device for each tag in accepted schedule.

D. Valve Chart Frame: Aluminum frame, plastic window; sized to accommodate included chart, 8- 1/2 by 11 inches.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

D. Identify pumps and water treatment devices with plastic nameplates.

E. Identify small devices with tags.

F. Identify control panels and major control components outside panels with plastic nameplates.

G. Tag automatic controls, instruments, and relays. Key to control schematic.

H. Install Pipe Markers on all piping systems at the following Locations:
1. Mechanical Equipment Rooms:
   a. Within 18 inches of each valve.
   b. Within 36 inches of each 90° elbow, tee, connection to equipment or vessel and point where pipe exits room.
   c. At not over intervals of 20 feet along all exposed piping.
2. Piping Exposed in Rooms Other Than Mechanical Equipment Areas:
   a. Omit identification on piping, 1-inch exterior diameter or smaller (insulated or uninsulated) or exposed at connections to equipment or plumbing fixtures.
   b. With the above exception, identify at not less than one point each piping run visible in each room, with identification on not over 20 feet intervals.

I. Valve Tags:
1. Identify all valves shown on HVAC flow diagrams with tags. Begin number series to follow on from the highest number in the series of existing valves.
2. Install valve tags on all valves in the central plant and at the cooling tower pad.
3. Valve Chart: List all tagged valves indicating system, valve identification number, location and purpose or special information. Mount to wall in mechanical room.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. Testing, adjusting, and balancing (TAB) of heating, ventilating and air conditioning (HVAC) systems. TAB includes the following:

1. Planning systematic TAB procedures.
2. Design Review Report.
3. Systems Inspection report.
4. Systems Readiness Report.
5. Balancing water distribution systems; adjustment of total system to provide design performance; and testing performance of equipment and automatic controls.
6. Vibration and sound measurements.
7. Recording and reporting results.

B. Definitions:

1. Basic TAB used in this Section: Chapter 38, "Testing, Adjusting and Balancing" of 2015 ASHRAE Handbook, "HVAC Applications."
2. TAB: Testing, Adjusting and Balancing; the process of checking and adjusting HVAC systems to meet design objectives.
3. AABC: Associated Air Balance Council.
4. NEBB: National Environmental Balancing Bureau.
5. Hydronic Systems: Includes chilled water and heating hot water.
6. Air Systems: Includes all outside air, supply air, return air, exhaust air and relief air systems (not in this project).
7. Flow rate tolerance: The allowable percentage variation, minus to plus, of actual flow rate from values (design) in the contract documents.

1.2 RELATED WORK

A. Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General Mechanical Requirements.

B. Section 23 05 12, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT: Noise and Vibration Requirements.

C. Section 23 07 11, HVAC AND PLUMBING INSULATION: Piping and Equipment Insulation.

1.3 QUALITY ASSURANCE

A. Refer to Articles, Quality Assurance and Submittals, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Qualifications:

1. TAB Agency: The TAB agency shall be a subcontractor of the Mechanical Contractor and shall report to and be paid by the Mechanical Contractor.

2. The TAB agency shall be either a certified member of AABC or certified by the NEBB to perform TAB service for HVAC, water balancing and vibrations and sound testing of equipment. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the agency loses subject certification during this period, the General Contractor shall immediately notify the Engineer and submit another TAB firm for approval. Any agency that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any work related to the TAB. All work performed in this Section and in other related Sections by the TAB agency shall be considered invalid if the TAB agency loses its certification prior to Contract completion, and the successor agency's review shows unsatisfactory work performed by the predecessor agency.

3. TAB Specialist: The TAB specialist shall be either a member of AABC or an experienced technician of the Agency certified by NEBB. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the General Contractor shall immediately notify the Engineer and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB specialist shall be considered invalid if the TAB Specialist loses its certification prior to Contract completion and must be performed by an approved successor.

4. TAB Specialist shall be identified by the General Contractor within 15 days after the notice to proceed. The TAB specialist will be coordinating, scheduling and reporting all TAB work and related activities and will provide necessary information as required by the Engineer. The responsibilities would specifically include:

a. Shall directly supervise all TAB work.

b. Shall sign the TAB reports that bear the seal of the TAB standard. The reports shall be accompanied by report forms and schematic drawings required by the TAB standard, AABC or NEBB.

c. Shall follow all TAB work through its satisfactory completion.

d. Shall provide final markings of settings of all HVAC adjustment devices.

5. All TAB technicians performing actual TAB work shall be experienced and must have done satisfactory work on a minimum of three projects comparable in size and complexity to this project. Qualifications must be certified by the TAB agency in writing.

C. Test Equipment Criteria: The instrumentation shall meet the accuracy/calibration requirements established by AABC National Standards or by NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems and instrument manufacturer. Provide calibration history of the instruments to be used for test and balance purpose.

D. Tab Criteria:

1. One or more of the applicable AABC, NEBB or SMACNA publications, supplemented by 2015 ASHRAE Handbook "HVAC Applications" Chapter 38, and requirements stated herein shall be the basis for planning, procedures, and reports.
2. Flow rate tolerance: The following tolerances are allowed. For tolerances not mentioned herein follow ASHRAE Handbook "HVAC Applications" Chapter 38 as a guideline.
   a. Chilled water and condenser water pumps: 0 percent to plus 5 percent.
3. Systems shall be adjusted for energy efficient operation as described in PART 3.
4. Typical TAB procedures and results shall be demonstrated to the Owner's Representative for one hydronic system (pump) as follows:
   a. When field TAB work begins.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submit names and qualifications of TAB agency and TAB specialists within 15 days after the notice to proceed. Submit information on three recently completed projects and a list of proposed test equipment.

C. For use by the Engineer, submit one complete set of applicable AABC or NEBB publications that will be the basis of TAB work.

D. Submit Following for Review and Approval:

1. Design Review Report within 30 days for conventional design projects after the system layout on water side is completed by the Contractor.
2. Systems inspection report on equipment and installation for conformance with design.
3. Systems Readiness Report.
4. Intermediate and Final TAB reports covering flow balance and adjustments, performance tests, vibration tests and sound tests.
5. Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.

E. Prior to request for Final or Partial Final inspection, submit completed Test and Balance report for the area.

1.5 APPLICABLE PUBLICATIONS

A. The following publications form a part of this specification to the extent indicated by the reference thereto. In text, the publications are referenced to by the acronym of the organization.

B. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):

2015 HVAC Applications ASHRAE Handbook, Chapter 38, Testing, Adjusting, and Balancing and Chapter 48, Noise and Vibration Control

C. Associated Air Balance Council (AABC): 2002 AABC National Standards for Total System Balance

D. National Environmental Balancing Bureau (NEBB):

7th Edition 2005 Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems

1st Edition 1994 Procedural Standards for the Measurement and Assessment of Sound and Vibration

2nd Edition 1999 Procedural Standards for Building Systems Commissioning

E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

3rd Edition 2002 HVAC SYSTEMS-Testing, Adjusting and Balancing

PART 2 – PRODUCTS

INSULATION REPAIR MATERIAL

See Section 23 07 11, HVAC, PLUMBING INSULATION.

Provide for repair of insulation removed or damaged for TAB work.

PART 3 – EXECUTION

3.1 GENERAL

A. Refer to TAB Criteria in Article, Quality Assurance.

B. Obtain applicable contract documents and copies of approved submittals for HVAC equipment and automatic control systems.

3.2 DESIGN REVIEW REPORT

The TAB Specialist shall review the Contract Plans and Specifications and advise the Owner's Representative and the Engineer of any design deficiencies that would prevent the HVAC systems from effectively operating in accordance with the sequence of operation specified or prevent the effective and accurate TAB of the system. The TAB Specialist shall provide a report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation.

3.3 SYSTEMS INSPECTION REPORT

A. Inspect equipment and installation for conformance with design.

B. The inspection and report is to be done after equipment and piping are on site and installation has begun, but well in advance of performance testing and balancing work. The purpose of the

inspection is to identify and report deviations from design andensure that systems will be ready for TAB at the appropriatetime.

C. Reports: Follow check list format developed by AABC, NEBB or SMACNA, supplemented by narrative comments, with emphasis on hydronic equipment and pipes. Check for conformance with submittals. Verify that pump and pipe sizes are correct.

3.4 SYSTEM READINESS REPORT

A. Inspect each System to ensure that it is completeincluding installation and operation ofcontrols.

B. Verify that all items such as piping, valves, etc., that is required for TAB are installed. Providea report to the Owner and the Engineer.

3.5 TAB REPORTS

A. Submit an intermediate report for 100 percent of new systems andequipment tested and balanced to establish satisfactory testresults.

B. The TAB contractor shall provide raw data immediately in writing to the Owner's Representative and to the Engineer if there is a problem in achieving intended results before submitting a formal report.

C. If over 20 percent of readings in the intermediate report fall outside the acceptable range, the TAB report shall be considered invalid and all contract TAB work shall be repeated and re-submitted for approval.

3.6 TAB PROCEDURES

A. Tab shall be performed in accordance with the requirement of the Standard under which TAB agency is certified by either the AABC or the NEBB.

B. General: During TAB, all related system components shall be in full operation. Fan and pump rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB. Set controls and/or block off parts of distribution systems to simulate design operation of variable water systems for test and balance work.

C. Coordinate TAB procedures with any construction completion requirements for the project.

D. Allow sufficient time in construction schedule for TAB and submission of all reports for an organized and timely correction ofdeficiencies.

E. Water Balance and Equipment Test: Include circulatingpumps, cooling tower, coils.

1. Adjust flow rates for equipment.
2. Primary-secondary (variable volume) systems: Coordinate TAB with Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC. Balance systems at design water flow and then verify that variable flow controls function properly.
3. Record final measurements for hydronic equipment on performance data sheets. Include entering and leaving water temperatures for chiller and for cooling tower. Make water temperature measurements at the same time.

3.7 VIBRATION TESTING

A. Furnish instruments and perform vibration measurements as specified in Section 23 05 12, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT. Field vibration balancing is specified in Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Provide measurements for all rotating HVAC equipment of 1/2 horsepower and larger, pumps and motors.

B. Record initial measurements for each unit of equipment on test forms and submit a report to the Owner's Representative and the Engineer. Where vibration readings exceed the allowable tolerance, Contractor shall be directed to correct the problem. The TAB agency shall verify that the corrections are done and submit a final report to the Owner's Representative and to the Engineer.

3.8 SOUND TESTING

A. Perform and record required sound measurements in accordance with Paragraph, QUALITY ASSURANCE in Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

1. Take readings in rooms, approximately three percent of all rooms. The Owner's Representative or the Engineer may designate the specific rooms to be tested.

B. Take measurements with a calibrated sound level meter and octave band analyzer of the accuracy required by AABC or NEBB.

C. Sound reference levels, formulas and coefficients shall be according to 2015 ASHRAE Handbook, "HVAC Applications", Chapter 48, SOUND AND VIBRATION CONTROL.

D. Determine compliance with specifications as follows:

1. When sound pressure levels are specified, including the NC Criteria in Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT:

a. Reduce the background noise as much as possible by shutting off unrelated audible equipment.

b. Measure octave band sound pressure levels with specified equipment "off."

c. Measure octave band sound pressure levels with specified equipment "on."

d. Use the DIFFERENCE in corresponding readings to determine the sound pressure due to equipment.

DIFFERENCE:	0	1	2	3	4	5 to 9	10 or More
FACTOR:	10	7	4	3	2	1	0

e. Sound pressure level due to equipment equals sound pressure level with equipment "on" minus FACTOR.

f. Plot octave bands of sound pressure level due to equipment for typical rooms on a graph which also shows noise criteria (NC) curves.

2. When sound power levels are specified:
   a. Perform steps 1.a. thru 1.d., as above.
   b. For indoor equipment: Determine room attenuating effect, i.e., difference between sound power level and sound pressure level. Determined sound power level will be the sum of sound pressure level due to equipment plus the room attenuating effect.
   c. For outdoor equipment: Use directivity factor and distance from noise source to determine distance factor, i.e., difference between sound power level and sound pressure level. Measured sound power level will be the sum of sound pressure level due to equipment plus the distance factor. Use 30 feet for sound level location.
3. Where sound pressure levels are specified in terms of dB(A), as in Section 23 65 00, COOLING TOWERS, measure sound levels using the "A" scale of meter. Single value readings will be used instead of octave band analysis.

E. Where measured sound levels exceed specified level, the installing contractor or equipment manufacturer shall take remedial action approved by the Owner's Representative and the Engineer and the necessary sound tests shall be repeated.

3.9 MARKING OF SETTINGS

Following approval of Tab final Report, the setting of all HVAC adjustment devices including valves shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time. Style and colors used for markings shall be coordinated with the Owner's Representative and the Engineer.

END of Section 23 05 93

SECTION 23 07 11
HVAC INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Field applied insulation for thermal efficiency and condensation control for
   1. HVAC piping and equipment.

B. Definitions
   1. ASJ: All service jacket, paper-free, white-finish facing or jacket.
   2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
   3. Cold: Equipment or piping handling media at design temperature of 60°F or below.
   4. Concealed: Piping above ceilings, in chases, and in pipe spaces.
   5. Exposed: Piping and equipment exposed to view in areas including mechanical and electrical equipment rooms or exposed to outdoor weather.
   6. FSK: Foil-scrim-kraft facing.
   7. Hot: HVAC equipment or piping handling media above 105°F and piping media and equipment 90°F to 450°F).
   8. Density: Pcf - pounds per cubic foot.
   9. Thermal conductance: Heat flow rate through materials.
      a. Flat surface: BTU per hour per square foot.
      b. Pipe or Cylinder: BTU per hour per linear foot.
   10. Thermal Conductivity (k): Watt per meter, per degree C (BTU per inch thickness, per hour, per square foot, per degree F temperature difference).
   11. Vapor Retarder (Vapor Barrier): A material which retards the transmission (migration) of water vapor. Performance of the vapor retarder is rated in terms of permeance (perms). For the purpose of this specification, vapor retarders shall have a maximum published permeance of 0.1 perms, and vapor barriers shall have a maximum published permeance of 0.001 perms.
   12. HWH: Hot water heating supply.
   13. HWHR: Hot water heating return.
   14. R: Pump recirculation.
   15. CW: Cold water.
   16. HW: Hot water.
   17. CH: Chilled water supply.

18. CHR: Chilled water return.
19. RS: Refrigerant suction.
20. PVDC: Polyvinylidene chloride vapor retarder jacketing, white.

1.2 RELATED WORK

A. Section 23 05 10, General Mechanical Requirements
B. Section 23 05 12, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT
C. Section 23 21 23, HYDRONIC PUMPS
D. Section 23 21 13, HYDRONIC PIPING.
E. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

1.3 QUALITY ASSURANCE

A. Refer to article QUALITY ASSURANCE, Section 23 05 10, General Mechanical Requirements.
B. Criteria:
   1. Comply with NFPA 90A, particularly paragraphs 4.3.3.1 through 4.3.3.6, 4.3.10.2.6, and 5.4.6.4, parts of which are quoted as follows:

      4.3.3.1 Pipe insulation and coverings, vapor retarder facings, adhesives, fasteners, tapes, and supplementary materials, unless otherwise provided for in 4.3.3.1.1 or 4.3.3.1.2., shall have, in the form in which they are used, a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*.

      4.3.3.2 Where these products are to be applied with adhesives, they shall be tested with such adhesives applied, or the adhesives used shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when in the final dry state. (See 4.2.4.2.)

   2. Test methods: ASTM E84, UL 723, or NFPA 255.
   3. Specified k factors are at 75 degrees F mean temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.

4. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.

C. Every package or standard container of insulation or accessories delivered to the job site for use must have a manufacturer's stamp or label giving the name of the manufacturer and description of the material.

1.4 SUBMITTALS

A. Submit in accordance with SECTION 23 05 10 General Mechanical Requirements.

B. Shop Drawings:

1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM specifications.
   a. Insulation materials: Specify each type used and state surface burning characteristics.
   b. Insulation facings and jackets: Each type used. Make it clear that white finish will be furnished for exposed piping and equipment.
   c. Insulation accessory materials: Each type used.
   d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.
   e. Make reference to applicable specification paragraph numbers for coordination.

C. Samples:

1. Each type of insulation: Minimum size 4 inches square for board/block/blanket; 6 inches long, full diameter for round types.
2. Each type of facing and jacket: Minimum size 4 inches square.
3. Each accessory material: Minimum 4 ounce liquid container or 4 ounce dry weight for adhesives / cement / mastic.

1.5 STORAGE AND HANDLING OF MATERIAL

Store materials in clean and dry environment, pipe covering jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics, and finishing cements.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

B. Federal Specifications (Fed. Spec.):

L-P-535E (2)- 99: Plastic Sheet (Sheeting): Plastic Strip; Poly (Vinyl Chloride) and Poly (Vinyl Chloride - Vinyl Acetate), Rigid.

C. Military Specifications (Mil. Spec.):

MIL-A-3316C (2)-90: Adhesives, Fire-Resistant, Thermal Insulation

MIL-A-24179A (1)-87: Adhesive, Flexible Unicellular-Plastic Thermal Insulation

MIL-C-19565C (1)-88: Coating Compounds, Thermal Insulation, Fire-and Water-Resistant, Vapor-Barrier

MIL-C-20079H-87: Cloth, Glass; Tape, Textile Glass; and Thread, Glass and Wire-Reinforced Glass

D. American Society for Testing and Materials (ASTM):

A167-99(2004): Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

B209-07: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

C411-05: Standard test method for Hot-Surface Performance of High-Temperature Thermal Insulation

C449-07: Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement C533-09: Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation

C534-08: Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

C547-07: Standard Specification for Mineral Fiber pipe Insulation

C552-07: Standard Specification for Cellular Glass Thermal Insulation

C553-08: Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

C585-09: Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System) R (1998)

C612-10: Standard Specification for Mineral Fiber Block and Board Thermal Insulation

C1136-10: Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation

D1668-97a (2006): Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing

E84-10: Standard Test Method for Surface Burning Characteristics of Building Materials

E119-09c: Standard Test Method for Fire Tests of Building Construction and Materials

E136-09b: Standard Test Methods for Behavior ofMaterials in a Vertical Tube Furnace at 750 degrees C (1380 F)

E. National Fire Protection Association (NFPA):

90A-09: Standard for the Installation of Air Conditioning and Ventilating Systems

101-09: Life Safety Code

251-06: Standard methods of Tests of Fire Endurance of Building Construction Materials

255-06: Standard Method of tests of Surface Burning Characteristics of Building Materials

F. Underwriters Laboratories, Inc. (UL):

723**:** UL Standard for Safety Test for Surface Burning Characteristics of Building Materials with Revision of 09/08

G. Manufacturer's Standardization Society of the Valve and Fitting Industry SS):

PART 2 - PRODUCTS

2.1 MINERAL FIBER OR FIBER GLASS

A. ASTM C612 (Board, Block), Class 1 or 2, density 3 pcf, k= 0.26 at 75°F, external insulation for temperatures up to 400°F with FSK facing.

B. ASTM C553 (Blanket, Flexible) Type I, Class B-5, Density 2 pcf, k = 0.27 at 75°F, for use at temperatures up to 400°F with FSK facing.

C. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), Class 1, k = 0.26 75°F, for use at temperatures up to 450°F with paper-free, all-service vapor retarder jacket with polyvinyl chloride pre-molded fitting covering.

2.2 CELLULAR GLASS CLOSED-CELL

A. Comply with Standard ASTM C177, C518, density 7.5 pcf nominal, k = 0.29 at 75°F.

B. Pipe insulation for use at temperatures up to 400°F with all service vapor retarder jacket.

2.3 FLEXIBLE ELASTOMERIC CELLULAR THERMAL

ASTM C177, C518, k = 0.27 at 75°F, flame spread not over 25, smoke developed not over 50, for temperatures from minus 40°F to 200°F. No jacket required.

2.4 CALCIUM SILICATE

A. Preformed pipe Insulation: ASTM C533, Type I and Type II with indicator denoting asbestos-free material.

B. Pre-molded Pipe Fitting Insulation: ASTM C533, Type I and Type II with indicator denoting asbestos-free material.

C. Equipment Insulation: ASTM C533, Type I and Type II.

D. Characteristics:

Insulation Characteristics		
ITEM	**TYPE I**	**TYPE II**
Temperature, maximum °F)	1200	1700
Density (dry), lb/ft^3	14.5	18
Thermal conductivity: Min Btu in/h ft^2 degrees F@ mean temperature of 200°)	0.41	0.540
Surface burning characteristics: Flame spread Index, Maximum	0	0
Smoke Density index, Maximum	0	0

2.5 INSULATION FACINGS AND JACKETS

A. Vapor Retarder, higher strength with low water permeance of 0.02 or less perm rating, Beach puncture 50 units for insulation facing on exposed pipe insulation jackets. Facings and jackets shall be paper-free all service type (ASJ) or PVDC Vapor Retarder jacketing.

B. ASJ jacket shall be paper-free, white, kraft bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture 50 units, suitable for painting without sizing. Jackets shall have minimum 1-1/2 inch lap on longitudinal joints and minimum 3 inch butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.

C. Glass Cloth Jackets: Pre-sized, minimum 7.8 ounces per square yard, 300 psig bursting strength with integral vapor retarder where required or specified. Weather proof if utilized for outside service.

D. Factory composite materials may be used provided that they have been tested and certified by the manufacturer.

E. Pipe fitting insulation covering (jackets): Fitting covering shall be pre-molded to match shape of fitting and shall be polyvinyl chloride (PVC) conforming to Fed Spec L-P-335, composition A, Type II Grade GU, and Type III, minimum thickness 0.03 inches. Provide

color matching vapor retarder pressure sensitive tape.

F. Aluminum Jacket-Piping systems: ASTM B209, 3003 alloy, H-14 temper, 0.023 inch minimum thickness with locking longitudinal joints. Jackets for elbows, tees and other fittings shall be factory-fabricated to match shape of fitting and of 0.024 inch minimum thickness aluminum. Fittings shall be of same construction as straight run jackets but need not be of the same alloy. Factory-fabricated stainless steel bands shall be installed on all circumferential joints. Bands shall be 0.5 inch wide on 18 inch centers. System shall be weatherproof if utilized for outside service.

2.7 PIPE COVERING PROTECTION SADDLES

A. Cold pipe support: Pre-molded pipe insulation 180 degrees (half-shells) on bottom half of pipe at supports. Material shall be cellular glass or high density Polyisocyanurate insulation of the same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 3.0 pcf.

Nominal Pipe Size and Accessories Material (Insert Blocks)	
Nominal Pipe Size in inches	Insert Blocks in inches
Up through 5	6 long
6	6 long
8, 10, 12	9 long
14, 16	12 long
18 through 24	14 long

B. Warm or hot pipe supports: Pre-molded pipe insulation (180 degree half-shells) on bottom half of pipe at supports. Material shall be high density Polyisocyanurate (for temperatures up to 300°F, cellular glass or calcium silicate. Insulation at supports shall have same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 3.0 pcf.

2.8 ADHESIVE, MASTIC, CEMENT

A. Mil. Spec. MIL-A-3316, Class 1: Jacket and lap adhesive and protective finish coating for insulation.

B. Mil. Spec. MIL-A-3316, Class 2: Adhesive for laps and for adhering insulation to metal surfaces.

C. Mil. Spec. MIL-A-24179, Type II Class 1: Adhesive for installing flexible unicellular insulation and for laps and general use.

D. Mil. Spec. MIL-C-19565, Type I: Protective finish for outdoor use.

E. Mil. Spec. MIL-C-19565, Type I or Type II: Vapor barrier compound for indoor use.

F. ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing

cement.

G. Other: Insulation manufacturers' published recommendations.

2.9

2.10 MECHANICAL FASTENERS

A. Pins, anchors: Welded pins, or metal or nylon anchors with galvanized steel-coated or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer. Metal pins shall be covered by self-locking washers.

B. Staples: Outward clinching monel.

C. Wire: 18 gage soft annealed galvanized or 14 gage copper clad steel or nickel copper alloy.

D. Bands: 0.5 inch nominal width, brass, galvanized steel, aluminum or stainless steel.

2.11 REINFORCEMENT AND FINISHES

A. Glass fabric, open weave: ASTM D1668, Type III (resin treated) and Type I (asphalt treated).

B. Glass fiber fitting tape: Mil. Spec MIL-C-20079, Type II, Class 1.

C. Tape for Flexible Elastomeric Cellular Insulation: As recommended by the insulation manufacturer.

D. Hexagonal wire netting: one inch mesh, 22-gage galvanized steel.

E. Corner beads: 2 inch by 2 inch, 26-gage galvanized steel; or, 1 inch by 1 inch, 28-gage aluminum angle adhered to 2 inch by 2 inch Kraft paper.

F. PVC fitting cover: Fed. Spec L-P-535, Composition A, 11-86 Type II, Grade GU, with Form B Mineral Fiber insert, for media temperature 40°F to 250°F. Below 40 °F and above 250°F. Provide double layer insert. Provide color matching vapor barrier pressure sensitive tape.

2.12 FLAME AND SMOKE

Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM, NFPA and UL standards and specifications. See paragraph 1.3 "Quality Assurance."

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

A. Required pressure tests of piping joints and connections shall be completed and the work approved by the Owner’s Representative or Engineer for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.

B. Except for specific exceptions, insulate entire specified equipment, piping (pipe, fittings, valves, accessories). Insulate each pipe individually. Do not use scrap pieces of

insulation where a full-length section will fit.

C. Insulation materials shall be installed in a first-class manner with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous through all sleeves and openings. Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperatures of 60°F and below. Lap and seal vapor retarder over ends and exposed edges of insulation. Anchors, supports, and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 6 inches.

D. Install vapor stops at all insulation terminations on either side of valves, pumps and equipment and particularly in straight lengths of pipe insulation.

E. Construct insulation on parts of equipment such as chilled water pumps and heads of chillers, convertors and heat exchangers that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 20-gage galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment.

F. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer or jacket material.

G. Protect all insulations outside of buildings with aluminum jacket using lock joint or other approved system for a continuous weather tight system. Access doors and other items requiring maintenance or access shall be removable and sealable.

H. Insulate PRVs and flow meters.

I. HVAC work not to be insulated:
   1. Equipment: Expansion tanks, hot water pumps, discharge vent piping, and safety valves.
   2. In hot piping: Unions, flexible connectors, control valves, vacuum breakers, thermostatic vent valves. Insulate piping to within approximately 3 inches of un-insulated items, and provide and install purpose made reusable insulating jackets, secured with straps with buckles, or ties.

J. Mechanical Room work not to be insulated:
   1. Pipes, valves and fittings:
      a. Compressed Air
      b. Flowmeter sensing piping
      c. Level sensor piping

d. Tank drains
e. Vents-tank, safety and back pressure valves except protective.
f. Threaded valves
g. Check valves
h. Unions
i. Orifice flanges
j. Dielectric flanges and unions
k. Pressure transmission to gages
l. Piping in control panels

2. Specialties (Non-hot applications):
   a. Pressure reducing valves
   b. Strainers under 2-1/2 inch pipe size
   c. Flexible connectors

K. Apply insulation materials subject to the manufacturer's recommended temperature limits. Clean surfaces and apply adhesives, mastic and coatings at the manufacturer's recommended minimum coverage.

L. Elbows, flanges, and other fittings shall be insulated with the same material as is used on the pipe straights. The elbow/fitting insulation shall be field-fabricated, mitered or factory prefabricated to the necessary size and shape to fit on the elbow/fitting. Use of polyurethane spray-foam to fill a PVC elbow jacket is prohibited.

M. Provide vapor barrier jackets over insulation as follows:
   1. All piping and ductwork exposed to outdoor weather.
   2. All interior piping and ducts conveying fluids exposed to outdoor air below ambient air temperature, in high humidity areas.

N. Provide metal jackets over insulation as follows:
   1. All piping exposed to outdoor weather.
   2. A 2-inch overlap is required at longitudinal and circumferential joints.

3.2 INSULATION INSTALLATION

A. Mineral Fiber Board:
   1. Faced board: Apply board on pins spaced not more than 12 inches on center each way, and not less than 3 inches from each edge of board. In addition to pins, apply insulation bonding adhesive to entire underside of horizontal metal surfaces. Butt insulation edges tightly and seal all joints with laps and butt strips. After applying speed clips cut pins off flush and apply vapor seal patches over clips.
   2. Plain board:
      a. Insulation shall be scored, beveled or mitered to provide tight joints and be

secured to equipment with bands spaced 9 inches on center for irregular surfaces or with pins and clips on flat surfaces. Use corner beads to protect edges of insulation.

b. For hot equipment: Stretch 1 inch mesh wire, with edges wire-laced together, over insulation and finish with insulating and finishing cement applied in one coat, 1/4 inch thick, trowelled to a smooth finish.

c. For cold equipment: Apply meshed glass fabric in a tack coat 60 to 70 square feet per gallon of vapor mastic and finish with mastic at 12 to 15 square feet per gallon over the entire fabric surface.

d. Chilled water pumps: Insulate with removable and replaceable 20-gage aluminum or galvanized steel covers lined with insulation. Seal closure joints/flanges of covers with gasket material. Fill void space in enclosure with flexible mineral fiber insulation.

3. Cold equipment: 1-1/2 inch thick insulation faced with non-paper ASJ.
   a. Chilled water pumps, water filter.

B. Molded Mineral Fiber Pipe and Tubing Covering:

1. Fit insulation to pipe, aligning longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.
2. Contractor's options for fitting, flange, and valve insulation:
   a. Insulating and finishing cement for sizes less than 4 inches operating at surface temperature of 61°F or more.
   b. Factory pre-molded, one piece PVC covers with mineral fiber, (Form B), inserts. Provide two insert layers for pipe temperatures below 40°F. Secure first layer of insulation with twine. Seal seam edges with vapor barrier mastic and secure with fitting tape.
   c. Factory molded, ASTM C547 or field-mitered sections, joined with adhesive or wired in place. For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 60°F or less, vapor seal with a layer of glass fitting tape imbedded between two 1/16 inch coats of vapor barrier mastic.
   d. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 2 inches.

3. Nominal thickness in inches specified in the schedule at the end of this section.

C. Cellular Glass Insulation:

1. Pipe and tubing, covering nominal thickness in inches as specified in the schedule at the end of this section.
2. Cold equipment: 2 inch thick insulation faced with non-paper ASJ for chilled water pumps, expansion tanks, air separators and air purgers.

D. Flexible Elastomeric Cellular Thermal Insulation:

1. Apply insulation and fabricate fittings in accordance with the manufacturer's installation instructions and finish with two coats of weather resistant finish as recommended by the insulation manufacturer.
2. Pipe and tubing insulation:
   a. Use proper size material. Do not stretch or strain insulation.
   b. To avoid undue compression of insulation, provide cork stoppers or wood inserts at supports as recommended by the insulation manufacturer. Insulation shields are specified under Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
   c. Where possible, slip insulation over the pipe or tubing prior to connection, and seal the butt joints with adhesive. Where the slip-on technique is not possible, slit the insulation and apply it to the pipe sealing the seam and joints with contact adhesive. Optional tape sealing, as recommended by the manufacturer, may be employed. Make changes from mineral fiber insulation in a straight run of pipe, not at a fitting. Seal joint with tape.
3. Apply sheet insulation to flat or large curved surfaces with 100 percent adhesive coverage, after careful cleaning and preparation of the metal surface, in accordance with manufacturer’s written instructions. For fittings and large pipe, apply adhesive to seams only.
4. Pipe insulation: nominal thickness in inches as specified in the schedule at the end of this section.
5. Minimum 0.75 inch thick insulation for pneumatic control lines for a minimum distance of 20 feet from discharge side of the refrigerated dryer.
6. Use Class S (Sheet), 3/4 inch thick for the following:
   a. Chilled water pumps
   b. Bottom and sides of metal basins for winterized cooling towers (where basin

water is heated).

c. Chillers, insulate any cold chiller surfaces subject to condensation which has not been factory insulated.

E. Calcium Silicate:

1. Minimum thickness in inches specified in the schedule at the end of this section for piping.

3.3 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.

B. Components provided under this section of the specification will be tested as part of a larger system. Refer to section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

3.4 PIPE INSULATION SCHEDULE

Provide insulation for piping systems as scheduled below:

Insulation Thickness in Inches					
		Nominal Pipe Size in Inches			
Operating Temperature Range/Service	Insulation Material	Less than 1	1 – 1¼	1½ - 3	4 and Above
100-200°F) (HWH, HWHR)	Mineral Fiber (Above ground piping only)	1.5	1.5	2.0	2.0
100-211°F) (LPR, PC, HWH, HWHR, GH and GHR)	Rigid Cellular Phenolic Foam	1.5	1.5	2.0	2.0
100-200°F (HWH, HWHR)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	1.5	1.5	----	----

40-60°F (CH, CHR, and RS for DX refrigeration)	Cellular Glass Closed-Cell	1.5	1.5	1.5	1.5
40-60 degrees F (CH, CHR, and RS for DX refrigeration)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	1.5	1.5	----	----

END OF SECTION

SECTION 23 07 16
HVAC EQUIPMENT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Equipment insulation.

B. Covering.

1.2 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.

B. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2013).

C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2015.

D. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2013.

E. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

1.3 SUBMITTALS

A. See Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thicknesses for equipment scheduled.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum of three years of experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage by storing in original wrapping off the ground and covered as required.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for a minimum period of 24 hours.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame Spread and Smoke Developed Index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.2 HYDROUS CALCIUM SILICATE

A. Manufacturer:

1. Manufacturers: Johns Manville IIG, Owens Corning, ITW Insulation Systems.

B. Insulation: ASTM C 533; rigid molded, asbestos free.
1. 'K' Value: 0.40 at 300°F, when tested in accordance with ASTM C177 or C518.
2. Maximum Service Temperature: 1200°F.
3. Density: 15 lb./cu ft.

C. Tie Wire: 0.048-inch stainless steel with twisted ends on maximum 12-inch centers.

D. Insulating Cement: ASTM C449. 1. ASTM C449/C449M.

2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
1. Armacell International; Model AP: www.armacell.com.
2. Aerocel; Sheet.
3. K-Flex USA; Insul-Sheet.

B. Insulation: Preformed flexible closed-cell elastomeric rubber insulation complying with ASTM C 534 Grade 1, in sheet form.
1. 'K' ('Ksi') value: 0.25 at 75°F (0.04 at 24 degrees C).
2. Maximum Moisture Absorption: < 1.0 percent by volume, when tested in accordance with ASTM C 209.
3. Water Vapor Permeability: 0.05 perm-inches, when tested in accordance with ASTM E96.
4. Minimum Service Temperature: -40°F.
5. Maximum Service Temperature: °F.
6. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.4 JACKETS

A. Interior Glass Fabric Vapor Barrier Finish:
1. Cloth: Untreated 9 oz./sq. yd. weight.
2. Blanket: 1.0 lb./cu ft. density.
3. Weave: 5x5.
4. Lagging Adhesive: Fire resistant compatible with insulation.
5. Finish: Vinyl emulsion type acrylic, compatible with insulation, white color.

B. Exterior: aluminum, equivalent to existing.
1. Thickness: 0.016-inch sheet.
2. Finish: Embossed.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016-inch-thick die shaped fitting covers with factory attached protective liner.

2.5 ADHESIVES, COATINGS, SEALING COMPOUNDS AND PROTECTIVE FINISHES

A. Lagging Adhesive and Coating for Glass Cloth Jackets and Other Facings - MIL-A-3316 B, Class 1.

B. Lap Adhesive for Vapor Barrier Jacket - MIL-A-3316 B, Class 2.

C. Bonding Adhesives - for securing insulation to metal surfaces - MIL-A-3316 B, Class 2 for temperature up to 200°F.

D. Contact Type Adhesive - For installing flexible unicellular insulation - MIL-A-24179, Type II, Class 1.

E. Bedding Compound and Joint Sealers - MIL-B-19564A.

F. Coating Compound - Vapor Barrier Treatment - MIL-C-19565B, Type 1 or II.

G. Protective Finish Outside of Buildings - Coating Compound MIL-C-19565 B, Type I.

H. Manufacturers: Childers, Foster, Armstrong, Mon-Eco.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that equipment has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Factory Insulated Equipment: Do not insulate.

C. Exposed Equipment: Locate insulation and cover seams in least visible locations.

D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

E. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

F. For hot equipment containing fluids 140°F or less, do not insulate flanges and unions, but bevel and seal ends of insulation.

G. Flexible Elastomeric Cellular Insulation: Secure sheet insulation with adhesive. Seal Joints with adhesive. Paint exposed insulation with two coats of vinyl insulation paint after adhesive has dried for twelve hours, minimum. Allow two hours, minimum, between coats.

H. Finish insulation at supports, protrusions, and interruptions.

I. Cover glass fiber insulation with metal mesh and finish with heavy coat of insulating cement.

J. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

K. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.3 SCHEDULE

A. Cooling Systems:
   1. Condenser Water Pump Bodies: Do not insulate.
   2. Chilled Water Pump Bodies: 1½” thick minimal fiberboard with glass cloth jacket with integral vapor retarder.

END OF SECTION

SECTION 23 07 19
HVAC PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.2 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus; 2013.

C. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2013 (Reapproved 2013).

D. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2013).

E. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2015.

F. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2013.

G. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.

H. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2015.

I. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing; 2016.

J. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation; 2013.

K. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).

L. ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation; 2015.

M. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2012.

N. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

O. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

P. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association 2006.

Q. UL 723 (ASTM E84) - Standard for Test for Surface Burning Characteristics of Building Materials; UL (Underwriters Laboratories); Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. See Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable

workmanship and installation standards will be achieved.

1.4 QUALITY ASSURANCE

A. All insulation, mastics, coatings, sealants, and adhesives shall be certified by the manufacturer to be Asbestos-free.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum Three years of experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame Spread and Smoke Developed Index of 25/50, maximum, when tested in accordance with UL 723 (ASTM E 84) or NFPA 255.

2.2 GLASS FIBER

A. Manufacturers:
   1. CertainTeed Corporation: www.certainteed.com.
   2. Johns Manville Corporation: www.jm.com.
   3. Knauf Insulation: www.knaufusa.com.
   4. Owens Corning Corporation: Fiberglas Pipe Insulation: commercial. Owenscorning.com/products/pipe

B. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
   1. 'K' value: ASTM C177, 0.24 at 75°F.
   2. Maximum service temperature: 650°F.
   3. Maximum moisture absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: Factory applied white Kraft paper with glass-fiber yarn, bonded to aluminized film with self-sealing lap and butt strips; moisture vapor transmission when tested in accordance with ASTM E 96/E 96M of 0.02 perm-inches.

D. Tie Wire: 0.048-inch stainless steel with twisted ends on maximum 12-inch centers.

E. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
   1. ASTM C195; hydraulic setting on mineral wool.

F. Insulating Cement: ASTM C449. 1. ASTM C449/C449M.

2.3 CELLULAR GLASS

A. Manufacturers:
   1. Pittsburgh Corning Corporation: www.foamglas.com.

B. Insulation: ASTM C552, Type II.
   1. 'K' value: 0.37 at 100°F.
   2. Service Temperature: Up to 900°F.
   3. Water Vapor Permeability: 0.005 perm inch.
   4. Water Absorption: 0.2 percent by volume, maximum.

2.4 HYDROUS CALCIUM SILICATE

A. Manufacturers:
   1. Industrial Insulation Group, LLC ; Model Thermo-12 Gold: www.jm.com.
   2. Owens Corning: www.owenscorning.com

B. Insulation: ASTM C533 and ASTM C795; rigid molded, asbestos free, gold color.

1. 'K' Value: ASTM C177 and C518; 0.40 at 300°F, when tested in accordance with ASTM C177 or ASTM C518.
2. Maximum Service Temperature: 1200°F.
3. Density: 15 lb./cu ft.

C. Tie Wire: 0.048-inch stainless steel with twisted ends on maximum 12-inch centers.

D. Insulating Cement: ASTM C449. 1. ASTM C449/C449M.

2.5 PHENOLIC

A. Manufacturers:
1. ITW; Model Trymer-Green
2. Dyplast DyTherm

B. Insulation Material: ASTM C 1126, closed cell rigid molded foam, 2# density, minimum.
1. Dimension: Comply with requirements of ASTM C585.
2. 'K' value: 0.19 at 75°F, when tested in accordance with ASTM C 518.
3. Minimum Service Temperature: Minus 70°F.
4. Maximum Service Temperature: 248°F.
5. Water Absorption: 0.5 percent by volume, maximum, when tested in accordance with ASTM D2842.
6. Moisture Vapor Transmission: 4.0 perm inch.
7. Connection: Waterproof vapor barrier adhesive.

2.6 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
1. Aeroflex USA, Inc ; Aerocel: www.aeroflexusa.com.
2. Armacell LLC : www.armacell.us.
3. K-Flex USA LLC ; Insul-Tube: www.kflexusa.com.

B. Insulation: Preformed flexible closed-cell elastomeric rubber insulation complying with ASTM C 534 Grade 1; use molded tubular material. Split tube installation is prohibited.
1. 'K' ('Ksi') value: 0.25 at 75°F.
2. Maximum Moisture Absorption: < 1.0 percent (pipe) by volume, when tested in accordance with ASTM C 209.
3. Water Vapor Permeability: 0.05 perm-inches, when tested in accordance with ASTM E 96.
4. Minimum Service Temperature: Minus 40°F.
5. Maximum Service Temperature: 220°F.
6. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.7 JACKETS

A. Saran Industrial Vapor Retardant Film:
1. Manufacturers: ITW
2. Material: Polyvinylidene chloride polymer film, 4-mil minimum thickness.
3. Adhesive: Compatible with insulation and jacket.
4. Vapor Retardant Tape: Compatible with film jacket by same manufacturer.

B. PVC Plastic.
1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
   a. Minimum Service Temperature: 0°F.
   b. Maximum Service Temperature: 150°F.
   c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
   d. Thickness: 10 mil.

e. Connections: Brush on welding adhesive.

C. ASJ (All Service Jacket): Factory applied white kraft and foil laminate, reinforced, fire retardant jacket (ASJ) with self-sealing lap and butt strips. Jackets shall meet the requirements of ASTM C1136.

D. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
1. Thickness: 0.016-inch sheet.
2. Finish: Embossed.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016-inch-thick die shaped fitting covers with factory attached protective liner.

E. Glass Fabric Vapor Barrier Finish;
1. Cloth: Untreated 9 oz./sq. yd. weight.
2. Blanket: 1.0 lb./cu ft. density.
3. Weave: 5x5.
4. Lagging Adhesive: Fire resistant compatible with insulation.
5. Finish: Vinyl emulsion type acrylic, compatible with insulation, grey color.

2.8 STAPLES, BANDS, AND WIRES

A. Staples shall be outward clinching type of type 304 or 316 stainless steel, or monel.

B. Bands shall be stainless steel of ¾-inch nominal width. The band thickness exclusive of coating shall be not less than 30 gauge for steel and nickel copper alloy.

C. Wire shall be 18-gauge stainless steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations. Exterior of insulation shall be uniform in appearance.

D. Insulation jacket shall fit snug to insulation.

E. Valves and fittings:
1. Insulate pipe and all valves and fittings including valve bonnets on A.C. condensate drain, chilled water, and refrigerant suction piping. Leave only valve stems, open ends of wells and gauge cocks exposed.
2. All Other Piping: Insulate pipe and fittings, but omit insulation on unions and valves. Taper insulation ends and cover with jacket material.

F. Insulation at Hangers: Hangers for horizontal, A.C. condensate drain, chilled water, refrigerant suction, and trapeze supports shall be outside of insulation with saddles as specified herein.

G. Saddles:
1. Provide galvanized steel saddles at each point where pipe insulation passes through a hanger or rests on a support.
2. Saddles shall be 180° arc for horizontal piping, 360° arch for vertical piping.
3. Center saddle on pipe hanger.

4. Length and gauge of saddle shall be as follows:
   a. 2-inch pipe size and smaller: 18 Gauge saddle, 8 inch long, minimum.
   b. 2-1/2 and 3-inch pipe size: 18 Gauge saddle, 12 inch long, minimum.
   c. 4-inch pipe size: 16 Gauge saddle, 16 inch long, minimum.
   d. 6-inch pipe size and larger: 16 Gauge saddle, 24 inch long, minimum.

H. Glass fiber insulated pipes conveying fluids above ambient temperature.
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjoining pipe. Finish with jacket(s) to match piping finish.

I. Flexible elastomeric cellular rubber insulation: Install without splitting and under compression during pipe fabrication. Seal Joints with adhesive. Paint exposed insulation with two coats of vinyl insulation paint after adhesive has dried for twelve hours, minimum. Allow two hours, minimum, between coats.

J. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.3 CLEANING

A. Clean adjacent surfaces, valves, valve handles, etc. of jacketing materials.

3.4 SCHEDULES

A. Chilled Water systems:
   1. Chilled Water Supply and Return and Condenser Water Supply and Return (above grade, inside):
      a. Pipe: 1-1/2-inch-thick cellular glass jacketed with all service jacket (ASJ) with self- sealing laps or 1-inch thick phenolic foam with Saran 560 vapor jacket.
      b. Fittings: Install pipe insulation over fittings.
         1) Where pipe sizes permit, miter insulation to fit at elbows.
         2) Provide molded insulation to fit fittings for larger pipes.
         3) Thickness of fitting insulation shall match piping insulation thickness.
         4) Finish insulation at fittings with PVC jacket where exposed and finish with glass fabric in mastic elsewhere.
   2. Fittings and valves at test plugs, thermometer sockets, and pressure gage tappings: Foamed plastic insulating tape, 1/8-inch thick, minimum.
   3. Interconnecting piping on pump pressure gages: ¾-inch-thick preformed flexible elastomeric cellular rubber insulation and with foamed plastic insulating tape, 1/8-inch, minimum.
   4. Interconnecting piping on Hydronic Differential Pressure Stations: ¾-inch-thick preformed flexible elastomeric cellular rubber insulation and with foamed plastic insulating tape, 1/8-inch, minimum.
   5. Pipe subject to condensation: ¾-inch-thick preformed flexible elastomeric cellular rubber insulation.
   6. Air Vents: Insulate piping from chilled water manual air vents for five feet from point of connection to chilled water pipe.
   7. Insulation at Suction diffusers and strainers: Removable so that access can be readily obtained without destroying the insulation or jacket.

B. Condenser Water:
   1. Exposed Condenser Water Piping at Cooling Tower: 1-1/2-inch-thick cellular glass with aluminum jacket.

C. Condensate Drains from Cooling Coils: ¾-inch-thick preformed flexible elastomeric cellular rubber insulation.

END OF SECTION

SECTION 23 08 00
COMMISSIONING OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section apply to all sections of Division 23.

B. This project will have new HVAC systems commissioned. The systems to be commissioned are:

1. Chilled Water Pumps
2. Condenser Water Pumps
3. Cooling Tower
4. Building Automation and Controls

C. The commissioning process will be executed by a Mechanical Contractor. A Commissioning Agent (CxA) appointed by the USCB will manage and witness the commissioning process.

1.2 RELATED WORK

A. Section 01 00 00 GENERAL REQUIREMENTS.

B. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

C. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.3 SUMMARY

A. This Section includes requirements for commissioning the Chiller Plant, subsystems, and equipment.

1.4 COMMISSIONED SYSTEMS

A. Commissioning of a system or systems specified in this Division is part of the construction process. Documentation and testing of these systems, as well as training of USCB's Operation and Maintenance personnel, is required in cooperation with the Owner's Representative, the Engineer, and the Commissioning Authority.

B. The following HVAC systems will be commissioned:

1. New chiller.

2. New Chilled Water and Condenser Water Systems (Chilled Water and Condenser Water pumps and motors, Variable Speed Drives, controls, instrumentation and safeties, and valves.
3. Interface with Direct Digital Control System (BACnet).
4. New Cooling Tower.

1.5 SUBMITTALS

A. The commissioning process requires review of selected Submittals. The Commissioning Authority will provide a list of submittals that will be reviewed by the Commissioning Authority. This list will be reviewed and approved by the Owner's Representative and the Engineer prior to forwarding to the Contractor. Refer to Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.

B. The commissioning process requires Submittal review simultaneously with Engineering review.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 PRE-FUNCTIONAL CHECKLISTS

The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation are complete, and systems are ready for Systems Functional Performance Testing. The Commissioning Authority will prepare Pre-Functional Checklists to be used to document equipment installation and start-up. The Contractor shall complete the checklists. Completed checklists shall be submitted to the Owner's Representative and to the Commissioning Authority for review. The Commissioning Authority may spot check a sample of completed checklists. If the Commissioning Authority determines that the information provided on the checklists is not accurate, the Commissioning Authority will return the marked-up checklists to the Contractor for correction and resubmission. If the Commissioning Authority determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Authority will select a broader sample of checklists for review. If the Commissioning Authority determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of

equipment will be returned to the Contractor for correction and resubmission. Refer to SECTION 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

3.2 CONTRACTORS TESTS

A. Contractor tests as required by other sections of Division 23 shall be scheduled and documented in accordance with Section 01 00 00 GENERAL REQUIREMENTS. The Commissioning Authority will witness Contractor tests. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.3 SYSTEMS FUNCTIONAL PERFORMANCE TESTING:

A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems' functional performance under steady state conditions, to test systems reactions to changes in operating conditions, and systems performances under emergency conditions. The Commissioning Authority will prepare detailed Systems Functional Performance Test procedures for review and approval by the Owner's Representative and the Engineer. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Authority will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed.

3.4 TRAINING OF USCB PERSONNEL

A. Training of USCB's operation and maintenance personnel is required in cooperation with the Owner's Representative, the Engineer, and the Commissioning Authority. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the Owner's Representative and the Engineer after submission and approval of formal training plans.

END OF SECTION
23 08 00

SECTION 23 09 13

INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Control panels.

B. Control valves.

C. Flow rate transducers.

D. Input/Output Sensors.

E. Tower basin level control.

F. Miscellaneous accessories.

1.2 RELATED REQUIREMENTS

A. Section 23 2113 - HYDRONIC PIPING: Installation of control valves, flow switches, temperature sensor sockets, gage taps.

B. Section 23 0994 - HVAC Sequence of Operation.

C. Section 23 05 53 Identification for HVAC Piping and Equipment

1.3 REFERENCE STANDARDS

A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2014.

1.4 SUBMITTALS

A. Refer to Section 23 05 10 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve.

D. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum of five years experience with the submitted system.

B. Products Requiring Electrical Connection: Listed and classified by UL (Underwriters Laboratories) as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by UL (Underwriters Laboratories) as suitable for the purpose specified and indicated.

2.2 CONTROL PANELS

A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gages, pilot lights, push buttons and switches flush on cabinet panel face.

B. NEMA 250, general purpose utility enclosures with hinged, lockable face panel.

C. Finish: Baked enamel factory finish.

D. Provide common keying for all panels with two keys per control panel.

E. Nameplates:
   1. Use device identification and number from control drawings.
   2. Identify panel with permanent label mounted on panel face. Nameplate shall be laminated, three-layer plastic with engraved white letters on black contrasting background, ½-inch minimum height.
   3. Identify all panel mounted devices with permanent label mounted adjacent to device. Nameplates shall be laminated three-layer plastic with engraved white letters on black contrasting background, ½-inch minimum height.

F. Door mounted devices: Refer to the Sequence of Operation for devices specified to be door mounted.

G. Wiring:
   1. Power supply of capacity required with disconnect switch, surge protection, fuse holder with fuses or circuit breaker, 120 VAC service receptacle.
   2. Conductors color coded with both ends identified with manufactured alpha-numeric self- adhesive vinyl tags, 3 mils thick, minimum, keyed to termination points.
   3. Connections and junctions to terminal strips and devices only.
   4. Route wiring parallel to cabinet side in wiring troughs or laced with nylon ties.
   5. Wiring and devices that derive power from other sources shall be located in a separate compartment and be provide with separate terminal strips.
   6. Cover all line voltage terminations in panel.

H. Indicator lights: 24 VAC light emitting diode. 100,000 hour lamp life. Provide single "Press-To- Test" button for all lights in panel.

2.3 CONTROL VALVES

A. Globe Pattern:
   1. Up to 2 inches: Bronze body, bronze trim, stainless steel rising stem, renewable composition disc, screwed ends with backseating capacity repackable under pressure.
   2. Over 2 inches: Iron body, bronze trim, stainless steel rising stem, plug-type disc, flanged ends, renewable seat and disc.
   3. Control valve shall be slow acting and shall not cause water hammer when closing or opening.
   4. Hydronic Systems:
      a. Rate for service pressure of 125 psig at 250°F.
      b. Replaceable plugs and seats of stainless steel.
      c. Packing: EDPM O-ring.
      d. Refer to Valve Coefficients indicated on drawings for size.
      e. Two way valves shall have equal percentage characteristics. Size two way valve operators to close valves against pump shut off head.

B. Electric Operators:
   1. Manufacturers: Belimo NF or AF Series, Neptune, Siemens.
   2. Valves shall spring return (reversible) to normal position as indicated on freeze, fire, or temperature protection.
   3. Valves shall spring return to normal position as indicated on freeze, fire, or temperature protection.
   4. Select operator for full shut off at maximum pump differential pressure.
   5. 24 VAC reversible motor with Class F insulation or better with drive mechanism in enclosure, 10VA maximum.
   6. Enclosure: Water-proof aluminum cover and base, NEMA-2, IP 54, coupling direct to valve.
   7. Provide all corrosion resistant (non-ferrous) components, fasteners and mounting

devices and connections.

8. Unit shall be prewired. Provide a conduit fitting and a three-foot long appliance cord.
9. Valve status display: Color coded visual indicator to display valve position through full range of travel.
10. External built-in travel limit switch to reverse direction.
11. Manual override with hex operator.

2.4 FLOW RATE TRANSDUCER (FRT)

A. Manufacturers: Omega, Onicon.

B. Insertion, electromagnetic flow meter.

C. Unit shall be mounted through a corporation stop permitting removal from active pipe and shall impose no more than three-foot pressure drop in pipe.

D. Unit coupled with DDC microprocessor shall provide an accuracy within +l% of actual flow rate, regardless of span, between 1/2 FPM minimum flow rate and maximum GPM when installed in line size schedule 40 pipe.

E. Repeatability shall be 0.5% of actual flow rate.

2.5 INPUT/OUTPUT SENSORS

A. Temperature Sensors:
   1. Platinum resistance temperature detectors with resistance tolerance of plus or minus 0.1 percent at 70°F, interchangeability less than plus or minus 0.2 percent, time constant of 13 seconds maximum for fluids.
   2. Measuring current maximum 5 mA with maximum self-heat of 0.031°/mW in fluids.
   3. Provide 3 lead wires and shield for input bridge circuit.
   4. Use insertion elements in ducts not affected by temperature stratification and smaller than nine square feet. Use averaging elements where larger or prone to stratification. Sensor length eight feet or 16 feet as required.
   5. Use sensor holder with mounting plate and conduit enclosure with cover plate for elements mounted on ducts. Provide extension between plate and enclosure on insulated ducts.
   6. Insertion elements for liquids shall be with brass socket with minimum insertion length of 2-1/2 inches. Provide lagging extensions on insulated pipes.

B. Hydronic Differential Pressure Sensors:
   1. Differential strain gauge with amplifier, self-contained, 24VDC power supply, externally adjustable span and range.
   2. Span:
      a. Span shall be continuously adjustable from 0-125% of expected full pressure or differential pressure.
      b. The zero shall be continuously adjustable on outputs.
   3. Sensor shall be capable of withstanding overpressure range limit of 300% of the normally expected value.
   4. Output: 4-20mA signal, 2 wire.

C. Equipment Operation Sensors:
   1. Status Inputs for Electric Motors:
      a. U.L. Listed current sensing relay with split core current transformer, 1 amp @ 30 VAC adjustable setpoint output switch, adjustable mounting bracket, power and trip LED indication.
      b. Variable speed pumps: Output switch trip setpoint at 5% below the lowest motor operating speed and current draw as determined in the commissioning process, typically 20%.
      c. Product: Veris Industries Hawkeye H-900, Kele D-150.

2.6 SWITCHING DEVICES

A. Electric Relays:

1. Heavy duty, isolated, cabinet mounted, blade plug-in type with base.
2. Rating: 10 amps, minimum at 125 VAC:

2.7 TOWER BASIN LEVEL CONTROL

A. Ultrasonic Type Level Transmitter:
   1. Ultrasonic liquid level transmitter with low voltage power supply, 4-20ma output. Mount sensor unit and transmitter in NEMA 4 enclosure for flanged mounting on tower pump

      basin with stilling pipe. Unit must be accessible for maintenance, and observation of LED readout.
   2. Manufacturer: Nivelco SCA.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that systems are ready to receive work.

C. Beginning of installation means installer accepts existing conditions.

D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

E. Coordinate installation of system components with installation of mechanical systems equipment.

F. Ensure installation of components is complementary to installation of similar components.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Locate all control devices except for sensors and devices integral to equipment within control panels, unless otherwise noted.

C. Install control devices in a readily accessible location. Refer to definitions in Section 23 05 10.

D. Coordinate with the Owner and monitor the work so that other trades do not obstruct control devices or other items requiring access for service.

E. Device mounting:
   1. All devices shall be permanently mounted and secured in place.
   2. Mount control panels on backboards adjacent to associated equipment on vibration free walls or free standing angle iron supports. Refer to Section 23 05 10 for backboards.
   3. Panel mounted controls: Secure to panel backs with non-ferrous sheet metal screws.
   4. Gypsum Board and Plaster walls: Install steel bracing anchored to wall studs and mount device on steel.
   5. Concrete Walls: Non-ferrous screws and expansion shields.
   6. Concrete masonry units: Mount to recessed box or secure with moly-bolt type anchor.
   7. Provide accessory wall adapter plates where required to cover block or wall opening edges.
   8. Pipe-mounted devices: Secure to well or mounting flange. Provide well and flange extensions on insulated duct and pipe to clear insulation thickness.
   9. Mount control valves with stem at or above the horizontal.

F. Identification:
   1. Nameplates: Identify all sensors mounted in mechanical rooms using device ID and number from control drawings with permanent label mounted adjacent to device.

      Nameplates shall be laminated three-layer plastic with engraved white letters on black contrasting background, ½-inch minimum height.
      a. Include sensor type, normal setpoints information on nameplate.

b. Mounting: Attach nameplates with epoxy cement or non-ferrous screws after final painting.

2. Color code conductors with both ends identified with manufactured alpha-numeric self- adhesive vinyl tags, 3 mils thick, minimum, keyed to termination points.

G. Electrical wiring:
1. All control and interlock wiring shall be provided under this section.
2. No splices between field devices and control panels are permitted.
3. All Wiring materials and methods shall comply with Division 26 except:
a. Minimum wire size shall be 14 AWG(copper) for line voltages.
b. Minimum wire size shall be 18 AWG(copper) for signal.
4. Electric Operators:
a. Power wiring for controls provided under Division 26 is shown on the Electrical Drawings. Provide conduit, conductors, power supplies and transformers as required for power to operate electric operators.
b. The feedback signal for each separately controlled damper operator shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.

H. Mount in center of 8x8 inch block face with recessed mounting box and accessory wall adapter plate covering block opening where mounted in concrete masonry units.

I. Provide separable sockets for liquid elements. Mount sockets as specified in Section 23 21 13. Cut element to length for full insertion into well and provide conducting compound.

J. Install current sensing relays in starter enclosure for equipment served.

K. Install control valves in a readily accessible location.

L. Install control valves with stems upright or horizontal, not inverted.

M. Mount control panels on backboards adjacent to associated equipment on vibration free walls or free-standing, angle-iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

N. Electrical material and installation shall be in accordance with appropriate requirements of the Electrical Drawings.

3.3 SCHEDULES

A. Refer to Sequence of Operation for valve normal position and to Drawings for valve coefficients.

END OF SECTION

SECTION 23 09 23
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. System Description
B. Controllers
C. Power Supplies and Line Filtering
D. Controller Software
E. HVAC Control Programs
F. Digital control equipment
G. Software set-up and application programming
H. Owner demonstration and training
I. Commissioning support services

1.2 RELATED REQUIREMENTS

A. Section 23 0510 - General Mechanical Requirements.
B. Section 23 0800 - Commissioning Requirements of HVAC Systems.
C. Section 23 0913 - Instrumentation and Control Devices for HVAC.

1.3 REFERENCE STANDARDS

A. ASHRAE Standard 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks; 2016.
B. BTL - BACnet Testing Laboratories.
C. NFPA 70 - National Electrical Code; National Fire Protection Association 2015.

1.4 SUMMARY

A. Integrate controls with the existing Building Automation System (BAS).
B. System shall use the BACnet protocol for communication to the operator workstation or web server and for communication between control modules.

1.5 SYSTEM DESCRIPTION

A. All devices down to field level controllers shall communicate using open BACnet protocol.
B. Base system exists.
C. For each BACnet device, the device supplier must provide a PICS document showing the installed device's compliance level. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135-BACnet, and have a BTL label for compliance and interoperability.
D. The BAS is a Web-based system communicating over the campus Local Area Network (LAN). Contractor shall be responsible for coordination with the Owner’s IT department to ensure that the building automation system will perform in the data network environment without disruption to any of other activities taking place on that LAN. TCP/IP connection and addresses will be provided by the Owner for interface with the network.
E. Provide control systems consisting of control valves, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.
F. The Contractor shall be responsible for all equipment, cables, installation, and programming to implement the required interface with the existing BAS and, if necessary, the campus network.

G. Include installation and calibration, supervision, adjustments, and fine tuning of all additional components necessary for complete and fully operational system.

1.6 SUBMITTALS

A. Refer to Section 23 05 10 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide data for each system component and additional software module.

C. Shop Drawings:
   1. Table of Contents listing sheet titles and sheet numbers.
   2. Each sheet shall have a title indicating the type of information included and the HVAC system controlled.
   3. Provide drawing legend and list of abbreviations.
   4. System architecture: Provide a drawing of the proposed additions to the system architecture showing configuration and locations for DDC controllers, connection to the existing BAS and the campus IT network (if required), power and control wiring for each device.
   5. DDC system compatibility data: Proposed controls and connections manufacturer's data sheets on DDC controllers, sensors, meters, relays, actuators, motors, protection devices, and other devices specified herein. Include data on any system software packages to be added and illustrations of proposed graphic displays, if modifications are required.
   6. Diagrams: Separate field wiring diagrams for each system, motor starting and interlock wiring, ladder diagrams, control wiring, interior electrical circuits of control instruments with terminal and control device designations, actuators and motors, colors of wires, locations of instruments and remote elements, interfaces with communications equipment provided with equipment specified in other Sections, and normal position of relays. Each diagram shall have terminals labeled as they will be marked on the installed equipment. Electrical wiring diagrams shall include diagrams with all wire numbers and terminal block numbers identified. Provide panel termination drawings on separate drawings. Ladder diagrams shall appear on system schematic. Clearly differentiate between portions of wiring, which is existing, factory-installed and portions to be field-installed.
   7. The control submittal is to include schematic control drawings showing the configuration of the added equipment, location of all sensors, monitoring inputs, and controlled devices and any equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
   8. With each schematic, provide a point summary table listing building number and abbreviation, system type, equipment type, full point name, point description, backbone network number, device ID, object ID (object type, instance number) Provide a full points list with the following included for each point:
      a. Controlled system
      b. Point abbreviation/acronym
      c. Point description
      d. Engineering unit to be displayed with the point
      e. Control point or set-point (Yes / No)
      f. Monitoring point (Yes / No)
      g. Intermediate point (Yes / No)
      h. Calculated point (Yes / No)
   9. Proposed Graphics: Submittal shall include all proposed changes to displays as required by the project documents and specifications.
   10. Sequences of operation: Complete detailed sequences of operation as modified for added equipment and components, sensors, and controls, including a narrative of the system operation and interactions and interlocks with other systems written by the control vendor; notations indicating whether interlock or interaction is accomplished through software or hard-wired connections; detailed delineation of control between packaged controls and the DDC system; and sequences of operation for packaged controlled equipment that interfaces with the DDC system describing what points the DDC system monitors only and what points are control points and are adjustable. Sequence shall include:

a. Equipment start-up sequences.
b. Warm-up mode sequences.
c. Normal operating mode sequences.
d. Detailed sequences for all control strategies, e.g., economizer control, optimum start/stop, capacity control, staging, optimization, etc.
e. Temperature and pressure control: setbacks, setups, resets, etc.
f. Shutdown sequences.
g. Unoccupied mode sequences.
h. Sequences for all alarms and emergency shut downs.
i. Effects of power or equipment failure with all standby component functions.
j. Initial and recommended values for all adjustable settings, set-points and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, or other parameters that will be useful during testing and operating the equipment.
k. Schedules coordinated with the Owner.
l. All sequences shall be written in small statements, each with a number for reference. For a given system, numbers will not repeat for different sequence sections, unless the sections are numbered

11. BACnet Systems:
    a. BACnet object description, object ID, and device ID, for each I/O point.
    b. Documentation for any non-standard BACnet objects, properties, or enumerations used detailing their structure, data types, and any associated lists of enumerated values.
    c. Submit PICS indicating the BACnet functionality and configuration of each controller.
12. Electronic Submittals: While all requirements for hard copy submittal apply, control submittals and O&M information shall also be provided in electronic format as follows:
    a. Drawings and Diagrams: Schematic flow diagrams and system architecture diagrams shall be provided on electronic media as AutoCAD drawing files. Other drawings and diagrams may be provided as either AutoCAD files or PDF files, as most appropriate.
    b. Other Submittals: All other submittals shall be provided in Adobe Portable Document Format.

D. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.

E. Project Record Documents: Submit full set of "As-Built" control drawings, reflecting all changes to the existing system made during construction, checkout, and commissioning process. The "As-Built" drawings shall include:
1. Accurate scaled floor plans showing the locations of all installed control equipment, sensors, monitoring points, and equipment connected to the DDC control system. Floor plans shall locate any electrical panels that provide power to the system or that are monitored or controlled by it. Equipment shall be identified on these floor plans by its control system designation.
2. A control schematic showing the location of all sensors, monitoring devices, and control outputs, an accurate Material Schedule identifying the installed equipment, and floor plans showing the installed locations of all control equipment and the locations of electrical panels supply power to control equipment.
3. Full as-built sequence of operations for each piece of equipment, reflecting any changes made to achieve the required system performance.
4. Points List - An updated points list, identifying all points, actual and virtual, installed in the system. Provide the following information for each point: Point type, Point identifier, and Point address.
5. Valve Schedule reflecting the actual equipment installed, with the following information for each device:
    a. Location.
    b. Normal position (Normally open/Normally closed).
    c. Maximum gpm.
    d. Valve flow coefficient (Cv)

e. Expected pressure drop at design flow.
f. Associated valve actuator.

6. Controller/Module data shall include specific instructions on how to perform and supply functions, features, and modes specified herein and other features of this system. These instructions shall be step-by-step. Indexes and clear tables of contents shall be included. The detailed technical manual for programming and customizing control loops and algorithms shall be included. Provide hardcopy and electronic copy on DVD or thumb-drive.
7. Control Equipment Data: The data of this section shall include a separate table of contents and/or index to document the information provided.
   a. Control equipment data should include the manufacturer's maintenance, set-up, testing, calibration, operation, and repair data sheets on all DDC controllers, sensors, meters, relays, actuators, motors, protection devices, and other devices provided as a part of the installed DDC system. This data must include specific step by step instructions on how to perform all routine servicing and maintenance procedures recommended by the device manufacturer. Provide specific sensor calibration procedures and recommended calibration intervals for each device used in the installed system.
   b. Data must include the detailed technical manual for programming and customizing control loops and algorithms. Specific procedures and instructions for applying all functions, features, modes, etc. of the equipment are required.
   c. In addition, include data on system software packages provided, documenting all functions and providing guidance on their use.
   d. Sensors, switches, and timers, including maintenance instructions and sensor calibration requirements and methods by sensor type.
   e. Full as-built documentation of software programming to include fully commented software program with English language comments describing the operation of the controller programming. Documentation shall include all schedules, set points, and alarm limits established during the commissioning and acceptance testing of the system. Provide an electronic copy of programming and database information for this facility, sufficient to restore the facility to full operation.

F. Operation and Maintenance Data:
   1. Include interconnection wiring diagrams complete field installed systems added with identified and numbered, system components and devices.
   2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
   3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
   4. Provide maintenance instructions and spare parts lists for each type of control device, control unit, and accessory.
   5. Provide changes to the BAS User's Guides (Operating Manuals) for each controller type and for all workstation hardware and software and workstation peripherals added for this project.
   6. Provide BAS advanced Programming Manuals for each controller type.
   7. Include all submittals (product data, shop drawings, control logic documentation, hardware manuals, software manuals, installation guides or manuals, maintenance instructions and spare parts lists) in maintenance manual; in accordance with requirements of Divisions 1 and 23.
   8. Provide as-built network architecture drawings showing all BACnet nodes including a description field with specific controller identification, description and location information.
   9. Record copies shall include individual floor plans with controller locations with all interconnecting wiring routing including space sensors, LAN wiring, power wiring, low voltage power wiring. Indicate device instance, MAC address and drawing reference number.
   10. Provide record system architecture riser diagram showing the location of all controllers.
   11. Complete original issue copies or software key for all software provided, including

operating systems, programming language, backup copy of programming code for the controllers in the project, operator workstation software and graphics software.

12. Licenses, guarantees, and warranty documents for all equipment and systems.
13. Maintain project record documents throughout the construction period and submit final documents at Material Completion.

G. Observation by the Design Professional: Provide an affidavit to the Engineer stating the Controls Systems are performing in accordance with the contract documents prior to Request for Material Completion.

H. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in the Owner's name and registered with manufacturer.

I. Certificate: Provide Manufacturer's Certificate complying with the requirements of the General Conditions.

1.7 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 70.

B. Personnel: Mechanics and electricians performing this work shall be regularly engaged in the installation of automatic temperature controls and be in the direct employ of the installing company and shall have a copy of the approved submittal data in immediate possession when performing work.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.8 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. All components, system software, and parts furnished and installed by the BAS contractor shall be guaranteed against defects in materials and workmanship for one year from data of Material Completion. Project-specific software, database software, and firmware updates which resolve known software deficiencies as identified by the BAS Contractor shall be provided to the Owner at no charge during the warranty period. All corrective software modifications made during warranty period shall be updated on all user documentation and on user and manufacturer archived software disks.

C. At Material Completion, the BAS contractor shall upgrade all control software and firmware packages to be fully compatible with the existing BAS system.

D. Provide five-year manufacturer's warranty for field programmable micro-processor based units.

1.9 PROTECTION OF SOFTWARE RIGHTS

A. The Owner shall sign a copy of the manufacturer's standard software and firmware licensing agreement as a condition of this contract if required by changes to the system. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software. All project developed software and documentation shall become the property of the Owner. These include, but are not limited to:

1. Project graphic images
2. Record drawings
3. Project network database
4. Project-specific application programming code
5. All documentation

B. The Contractor shall provide additional software licensing if required as follows:

1. Provide or upgrade all licensing for all software packages at all required workstations. Building automation system licensing shall allow unlimited simultaneous users for access to all aspects of the system including system access, workstations, points, programming,

database management, graphics, etc. No restrictions shall be placed on the licensing. All operator interfaces, programming environment, networking, database management and any other software used by the Contractor to install the system or needed to operate the system to its full capabilities shall be licensed and provided to the Owner.

2. All software should be available on all Operator Workstations or servers provided, and on all Portable Operator Terminals. Hardware and software keys to provide all rights shall be installed on all workstations. At least two sets of CDs, if provided by manufacturer, shall be provided with backup software for all software provided, so that the Owner may reinstall any software as necessary. Include all licensing for workstation operating systems, and all required third-party software licenses.
3. Provide licensing and original software copies for each Operator Workstation or server.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Current system is manufactured by Automated Logic Corporation.

2.2 BACNET COMMUNICATION

A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication additions shall conform to the latest edition of ANSI/ASHRAE Standard 135, BACnet, provided they are compatible with the existing BAS.

B. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.

C. Controllers with real-time clocks shall use the BACnet Time Synchonization service. The system shall automatically synchronize system clocks daily from an operator-designated controller via then internetwork. If applicable, system shall automatically adjust for the current daylight savings and standard time changes.

D. Web server or workstation and controllers shall communicate using BACnet protocol. Web server or workstation and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ANSI/ASHRAE 135, BACnet Annex J.

2.3 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies:
   1. Provide UL listed control transformers with Class 2 current limiting type or over-current protection in both primary and secondary circuits for Class 2 service as required by the NEC.
   2. Limit connected loads to 80 percent of rated capacity.
   3. Match DC power supply to current output and voltage requirements.
   4. Unit to be full wave rectifier type with output ripple of 5.0 mV maximum peak to peak.
   5. Regulation to be one percent combined line and load with 100 microsecond response time for 50 percent load changes.
   6. Provide over-voltage and over-current protection to withstand a 150 percent current overload for three seconds minimum without trip-out or failure.
   7. Operational Ambient Conditions: 32 to 120 degrees F.
   8. EM/RF meets FCC Class B and VDE 0871 for Class B and MIL-STD 810 for shock and vibration.
   9. Line voltage units UL recognized and CSA approved.

B. Power Line Filtering:
   1. Provide external or internal transient voltage and surge suppression component for all workstations and controllers. Suppressor shall be solid state, operate bi-directionally, and have a turn-on and turn-off time of less than one nanosecond, and all shall

provide the protection specified herein, either as an internal part of the DDC controllers or as an separate component.

2. Communication of Signal Conductor Transient Suppressors shall require the following:
   a. Maximum signal impulse current conductor-to-conductor or conductor-to-ground: 10000 amperes, 8x20 microsecond waveform.
   b. Pulse life rating: 3000 amperes, 8x20 microsecond waveform, 2000 occurrences.
   c. Maximum clamping voltage at 10000 amperes, 8x20 microsecond waveform, with the peak current not to exceed the normal applied voltage by 200%.

2.4 LOCAL AREA NETWORK (LAN)

A. Provide communication between control units and BAS through direct wired connections.

B. The BAS shall continue to network multiple user interface clients, automation engines, system controllers and application-specific controllers. Provide application and data server(s) as required for systems operation.

C. BACnet Router: Communication between the BAS and the controllers shall be existing BACnet/IP. A router, if required, shall be provided to interface the BACnet/IP and the data network installed between controllers.

D. Break in Communication Path: Continue setting to alarm and automatically notify Owner's required parties.

E. Transmission Median: compatible with existing.

F. Network Support: Time for global point to be received by any station, shall be less than 3 seconds. Provide automatic reconfiguration if any station is added or lost. If transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

2.5 OPERATING SYSTEM SOFTWARE

A. Continue settings for existing system.

B. Input/Output Capability From Operator Station:
   1. Request display of current values or status in tabular or graphic format.
   2. Command selected equipment to specified state.
   3. Initiate logs and reports.
   4. Change analog limits.
   5. Add, delete, or change points within each control unit or application routine.
   6. Change point input/output descriptors, status, alarm descriptors, and engineering unit descriptors.
   7. Add new control units to system.
   8. Modify and set up maintenance scheduling parameters.
   9. Develop, modify, delete or display full range of color graphic displays.
   10. Automatically archive select data even when running third party software.
   11. Provide capability to sort and extract data from archived files and to generate custom reports.
   12. Support printer operations.
      a. Print alarms, operator acknowledgments, action messages, system alarms, operator sign-on and sign-off.
      b. Print reports, page prints, and data base prints.

C. Web Based Operator System Access: Continue existing. Via software password with full access levels as at work station.

D. Data Base Creation and Support: Changes shall utilize standard procedures. Control unit shall automatically check work station data base files upon connection and verify data base match. Minimum capability shall include:
   1. Add and delete points.
   2. Modify any point parameter.

3. Change, add, or delete English language descriptors.
4. Add, modify, or delete alarm limits.
5. Add, modify, or delete points in start/stop programs, trend logs, etc.
6. Create custom relationship between points.
7. Create or modify DDC loops and parameters.
8. Create or modify override parameters.
9. Add, modify, and delete any applications program.
10. Add, delete, develop, or modify dynamic color graphic displays.

E. Dynamic Color Graphic Displays:
1. Utilizes existing symbols or system supported library of symbols.
2. Sixteen (16) colors, minimum.
3. Existing number of outputs of real time, live dynamic data per graphic.
4. Dynamic graphic data.
5. 1,000 separate graphic pages, minimum.
6. Modify graphic screen refresh rate between 1 and 60 seconds.

F. Web Server or Existing Operator Station:
1. Continue existing or else:
2. Accept data from LAN as needed without scanning entire network for updated point data.
3. Interrogate LAN for updated point data when requested.
4. Allow operator command of devices.
5. Allow operator to place specific control units in or out of service.
6. Allow parameter editing of control units.
7. Store duplicate data base for every control unit and allow down loading while system is on line.
8. Control or modify specific programs.
9. Develop, store and modify dynamic color graphics.
10. Provide data archiving of assigned points and support overlay graphing of this data utilizing up to four (4) variables.

G. Alarm Processing:
1. For added components and systems, BAS input and status objects shall be configurable to alarm on departing from and on return to normal state compatible with existing. Operator shall be able to enable or disable each alarm and to configure alarm limits, alarm limit differentials, alarm states, and alarm reactions for each system object. Configure and enable alarm points as specified in Sequences of Operation and as designated by the User. Additional alarms can be added to all system points in the future without additional software, hardware or wiring. Alarms shall be BACnet alarm objects and shall use BACnet alarm services.
2. Alarm Messages
   a. Alarm messages shall use an English language descriptor without acronyms or mnemonics to describe alarm source, location, and nature for added components and systems.
3. Alarm Reactions
   a. Operator shall be able to configure (by object) the actions that workstation or web server shall initiate on receipt of each alarm for added components and systems. As a minimum, workstation or web server shall be able to log, print, start programs, display messages, send e-mail, and able to run a report and attach it to the e-mail. The e-mail shall use SSL to secure the communications between the system server and the mail server.
   b. Operator shall also be able to set the following conditions for an alarm action for added components and systems:
      1) Run the alarm action only when the alarm source generates an alarm or when it returns to normal.
      2) Wait a specified amount of time, then run the alarm action if the alarm has

not been acknowledged or has not returned to normal.

3) Run if the alarm occurs during the occupied hours defined for a schedule group, or run if the alarm occurs during the group's unoccupied hours.

4. Alarm Maintenance
   a. Operators shall be able to view system alarms and changes of state chronologically, to acknowledge and delete alarms, and to archive closed alarms to the workstation or web server hard disk from each workstation or web browser interface.

5. Event Processing: Automatically initiate commands, user defined messages, take specific control actions or change control strategy and application programs resulting from event condition. Event condition may be value crossing operator defined limit, change-of-state, specified state, or alarm occurrence or return to normal.

H. Automatic Restart: Automatically restart field equipment on restoration of power. Provide time delay between individual equipment restart and time of day start/stop.

I. Messages:
   1. Automatically display or print user-defined message subsequent to occurrence of selected events.
   2. Compose, change, or delete any message.
   3. Display or log any message at any time.
   4. Assign any message to any event.

J. Reports for added components and systems:
   1. Manually requested with time and date.
   2. Long term data archiving to hard disk.
   3. Automatic directives to download to transportable media such as floppy diskettes for storage.
   4. Data selection methods to include data base search and manipulation.
   5. Data extraction with mathematical manipulation.
   6. Data reports shall allow development of XY curve plotting, tabular reports (both statistical and summary), and multi-point timed based plots with not less than four (4) variables displayed.
   7. Generating reports either normally at operator direction, or automatically under work station direction.
   8. Reports may either manually displayed or printed, or may be printed automatically on daily, weekly, monthly, yearly or scheduled basis.
   9. Include capability for statistical data manipulation and extraction.
   10. Provide capability to generate four types of reports: Statistical detail reports, summary reports, trend graphic plots, x-y graphic plots.

K. Parameter Save/Restore: Store most current operating system, parameter changes, and modifications on disk or thumb drive for added components and systems.

L. Data Collection:
   1. The supplied changes to the existing system must incorporate the ability to access all data using browsers without proprietary operator interface and configuration programs. An Open Database Connectivity (ODBC) compliant web-server database is required for all system database parameter storage to allow all historical data to be easily imported in to any ODBC compliant software (i.e.: Microsoft ACCESS, EXCEL, etc.).This data shall reside on a supplied-installed server for all database access. Systems requiring proprietary database and user interface shall not be acceptable.
   2. Automatically collect and store in disk files.
   3. Daily electrical energy consumption for building electrical meters and submeters.
   4. Daily gas consumption for building gas meter and submeters.
   5. Daily energy consumption for building HVAC flow meters.

6. Daily water consumption for building domestic water flow meter.
7. Provide archiving of stored data for use with system supplied custom reports.

M. Trends:
1. The contractor shall build graphic trends for the following for each added HVAC system, multiple trend point:
   a. Analog outputs trend with output value, control input variable, setpoint value, reset value, modes, one trend per control loop.
   b. Analog input trend with all input variables for a system.
   c. Digital input/output trend with all digital variables for a system.
2. Operator shall be able to configure trend sample or change of value (COV) interval, start time, and stop time for each added system date object. Controller shall sample and store trend data and shall be able to archive data to the existing web-server. Owner shall be able to add additional trend points, intranet and internet viewable, and build trend graphs to display without additional hardware or software. Authorized operators shall have the capability of viewing trends from any workstation that is connected to the web.

N. Graphic Display: Support graphic development of added components or systems on work station with software features:
1. Page linking.
2. Generate, store, and retrieve library symbols.
3. Single or double height characters.
4. Sixty (60) dynamic points of data per graphic page.
5. Pixel level resolution.
6. Animated graphics for discrete points.
7. Analog bar graphs.
8. Display real time value of each input or output line diagram fashion.

O. Maintenance Management:
1. Run time monitoring, per added point.

P. Advisories:
1. Summary which contains status of points in locked out condition for added components or systems.
2. Continuous operational or not operational report of interrogation of system hardware and programmable control units for failure.
3. Report of power failure detection, time and date.
4. Report of communication failure with operator device, field interface unit, point, programmable control unit.

2.6 LOAD CONTROL PROGRAMS

A. General: For added components and systems, support inch-pounds and SI (metric) units of measurement. Make added equipment compatible with scheduling, calculated points, event programming, automatic digital control, and trend logging.

2.7 HVAC CONTROL PROGRAMS

A. General:
1. Support Inch-pounds and SI (metric) units of measurement.
2. Identify each HVAC Control system.

B. Optimal Run Time:
1. Control start-up and shutdown times of HVAC equipment for cooling.
2. Base on occupancy schedules, outside air temperature, seasonal requirements, and interior room mass temperature.
3. Start-up systems by using outside air temperature, room mass temperatures, and adaptive model prediction for how long building takes to warm up or cool down under different conditions.

2.8 PROGRAMMING APPLICATION FEATURES

A. Trend Point:
   1. Equivalent to existing, else sample up to 6 points, real or computed, with each point capable of collecting samples at intervals specified in minutes, hours, days, or month.
   2. Output trend logs as line graphs or bar graphs equivalent to existing, else output graphic on terminal, with each point for line and bar graphs designated with a unique pattern, vertical scale either actual values or percent of range, and horizontal scale time base. Print trend logs up to 12 columns of one point/column.

B. Alarm Messages:
   1. Compatible with existing, else:
   2. Allow definition of minimum of 50 messages, each having minimum length of 180 characters for each individual message.
   3. Assign alarm messages to system messages including point's alarm condition, point's off-normal condition, totalized point's warning limit, hardware elements advisories.
   4. Output assigned alarm with "message requiring acknowledgments".
   5. Operator commands include define, modify, or delete; output summary listing current alarms and assignments; output summary defining assigned points.

C. Weekly Scheduling:
   1. Make compatible with existing and automatically initiate equipment or system commands, based on preselected time schedule for points specified.
   2. Provide program times for each day of week, per point, with one minute resolution.
   3. Automatically generate alarm output for points not responding to command.
   4. Provide for holidays, minimum of 100 consecutive holidays.
   5. Output summary: Listing of programmed function points, associated program times, and respective day of week programmed points by software groups or time of day.

D. Interlocking:
   1. Equivalent to existing:
   2. Permit events to occur, based on changing condition of one or more associated master points.
   3. Binary contact, high/low limit of analog point or computed point shall be capable of being utilized as master. Same master may monitor or command multiple slaves.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that conditioned power supply is available to the control units and to the operator work station.

C. Verify that field end devices and wiring are installed prior to installation proceeding.

3.2 PROGRAMING

A. Include existing operating system programming of software capability specified to provide:
   1. Maintain system I/O capability, operator access as defined by the User, database creation, and support.
   2. Existing DDC system shall be programmed with required changes for this project shall accomplish the sequence of operation as defined on the project documents. Programming shall be arranged to allow the "stand-alone" operation of the mechanical systems and to minimize the impact of failures of individual controllers and/or communication links.
   3. Programming additions shall be configured such that ALL setpoints, high/low limits, decision points, and other variables in the programming are variables than can be adjusted by an operator with the appropriate access authority through the use of graphic displays.

4. Equipment responses to fire alarm system signals, as exists, shall continue to be independent of the DDC controller and its output. As defined by the project documents, secondary responses to these signals or responses of other associated equipment may be accomplished through the DDC system and programming.
5. Graphic Display - Levels: Provide graphic display leveling scheme for building site, floor plans, and system diagrams as follows showing changes as made under this project:
    a. Level 1: Identify location of building on the site.
    b. Level 2: Show each floor plan of the building.
    c. Level 3: Show each mechanical room and equipment layout.
    d. Level 4: Show each individual system such as chilled water loop, condenser water loop.
6. Graphic Display-Systems:
    a. Compatible with existing BAS, provide and generate additional dynamic color graphics providing menu-generated flow charting of the Facilities Building process using background graphics, standard and user defined symbols and dynamic variables.
    b. Provide flow charting for the added system components indicating all available points.
    c. Indicate setpoint condition status by changing color, flashing compatible with existing. Provide flow charting for each system indicating all available points.
    d. Dynamic updates: All graphic I/O object values shall continue to update with change of value, or by operator selected discrete intervals.
7. Graphic Displays - Floor Plans:
    a. Provide building floor plan graphics with component point readouts and a change in color during alarms.
    b. Show actual locations of equipment on the graphics.
8. Graphic Trends - Each HVAC System:
    a. Analog outputs trend with output value, control input variable, setpoint value, reset value, modes, one trend per control loop.
    b. Analog input trend with all input variables for a system.
    c. Digital input/output trend with all digital variables for a system.
9. Sequence of Operation:
    a. Provide a graphic screen displaying the written out full sequence of operation for each added piece of HVAC equipment.
    b. Provide a link to the sequence of operation displays on their respective equipment graphics.
10. Equipment Runtime monitoring.

B. Include changes required by new components to the Load Control and HVAC programming of software to provide:
    1. System and equipment operating to specified Sequence of Operation as changed:
    2. Night set-up/set-back of temperature set-points as directed by User.

C. Include any required changes to Load Control and Chiller Programming of software to provide:
    1. Control functions of chilled water reset control.
    2. Chilled Water Reset: Automatically reset controlled chilled water temperature between 42 - 48 degrees F (adj.) satisfying the cooling load requirements of the campus buildings.

D. Include Application system programming of software capability specified to provide:
    1. Trend logging:
        a. Logging, reporting and graphing of user defined system trends on electronic file and printer as directed by Owner.
        b. Organize data in each trend logs to facilitate documenting system operation in compliance with Sequence of Operation.

2. Alarms: Logging, reporting and printing of user defined system alarms on electronic file and printer as directed by Owner.
3. Scheduling:
   a. Program user defined system scheduling of occupied times as directed by user.
   b. Implement optimized starting and stopping for building warm-up/cool-down before occupancy.

3.3 INSTALLATION

A. Install control units and other hardware in position on permanent walls where accessible for inspection, maintenance and repair and not subject to excessive vibration.

B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 23 09 93.

C. Identification:
1. Nameplates: Identify all sensors mounted in mechanical rooms using device ID and number from control drawings with permanent label mounted adjacent to device. Nameplates shall be engraved plastic laminate with uppercase white letters on black background, ½-inch minimum height.
   a. Mounting: Attach nameplates with epoxy cement or non-ferrous screws after final painting.
2. Conduit/Cable Markers:
   a. Color coded, sunlight resistant cable ties.
   b. Do not obscure or write over existing codes or markers.
   c. Location: Install on all conduit and raceways exposed or above ceilings in a visible location at:
      1) Connections to junction, pull boxes, or manholes. Label box cover with nominal system voltage, circuit number and panel identification legibly written with permanent marker.
      2) Connections to equipment.
      3) Each side of a wall, roof or floor penetration.
      4) Along straight runs at 50 feet intervals.
      5) At changes of direction.
      6) Parallel Conduits: Group markers on each conduit in-line with the adjacent marker.
   d. Color: Compatible with existing, else Baby Blue.
3. Color code cable with both ends identified with manufactured alpha-numeric self-adhesive vinyl tags, 3 mils thick, minimum, keyed to termination points.

D. Communication Wiring:

1. All wiring shall be in accordance with National Electrical Codes and Electrical Drawings of this specification and compatible with existing. Communication wiring shall be provided in a customized color jacketing material. Material color shall be as submitted and approved by Owner. In addition, all wiring jackets shall be labeled "BAS" in 3 foot or fewer intervals along the length of the jacket material.
2. Contractor shall supply all communication wiring between Controllers, Routers, and other devices.
3. Control LAN for any portions of this network required under this section of the specification, contractor shall use Category 5 or better cable if compatible with existing as specified in TIA-568B. Media shall be Class 2 plenum rated and installed in accordance with manufacturer's recommendations. Network shall be run with no splices and separate from any wiring over thirty (30) volts.

E. Signal Wiring:
1. Contractor shall run all signal wiring in accordance with National Electrical Codes and Division 26 of this Specification.

2. Signal wiring to all field devices, including, but not limited to, all sensors, transducers, transmitters, switches, etc. shall be twisted, 100% shielded pair, minimum 18 gauge wire with PVC cover, Class 2 plenum rated. Signal wiring shall be run with no splices and separate from any wiring above thirty (30) volts.
3. Signal wiring shield shall be grounded at controller end only unless otherwise recommended by the controller manufacturer.

F. Low Voltage Analog Output Wiring:
1. Contractor shall run all low voltage control wiring in accordance with National Electrical Codes and Division 26 of this Specification.
2. Low voltage control wiring shall be minimum 18 gauge, twisted pair, 100% shielded, with PVC cover, Class 2 plenum-rated. Low voltage control wiring shall be run with no splices separate from any wiring above thirty (30) volts.

G. Electrical wiring:
1. All terminations of field wiring shall be to terminal strips.
2. Power wiring to control units shown on drawings is provided under Electrical Drawings. Provide conduit and conductors and power supplies and transformers to extend power to all supplemental control units.
3. Wiring System: Install complete wiring system for electric control systems. Installation of wiring shall generally follow building lines. Install in accordance with National Electrical Codes and Electrical Drawings of this Specification. Fasten flexible conductors bridging cabinets and doors, neatly along hinge side, and protect against abrasion. Tie and support conductors neatly.
4. Control Wiring Conductors: Install control wiring conductors, without splices between terminal points, color-coded. Install in neat workmanlike manner, securely fastened. Install in accordance with National Electrical Codes and Electrical Drawings of this Specification.
5. Communication wiring, signal wiring and low voltage control wiring shall be installed separate from any wiring over thirty (30) volts. Signal wiring shield shall be grounded at controller end only, unless otherwise recommended by the controller manufacturer.
6. All control network wiring shield shall be terminated as recommended by controller manufacturer. All control network wiring shall be labeled with a network number, NodeID at each termination and shall correspond with the network architecture and floor plan submittals.

7. Install all control wiring external to panels in electric metallic tubing or raceway. Installation of wiring shall generally follow building lines. Provide compression type connectors. Provide rigid conduit at all exterior locations and where subjected to moisture. All conduits penetrating partitions, wall, or floors shall be sealed with an approved material to prevent migration of air through the conduit system and maintain the required firestopping performance. Comminication wiring, signal wiring and low voltage wiring may be run without conduit in concealed, accessible locations if noise immunity is ensured. Contractor will be fully responsible for noise immunity and rewire in conduit if electrical or RF noise affects performance. Accessible locations are defined as areas inside mechanical equipment enclosures, such as heating and cooling units, instrument panels, etc.; in accessible pipe chases in each access, or suspended ceilings with easy access.

Installation of wiring shall general follow building lines. Run in a neat and orderly fashion, bundled where applicable, and completely suspended (strapped to rigid elements or routed through wiring rings) away from areas of normal access. Tie and support conductors neatly with suitable nylon ties. Conductors shall not be supported by the ceiling system or ceiling support system. Conductors shall be pulled tight and be installed as high as practically possible in ceiling cavities. Wiring shall not be supported by piping, conduit, the ceiling or ductwork. Conductors shall not be installed

between the top cord of joist or beam and the bottom of roof decking. Contractor shall be fully responsible for noise immunity and rewire in conduit if electrical or RF noise affects performance.

H. DDC Panel Installation:
   1. Power wiring to control units shown on drawings is provided under the Electrical Drawings. Use existing conduit and provide conductors and power supplies and transformers to extend power to all supplemental control units. Provide conduit where required.
   2. Wire controllers, relays, switches, and controls in the control panel to a terminal block. Line voltage and low voltage shall be separated on different terminal blocks with labels indicating voltage. Each sensor or other electrical device shall be wired back to the terminal block in the control panel. Devices in series shall be individually terminated at the terminal block, such that each side of each device is available at the control panel for troubleshooting. In addition to number markings on each conductor, conductor color shall be the same throughout each wiring run.
   3. Wiring shall be neatly and tied and routed in the control panel. Shielded wiring shall be terminated neatly, with heat shrink tubing placed over the bare end of the shield. Ground conductors over 4" long shall be insulated with tubing.
   4. DDC panel installation shall include 120V duplex convenient outlet wired from the same circuit as the DDC controller.
   5. Each item in the panel shall be labeled with the nameplates or tags bearing the functional designations shown on approved control diagrams. Each control panel shall be labeled to identify the system or equipment served and to identify the location and circuit designation of the electrical power source.
   6. Panels shall be located to avoid conflicts with ductwork, piping, equipment, the work of other trades, and building conditions. Panel locations indicated on the Drawings shall coordinated prior to installation and adjusted to avoid conflict.
   7. All wiring materials and methods shall comply with Division 26 except:
      a. Minimum wire size shall be 14 AWG (copper) for line voltages.
      b. Minimum wire size shall be 18 AWG (copper) for signal.

I. Provide conduit and electrical wiring in accordance with Section 26 2717. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

3.4 MANUFACTURER'S FIELD SERVICES

A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

B. Provide the services of control technicians at start-up to check-out the system, verify and calibrate sensors and outputs, input data supplied by the Owner and place system in operation. Verify proper operation of each item in the sequence of operation, including hardware and software.

C. Check-out each system for control function through the entire sequence. Check actuator travel on dampers and valves for action and extent. Verify that control dampers and valves open and close completely. Check calibration of instruments. Calculate and verify instrument setpoints.

D. Calibration and testing: Calibrate sensors and monitoring inputs and verify proper operation of outputs before system is placed on-line. Check each point within the system by making a comparison between the operator console and field device. DDC control loops, failure modes, interlocks, sequences, energy management programs, and alarm shall be debugged, tested, and stable operation verified. Control loop parameters and tuning constants shall be adjusted to produce accurate, stable control system operation. Before obtaining permission to schedule the functional test, provide written documentation of system calibration and certification that the installed complete system has been calibrated, verified, and ready to begin testing.

E. Provide start-up certificate in the format prescribed by the General Conditions.

3.5 DEMONSTRATION, TRAINING AND INSTRUCTIONS

A. Refer to Section 23 05 10 - Demonstration, Training and Instructions for additional requirements.

B. Demonstrate a complete and operating system to the Owner.

3.6 COMMISSIONING SUPPORT REQUIREMENTS:

A. The Mechanical Contractor shall attend a preliminary commissioning scoping meeting and other commissioning coordination meetings during the construction process as necessary to facilitate the commissioning process. Mechanical Contractor shall keep the Commissioning Authority (CxA) and mechanical Commissioning Supervisor informed of progress with the Project and of changes to the proposed installation, programming and test plan.

B. The Mechanical Contractor shall provide assistance to the Commissioning Authority for scheduling and witnessing of testing. Review the Prefunctional and Functional test procedures to ensure feasibility, safety, and equipment protection.

C. Preparation of a written start-up and initial checkout plan indicating in a step-by-step manner the procedures that will be followed to test, check-out, and adjust the control system prior to beginning functional testing. Submit the proposed plan to the Commissioning Authority and mechanical Commissioning Supervisor for review and approval prior to startup. At minimum, the plan shall include for each type of equipment controlled by the automatic controls:

1. Step-by-step procedures for testing each type controller after installation, including:
    a. Process of verifying proper hardware and wiring installation.
    b. Process of downloading programs to load controllers and verifying that they are addressed correctly.
    c. Process of verifying proper hardware and wiring installation.
    d. Process of performing operational checks of each controlled component.
    e. Plan and process for calibrating valve actuators and sensors.
    f. A description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.
    g. A copy of the log and field check-out sheets that will document the process. This log shall include a place for initial and final values read during calibration of each point and clearly indicate when a sensor or controller has passed and is operating within the contract parameters. Notification of any equipment failures shall be documented.
    h. A description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.
    i. A description of the instrumentation required for testing, including a certification of calibration for each test instrument.
    j. Identify which tests and systems should be completed prior to using the control system for test, adjustment, and balance work.
    k. The Commissioning Authority may request further documentation necessary for the commissioning process.
2. Provide the Commissioning Authority and mechanical Commissioning Supervisor complete system logic diagrams, describing the proposed system programming, with programmed attributes shown. These diagrams shall be updated with field modifications

    from the start-up, check-out, and pre-functional testing prior to the beginning of the functional testing of the DDC system. Provide a copy of each proposed graphical interface screen with interface points shown for the entire system. Provide assistance to the Commissioning Authority in preparing the specific functional performance test

procedures required, to include normal cut sheets and shop drawing submittals of commissioned equipment and any additional requested documentation, prior to normal O&M manual submittals. Review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.

3. Pre-functional tests: Provide skilled technicians to execute startup of equipment and to execute the pre-initial checkout as described by the approved plan. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem solving. Verify and document the proper installation, addressing, calibration, programming, operation, and failure mode of DDC control points, sequences, and equipment and provide a copy to the commissioning authority. Provide a signed and dated certification to the Commissioning Authority and Commissioning Supervisor upon completion of the check-out of each controlled device, equipment, and system that installation, set-up, adjustment, calibration, and system programming is complete and as indicated on the Drawings, except functional testing. Completed pre-functional documentation of the system verification shall be submitted to the Commissioning Authority and Commissioning Supervisor for review and approval prior to the functional testing of the DDC control system or its being used in the testing of other equipment or systems, or other purposes. Copies of final field check-out sheets and trend logs shall be provided to the Commissioning Authority and Commissioning Supervisor for inclusion in the Commissioning Report.
4. Meet with the testing, adjusting, and balancing contractor prior to beginning the test, adjustment, and balance process and review the test, adjusting, and balancing plan to determine the capabilities and requirements of the control system in completing the testing, adjusting, and balancing process. For a given area, have all required pre-functional checklists, calibrations, startup and selected functional tests of the system completed and approved by the Commissioning Authority prior to beginning the testing, adjusting, and balancing effort. Provide the testing, adjusting, and balancing contractor with the appropriate software and any needed unique instruments for setting terminal units and instruct the testing, adjusting, and balancing contractor personnel in their use. Assist and cooperate with the testing, adjusting, and balancing contractor by providing a qualified technician to operate the controls as required to assist the testing, adjusting, and balancing contractor in performing his work, or alternatively, provide sufficient training for the testing, adjusting, and balancing contractor to operate the system without assistance. Verify the proper operation of affected controls at the completion of the test, adjustment, and balance procedure.
5. Address current Owner's and Engineer's punch list items before functional testing. Water TAB shall be completed with discrepancies and problems remedied before functional testing of the control systems for the respective air- or water-related systems.
6. Functional tests: Conduct and document a functional test under the direction of the Commissioning Authority of the complete installed DDC control system. Functional testing is intended to begin upon completion of a system but may be conducted in phases or sections, as defined by the requirements of the Functional Test, or as approved by the Commissioning Authority. The DDC system, or applicable portions of the system, shall have completed pre-functional testing and be approved by the Commissioning Authority and Commissioning Supervisor before being used for other purposes, such as test and balance measurements, or in support of the functional testing of other systems.
    a. Provide technicians and or knowledgeable programming personnel as required to conduct the required functional testing. Assist the Commissioning Authority in resolving issues found during the functional testing process.
    b. Assist in the functional testing of equipment and systems by implementing trend logs and equipment monitoring as specified in the contract documents.

The monitoring and data logging capabilities of the DDC system shall be available for use in the commissioning process. Assist the Commissioning Authority in the testing and documentation process by using the data logging and trending capability of the DDC system in monitoring the testing effort and recording the performance of systems and interpreting the monitoring data, as necessary.

c. The controls contractor shall coordinate with the University Facilities personnel and provide and set up a temporary testing operator station to allow full operator station interface with the system during the entire functional testing process. This temporary operator station shall provide all functions required of the system at the operator station, including real time graphic displays and report generation.

d. Correct deficiencies (differences between specified and observed performance) as interpreted by the Commissioning Authority and Design Professional and retest the equipment.

e. Where deficient operation or defective equipment is discovered, provide corrective measures as required by the warranty provisions specified herein.

END OF SECTION

SECTION 23 09 94
HVAC SEQUENCE OF OPERATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Listing of required monitor points.

B. Changes to the sequence of operation for:
   1. Campus Chilled Water System.

1.2 RELATED SECTIONS

A. Section 23 05 10 - General Mechanical Requirements

B. Section 23 08 00 - HVAC Commissioning Requirements.

C. Section 23 09 23 - Digital Control Equipment.

D. Section 23 09 13 - Instruments and Control Elements.

1.3 SYSTEM DESCRIPTION

A. This Section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other Sections.

1.4 SUBMITTALS

A. Refer to Section 23 05 10 - General Mechanical Requirements for submittal procedures.

B. Shop Drawings: Indicate mechanical system controlled and control system components.
   1. Label with settings, adjustable range of control and limits.
   2. Include written description of control sequence.
   3. Include flow diagrams for each control system, graphically depicting control logic.

C. Review controls with and obtain approval of chiller manufacturer. Mark control diagrams "Approved" by chiller manufacturer.

D. Project Record Documents: Record actual locations of components and setpoints of controls, including changes to sequences made after submission of shop drawings.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. New sequences of operation for the added components and equipment shall be compatible with existing sequences of operation and compatible with the existing BAS.

B. All operators shall be in NORMAL position when each system is OFF.

C. All temperatures are in degrees Fahrenheit.

D. Sequences specified herein indicate the functional intent of the systems operation and may not fully detail every aspect of the programming that may be required to obtain the indicated operation. Contractor shall provide all programming necessary to obtain the sequences/system operation indicated.

E. Where any sequence or occupancy schedule calls for more than one motorized unit to start simultaneously, the DDC System start commands shall be staggered by 5 second (adj.) intervals to minimize inrush current.

F. Alarm messages specified throughout the sequences shall be assigned to discrete priority levels. Priority levels dictate the handling and destination of alarm reports.

G. Wherever a value is indicated as adjustable (adj.), it shall be modifiable, with the proper password level, from the operator interface or via a function block menu. For these points, it is unacceptable to have to modify programming statements to change setpoints, schedules, or other Owner-changeable parameters.

H. When reset action is specified in a sequence of operation, but a reset schedule is not indicated on the drawings, the contractor shall determine a fixed reset schedule that shall result in stable operation and shall maintain the primary variable within the specified maximum allowable

variance one of the following methods shall be employed. Obtain approval of reset schedule from the Owner and Engineer. All parameters of reset schedule shall be adjustable without programming statement modification.

I. The DDC System shall provide for adjustable maximum rates of change for increasing and decreasing output from the following analog output points on new equipment:
   1. Speed control of variable speed drives.
   2. Chilled water supply temperature setpoint reset.

J. Wherever a value is to be dependent on another value (i.e.: setpoint plus 5°F) the DDC System shall continue to use that equation to determine the value. Simply providing a virtual point that the operator must set is unacceptable. In this case three virtual points shall be provided. One to store the parameter (5°F), one to store the setpoint, and one to store the value which is the result of the equation.

3.2 COMMISSIONING TESTS

A. Provide assistance to the Commissioning Authority (CxA) for scheduling and witnessing of testing.

B. Review the Prefunctional and Functional test procedures to ensure feasibility, safety, and equipment protection.

3.3 MONITOR POINTS

A. Arrangement: Locate all new control points for added systems within one DDC panel within the mechanical equipment room containing the majority of the equipment for that system.

B. Each added DDC controller including associated input/output modules, shall be provided with a minimum of three spare input and output points of each type installed.

C. Monitoring: In addition to the temperature, pressure, digital or flow sensor points required to implement the sequence of operation for the added equipment and systems, refer to the HVAC system flow diagrams and Input/Output point Schedules shown on the drawings.

3.4 CENTRAL CHILLED WATER SYSTEMS

A. General: The Central Chiller Plant Automation System shall fully control the added chilled water system and equipment and provide monitoring and diagnostic information for management purposes.

B. Equipment Starting Order: The DDC System shall be changed to make the new chiller the default lead chiller. Starting order for the other equipment, including cooling towers, chilled water pumps, and condenser water pumps shall be determined automatically at 8:00 a.m. on the second Tuesday of each month based on lowest to highest runtime of equipment. Selection can be manually overridden through the central operator station by authorized USCB facilities personnel.

C. Cooling Enable: Cooling from chiller plant operation shall be enabled when any chilled water air system served by the Central Chiller Plant is calling for cooling and ODT is above 55°F, or whenever manually enabled by the plant operator from the operator interface or network connection.

D. Refrigerant Detection:
   1. The chiller(s) shall shut down and an alarm generated upon receiving a refrigerant leak detection status.

E. Bypass chilled water valve control:
   1. The plant bypass valve shall be modulated in sequence to prevent the chiller flow rate from going below the minimum flow rate recommended by the chiller manufacturer based on a signal from the chiller flow meter.

F. Primary Chilled Water Pump Control – P-CP-1 and P-CP-2 (new):
   1. The chilled water pumps shall operate in a lead/lag sequencing:
      a. The lead pump shall run first.
      b. On failure of the lead pump, the lag pump shall run and the lead pump shall turn off.

2. The lead pump shall start prior to the chiller being enabled and shall stop only after the chiller is disabled. The chilled water pumps shall therefore have:
   a. A user adjustable delay on start.
   b. AND a user adjustable delay on stop.
3. The delay times shall be set appropriately for orderly chilled water system start-up and shutdown.
4. The designated lead pump shall rotate upon one of the following conditions (user selectable):
   a. manually through a software switch
   b. monthly
5. Lead Pump P-CP-*: The lead pump shall run continuously when enabled by the plant BAS. The pump VFD shall modulate pump speed based on the controlling remote differential pressure setpoint. The pump minimum speed shall not drop below 25% (adj.).
6. Lag Pump P-CP-*: Lag pump shall start automatically when enabled by the plant BAS or upon failure of lead pump. The lag pump VFD shall modulate pump speed based on the controlling remote differential pressure sensor. The pump minimum speed shall not drop below 25% (adj.).
7. Maintain the same chilled water loop differential setpoint. Setpoint may be trimmed with optimum value determined during Test and Balance work.

G. Chiller – CH-CP-1 (existing 750-ton chiller):
   1. Start - Stop: Runs when the default lead chiller fails or during the weekly scheduled four-hour run on Wednesday afternoons. It only runs when the lead chilled water pump is running through DP switch sensing pressure drop through chiller evaporator and electrical interlock with pump variable speed drive controller.
   2. At noon on Wednesday of each week when the load is greater than 350 tons and the ambient temperature is higher than 50°F, the DDC System shall select the 750-ton original chiller to run as the lead chiller for four hours. At the end of the four-hour run time, the DDC System shall transition to the new 450-ton chiller as the lead chiller.
   3. Operating Controls: Built-in operating controls operated chiller in accordance with the equipment specifications.
   4. Safety Control: Sensor in chilled water entering chiller shall stop chilled water pump at 90°F CHR temperature.
   5. Provide remote reset of the chiller leaving water temperature.

H. Chiller – CH-CP-2 (new 450-ton, magnetic-bearing chiller):
   1. Start - Stop: Runs as the default lead chiller and when the default lag chiller fails during the weekly scheduled four-hour run on Wednesday afternoons. It only runs and when the lead chilled water pump is running through DP switch sensing pressure drop through chiller evaporator and electrical interlock with pump variable speed drive controller.
   2. Operating Controls: Built-in operating controls operate chiller in accordance with the equipment specifications.
   3. Safety Control: Sensor in chilled water entering chiller shall stop chilled water pump at 90°F CHR temperature.

I. Provide remote reset of the chiller leaving water temperature.

J. Chilled Water Supply Temperature Reset:
   1. The chilled water supply temperature setpoint shall be reset based on outside air temperatures.
   2. Chilled water supply temperature shall be 44°F at ODT of 80°F and higher.
   3. Chilled water supply temperature shall reset at ODT below 80°F, proportionally from 44°F to 48°F at 60°F ODT. Reset signal shall be provided by the BAS.

4. The chilled water supply reset sequence will not increase setpoint if the return air relative humidity rises above 57% RH.

K. Condenser Water Pump Control – P-CP-4 and P-CP-5:
   1. The lead condenser water pump shall run anytime the chiller is called to run. Interlock as required by the chiller manufacturer.
   2. The lead pump shall start prior to the chiller being enabled and shall stop only after the chiller is disabled. The pumps shall therefore have:
      a. A user adjustable delay on start.
      b. AND a user adjustable delay on stop.
   3. If the lead condenser water pump fails, the lag condenser water pump shall be ordered on.
   4. The delay times shall be set appropriately to allow for orderly chilled water system start-up and shutdown.

L. Condenser Water Head Pressure Control: The condenser water supply temperataure shall be kept above a minimum limit of 55°F (adj.) to prevent surge and other chiller problems at all load conditions. Measure the condenser water supply temperature and use that temperature as input to a feedback-control algorithm that controls the position of the cooling tower bypass valve. The control valve shall be sequenced through the local chiller controls when the chiller is enabled per the start and stop sequences specified.

M. Provide logic so that all cooling tower fans shall be commanded off whenever it becomes necessary to open the cooling tower bypass valve.

N. Cooling Tower:
   1. The cooling tower fans shall be enabled to run whenever the chiller runs.
   2. Vibration Switches:
      a. The cooling tower shall shut down and an alarm generated upon receiving a vibration switch status.
   3. Cooling Tower - Condenser Water Temperature Control:
      a. The controller shall measure the cooling tower condenser water supply temperature and modulate the fan's VFD to maintain setpoints.
      b. The following setpoints are recommended values. All setpoints shall be field adjusted during the commissioning period to meet the requirements of actual field conditions.
      c. Cooling Tower VFD fans:
         1) Tower Fan: VFDs modulate cooling tower fans from maximum RPM to minimum RPM setting to maintain tower basis temperature five degrees Fahrenheit above circulated outdoor wet-bulb, 65°F minimum and 85°F maximum.
         2) Cooling tower fans shall be sequenced to minimize the sum of the chiller and cooling tower fan power consumption at all load conditions.
         3) Program VFDs to skip tower resonant frequencies and maintain minimum fan/drive RPM required by tower manufacturer. Provide output to cycle fan if VFD malfunctions. Provide interlock wiring from fan disconnects to the VFD.
   4. Tower Basis Level Control:
      a. Normal Levels: Make up water valve shall open to maintain sump basin levels. Provide new water level sensor devices in the new cooling tower pump basin. Refer to Section 23 09 13.
      b. High Level Alarm: If the sump level rises above the high-water level switch in tower basin, an alarm shall be generated.
      c. Emergency Low Level Alarm and Cutoff: Cooling tower shall stop when this level is reached and alarm shall be generated. A manual reset relay shall be provided in control panel to prevent automatic restarting.
      d. When the lead cooling tower fan stops, the next fan in rotation shall start.

e. Blowdown: A conductivity meter shall, when cooling water is flowing, hold bleed water valve open until water conductivity is reduced to an acceptable level.

5. Device Failure:
   a. If a device failure is detected, it will be shut down in an orderly manner, and the next available device in the sequence shall be started.
   b. A frequency converter fault input shall shut the cooling tower fan down and generate an alarm at the OWS. The next available cooling tower shall be enabled.
6. The condenser water treatment system and the condenser water filtration system shall be activated whenever any condenser water pump operates.

O. Upon power failure and restoration, systems shall automatically restart and return to their normal mode of operation. Adjustable time delays shall be provided to sequentially stage starting of chillers, pumps, and cooling towers.

P. Waterside Economizer:
1. THE WATERSIDE ECONOMIZER MODE SHALL BE AUTOMATICALLY ACTIVATED WHEN THE CALCULATED OUTSIDE AIR WET BULB TEMPERATURE DROPS BELOW THE SETPOINT OF 40°F. THIS ASSUMES THAT THE 450-TON CHILLER WILL BE OPERATING AT THESE LOW AMBIENT TEMPERATURES.
2. WHEN IN WATERSIDE ECONOMIZER OPERATION, THE COOLING TOWER BYPASS VALVE WILL NEVER MODULATE. THE COOLING TOWER BYPASS VALVE EITHER WILL BE FULLY OPEN TO THE TOWER OR FULLY CLOSED TO THE TOWER.
3. WITH THE WATERSIDE ECONOMIZER MODE ACTIVATED, THE CONDENSER WATER SETPOINT SHALL BE RESET TO 46°F. AS CONDENSER WATER FROM THE COOLING TOWERS REACHES 60°F, THE 2-WAY VALVES SHALL OPEN TO ALLOW FLOW OF CONDENSER WATER THROUGH THE PLATE HEAT EXCHANGER. WHEN CONDENSER WATER FROM THE COOLING TOWERS REACHES 46°F, THE 2-WAY VALVE SHALL OPEN TO ALLOW CHILLED WATER FLOW THROUGH THE PLATE HEAT EXCHANGER. WHEN CHILLED WATER LEAVING THE PLATE HEAT EXCHANGER REACHES 50°F, DEACTIVATE THE CHILLER.
4. ON INITIAL ACTIVATION OF THE WATERSIDE ECONOMIZER MODE, AN ADJUSTABLE TIME DELAY, SET AT 30 MINUTES, SHALL ALLOW THE SYSTEM TO OPERATE TO PROVIDE 46°F CONDENSER WATER FROM THE COOLING TOWERS. THE SYSTEM SHALL AUTOMATICALLY CHANGE BACK TO THE NORMAL MODE AFTER THE 30 MINUTE DELAY IF THE CONDENSER WATER TEMPERATURE FROM THE COOLING TOWERS IS ABOVE THE SETPOINT. THE SYSTEM SHALL RUN UNDER NORMAL OPERATION FOR 2 HOURS UNTIL THE NEXT CHANGEOVER ATTEMPT CAN BE MADE.
5. IN THE WATERSIDE ECONOMIZER MODE, MODULATE THE COOLING TOWER FAN MOTORS TO MAINTAIN 46°F COMMON CONDENSER WATER SETPOINT.
6. IF THE CHILLED WATER LEAVING THE PLATE HEAT EXCHANGER RISES ABOVE 50°F FOR 15 MINUTES, TERMINATE THE WATERSIDE ECONOMIZER MODE AND RETURN TO THE NORMAL MODE.

END OF SECTION

SECTION 23 21 13
HYDRONIC PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Water piping to connect new HVAC equipment to existing piping that is stubbed out and closed with butterfly valves and caps, including the following:

1. Chilled water, condenser water, and drain piping.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS

B. Section 01 33 23, SHOP DRAWINGS, PRODUCTS, AND SAMPLES

C. Section 23 05 11, COMMON WORK RESULTS FOR HVAC, General mechanical requirements and items, which are common to more than one section of Division 23.

D. Section 23 21 23, HYDRONIC PUMPS: Pumps.

E. Section 23 07 11, HVAC, PLUMBING INSULATION: Piping insulation.

F. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Temperature and pressure sensors and valve operators.

1.3 QUALITY ASSURANCE

A. Submit prior to welding of steel piping, IF ANY, a certificate of Welder's certification. The certificate shall be current and not more than one year old.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Pipe and equipment supports.
2. Pipe and tubing, with specification, class or type, and schedule.
3. Pipe fittings, including miscellaneous adapters and special fittings.
4. Flanges, gaskets, and bolting.
5. Valves of all types.
6. Strainers.
7. Flexible connectors for water service.
8. Pipe alignment guides.
9. Expansion joints.
10. Expansion compensators.
11. All specified hydronic system components.
12. Water flow measuring devices.
13. Gages.

14. Thermometers and test wells.
15. Pipe fittings, and mechanical couplings.

C. As-Built Piping Diagrams: Provide drawing as follows for chilled water and condenser water and other piping systems and equipment. .
   1. One wall-mounted stick file with complete set of prints. Mount stick file in the chiller plant or control room along with control diagram stick file.
   2. One complete set of reproducible drawings.
   3. One complete set of drawings in electronic format (Autocad, pdf, or format approved by the Owner's Representative and the Engineer).

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society of Mechanical Engineers (ASME):

B1.20.1-83, Pipe Threads, General Purpose (Inch)

B16.1-98, Cast Iron Pipe Flanges and Flanged Fittings

B16.3-98, Malleable Iron Threaded Fittings

B16.4-98, Gray Iron Threaded Fittings

B16.5-03, Pipe Flanges and Flanged Fittings

B16.11-05, Forged Fittings, Socket-Welding and Threaded

B16.14-91, Ferrous Pipe Plugs, Bushings, and Locknuts with Pipe Threads

B16.22-01, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

B16.23-02, Cast Copper Alloy Solder Joint Drainage Fittings

B16.24-01, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500, and 2500

B16.39-98, Malleable Iron Threaded Pipe Unions, Classes 150, 250, and 300

B16.42-98, Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300

B31.1-01, Power Piping

B31.9-04, Building Services Piping

B40.100-05, Pressure Gauges and Gauge Attachments

C. American National Standards Institute, Inc. (ANSI):

B16.3 00.....Malleable Iron Threaded Fittings Classes 150 and 300

B16.5 03.....Pipe Flanges and Flanged Fittings NPS ½ through NPS 24

B16.9 03.....Factory Made Wrought Butt Welding Fittings

B16.11 01.....Forged Fittings, Socket Welding and Threaded

B16.14 91.....Ferrous Pipe Plugs, Bushings and Locknuts with Pipe Threads

B16.18-01.....Cast Copper Alloy Solder joint Pressure fittings

B16.22 00.....Wrought Copper and Bronze Solder Joint Pressure Fittings

B16.24 01.....Cast Copper Alloy Pipe Fittings and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500, and 2500

B31.1 01.....Power Piping

D. American Society for Testing and Materials (ASTM):

A47/A47M-99 (2004).....Ferritic Malleable Iron Castings

A53/A53M-06.....Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

A106/A106M-06.....Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service

A126-04.....Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

A181/A181M-01.....Standard Specification for Carbon Steel Forgings, for General-Purpose Piping

A183-03 ..... Standard Specification for Carbon Steel Track Bolts and Nuts

A216/A216M-04 ..... Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service

A234/A234M 04 ..... Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service

A307-04 ..... Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

A536-84 (2004) ..... Standard Specification for Ductile Iron Castings

A 615/A 615M-04..... Deformed and Plain Carbon Steel Bars for Concrete Reinforcement

A653/A 653M-04 ..... Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) By the Hot-Dip Process

B32-04 ..... Standard Specification for Solder Metal

B61-02..... Standard Specification for Steam or Valve Bronze Castings

B62-02 ..... Standard Specification for Composition Bronze or Ounce Metal Castings

B88-03 ..... Standard Specification for Seamless Copper Water Tube

B209 04 ..... Aluminum and Aluminum Alloy Sheet and Plate

C177 97 ……..Standard Test Method for Steady State Heat Flux Measurements

and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus

C478-03 ..... Precast Reinforced Concrete Manhole Sections

C533 03 ..... Calcium Silicate Block and Pipe Thermal Insulation

C552 03 ..... Cellular Glass Thermal Insulation

D 3350-02 ..... Polyethylene Plastics Pipe andFittings Materials

C591-01 ..... Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation

D1784 03 ..... Rigid Poly Vinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride (CPVC) Compounds

D1785 03 ..... PVC Plastic Pipe, Schedules 40, 80 and 120

D2241 04 ..... PVC Pressure Rated Pipe (SDR Series)

D2464 99 ..... Threaded PVC Plastic Pipe Fittings, Schedule 80.

D3139 98 ..... Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

F439-06 ..... Standard Specification for CPVC Plastic Pipe Fittings, Schedule 80

F441/F441M-02 ..... Standard Specification for CPVC Plastic Pipe, Schedules 40 and 80

F477-02 ..... Elastomeric Seals (Gaskets) for Joining Plastic Pipe

E. American Water Works Association (AWWA):

F. C110/03.....Ductile Iron and Grey Iron Fittings forWater

G. American Welding Society (AWS):

A5.8/A5.8M-04.....Specification for Filler Metals for Brazing and Braze Welding

B2.1-02.....Standard Welding Procedure Specification

H. Copper Development Association, Inc. (CDA): CDA

A4015-95.....Copper Tube Handbook

I. Expansion Joint Manufacturer's Association, Inc. (EJMA):

EMJA-2003.....Expansion Joint Manufacturer's Association Standards, Eighth Edition

J. Manufacturers Standardization Society (MSS) of the Valve and Fitting Industry, Inc.:

SP-67-02a.....Butterfly Valves

SP-70-06.....Gray Iron Gate Valves, Flanged and Threaded Ends

SP-71-05.....Gray Iron Swing Check Valves, Flanged and Threaded Ends

SP-72-99.....Ball Valves with Flanged or Butt-Welding Ends for General Service

SP-78-05.....Cast Iron Plug Valves, Flanged and Threaded Ends

SP-80-03.....Bronze Gate, Globe, Angle and Check Valves

SP-85-02.....Cast Iron Globe and Angle Valves, Flanged and Threaded Ends

K. Tubular Exchanger Manufacturers Association: TEMA 8th Edition, 2000

PART 2 - PRODUCTS

2.1 PIPE AND TUBING

A. Chilled Water (above ground):
   1. Steel: ASTM A53 Grade B, seamless or ERW, Schedule 40.
B. Extension of Domestic Water Make-up Piping: ASTM B88, Type K or L, hard drawn copper tubing.
C. Pipe supports, including insulation shields, for above ground piping.

2.2 FITTINGS FOR STEEL PIPE

A. 2-1/2 inches and Larger: Grooved Pipe. See SECTION 23 21 14 Grooved Pipe
B. 2 inches and Smaller: Screwed or welded. Mechanical couplings are optional for water piping only.
   1. Butt welding: ASME B16.9 with same wall thickness as connecting piping.
   2. Forged steel, socket welding or threaded: ASME B16.11.
   3. Screwed: 150 pound malleable iron, ASME B16.3. 125 pound cast iron, ASME B16.4, may be used in lieu of malleable iron. Bushing reduction of a single pipe size, or use of close nipples, is not acceptable.
   4. Unions: ASME B16.39.
C. Welded Branch and Tap Connections: Forged steel weldolets, or branchlets and threadolets may be used for branch connections up to one pipe size smaller than the main. Forged steel half-couplings, ASME B16.11 may be used for drain, vent and gage connections.

2.3 FITTINGS FOR COPPER TUBING

A. Solder Joint:
   1. Joints shall be made up in accordance with recommended practices of the materials applied. Apply 95/5 tin and antimony on all copper piping.
   2. Mechanically formed tee connection in water and drain piping: Form mechanically extracted collars in a continuous operation by drilling pilot hole and drawing out tube surface to form collar, having a height of not less than three times the thickness of tube wall. Adjustable collaring device shall insure proper tolerance and complete uniformity of the joint. Notch and dimple joining branch tube in a single process to provide free flow where the branch tube penetrates the fitting.
B. Bronze Flanges and Flanged Fittings: ASME B16.24.

2.4 DIELECTRIC FITTINGS

A. Provide where copper tubing and ferrous metal pipe are joined.

B. 2 inches and Smaller: Threaded dielectric union, ASME B16.39.

C. 2 1/2 inches and Larger: Flange union with dielectric gasket and bolt sleeves, ASME B16.42.

D. Temperature Rating, 210°F.

2.5 SCREWED JOINTS

A. Pipe Thread: ANSI B1.20.

B. Lubricant or Sealant: Oil and graphite or other compound approved for the intended service.

2.6 VALVES

A. Asbestos packing is not acceptable.

B. All valves of the same type shall be products of a single manufacturer. Provide gate and globe valves with packing that can be replaced with the valve under full working pressure.

C. Provide chain operators for valves four inches and larger when the centerline is located eight feet or more above the floor or operating platform.

D. Non-Slam or Silent Check Valve: Spring loaded double-disc swing check or internally guided flat disc lift type check for bubble tight shut-off. Provide where check valves are shown in chilled water piping. Check valves incorporating a balancing feature may be used. Chilled water piping shall be grooved pipe.

1. Body: Cast iron, ASTM A126, Class B, or steel, ASTM A216, Class WCB, or ductile iron, ASTM 536, flanged or wafer type.
2. Seat, disc and spring: 18-8 stainless steel, or bronze, ASTM B62. Seats may be elastomer material.

E. Butterfly Valves: Provide stem extension to allow 2 inches of pipe insulation without interfering with valve operation.

1. MSS-SP 67, flange lug type (for end of line service) rated 175 psig working pressure at 200°F).
   a. Body: Cast iron, ASTM A126, Class B. Malleable iron, ASTM A47 electro-plated, or ductile iron, ASTM A536, Grade 65-45-12 electro-plated.
   b. Trim: Bronze, aluminum bronze, or 300 series stainless steel disc, bronze bearings, 316 stainless steel shaft and manufacturer's recommended resilient seat. Resilient seat shall be field replaceable, and fully line the body to completely isolate the body from the product. A phosphate coated steel shaft or stem is acceptable, if the stem is completely isolated from the product.
   c. Actuators: Field interchangeable. Valves for balancing service shall have adjustable memory stop to limit open position.

1) Valves six inches and smaller: Lever actuator with minimum of seven locking positions, except where chain wheel is required.
2) Valves eight inches and larger: Enclosed worm gear with handwheel, and where required, chain-wheel operator.

H. Ball Valves: Brass or bronze body with stainless steel ball with full port and Teflon seat at 400 psig working pressure rating.

Screwed or solder connections. Provide stem extension to allow operation without interfering with pipe insulation.

I. Where modulating flow is not required use:

1. Butterfly valve as specified herein with memory stop.
2. Circuit Setter Valve: A dual purpose flow balancing valve and adjustable flow meter, with bronze or cast iron body, calibrated position pointer, valved pressure taps or quick disconnects with integral check valves and preformed polyurethane insulating enclosure. Provide a readout kit including flow meter, readout probes, hoses, flow charts or calculator, and carrying case.

2.7 STRAINERS

A. Basket or Y Type. Tee type is acceptable for water service.

B. Screens: Bronze, monel metal or 18-8 stainless steel, free area not less than 2-1/2 times pipe area, with perforations as follows: 0.045 inch) diameter perforations.

C. 4 inches and larger: 0.125 inch diameter perforations.

D. Suction Diffusers: Specified in Section 23 21 23, HYDRONIC PUMPS.

2.8 FLEXIBLE CONNECTORS FOR WATER SERVICE

A. Flanged Spool Connector:

1. Single arch or multiple arch type. Tube and cover shall be constructed of chlorobutyl elastomer with full faced integral flanges to provide a tight seal without gaskets. Connectors shall be internally reinforced with high strength synthetic fibers impregnated with rubber or synthetic compounds as recommended by connector manufacturer, and steel reinforcing rings.
2. Working pressures and temperatures shall be as follows:
   a. Connector sizes 2 inches to 4 inches, 165 psig at 250°F.
   b. Connector sizes 5 inches to 12 inches, 140 psig at 250°F.
3. Provide ductile iron retaining rings and control units.

B. Mechanical Pipe Couplings:
See other fittings specified under Part 2, PRODUCTS.

2.9 GAGES, PRESSURE AND COMPOUND

A. ASME B40.100, Accuracy Grade 1A, (pressure, vacuum, or compound for air, oil or

water), initial mid-scale accuracy 1 percent of scale (Qualify grade), metal or phenolic case, 4-1/2 inches in diameter, 1/4 inch NPT bottom connection, white dial with black graduations and pointer, clear glass or acrylic plastic window, suitable for board mounting. Provide red "set hand" to indicate normal working pressure. Gauges shall be glycerin filled.

B. Provide brass lever handle union cock. Provide brass/bronze pressure snubber for gages in water service.

C. Range of Gages: Provide range equal to at least 130 percent of normal operating range.

1. For condenser water suction (compound): 30 inches Hg to plus 100 psig.

2.10 PRESSURE/TEMPERATURE TEST PROVISIONS

A. Pete's Plug: 1/4 inch MPT by 3 inches long, brass body and cap, with retained safety cap, nordel self-closing valve cores, permanently installed in piping where shown, or in lieu of pressure gage test connections shown on the drawings.

B. Provide one each of the following test items to the Resident Engineer:

1. 1/4 inch FPT by 1/8 inch diameter stainless steel pressure gage adapter probe for extra long test plug. PETE'S 500 XL is an example.
2. 3-1/2 inch diameter, one percent accuracy, compound gage, , ——30 inches Hg to 100 psig range.
3. 220°F pocket thermometer one-half degree accuracy, one inch dial, 5 inches long stainless steel stem, plastic case.

2.11 THERMOMETERS

A. Mercury or organic liquid filled type, red or blue column, clear plastic window, with 6 inch brass stem, straight, fixed or adjustable angle as required for each in reading.

B. Case: Chrome plated brass or aluminum with enamel finish.

C. Scale: Not less than 9 inches, range as described below, two degree graduations.

D. Separable Socket (Well): Brass, extension neck type to clear pipe insulation.

E. Scale ranges may be slightly greater than shown to meet manufacturer's standard. Required ranges in degrees F:

Chilled Water 32-100°F	Condenser Water 0-180°F

PART 3 - EXECUTION

3.1 GENERAL

A. The drawings show the general arrangement of pipe and equipment but do not show all required fittings and offsets that may be necessary to connect pipes to equipment and to coordinate with other trades. Provide all necessary fittings, offsets and pipe runs based on field measurements and at no additional cost to the Owner. Coordinate with Owner and other trades for space available and relative location of HVAC equipment and accessories to be connected on ceiling grid. Pipe location on the drawings shall be altered by contractor where necessary to avoid interferences and clearance difficulties.

B. Store materials to avoid excessive exposure to weather or foreign materials. Keep inside of piping relatively clean during installation and protect open ends when work is not in progress.

C. Install piping generally parallel to walls and column center lines, unless shown otherwise on the drawings. Space piping, including insulation, to provide one inch minimum clearance between adjacent piping or other surface. Unless shown otherwise, slope drain piping down in the direction of flow not less than one inch in 40 feet. Provide eccentric reducers to keep bottom of sloped piping flat.

D. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown on the drawing. Install butterfly valves with the valve open as recommended by the manufacturer to prevent binding of the disc in the seat.

E. Offset equipment connections to allow valving off for maintenance and repair with minimal removal of piping. Provide flexibility in equipment connections and branch line take-offs with 3-elbow swing joints where noted on the drawings.

F. Tee water piping runouts or branches into the side of mains or other branches. Avoid bull-head tees, which are two return lines entering opposite ends of a tee and exiting out the common side.

G. Provide manual air vent at all piping system high points and drain valves at all low points.

H. Connect piping to equipment as shown on the drawings. Install components furnished by others such as:

1. Water treatment pot feeders and condenser water treatment systems.

2. Flow elements (orifice unions), control valve bodies, flow switches, pressure taps with valve, and wells for sensors.

I. Thermometer Wells: In pipes 2-1/2 inches and smaller increase the pipe size to provide free area equal to the upstream pipe area.

J. Firestopping: Fill openings around uninsulated piping penetrating floors or fire walls, with firestop material. For firestopping insulated piping refer to Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.

K. Where copper piping is connected to steel piping, provide dielectric connections.

3.2 PIPE JOINTS

A. Welded: Beveling, spacing and other details shall conform to ASME B31.1 and AWS B2.1.

B. Screwed: Threads shall conform to ASME B1.20; joint compound shall be applied to male threads only and joints made up so no more than three threads show. Coat exposed threads on steel pipe with joint compound, or red lead paint for corrosion protection.

C. 125 Pound Cast Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast iron flange.

3.3 LEAK TESTING ABOVEGROUND PIPING

A. Inspect all joints and connections for leaks and workmanship and make corrections as necessary, to the satisfaction of the Engineer. Tests may be either of those below, or a combination, as approved by the Engineer.

B. An operating test at design pressure.

C. A hydrostatic test at 1.5 times design pressure. For water systems the design maximum pressure would usually be the static head, or expansion tank maximum pressure, plus pump head. Factory tested equipment (convertors, exchangers, coils, etc.) need not be field tested. Isolate equipment where necessary to avoid excessive pressure on mechanical seals and safety devices.

3.4 FLUSHING AND CLEANING PIPING SYSTEMS

A. Existing Water Piping Not in Service: Clean systems as required.

1. Initial flushing of existing, but un-used, chilled water and condenser water piping for the second chiller and second cooling tower (this project): Remove loose dirt, mill scale, metal chips, weld beads, rust, and like deleterious substances without damage to any system component. Provide temporary piping or hose to bypass coils, control valves, exchangers and other factory cleaned equipment unless acceptable means of protection are provided and

subsequent inspection of hide-out areas takes place. Isolate or protect clean system components, including pumps and pressure vessels, and remove any component which may be damaged. Open all valves, drains, vents and strainers at all system levels of the existing piping for the second chiller (this project) and extensions of existing pipes for potential third chiller and cooling tower. Remove plugs, caps, spool pieces, and components to facilitate early debris discharge from system. Sectionalize system to obtain debris carrying velocity of 6 feet per second, if possible. Connect dead-end supply and return headers as necessary. Flush bottoms of risers.

Install temporary strainers where necessary to protect down-stream equipment. Supply and remove flushing water and drainage by various type hose, temporary and permanent piping and Contractor's booster pumps. Flush until clean as approved by the Owner and Engineer.

2. Cleaning: Circulate systems at normal temperature to remove adherent organic soil, hydrocarbons, flux, pipe mill varnish, pipe joint compounds, iron oxide, and like deleterious substances not removed by flushing, without chemical or mechanical damage to any system component. Removal of tightly adherent mill scale is not required. Keep isolated, existing equipment which is "clean" (in use) and where dead-end debris accumulation cannot occur. Sectionalize system if possible, to circulate at velocities not less than 6 feet per second. Circulate each section for not less than four hours. Blow-down all strainers, or remove and clean as frequently as necessary. Drain and prepare for final flushing.

3. Final Flushing: Return systems to conditions required by initial flushing after all cleaning solution has been displaced by clean make-up. Flush all dead ends and isolated clean equipment. Gently operate all valves to dislodge any debris in valve body by throttling velocity. Flush for not less than one hour.

3.5 WATER TREATMENT

A. Connect new condenser water pipes to existing water treatment equipment and provide water treatment system piping.

B. Close and fill pipes for new cooling tower and chiller system as soon as possible after final flushing to minimize corrosion.

C. Charge systems with chemicals as recommended by chemical treatment service company.

D. Utilize this activity, by arrangement with the Owner and Engineer for instructing Owner’s operating personnel.

3.6 OPERATING AND PERFORMANCE TEST AND INSTRUCTION

A. Refer to PART 3, Section 23 05 10, GENERAL MECHANICAL REQUIREMENTS.

B. Adjust red set hand on pressure gages to normal working pressure.

END OF SECTION 23 21 13

SECTION 23 21 14
Grooved Piping System

PART 1: GENERAL

1.01 SECTION INCLUDES:

Part 1: General
Part 2: Products
Part 3: Execution
Part 4: Training

1.02 RELATED SECTIONS

A. Section 01 00 00, GENERAL REQUIREMENTS
B. Section 01 33 23, SHOP DRAWINGS, PRODUCTS, AND SAMPLES
C. Section 23 05 10, GENERAL MECHANICAL REQUIREMENTS and items, which are common to more than one section of Division 23.
D. Section 23 21 23, HYDRONIC PUMPS: Pumps.
E. Section 23 07 11, HVAC, PLUMBING INSULATION: Piping insulation.
F. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Temperature and pressure sensors and valve operators.

1.03 REFERENCES:

A. American Society for Testing Materials (ASTM)
1. ASTM A-53 – Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
2. ASTM A-183 – Carbon Steel Track Bolts and Nuts
3. ASTM A-234 – Standard Specification For Piping Fittings or Wrought Carbon Steel and Alloy Steel.
4. ASTM A-449 – Quenched and Tempered Steel Bolts and Studs
5. ASTM A-536 – Ductile Iron Castings
6. ASTM F-1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications
7. American Society of Mechanical Engineers
    a. ASME B16.9 – Factory Made Wrought Butt Welded Fittings
    b. ASME B31.1 – Chemical Plant and Petroleum Refining Piping
    c. ASME B31.9 – Building Services Piping
8. American Water Works Association
    a. AWWA C-606 – Grooved and Shouldered Joints

1.04 QUALITY ASSURANCE

A. To assure uniformity and compatibility of piping components in grooved end piping systems, all grooved products utilized shall be compatible with existing piping systems and the new products shall all be supplied by one manufacturer. Grooving tools shall be supplied by the same manufacturer as the grooved components.

1.05 SUBMITTAL DOCUMENTATION REQUIRED:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Pipe and equipment supports.
2. Pipe and tubing, with specification, class or type, and schedule.
3. Pipe fittings, including miscellaneous adapters and special fittings.
4. Valves of all types.
5. Strainers.
6. Flexible connectors for water service.
7. Pipe alignment guides.
8. Accessories.
9. Water flow measuring devices.
10. Gages.
11. Thermometers and test wells.
12. Pipe fittings, and mechanical couplings.

C. Coordination Drawings: Refer to Article, SUBMITTALS of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

D. As-Built Piping Diagrams: Provide drawing as follows for chilled water and condenser water.

1. One wall-mounted stick file with complete set of prints. Mount stick file in the chiller plant or control room along with control diagram stick file.
2. One complete set of reproducible drawings.
3. One complete set of drawings in electronic format (Autocad, pdf, or format approved by the Owner's Representative and the Engineer).

PART 2: PRODUCTS

2.1 MATERIALS:

A. Pipe/Grooved (Standard/Lightwall): Carbon Steel, A-53B/A-106B - Roll or cut grooved-ends as appropriate to pipe material, wall thickness, pressures, size and method of joining. Pipe ends to be grooved in accordance with current listed standards conforming to ANSI/AWWA C-606.

B. Grooved Pipe Mechanical Couplings for Joining Carbon Steel Pipe

1. Grooved Pipe Standard Mechanical Couplings, 2-inch through 12 inch: Manufactured in two segments of cast ductile iron, conforming to ASTM A-536, Grade 65-45-12. Gaskets shall be pressure-responsive synthetic rubber, grade to suit the intended service, conforming to ASTM D-2000. Mechanical

Coupling bolts shall be zinc-plated (ASTM B-633), heat-treated, carbon-steel, track head conforming to ASTM A-449 and ASTM A-183, minimum tensile strength 110,000 psi (758450 kPa) as provided standard Grooved Pipe.

a. **Rigid Type**: Coupling housings with offsetting, angle-pattern bolt pads shall be used to provide system rigidity and support and hanging in accordance with ANSI B31.1, B31.9, and NFPA 13.
   a. 2" through 8": Grooved Pipe. Installation-ready rigid coupling for direct stab installation without field disassembly. Gasket shall be Grade "EHP" EPDM compound with red color code designed for operating temperatures from -30 deg F to +250 deg F.
   b. 10" through 12". Standard rigid coupling. Gasket shall be Grade "E" EPDM compound with green color code designed for operating temperatures from -30 deg F to +230 deg F.
b. **Flexible Type**: Use in locations where vibration attenuation and stress relief are required. Flexible couplings may be used in lieu of flexible connectors at equipment connections. Three couplings, for each connector, shall be placed in close proximity to the vibration source.
   a. 2" through 8". Installation-ready flexible coupling for direct stab installation without field disassembly. Gasket shall be Grade "EHP" EPDM compound with red color code designed for operating temperatures from -30 deg F (-34 deg C) to +250 deg F (+120 deg C).
   b. 10" through 12". Gasket shall be Grade "E" EPDM compound with green color code designed for operating temperatures from -30 deg F to +230 deg F.

2. **Flange Adapters**: For use with grooved end pipe and fittings, flat faced, for mating to ANSI Class 125 / 150 flanges (existing Victaulic Style 741). For direct connection to ANSI Class 300 flanges use appropriate style fitting.

3. Grooved couplings shall meet the requirements of ASTM F-1476.

4. **Gasket:** Synthetic rubber conforming to steel pipe outside diameter and coupling housing, manufactured of elastomers as designated in ASTM D-2000.
   a. Reference shall always be made to the latest manufacturer's Guide for Gaskets for proper gasket selection for the intended service.

5. **G Mechanical Couplings, 14 inch through 60 inch**: Couplings shall consist of two ASTM A-536 ductile iron housing segments, a wide elastomer pressure responsive gasket, and zinc electroplated carbon steel track head bolts and nuts conforming to the physical and chemical requirements of ASTM A-449 and the physical requirements of ASTM A-183.
   a. Coupling housings designed with the wedge-shaped, key profile to engage the mating pipe(s)/component(s) wedge-shaped grooves. Housings include lead-in chamfer to accommodate a wider acceptable range of initial pipe positions. Housings shall be coated with orange enamel or galvanized.
   b. Gasket: Wide width, pressure-responsive, synthetic rubber of an appropriate design, conforming to steel pipe outside diameter and

coupling housing, manufactured of elastomers as designated in ASTM D-2000.

1) Grade “E” EPDM with green color code designed for operating temperatures from -30 deg F to +230 deg F.
2) Grade “T” Nitrile with orange color code designed for operating temperatures from -20 deg F to +180 deg F.
3) Grade “L” Silicone with red color code designed for operating temperatures of -30 deg F to +350 deg F; recommended for dry heat service (air without hydrocarbons).
4) Reference shall always be made to the latest published, manufacturer’s Selection Guide for Gaskets for proper gasket selection for the intended service.

c. Coupling Types:

1) **Grooved Pipe Rigid Coupling**: Coupling key shall be designed to fill the wedge shaped groove to provide a rigid joint that corresponds with support spacings as defined by ASME B31.1 and B31.9. Systems incorporating rigid couplings require the calculated thermal expansion/contraction of the piping system to be fully compensated for in the design of the piping system through use of adequate flexible components.
2) **Grooved Pipe Flexible Coupling:** Coupling key shall be designed to fit into the wedge shaped groove and allow for linear and angular movement, vibration attenuation, and stress relief. Support requirements defined by manufacturer’s data.
3) **Grooved Pipe Flange Adapter 14 inch to 24 inch:** For use with grooved end pipe and fittings, flat faced, for mating to ANSI Class 125 / 150 flanges.

C. Grooved Pipe End Fittings:

1. Standard fittings shall be cast of ductile iron conforming to ASTM A-536, Grade 65-45-12, forged steel conforming to ASTM A-234, Grade WPB 0.375" wall, or fabricated from Std. Wt. Carbon Steel pipe conforming to ASTM A-53, Type F, E or S, Grade B. Fittings provided with an alkyd enamel finish or hot dip galvanized to ASTM A-153. Zinc electroplated fittings and couplings conform to ASTM B633.

2. Advanced fittings shall be supplied with factory advanced grooved ends, for use with appropriate couplings and appropriate flange adapter. Fittings shall be manufactured of ductile iron conforming to ASTM A-536, forged carbon steel conforming to ASTM A-234, or factory fabricated from carbon steel pipe conforming to ASTM A-53. Fittings shall be manufactured to the dimensional standards ASME B16.9. Orange enamel coated or galvanized.

3. Grooved Pipe Hole-Cut Branch Outlets:

a. Bolted Branch Outlet: Branch reductions on 2" through 8" header piping. Bolted branch outlets shall be manufactured from ductile iron conforming to ASTM A-536, Grade 65-45-12, with synthetic rubber gasket, and heat treated carbon steel zinc plated bolts and nuts conforming to physical properties of ASTM A-183. Appropriate manufacturer’s style.

b. Strapless Outlet: 1/2" or 3/4" NPT outlet on 4" and larger header sizes rated for 300 PSI. Appropriate manufacturer's style.

c. Strapless Thermometer Outlet: To accommodate industrial glass bulb thermometers with standard 1-1/4"-18 NEF 2B extra fine thread and 6" (152mm) nominal bulb length on 4" and larger header sizes rated for 300 PSI.

D. Grooved End Valves

1. Butterfly Valves

a. 2" through 12" Sizes: 300 psi CWP suitable for bidirectional and dead-end service at full rated pressure. Body shall be grooved end black enamel coated ductile iron conforming to ASTM A536. Disc shall be electroless, nickel-plated, ductile iron with blowout proof 416 stainless steel stem. Disc shall be offset from the stem centerline to allow full 360 degree seating. Seat shall be pressure responsive Lubricated Nitrile. Valve bearings shall be TFE lined fiberglass, and stem seals shall be of the same grade elastomer as the valve seat. Valve shall be complete with ISO flange for actuation mounting. Valve operators shall be lever handle or gear operator, available with memory stop feature, locking device, chain wheel, or supplied bare.

b. 14" through 24" Sizes: 300 psi, advanced grooved ends, polyphenylene sulfide (PPS) coated ductile iron body (ASTM A-536, Grade 65-45-12), PPS coated ductile iron disc (ASTM A-536), and two piece 17-4 PH S/S stem design. Seat and seal material to suit intended service. Reinforced PTFE bearings and gear operator. Bubble tight, dead-end, or bi-directional service. With memory stop for throttling, metering or balancing service. Appropriate manufacturer's style.

2. Check Valves:

a. **2" through 3" Sizes Spring Assisted:** Black enamel coated ductile iron body, ASTM A-536, Grade 65-45-12, stainless steel non-slam tilting disc, stainless steel spring and brass shaft, nickel-plated seat surface, 365 psi (2517 kPa). Appropriate manufacturer's series.

c. 4" through 12" Sizes Spring Assisted: Black enamel coated ductile iron body, ASTM A-536, Grade 65-45-12, elastomer encapsulated ductile iron disc suitable for intended service, stainless steel spring and shaft, welded-in nickel seat, 300 psi (2065 kPa). Appropriate manufacturer's style.

d. 2" through 4" Sizes Horizontal Swing: Horizontal installation, ductile iron body, ASTM A-536, Grade 65-45-12, and Type 316 stainless steel clapper. Synthetic rubber bumper & bonnet seals suitable for intended service, stainless steel wetted parts, 300 psi (2065 kPa). Appropriate manufacturer's style.

e. 4" through 12" Sizes Venturi Check: Black enamel coated ductile iron body, ASTM A-536, Grade 65-45-12 with venturi-like taps, elastomer encapsulated ductile iron disc suitable for intended service, stainless steel spring and shaft, welded-in nickel seat, 300 psi (2065 kPa). Appropriate manufacturer's style.

e. 14" through 24" Check Valves: 230 psi, advanced grooved ends, spring-assisted dual disc check valve. ASTM A-536, Grade 65-45-12 coated ductile iron body, EPDM seat bonded to the valve body, 304

stainless steel disc, and 300 series stainless steel spring and shaft. Appropriate manufacturer's style.

3. **Tri-Service Valve Assembly**: Combination shut-off, throttling and non-slam check valve.
   a. **2-1/2" through 12" Sizes:** Butterfly valve with memory stop feature assembled with 2-1/2" & 3" or appropriate manufacturer's style venturi check valve (4" – 12"). Manufacturer's appropriate series check valve with venturi like taps for flow measurement. Working pressures to 300 psi.
   b. **14" through 24" Sizes:** Butterfly valve with gear operator and memory stop feature assembled with appropriate manufacturer's check valve. Working pressures to 232 psi.
4. **Ball Valves**: 1-1/2" through 6" sizes, ASTM A-536, Grade 65-45-12, ductile iron body, chrome plated carbon steel ball and stem, TFE seats, with Fluoroelastomer seals. 800 psi. Appropriate manufacturer's series.
5. **Plug Valves**: 3"through 12" sizes, with memory stop for throttling, metering or balancing service. Unidirectional bubble-tight shut-off, bi-directional sealing optional. ductile iron body, bonnet, and plug, ASTM A-536, Grade 65-45-12. Plug encapsulated with synthetic rubber suitable for intended service. Welded-in nickel seat, stainless steel self-lubricating bearings. 175 PSI (1200 kPa). Rigid groove dimensions may be adapted to IPS sized system through the use of Victaulic Style 307 transition couplings. Appropriate manufacturer's series eccentric plug balancing valves.
6. **Circuit Balancing Valves:**
   a. **2" and Smaller Sizes**: 300 psi, y-pattern, globe type with soldered or threaded ends, non-ferrous Ametal® brass copper alloy body, EPDM o-ring seals. 4-turn digital readout handwheel for balancing, hidden memory feature with locking tamper-proof setting, and connections for portable differential meter. Appropriate manufacturer's series.
      1. Install union port fitting and strainer/ball valve combination to complete terminal hookup at coil outlet.
      2. Install differential pressure controller to stabilize differential pressure and ensure stable and accurate modulating control. Ametal® brass copper alloy body, bonnet, cone and spindles, threaded ends only.
   b. **2-1/2" and Larger Sizes**: 300 psi, y-pattern, globe type with flanged or grooved ends, ASTM A536 ductile iron body, all other metal parts of Ametal® brass copper alloy, EPDM O-ring seals. 8, 12 or 16-turn digital readout handwheel for balancing, hidden memory feature with locking tamper-proof setting, and connections for portable differential meter. Appropriate manufacturer's series.
   c. **Differential Pressure Controller**: For use in conjunction with TA Balancing valves to stabilize differential pressure and ensure stable and accurate modulating control. Ductile iron or Ametal body, Ametal® brass copper alloy bonnet, cone, and spindles, flanged ends only.

E. Grooved Pipe End Specialties

1. Expansion Joints:

a. **2" through 6" Sizes**: Packless, gasketed, type with grooved end telescoping body, suitable for axial end movement to 3". 350 psi. Appropriate manufacturer's style.

b. **3/4" and Larger Sizes**: Expansion joint consisting of a series of grooved end nipples joined with flexible-type couplings. Joint movement and expansion capabilities determined by number of couplings / nipples used in the joint. Appropriate manufacturer's style..

2. Dielectric Waterways: 1" through 8" sizes, grooved, plain end, or threaded end, ASTM A-53 carbon steel or ASTM A-536 ductile iron body, zinc electroplated, with LTHS high temperature stabilized polyolefin polymer liner. Appropriate manufacturer's style.

3. Strainers - Grooved-End

a. T-Type Strainer. 2" through 12" sizes, 300 PSI T-Type Strainer shall consist of ductile iron (ASTM A-536, Grade 65-45-12) body, Type 304 stainless steel frame and mesh removable basket with No. 12 mesh, 2"-3" strainer sizes, or No. 6 mesh, 4"-12" strainer sizes, 57% free open area. Appropriate manufacturer's style.

b. **T-Type Strainer:** 14" through 24" sizes, 300 PSI, advanced grooved end "Tee" strainer. Factory fabricated carbon steel body conforming to ASTM A-53, Grade B, carbon steel T-bolt hinged closure/cap, and type 304 stainless steel frame and mesh basket, (6x6 mesh for 14", and 4x4 mesh for 18" through 24" sizes). Appropriate manufacturer's style.

c. Y-Type Strainer. 2" through 18" sizes, 300 PSI, Y-Type strainer shall consist of ductile iron body, ASTM A-536, Grade 65-45-12, Type 304 stainless steel perforated metal removable baskets with 1/16" diameter perforations 2"-3" strainer sizes, 1/8" diameter perforations 4"-12" strainer sizes, and 0.156" diameter perforations 14" -18" strainer sizes. Appropriate manufacturer's style.

4. Suction Diffuser – Flanged outlet with grooved inlet connections, rated to 300 psi. Ductile iron (ASTM A-536) body, 304 stainless steel frame and perforated sheet diffuser with 5/32" diameter holes. Removable 20-mesh, 304 stainless steel start-up pre-filter, outlets for pressure/temperature drain connections, and base support boss. Appropriate manufacturer's series.

F. Grooved Pipe Tooling:

1. Tools shall be manufactured and supplied by manufacturer of grooved pipe. Use roll sets or cut groovers compatible with the pipe material and wall thickness per manufacturer's installation instructions.

3. Common wedge-shaped groove for pipe sizes 14" through 24" requiring one common advanced groove roll set per tool, for use with approved manufacturer's grooving tools.

PART 3 - EXECUTION

3.1 GENERAL

A. The drawings show the general arrangement of pipe and equipment but do not show all required fittings and offsets that may be necessary to connect pipes to equipment. Provide all necessary fittings, offsets and pipe runs based on field measurements and at no additional cost. Pipe location on the drawings shall be altered by contractor where necessary to avoid interferences and clearance difficulties.

B. Store materials to avoid excessive exposure to weather or foreign materials. Keep inside of piping relatively clean during installation and protect open ends when work is not in progress.

C. Install piping generally parallel to walls and column center lines, unless shown otherwise on the drawings. Space piping, including insulation, to provide one inch minimum clearance between adjacent piping or other surface. Provide eccentric reducers to keep bottom of sloped piping flat.

D. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally, locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown on the drawing. Install butterfly valves with the valve open as recommended by the manufacturer to prevent binding of the disc in the seat.

E. Offset equipment connections to allow valving off for maintenance and repair with minimal removal of piping. Provide flexibility in equipment connections and branch line take-offs with 3-elbow swing joints where noted on the drawings.

F. Tee water piping runouts or branches into the side of mains or other branches.

G. Provide manual air vent at all piping system high points and drain valves at all low points.

H. Connect piping to equipment as shown on the drawings. Install components furnished by others such as:

I. Flow elements (orifice unions), control valve bodies, flow switches, pressure taps with valve, and wells for sensors.

J. Thermometer Wells: In pipes 2-1/2 inches and smaller increase the pipe size to provide free area equal to the upstream pipe area.

K. Where copper piping is connected to steel piping, provide dielectric connections.

3.2 INSTALLATION:

A. Pipe ends shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove for proper gasket sealing.

B. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified.

C. Install the manufacturer’s advanced grooved piping system in accordance with the latest installation instructions from the manufacturer for that system.

D. Advanced grooved system products shall not be installed with standard grooved end pipe or components. (Installing advanced grooved products in combination with standard grooved end products could result in joint separation and/or leakage.)

E. Use manufacturer’s grooving tools with roll sets to groove the pipe. Follow manufacturer’s guidelines for tool selection and operation.

F. Couplings installation shall be complete when visual metal-to-metal contact is reached.

G. Use the latest copy of the manufacturer’s instructions for field assembly and installation.

3.3 Application:

A. A manufacturer's representative shall periodically visit the job site and review installation. Contractor shall remove and replace any improperly installed products.

B. There is no option for welding, threading or flanged methods to replace connections to existing Victaulic grooved pipe and fittings or in other connections of the chilled water and condenser water pipe systems.

PART 4: TRAINING:

A. A manufacturer's factory-trained representative (direct employee) shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and product installation.

END OF SECTION 23 21 14

SECTION 23 21 15
HYDRONIC SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Make-up water station.

B. Air vents.

C. Air separators.

D. Pump suction diffuser fittings.

E. Relief valves.

1.2 RELATED REQUIREMENTS

A. Section 23 2113 - HYDRONIC PIPING.

B. SECTION 23 21 14 Grooved Pipe

1.3 REFERENCE STANDARDS

A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; 2013.

1.4 SUBMITTALS

A. Refer to Section 23 0510 - General Mechanical Requirements for submittal procedures.

B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model and dimensions.

C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

D. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on specialties. Maintain in place until installation.

C. Protect from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 AIR VENTS

A. Manual Type:
   1. Pipe Sizes up to 2 inches: Short vertical sections of pipe to form air chamber, same size as pipe, with ½-inch brass ball valve at top of chamber.
   2. Pipe Sizes 2-1/2 inches and over. Short vertical sections of 2-1/2-inch diameter pipe to form air chamber, with ½-inch brass ball valve at top of chamber.

B. Automatic Float Type:
   1. Manufacturers: Amtrol 706, Armstrong 75, Hoffman 79, Wheatley 79, Watts 4VA.
   2. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

2.2 PUMP SUCTION DIFFUSER FITTINGS

A. Manufacturers:
   1. Armstrong SG.
   2. ITT Bell & Gossett: www.bellgossett.com.
   3. Mueller 1011.
   4. Patterson SD.
   5. Weatley SO.
   6. Taco SD

B. Fitting: Angle pattern, cast-iron body, threaded for 2 inch and smaller, grooved pipe for 2-1/2 inch and larger, rated for 175 psi working pressure and sized for pump and system connections, with stainless steel inlet vanes, stainless steel cylinder strainer arranged for horizontal removal, disposable fine mesh start-up strainer to fit over cylinder strainer, and permanent magnet located in flow stream and removable for cleaning.

C. Cylinder strainer with 3/16-inch diameter openings for closed piping systems.

D. Cylinder strainer with 1/8-inch diameter openings for open piping systems.

E. Accessories: Adjustable foot support, blowdown tapping in bottom, gage tapping in side.

2.3 RELIEF VALVES

A. Manufacturers:
   1. Watts Model 3L; 174A.
   2. Other acceptable manufacturers offering equivalent products: Armstrong, Bell & Gossett, Hoffman, Kunkle, Spence.

B. Bronze body, teflon seat, stainless steel stem and springs and test lever, automatic, direct pressure actuated, capacities ASME certified and labelled.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Install specialties in a readily accessible location.

C. Adjust pressure reducing valve for initial fill pressure indicated on Drawings.

D. Provide manual air vents at system high points and as indicated.

E. Remove temporary strainers after cleaning systems and approximately 60 hours operating time. Tie to pump fitting without cleaning for removal after observation.

F. Pipe relief valve outlet to floor. End of pipe or fitting shall not be threaded.

END OF SECTION

SECTION 23 21 23
HYDRONIC PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Base mounted, end suction pumps.

1.2 RELATED REQUIREMENTS

A. SECTION 23 05 10 General Mechanical Requirements

B. Section 03 3000 - Cast-in-Place Concrete.

C. Section 23 0513 - MOTORS FOR HVAC EQUIPMENT.

D. SECTION 23 09 13 Instrumentation and Control Devices for HVAC

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code, 2011 Edition; National Fire Protection Association

B. UL 778 - Standard for Motor-Operated Water Pumps; Underwriters Laboratories Inc. ; Current Edition, Including All Revisions.

1.4 PERFORMANCE REQUIREMENTS

A. All pumps shall operate at 1750 RPM unless noted otherwise.

B. Pump motors shall not overload at any point on the pump curve.

C. Impeller diameter shall not exceed 85% of casing accommodation as measured from pump cut water through centerline of shaft.

D. Pump characteristic curve shall rise continuously from maximum capacity to shut-off with shut-off head a minimum 10% greater than design head.

1.5 SUBMITTALS

A. Refer to Section 23 0510 - General Mechanical Requirements for submittal procedures.

B. Submit all items in the fluid stream with or prior to pump submittals.

C. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.

E. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

F. Certificate: Provide Manufacturer's Certificate complying with the requirements of the General Conditions.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with minimum three years of documented experience.

1.7 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by UL 778 as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 HVAC PUMPS - GENERAL

A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Products Requiring Electrical Connection: Listed and classified by UL or testing agency acceptable to the Engineer as suitable for the purpose specified and indicated.

2.2 BASE MOUNTED END SUCTION PUMPS (ES)

A. Manufacturers:

1. Bell & Gossett VSH: www.bellgossett.com
2. Aurora; Model 344A: www.aurorapump.com
3. Armstrong ; Model 4030: www.armstrongpumps.com
4. Patterson ; Model Pro-Max: www.pattersonpumps.com
5. Paco ; Model LF: www.paco-pumps.com
6. Taco ; Model FE: www.taco-hvac.com

B. Type: Horizontal shaft, double-suction, split-case, for 175 psi maximum suction pressure.

C. Casing: Casing shall be minimum Class 35 cast iron and provided with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connection, drain plug(s) at the low point(s), vent(s) at the high point(s), flanged suction and discharge.

D. Impeller: Impeller shall be centrifugal, fully enclosed, non-overloading, bronze and keyed to shaft with a guide ring and mechanical seal.

E. Bearings: Bearings shall be heavy duty, maintenance free.

F. Shaft: Shaft shall be SAE 1144 steel with a #304 stainless steel shaft sleeve.

G. Seal: Unitized Mechanical seal(s) shall be EPR/Carbon/Silicon Carbide, 225°F maximum continuous operating temperature.

H. Coupling: Pump and motor shall be direct connected through Woods Standard Sureflex or demonstrated equivalent flexible coupling with coupling guard mounted on a common metal base.

I. Motor: 1750 rpm unless specified otherwise; refer to Section 23 05 13.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.

C. Install base mounted pumps on inertia base. Refer to SECTION 23 05 48 Vibration and Seismic Controls for HVAC Equipment and Piping.

D. Check, align, and certify alignment of base mounted pumps after pump leveling, after piping connections are made, and again after operation of the system for a three week continuous period of time.

3.3 STARTING EQUIPMENT

A. Provide manufacturer's field representative to prepare and start equipment.

B. Adjust for proper operation within manufacturer's published tolerances.

C. Demonstrate proper operation of equipment to the Owner 's designated representative.

D. Provide start-up certificate in the format prescribed by the General Conditions.

3.4 SCHEDULES

A. Refer to Pump Schedule on Drawings.

END OF SECTION

SECTION 23 64 16
CENTRIFUGAL WATER COOLED CHILLER

PART 1: GENERAL

1.01 SECTION INCLUDES

A. Centrifugal compressor water cooled chiller as indicated on the schedules and shown on the drawings.

B. Water connections (chilled water, condenser water, and auxiliary water connections.

C. Motor starters and variable frequency drives

D. Electrical Connections

E. Controls and control accessories

F. Charge of refrigerant and oil (if applicable)

1.02 RELATED SECTIONS

A. The requirements of the General Conditions, Supplementary Conditions, Division 1, equipment schedules and drawings apply.

B. Section 23 05 10 General Mechanical Requirements

C. Section 23 05 13 MOTORS FOR HVAC EQUIPMENT

D. Section 23 05 14 VSD

E. Section 23 05 15 Enclosed Motor Controllers

F. Section 23 05 19 Gages and Meters

G. Section 23 05 33 Heat Tracing for HVAC Piping

H. Section 23 05 41 Noise Control for HVAC Equipment

I. Section 23 05 48 – Vibration and Seismic Controls for HVAC

J. Section 23 05 53 – Identification for HVAC Piping and Equipment

K. Section 23 05 93 - TAB

L. Section 23 07 11 – HVAC Insulation

M. Section 23 07 16 – HVAC Equipment Insulation

N. Section 23 07 19 – HVAC Piping Insulation

O. Section 23 08 00 – HVAC Cx

P. Section 23 09 13 – Instrumentation and Control Devices for HVAC

Q. Section 23 09 23 – Direct-Digital Control System for HVAC

R. Section 23 09 94 – HVAC Sequence of Operations

S. Section 23 21 13 – Hydronic Piping

T. Section 23 21 14 – Grooved Piping

U. Section 23 21 15 – Hydronic Specialties

V. Section 23 21 23 – Hydronic Pumps

W. Section 23 65 16 Induced Draft Cooling Tower

1.03 REFERENCES

A. AHRI 550/590 – Standard for Water Chilling Packages Using the Vapor Compression Cycle

B. AHRI 575 – Method of Measuring Machinery Sound within an Equipment Space

C. AHRI 580 – Non-Condensable Gas Purge Equipment for Low Pressure Centrifugal Chillers

D. AHRI 740 – Refrigerant Recovery / Recycling Equipment

E. ASHRAE 15 – Safety Standard for Refrigeration Systems

F. ASHRAE 34 – Designation and Safety Classification of Refrigerants

G. ASHRAE 90.1 – Energy Standard for Buildings except Low-Rise Residential Buildings

H. ASME Boiler and Pressure Vessel Code: Section VIII, Division 1

I. NFPA 70 / NEC – National Electrical Code

J. OSHA – Occupational Safety and Health Act

K. UL 465 – Construction of Centrifugal Chillers

L. UL 508 – Industrial Control Equipment (Short Circuit Current Rating)

M. UL 1995 – Standard for Safety for Heating and Cooling Equipment

N. IBC 2009 - International Building Code, 2009 Edition.

O. AC-156, Acceptance Criteria for Seismic Certification by Shake-Table

1.04 QUALITY ASSURANCE

A. Manufacturers: Manufacturer shall have a minimum of 30 years of experience in designing, manufacturing and servicing centrifugal chillers and a minimum of 10 years of experience designing and manufacturing with lubrication free or magnetic bearing chillers. The proposed model of chiller should have minimum five years of field operational experience.

B. Comply with codes and standards in Section 1.03

1.05 RATINGS AND CERTIFICATIONS

A. Chiller rating and testing: AHRI 550/590 or AHRI 551/591 – Provide conformance certification statement on ratings

B. Modular chiller packages must include AHRI certified ratings for the entire chiller package, not the individual module.

B. Chiller energy efficiency requirements: ASHRAE 90.1 – Affix compliance label to chiller

C. Safety: UL 465 and UL 1995 – Provide UL label

D. Motor manufacturing and performance: NEMA MG1

E. Pressure vessel construction and testing: ASME Boiler and Pressure Vessel Code: Section VIII, Division 1 – Provide ASME 'U' Stamp

F. Electrical and control wiring: NEC codes & ETL requirements – Affix certification labels to control panel and starter

G. Refrigeration system design, construction, installation and operation: ASHRAE 15

1.06 SUBMITTAL DOCUMENTATION REQUIRED

A. Chiller performance ratings conforming to and reported in accordance with AHRI-550/590 [capacity (tons), energy efficiency (kW/ton), water pressure drop (ft of water), Integrated Part Load Value (IPLV) efficiency or Non-Standard Part Load Value (NPLV)].

B. NPLV calculated to AHRI Standard 550/590 equation.

D. Statement of Compliance with ASHRAE 90.1.

E. Part Load Performance: Efficiencies at 10% load increments at the following entering condenser water temperatures (ECWTs): 85 °F, 80, 75, 70, 65, 60, 55, 50, 45, 40, 39, 38, 37, 36 or lowest minimum possible at each load. Demonstrate that chiller will provide 100% design capacity at the minimum possible ECWT. Clearly note any points where continuous, stable operation may not be achievable. Hold condenser water flow constant for all points.

F. Manufacturer's required maintenance schedule.

H. Manufacturer's recommended driveline teardown inspection intervals and estimated Labor costs.

I. List of components not designed for the life of the chiller including expected replacement
intervals and replacement part including labor costs (VSD capacitors, oil filters, bearings)

J. Acoustics:

1. Sound pressure levels are expected from measurements performed in accordance with AHRI-575.
2. Include estimates for each octave band and A-Weighted values at each of the four standard AHRI points.
    a. Manufacturer sound levels must meet or exceed the specified levels at all load points. Active sound control devices and attenuation should be supplied if required.

H. Unit Drawing: Indicate overall unit dimensions, key component locations and dimensions, and field connection details for piping and electrical wiring.

I. Floor layout drawing: Indicate centerlines; Indicate locations and dimensions of chiller points of contact with the floor.

J. Other Diagrams: Thermal insulation requirements diagram and vibration isolator diagrams.

K. Weights: Shipping weight, operating weight, weight of each major component, weight load at each vibration isolator.

L. Capacities and Charges: Refrigerant and Oil (if applicable).

M. Wiring Diagram: Including main power connections, control wiring connections (contacts and terminations), internal wiring schematic including transformers and other devices.

N. Electrical data: Job full load amperage, minimum circuit ampacity, max fuse size / breaker size.

O. Electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

1. Only single point chiller wiring is acceptable.

P. Control Panel Details: system operating data points, status messages, safety shutdowns, cycling shutdowns, trending capability, programmable set points, interface capability for data transfer.

Q. Safety Data Sheet (SDS) for any refrigerants used.

R. Manufacturer's warranty certificate.

1.07 SHIPMENT

A. Protect, pack and secure loose-shipped items and attach to chiller. Include detailed packing list of loose-shipped items, including illustrations and instructions for application.

B. Cap and seal water nozzle openings to prevent moisture, foreign materials and other objects from entering heat exchangers.

C. Provide reinforced shrink-wrap around entire exterior of the chiller. The membrane shall cover the entire top, sides and ends to fully protect the chiller during shipping and storage. Cover equipment, regardless of size or shape.

1. Ship units that are not shrink wrapped in an enclosed truck or shipping container. Tarping is not acceptable.

D. Ship chiller in one major assembly.

E. Ship refrigerant in the condenser barrel of the chiller.

1.08 KNOCKED-DOWN SHIPMENT AND REASSEMBLY

A. Chiller shall be fully assembled and tested before it is disassembled and prepared for shipment.

B. All disassembly work is to be performed at the manufacturer's factory prior to shipment.

C. No insulation shall be applied at the factory. Under a separate contract, field insulate chiller per manufacturer's insulation diagram and bill of materials.

D. Ship chiller knocked-down into four major assemblies:

1. Driveline (motor and compressor)
2. Evaporator shell
3. Condenser shell
4. Chiller starter (skidded)

E. Ship refrigerant separately. Mechanical contractor shall rig refrigerant into equipment room and place adjacent to the chiller. Manufacturer's technician shall charge unit at startup. Mechanical contractor shall remove and return empty refrigerant vessels.

F. Place compressor/motor assembly on skids. Seal refrigerant suction and discharge openings with a steel plate. Charge with dry nitrogen at 2-3 psig.

G. (If 2- or 4-piece shipment) Separate the evaporator and condenser shells. Close all refrigerant lines between the shells with steel cover plates. Charge with dry nitrogen at 2-3 psig.

H. Prepare and protect each piece for shipment per specification Section 1.07.

I. Perform all rigging work with rigging contractor's labor. Supervise rigging activities with a technician who is factory trained and employed by the chiller manufacturer. The technician (as a minimum) shall be present when the shells are set in place and leveled, and when the driveline, starter, and suction elbow are lowered into position on the shells.

J. The manufacturer's technician shall complete re-assembly, including tightening of bolts to their recommended torque ratings, reconnection of intra-chiller electrical wiring, control wiring, and refrigerant lines, etc.

K. The manufacturer's technician shall leak test the unit, checking thoroughly for leaks. Any leaks must be repaired before the technician charges the machine with refrigerant.

1.09 DELIVERY, STORAGE AND HANDLING

A. Follow manufacturer's recommendations for storage, handling and unloading.

B. Do not store equipment in wet or damp areas even when sealed and secured.

1.10 WARRANTY

A. Provide manufacturer's warranty for 18 months from the date of shipment from the factory or 12 months from commissioning; whichever comes first. Warranty shall cover parts and labor required to remedy defects in materials or workmanship for the entire chiller. Perform warranty work with manufacturer's factory-trained and factory-employed service technicians.

1.11 MAINTENANCE

A. Perform maintenance work using with manufacturer's factory-trained and factory-employed service technicians.

B. EXTENDED 5-Year Maintenance Agreement: Provide a 5-year extended maintenance agreement covering the period from the date of shipment to 66 months after the ship date. Provide the following each year, unless otherwise indicated:

1. Seasonal startup and shutdown
2. Four inspections including – but not limited to – the following:
    a. Operating temperatures and pressures
    b. Operating and safety controls
    c. Purge unit (if applicable)
    d. Starter: mechanical linkages, start contactors and timers. Dry run starter to ensure proper timing of starting sequence and proper starter operation. Recalibrate starter overloads. Change air filters if air-cooled starter provided.
    e. Once per year, make recommendations for the cleaning of each heat exchanger. Technician shall take measurements of small temperature difference across heat exchanger tubes and base the recommendation on this data.
3. Oil analysis (if applicable) and a refrigerant analysis. Submit results and recommendations to the owner.
4. Oil filter changes (if applicable)
5. Eddy current testing of evaporator (baseline and year 5)
6. Eddy current testing of condenser (baseline, year 3, and year 5)
7. Vibration analysis for chillers not utilizing magnetic bearings to levitate the shaft (baseline, year 3, and year 5)

PART 2: PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Basis of Design: YORK YMC2

B. The design scheduled and shown on the drawing are based upon products manufactured by Johnson Controls. Alternate equipment from the other acceptable manufacturers must meet the scheduled performance and comply with these specifications. If equipment manufactured by another manufacturer is utilized, then the Mechanical Contractor shall be responsible for coordinating with all affected Subcontractors to insure proper provisions for installation of the furnished unit. This coordination shall include, but is not limited to, the following:

1. Structural supports for units
2. Piping size and connection/header location
3. Electrical power requirements and wire, conduit and overcurrent protection sizes
4. The Mechanical Contractor shall be responsible for all costs incurred by the Sub-contractors, and Consultants to modify the building provisions (ductwork, piping, and wiring) to accept the furnished unit.

C. Approved Equal (Prior written approval by engineer of record is required)

2.02 GENERAL DESCRIPTION

A. Packaged centrifugal chiller including the following: evaporator, motor and compressor, capacity control device, condenser with integral sub cooler, variable refrigerant metering device, motor starter, control panel with user interface.

B. Provide chiller utilizing an HFC refrigerant that has an Ozone Depletion Potential (ODP) of ZERO, and with an assurance from the manufacturer that the unit shall be future compatible with a refrigerant that has no production phase-out date and no phase out date for equipment that uses that refrigerant.

C. Provide chiller to meet or exceed the scheduled performance within the limits of the scheduled parameters.

1. Chiller shall be capable of starting with entering condenser water temperatures as low as 30°F below the leaving chilled water design point at constant flows.

Chillers unable to start up with tower water temperatures as low as 36°F entering condenser water or 30°F below the design leaving chilled water temperature shall include field installed tower bypass lines to increase head pressure to an acceptable temperature. Contractor shall include all necessary piping and BAS modifications to ensure cold tower water start up.

2. Chiller shall be capable of continuous operation with ECWT as low as 36°F or 30°F below the design leaving chilled water temperature.

Chillers not capable of this operating range shall include field installation of water-to-water heat exchangers sized to provide sufficient cooling capacity for the chilled water system. Contractor is responsible for sizing, purchasing, and installing the heat exchanger including all piping and controls to ensure stable system operation when transitioning from chiller operation to water-to-water heat exchangers. Additional pump HP sizing shall also be calculated and included in the installation. (if applicable)
Water-to-water heat exchanger submittals shall include additional pumping and tower power consumption costs in addition to the required maintenance schedule and yearly costs to clean and maintain the heat exchanger. (if applicable)

D. Neoprene vibration isolation pads (for slab-on-grade or basement installations): provide four neoprene pads 7/8” thick (minimum) bonded to a steel plate for each support point.

E. Refrigerant isolation valves: two butterfly valves, one on the compressor discharge line and one on the liquid line.

2.03 HEAT EXCHANGERS

A. General requirements: evaporator and condenser

1. Heat exchanger type:

a. Evaporator: Shell and tube, hybrid falling film design

b. Condenser: Shell and tube, flooded design

2. Construct in accordance with the current ANSI/ASHRAE-15 Safety Code for Mechanical Refrigeration and ASME Pressure Vessels Code and shall bare the ASME stamped nameplate.

3. Shells: Carbon steel with fusion welded seams

4. Tubes: Internally rifled, externally enhanced, individually cleanable and individually replaceable from either chiller end, and roller expanded into tube sheets.

5. Tube supports: Carbon steel, 3/8" thick minimum, no more than 4 feet apart, self-supporting and welded to the shell.

6. End sheets: Carbon steel, 1" thick minimum.

7. Water boxes: Steel, bolted to end sheet, cover plate bolted to box, taps for vent and drain.

8. Pressure Relief: automatically reseating relief valves. Rupture discs are not acceptable.

B. Evaporator

1. Waterside working pressure: 150 psig.

2. Water boxes: Compact (end nozzle locations) with grooved connections.

3. Provide water box hinges or davits on both ends of the heat exchanger.

4. Tubes: Copper, removable from either end, minimum tube wall thickness of 0.035" at the plain lands contacting the intermediate tube supports and end sheets.

5. Suction baffle: Installed along the entire length of the evaporator.

6. Sight glass: Located such that the proper refrigerant charge is near the center of the glass when the machine is off.

C. Condenser

1. Waterside working pressure: 150 psig.

2. Water boxes: Compact (end nozzle locations) with grooved connections.

3. Provide water box hinges or davits on both ends of the heat exchanger.

4. Tubes: Copper, removable from either end, minimum tube wall thickness of 0.035" at the plain lands contacting the intermediate tube supports and end sheets.

2.04 REFRIGERANT FLOW CONTROL

A. Variable orifice

B. Refrigerant level sensing: Monitor refrigerant level in the condenser; report refrigerant level back to unit control panel and control chiller accordingly.

C. Refrigerant level control: Adjust valve position via control panel to optimize refrigerant level.

2.05 COMPRESSOR

A. Single stage.

B. Capacity control achieved with variable speed and mechanical capacity control utilizing pre-rotation vanes or variable geometry diffuser.

Pre-rotation vane material shall consist of cast-manganese-bronze or equivalent. Plastic is not an acceptable material for pre-rotation vanes, PRV assemblies, or other internal compressor components.

B. Fully accessible housing with vertical circular joints.

C. Direct driven

D. Magnetic bearings

1. Levitated shaft position shall be actively controlled and monitored by an X-, Y-, and Z-axis digital position sensor.

2. The compressor shall be capable of coming to a controlled, safe stop in the event of a power failure by diverting stored power from the DC bus to the magnetic bearing control system.

E. Mechanical linkage system that continuously monitors compressor-discharge gas characteristics and optimizes diffuser spacing to minimize impeller gas-flow disruptions.

F. The driveline (compressor and motor) and chiller starter shall be individual unit assemblies allowing for independent inspection, service, and repair/replacement. If an integrated driveline and starter package is utilized which is not fully field repairable, the supplier must provide one spare package with the unit.

G. The chiller shall utilize a single compressor that delivers the specified performance at all load and lift conditions.

2.06 MOTOR

A. Semi-hermetic permanent magnet motor.

B. Electrical connection: Steel terminal box with gasketed front access cover; overload and overcurrent transformers.

2.07 POSITIVE PRESSURE SYSTEM (NEGATIVE PRESSURE MACHINES)

A. Operates automatically when chiller is idle to prevent non-condensables from entering the system.

B. Factory install pressurization unit, including heater, wiring, pump, piping, valves, and controls.

C. Heater: Of sufficient capacity to pressurize machine above atmospheric pressure within 2 hours.

D. Controls: On / off / auto switch to automatically maintain positive pressure during idle periods.

E. Valves: Check valves and balancing valve

2.08 SOURCE QUALITY CONTROL: TESTS AND INSPECTIONS

A. Heat Exchangers (evaporator and condenser):

1. Design and test in full conformance to the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

2. Hydrostatically test evaporator and condenser refrigerant side at 1.3 times design working pressure AFTER tubing using LIQUID REFRIGERANT.

3. Alternative to item ‘2’ above, test at 1.1 times design working pressure AFTER tubing, using an approved air/gas mixture.

B. Compressor Components:

1. Leak tested at design working pressure using air under water.
2. Hydrostatic strength test at 1.5 times design working pressure.
3. To ensure UL label qualification, manufacturer shall perform a hydrostatic strength test at 3 times design working pressure every year on the compressor castings.
4. Statically and dynamically balance each impeller.
5. Overspeed test each impeller at 120% of its maximum design RPM.

C. Motor

1. Balance rotor in accordance with ISO 1940 G2.5 (performed by motor manufacturer).
2. High-potential test stator for dielectric strength for 60 seconds per UL1995 and 984 and the following formula: 2 * RATED VOLTAGE + 1000 (performed by chiller manufacturer).

D. Chiller air run test for 30 minutes:

1. Measure current and voltage across each phase.
2. Operate control panel, test functionality and log instrument readings at 10-minute intervals.
3. Operate oil pump motor and search lubrication system for leaks (if applicable).
4. Vibration readings on driveline assembly in the horizontal, vertical and axial planes.

E. Chiller leak integrity testing: Pressurize entire system to design working pressure. Leak test using soap and water. Repair any leaks and repeat test until leak tight.

F. Vacuum hold testing: Evacuate system to 500 microns and hold for one hour. Ensure that pressure does not rise more than 150 microns during the hour. Repair and repeat until passes.

2.11 CONTROL PANEL

A. Type: Microprocessor based, stand alone

B. Scope: Chiller operation, monitoring of chiller sensors, actuators, relays and switches, and display of all operating parameters.

C. Capability: Stable chiller operation at 36°F leaving chilled water temperature without warnings or shutdowns; no freezing or slushing of chilled water.

D. Enclosure: Lockable, NEMA 1

E. Information Display: 10.4” (minimum) color liquid crystal display (LCD) mounted on control panel enclosure door. All warning and safety faults shall include a text description. Panels with numerical codes requiring reference manuals for fault codes are not acceptable.

F. User interface: Operating parameters displayed in a user-friendly, color, and graphical format.

G. Keypad: Universal type with soft-keys

H. Temperature rating: 0 to 40 °C

I. System status information: Displayed on screen at all times, including the following as a minimum:

1. System status
2. System details
3. Control source (remote or local)
4. User access level
5. Date and time
6. Startup sequence timer
7. Shutdown sequence timer

J. Status messages: In color according to importance, indicate the following as a minimum:

1. Ready to start
2. Cycling shutdown – chiller will automatically restart
3. Safety shutdown – chiller requires manual restart
4. Soft shutdown – chiller requires manual restart
5. System run (with countdown timers)
6. Systems coast down (with countdown timers)

K. System operating information, including the following as a minimum:

1. Return and leaving chilled water and condenser water
2. Evaporator and condenser refrigerant saturation temperatures
3. Sub-cooling refrigerant temperature
4. Evaporator and condenser pressure
5. Evaporator tube and condenser tube small temperature difference
6. Compressor discharge temperature
7. Percent of motor full load current
8. Input power
9. KiloWatt hours
10. Operating hours
11. Refrigerant level position (condenser)
12. Motor winding temperature (each phase)
13. Average motor winding temperature
14. VSD – Output frequency

15. VSD – Output voltage (each phase)
16. VSD – Current (each phase)
17. VSD – Input current limit setpoint
18. VSD – Total supply KVA
19. VSD – Total power factor
20. VSD - Voltage total harmonic distortion (each phase)
21. VSD – Current total demand distortion (each phase)
22. VSD – DC bus voltage
23. VSD – DC bus current
24. VSD – Input and output Peak and RMS voltages and currents (each phase)
25. VSD – Internal ambient temperature
26. UPS Battery voltage
27. VGD Position
28. Discharge Pressure
29. Motor Housing and Winding Temperatures
30. MBC – Positions
31. MBC – Currents
32. MBC – Temperatures
33. MBC – Rotor Elongation
347. MBC – Motor Speed

L. Programmable setpoints including the following, as a minimum:

1. Chilled liquid temperature (setpoint and range)
2. Chilled liquid temperature cycling offset (shutdown and restart)
3. Motor current limit (%)
4. Pull-down demand (limit and time)

M. Schedule function: Programmable six-week schedule for starting and stopping the chiller, pumps and cooling tower.

N. Regional functionality: System language and units selection

O. Warning messages including the following, as a minimum:

1. Real time clock failure
2. Condenser or evaporator transducer error
4. Setpoint override
5. Condenser high pressure limit
6. Evaporator low pressure limit
7. MBC – Vibration

8. MBC – Landing counter high
9. Excess Surge Detection
10. Motor – High Housing, Rotor, and Winding Temperatures
11. Motor – High Current Limit
12. VSD – DC Bus Active
13. Liquid Level Setpoint Not Achieved
14. Loss of Subcooler Liquid Seal
15. Condenser – Freeze Threat From Low Pressure

P. Safety Shutdowns: Trigger a safety shutdown for any of the following, as a minimum:

1. Evaporator – low pressure
2. Condenser – high pressure
3. Condenser – high pressure contacts open
4. Auxiliary safety – contacts closed
5. Compressor discharge – high or low refrigerant temperature
6. Control panel – power failure
7. Motor or starter – current imbalance
8. Motor – high housing, winding, and rotor temperatures
9. Watchdog – software reboot
10. Sensor – failure or out of range
11. Transducer – failure or out of range
12. Surge Protection – Excess Surge
13. MBC – internal fault
14. MBC – high bearing temperature or current
15. MBC – startup failure
16. MBC – speed signal fault
17. MBC – overspeed fault
18. MBC – communication
19. MBC – rotor elongation
20. MBC – oscillator fault
21. MBC – rotor contraction
22. MBC – unauthorized rotation
23. MBC – high and low voltage
24. VSD – shutdown, requesting fault data
25. VSD – stop contacts open
26. VSD – 105% motor current overload

27. VSD – input current overload
28. VSD – high phase input and motor baseplate temperatures (each phase)
29. VSD – pre-charge lockout
30. VSD – ground fault
31. VSD – motor current total harmonic distortion (THD) fault
32. VSD – inverter or rectifier program fault
33. VSD – phase motor and input DCCT (each phase)
34. VSD – high total demand distortion
35. VSD – high phase input and motor current (each phase)
36. VSD – line voltage phase rotation
37. VGD Actuator Fault
38. VGD Positioning Fault
39. Safety Stop

Q. Safety Shutdowns: For each safety shutdown, indicate the following, as a minimum:

1. System status and details
2. Day and time of shutdown
3. Cause of shutdown with text description
4. Type of restart required

S. Cycling Shutdowns: For each cycling shutdown, indicate the following, as a minimum:

1. Multiunit cycling – contacts open
2. System cycling – contacts open
3. Control panel – power failure
4. Leaving chilled liquid – low temperature
5. Leaving chilled liquid – flow switch open
6. Condenser – flow switch open
7. Control panel – schedule
8. VGD Actuator – serial communications
9. Evaporator – low pressure
10. Condenser – freeze threat – flow switch open
11. Control Panel – loss of control voltage
12. MBC - position
13. MBC – low frequency displacement
14. MBC – vibration
15. MBC – speed signal fault
16. MBC – startup failure

17. MBC – serial communications fault
18. VSD shutdown – requesting fault data
19. VSD – fault contacts open
20. VSD – initialization failed
21. VSD – gate driver (indicate phase)
22. VSD – single phase input power
23. VSD – high or low DC bus voltage
24. VSD – pre-charge: low DC bus voltage
25. VSD – pre-charge: DC bus voltage imbalance
26. VSD – high internal ambient temperature
27. VSD – logic board power supply
28. VSD – low phase input and motor baseplate temperatures (each phase)
29. VSD – logic board processor
30. VSD – run signal
31. VSD – high phase input and motor current (each phase)
32. VSD – DC bus pre-regulation
33. VSD – input DCCT offset (each phase)

T. Security Access: Through ID and password recognition defined by a minimum of three different levels of user capability:

1. View: prevent unauthorized changing of setpoints.
2. Operator: allow local or remote control of chiller.
3. Service: In the event that advanced diagnostics are necessary for qualified service personnel.

U. Chiller information screen including on-screen display of the following, as a minimum:

1. Model number
2. Chiller serial number
3. Control panel serial number
4. Manufacturer contract number
5. Design voltage
6. Refrigerant type
7. Starter type
8. Original factory chiller rating information

V. Data tracking and trend display including on-screen graphical display of the following, as a minimum:

1. Parameters selected from a list of a minimum of 140 possibilities
2. Data collected once per second up to once per hour for each parameter

3. Data trend lines displayed for a minimum of 5 parameters at once

W. History: Store last ten shutdowns with text description and display all system parameters at the time of shutdown.

X. Memory: Non-volatile type containing operating program and setpoints, capable of retention for 10 years without memory loss, despite AC or backup battery power loss.

Y. Terminal strip has to be clearly numbered to accept field interlock wiring.

Z. Remote communications: Via electrical contacts, control panel capability to indicate the following as a minimum:

1. Ready to start contacts
2. Safety shutdown contacts
3. Cycling shutdown contacts
4. Running contacts

AA. Remote communications: Via 4-20 mA or 0-10V analog signals, control panel capability to adjust the following as a minimum:

1. Leaving chilled liquid setpoint
2. Current limit setpoint
3. Chiller start and stop

BB. Data logging and printing: Via RS-232 or similar, control panel capability for exporting at user-programmable intervals:

1. All system operating data
2. Shutdown and cycling messages
3. Operating details of last 10 cycling or safety shutdowns

2.12 COMPRESSOR MOTOR STARTER: VARIABLE SPEED DRIVE

A. General: Variable Speed Drive (VSD) compressor motor starter to start motor and control motor speed by controlling the frequency and voltage of the electrical power supplied to the motor.

B. Drive type: Pulse width modulated (PWM) utilizing insulated gate bipolar transistors (IGBTs).

C. Control Logic: Independently control motor speed and pre-rotation vane (PRV) position for optimum efficiency and operational stability. Base motor speed and PRV position on a minimum of 4 inputs: leaving chilled water temperature, return chilled water temperature, evaporator refrigerant pressure, condenser refrigerant pressure; Verify motor speed and PRV position and also use as inputs to the control logic.

D. Power Factor: At all loads and speeds, provide a minimum of a .97 power factor.

E. Capacitors shall not require scheduled replacement. If capacitors do not meet this requirement, the chiller manufacturer shall provide one spare sets of capacitors per compressor for the building owner’s stock.

F. Enclosure: NEMA-1 type with hinged access door with door interlock, lock and keys, and padlockable

G. Packaging: Factory mounted on chiller, piped to cooling circuit; wired to control panel and compressor motor; entire package (including active harmonic filter) shall be UL listed.

H. Cooling: Cool drive pole assembly components and internal ambient air via fluid-cooled, closed loop; all starter components accessible for service and replacement without opening the chiller's main refrigerant circuit.

a. VSD enclosures utilizing fans to circulate ambient plant room air for cooling shall include filters at air vents and openings to prevent dust accumulation on the circuit boards and VSD components.

I. Factory run test: Perform an electrical and mechanical run test of VSD starter prior to shipment to verify proper wiring and phasing.

J. Factory settings: Set starting design current and current overload settings prior to shipment.

K. Harmonic Distortion: Provide a drive and chiller system with an integrated active harmonic filter mounted inside the starter cabinet. System must generate harmonic distortion levels less than the following, measured at the input side of the drive:

1. Current: 5% maximum current total demand distortion

L. Inrush amperage: Limited to the design full load amperage of the chiller.

M. Protective devices: provide the following, as a minimum:

1. Electronic current-sensing overloads (1 per phase) – with indicating message on the control panel and reset button; shut down chiller upon detection of operating current exceeding 105% full load amperage.
2. High instantaneous current overload – with indicating message on the control panel and reset button; shut down chiller upon detection of starting current exceeding 115% of design inrush starting current for 1 second.
3. Phase rotation insensitivity
4. Single phase failure protection circuit with indicating light – shut unit down if power loss occurs in any phase at startup.
5. High temperature safety protection system on IGBTs with indicating light and reset button; via thermistors embedded on IGBT heat sinks – shut unit down if IGBT temperature exceeds acceptable limits.
6. Power fault protection for momentary power interruptions – interrupt power to the compressor motor within 4 line cycles upon detection of power interruptions longer than ¾ of a line cycle.
7. High and low line voltage protection.
8. Additional Voltage surge suppression devices if standard design unable to exceed IEEE C62.41.1 recommendations.

N. Features: Factory mount and wire the following as a minimum:

1. Control transformer: 115-volt and sized to power control panel and all unit controls.
2. Electrical lugs: Sized to accept the copper power lines required by the chiller.
3. Single point power: From electrical lugs at starter, power all powered devices on the chiller including control panel, control devices.
4. Circuit-breaker disconnect: Door interlocked; ground fault protection; minimum 100,000-A short circuit withstand RMS Symmetrical Amperes capacity.

O. Control panel readouts: Display on the control panel and provide to BAS via communication port the following as a minimum:

1. Output frequency
2. Output voltage
3. Output current (each phase)
4. Input power (kW)
5. Energy consumption (kWh)
6. Elapsed running time
7. Three phase voltage total harmonic distortion (THD)
8. Three phase current total demand distortion (TDD)
9. Total unit power factor
10. Total supply KVA

2.13 FINISHES

A. Dry chiller components for shipment, including inside of water boxes and tubes.

B. Blast and clean chiller surfaces thoroughly. Apply prime coat for painting.

C. Paint all exposed surfaces with alkyd-modified, vinyl enamel machinery paint, including all factory-applied insulation for consistent color matching. If not painted in the factory, paint over insulation in the field with manufacturer's standard paint and color.

2.14 VERIFICATION OF PERFORMANCE:

A. Execute test per AHRI Standard 550/590.

B. One representative from both the owner and the engineer shall witness test. Manufacturer shall pay food, lodging and transportation expenses for two witnesses.

C. AHRI Points Test: Factory test each chiller for capacity and efficiency at the four standard AHRI rating points:

1. 100% load and 85 °F entering condenser water temperature (ECWT) and design flow rates
2. 75% load and 75 °F ECWT and design flow rates

3. 50% load and 65 °F ECWT and design flow rates
4. 25% load and 65 °F ECWT and design flow rates
5. 25% load and 55 °F ECWT and design flow rates
6. 25% load and EWCT equal to the design entering evaporator water temperature and design flow rates

D. Cold Condenser Water Test: Factory test each chiller for capacity and efficiency at the four standard AHRI rating points:

1. 100% load and EWCT equal to the design entering evaporator water temperature and design flow rates
2. 75% load and EWCT equal to the design entering evaporator water temperature and design flow rates
3. 50% load and EWCT equal to the design entering evaporator water temperature and design flow rates
4. 25% load and EWCT equal to the design entering evaporator water temperature and design flow rates

E. Extended Duration Test: Factory test each chiller for capacity and efficiency at the four standard AHRI rating points for four hours:

1. 100% load and 85 °F entering condenser water temperature (ECWT) and design flow rates
2. 75% load and 75 °F ECWT and design flow rates
3. 50% load and 65 °F ECWT and design flow rates
4. 25% load and 65 °F ECWT and design flow rates
5. 25% load and EWCT equal to the design entering evaporator water temperature and design flow rates

F. Should a unit fail any test, treat unit with a permanent remedy at manufacturer's expense until the test is successfully passed.

G. Provide test data and results in a report to the owner.

H. After the test and prior to shipment, perform the following:

1. Check / change oil filter (if applicable).
2. Drain oil from sump (if applicable).
3. Drain water from boxes and heat exchangers and dry thoroughly.
4. Remove refrigerant and pressurize refrigerant side to 5 psig with dry nitrogen unless shipping with refrigerant in unit.
5. Follow procedures in PART 1, Section 1.07 (SHIPMENT).

PART 3: EXECUTION

3.01 INSTALLATION

A. General Requirements: Install per industry standards, applicable building codes and manufacturer's written instructions.

B. Refrigerant: Rig refrigerant into equipment room and place next to what will be the final location of the chiller. Manufacturer will be responsible for charging the machine.

C. Temporary use: Use of any chiller for temporary heating, cooling or ventilation is strictly prohibited unless a complete inspection and startup has been performed by manufacturer's factory-trained and factory-employed service personnel.

D. Concrete base: Install chiller on a minimum 4" thick reinforced concrete pad, designed to support the operating weight of the unit.

E. Level the chiller to within ¼" in both directions (end-to-end and side-to-side).

F. Access clearance: For regular service and tube pull clearances, install chiller with the following minimum recommended clearances:

1. End of unit: distance equal to the length of the heat exchanger shell
2. Front of unit (control panel side): 3 feet minimum
3. Rear of unit: 2 feet minimum
4. Top of unit: 2 feet minimum

3.02 FIELD QUALITY CONTROL

A. Storage: Store per chiller manufacturer's written recommendations. Store chiller indoors in a warm, clean, dry place where the chiller will be protected from weather, construction traffic, dirt, dust, water and moisture. If chiller will sit idle for more than 3 months, purchase long-term storage service from the manufacturer to ensure warranty coverage.

B. Rigging: Follow manufacturer's written instructions for rigging, off-loading, and use of rigging tools such as spreader bars, forklifts, come-a-longs, and shackles.

3.03 STARTUP SERVICE

A. Provide two weeks' notice to chiller manufacturer's service department for startup.

B. Notify chiller manufacturer's service department once chiller has been fully piped and wired for primary power and controls, including flow switches. Confirm that sufficient load will be available for starting the chiller on the desired date.

C. Hire manufacturer's factory-trained and factory-employed service technicians for a minimum of three days to startup, test, check, and adjust chiller.

D. Technicians shall perform the following steps as a minimum:

1. Check chiller installation.
2. Charge the machine with refrigerant.
3. Energize the machine disconnect switch.
4. Verify correct voltage, phases and cycles.

5. Energize motor briefly and verify correct direction of rotation.
6. Start the chiller.
7. Test machine for performance within design rating parameters.
8. Make adjustments as required.

E. Submit a startup report summarizing findings and activities performed.

3.04 OWNER INSTRUCTION

A. Provide training of the owner's personnel. Cover startup, shutdown, general maintenance and troubleshooting. Review operating and maintenance manual and familiarize personnel with control panel, including its special features and capabilities.

B. Provide a minimum of 4 hours of training for owner's personnel by manufacturer's factory-trained and factory-employed service technician.

C. Training shall include control panel, motor starter / VSD, operation, maintenance requirements.

D. Training shall include startup and shutdown procedures as well as regular operation and maintenance requirements.

3.05 CLEANING

A. Clean exterior prior to transfer to owner.

3.06 DOCUMENTATION

A. Provide Installation, Operation & Maintenance Manual(s) in the chiller's control panel door. Provide six additional copies for owner's project system manual.

B. Provide six copies of Spare Parts Manual for owner's project system manual.

END OF SECTION 23 64 16

SECTION 23 65 16
INDUCED DRAFT COOLING TOWERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cooling tower.

B. Safety railings and ladder.

1.2 RELATED REQUIREMENTS

A. Section 23 05 10 - General Mechanical.

B. Section 23 05 13 – Motors for HVAC Equipment.

C. Section 23 21 13 - Hydronic Piping.

D. Section 23 05 53 - Identification for HVAC Piping and Equipment

E. Section 23 05 93 - Testing, Adjusting, And Balancing For HVAC.

F. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; American Bearing Manufacturers Association, Inc.; 2015.

B. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings; American Bearing Manufacturers Association, Inc.; 2014.

C. CTI ATC-105 - Acceptance Test Code; Cooling Technology Institute; 2000.

1.4 SUMMARY

A. Provide all labor, materials, transportation and equipment to complete the furnishing, installation, assembly, set up, connection, and testing of the induced-draft cooling tower work indicated on the drawings and specified herein. Notwithstanding any detailed information in this Section, provide a complete, working system.

1.5 SUBMITTALS

A. Refer to Section 23 05 10 - General Mechanical Requirements, for submittal procedures.

B. Product Data: Provide rated capacities, pressure drop, performance curves with selected points indicated assembled dimensions, weight and point loadings, accessories, required clearances, control panels, electrical requirements and wiring diagrams, furnished specialties, accessories, and location and size of field connections. Submit schematic indicating capacity controls.

C. Shop Drawings: Indicate suggested structural steel supports including dimensions, sizes, and locations for mounting bolt holes.

D. Tower Base Shop Drawings: Refer to the details indicated on the mechanical drawings and provide dimensioned shop drawings for the tower base type specified.

E. Manufacturer's Instructions: Submit manufacturer's complete installation instructions.

F. Manufacturer's Certificate: Certify that cooling tower performance, based on CTI ATC-105, meet or exceed specified requirements, and submit performance curve plotting leaving water temperature against wet bulb temperature.

G. Operation and Maintenance Data: Include start-up instructions, maintenance data, parts lists, controls, and accessories; Operations and Maintenance Manual.

H. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in the Owner's name and registered with manufacturer.

I. Certificate: Provide Manufacturer's Certificate complying with the requirements of the General Conditions.

1.6 QUALITY ASSURANCE

A. Verification of Performance:

1. The thermal performance shall be certified by the Cooling Technology Institute in accordance with CTI Certification Standard STD-201. Lacking such certification, a field acceptance test shall be conducted within the warranty period in accordance with CTI Acceptance test Code ATC-105, by a certified CTI Thermal testing Agency. The Evaporative HEAT Rejection Equipment shall comply with the energy efficiency requirements of ASHRAE 90.1
2. Unit Sound Performance ratings shall be tested to CTI ATC-128 standard. Sound ratings shall not exceed specified ratings.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Factory assemble entire unit. For shipping, disassemble into large sub-assemblies to minimize field work required for re-assembly.

B. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

1.8 WARRANTY

A. See Section 23 05 10 - General Mechanical Requirements, for additional warranty requirements.

B. Provide a five-year warranty to include coverage for corrosion resistance of cooling tower structure, labor only.

C. Fan Motor/Drive System: Warranty Period shall be five years from the date of shipment from the Factory (fan motors, fans, bearings, mechanical support, sheaves, bushings, and belts).

PART 2 PRODUCTS

2.1 STEEL COOLING TOWERS

A. Manufacturers:

1. Basis of Design: EVAPCO, Inc.; Model USS 29-4J21.
2. Acceptable Alternate Manufacturers with approval of Owner’s Representative and Engineer:
   i. Baltimore Aircoil Company: approved model
   ii. Marley Cooling Tower/A United Dominion Company: approved model.

B. Thermal Performance:

1. The unit shall be capable to cool 1,350 GPM of water entering at 95.00°F at a design wet bulb of 80.20°F.

C. IBC Compliance:

1. The unit structure shall be designed, analyzed, and constructed in accordance with the latest edition of the South Carolina Building Code for Ip = 1.0, SDS = 0.84, P = 119 psf.

D. Components:

1. Description: Factory assembled and tested, induced-draft, counter-flow, cooling tower complete with fan, fill, louvers, accessories, and rigging supports.
2. Materials of Construction:
   i. All cold-water basin components including vertical supports, air-inlet louver frames, and panels up to rigging seam shall be constructed of Type 304 stainless steel. All factory cold water basin seams shall be welded for water tight construction.
   ii. Casing and fan section, including channels and angle supports, shall be constructed of Type 304 stainless steel. Fan cowl and guard shall be constructed of Type 304 stainless steel. “Series 300” stainless steel will not be acceptable as equivalent to Type 304 stainless steel.
3. Fans:
   i. Unit shall be provided with super-low sound fans. Fans shall be high efficiency, axial, propeller type, with non-corrosive fiber-reinforced polyester blade construction. Fans shall be heavy duty and utilize a forward swept blade design for sound reduction. Each fan shall be dynamically balanced and installed in a closely fitted fan cowl with venture air inlet for increased fan efficiency.
4. Drift Eliminators:
   i. Drift eliminators shall be constructed entirely of polyvinyl chloride (PVC) in easily handled sections. Design shall incorporate three changes in air direction and limit the water carryover to a maximum of 0.001 percent of the recirculating water rate.
5. Water Distribution System:
   i. Spray nozzles shall be precision molded ABS, large-orifice, nozzles utilizing a technology to achieve enhanced water distribution over the fill media. Nozzles shall be designed to minimize water distribution system maintenance. Spray header and branches shall be Schedule 40 PVC for corrosion resistance with a steel connection to attach external piping.
6. Heat Transfer Media:
   i. Fill media shall be constructed of PVC with cross-fluted design and suitable for inlet water temperatures up to 130°F. the bonded block fill shall be bottom supported and suitable as an internal working platform. Fill shall be self-extinguishing, have a flame spread of 5 under A.S.T.M. designation E-84-81a, and shall be resistant to rot, decay, a biological attach.
7. Air Inlet Louvers:
   i. The air inlet louver screens shall be constructed from Ultraviolet (UV) inhibited PVC and incorporate a framed interlocking design that allows for easy removal of louver screens for access to the entire basin area for maintenance. The louver screens shall have a minimum of two changes in air direction and shall be of a non-planar design to prevent splash-out and block direct sunlight and debris from entering the base.

E. Motors and Drives

1. General requirements for motors are specified in Section 23 05 13 HVAC Motor Requirements.

2. Fan motors shall be totally enclosed, ball-bearing type electric motor(s) suitable for moist air service. Motor(s) shall be Premium Efficient, Class F insulated, 1.15 service factor design. Inverter rated per NEMA MG1 Part 31.4.4.2 and suitable for variable torque applications and constant torque speed range with properly sized and adjusted variable frequency drives.
3. Fan drives shall be multi-groove, solid-back, V-belt-type with QD tapered bushings designed for 150% of the motor nameplate power. The belt material shall be neoprene reinforced with polyester cord and specifically designed for evaporative equipment service. Fan sheave shall be aluminum alloy construction. Belt adjustment shall be accomplished from the exterior of the unit.
4. Fan shaft shall be solid and polished stainless steel.
5. Fan shaft bearings shall be heavy-duty, self-aligning ball-type bearings with extended lubrication lines to grease fittings located on access door frame. Bearings shall be designed for a minimum L-10 life of 100,000 hours.
6. Unit shall be provided with a vibration cutout switch, operating on 120 VAC feed, to protect the fan and drive assembly from damage in the event of excess vibration. Vibration switch shall be DPDT.

F. Design Loading:
1. The tower and all its components shall be designed to withstand a wind speed range of 133 to 144 miles per hour, as well as seismic design category C, per the South Carolina Building Code. It shall be designed to withstand shipping and hoisting loads of 2g horizontal and 3g vertical.
2. The fan deck and hot water basin covers shall be designed for 50-psf live load or a 200-lb. concentrated load. Fork lift slots shall be provided in the basin side supports to allow handling of the tower at grade level
3. Handrails shall be capable of withstanding a 200-lb. concentrated live load in any direction, and shall be designed in accordance with OSHA guidelines.

G. Distribution Basin:
1. The hot distribution basin shall be of stainless steel, Type 304 construction, gravity type basin utilizing weirs and plastic metering orifices , with flow control valves and covered with removable or sliding basin covers.
2. Single bottom inlet connection with factory PVC piping.

H. Pipe-to-Equipment Connections: grooved.

I. Maintenance Access:
1. Fan Section:
   i. Access door shall be hinged and located in the fan section for fan drive and water distribution system access. Swing away motor cover shall be hinged for motor access.
2. Basin Section:
   i. Framed removable louver panels shall be on all four sides of the unit for pan and sump access.
3. Internal Working Platform:
   i. Internal working platform shall provide easy access to the fans, belts, motors, sheaves, bearings, all mechanical equipment, and complete water distribution system. The fill shall be an acceptable means of accessing these components.
4. Ladder:

i. An aluminum sloped ladder shall be provided and attached to the outside of the unit for access to the motor-access door.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Refer to the project drawings and the mechanical details for modifications of the existing tower support.

C. Install tower on the modified, existing structure.

D. Connect condenser water piping with grooved connections to tower. Pitch condenser water supply to tower and condenser water suction away from tower. Refer to Section 23 21 13.

3.2 SYSTEM STARTUP

A. Start no equipment or systems until all manufacturer’s start-up checklists have been completed, signed, and sent to the Owner’s Representative and the Engineer for approval.

B. Inspect tower and basin after installation verifying installation is in accordance with specifications and manufacturer's recommendations.

C. Start-up tower and basin and instruct the Owner's personnel in the operation and maintenance of the equipment.

D. Provide start-up certificate in the format prescribed by the General Conditions.

3.3 SCHEDULES

A. Refer to Schedule on Drawings.

END OF SECTION 23 65 16