Authority Boiler Repair and

Snow Melt System Activation Project

Project Manual

Prepared by:

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August 2017

The Transit Authority of the City of Omaha (Authority)

Boiler Repair and Snow Melt System Activation Project

AUTHORITY

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d.b.a. Authority
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Omaha, Nebraska 68102
Telephone: (402) 341-7560

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The Transit Authority of the City of Omaha (Authority)

Boiler Repair and Snow Melt System Activation Project

TABLE OF CONTENTS

SPECIFICATIONS:

END TABLE OF CONTENTS

BID SOLICITATION

Authority – Boiler Repair and Snow Melt System Activation Project

AUGUST 30, 2017

The Transit Authority of the City of Omaha (Authority) will receive bids for a combined contract for the Work associated with The project is described as the connection of existing snow melt piping within the 21st and 22nd Street drive lanes (at the site of the Administration Facility of the Transit Authority of the City of Omaha located at 2222 Cuming Street in Omaha, Nebraska) to the existing boiler system. The project is located at Authority's Administration Facility, 2222 Cuming Street in Omaha, Nebraska. A more detailed description of the Work of the project is included in the Project Manual.

Bids will be received under the conditions set forth in the documents included in this Project Manual.

A Pre-Bid Conference will be held at the project site on September 7th, 2017 at 2:00 pm See Information for Bidders for exact times and location. This meeting will include a review of the scope of work, and bidders will have the opportunity to ask questions. All bidders are strongly encouraged to attend the Pre-Bid Conference. While the Pre-Con is optional, this will be the bidders only opportunity to perform a site visit prior to bid due date.

Contract Documents will be available online at the Authority website www.ometro.com and at www.standardshare.com. Hardcopies can be downloaded from the StandardShare website for a fee.

Hardcopies are also available at Standard Digital Imaging, 4426 South 108th Street, Omaha, Nebraska, 68137 / Phone: 402-592-1292, and may be obtained for a refundable deposit of $100.00 per set (make checks payable to Authority). The entire deposit will be refunded upon return of the documents in satisfactory condition within thirty (30) days of the bid date.

Documents may also be examined at any of the following locations:

- **Dodge Data/Bee Line & Blue**, 2507 Ingersoll Avenue, Des Moines, IA 50312 (515-981-5654)
- **Omaha Builders Exchange**, 4159 South 94th Street, Omaha, NE 68127 (402-991-6906)

Bidders will be required to provide bid security in the form of a Bid Bond as noted in the Information for Bidders section of the Project Manual. The selected Bidder will also be required to provide a Performance Bond and Labor and Material Payment Bond as noted in the Information for Bidders section.

Attention is called to the special provisions of the contract based upon the Federal Clauses for Procurement of Construction, Davis-Bacon Wage Rates, Disadvantaged Business Program, and Small Business Participation Program requirements detailed herein.

INFORMATION FOR BIDDERS

Authority – Boiler Repair and Snow Melt System Activation Project

1. **DESCRIPTION OF PROJECT**

   A. The project is described as the connection of existing snow melt piping within the 21st and 22nd Street drive lanes (at the site of the Administration Facility of the Transit Authority of the City of Omaha located at 2222 Cuming Street in Omaha, Nebraska) to the existing boiler system.

   B. Davis-Bacon Wage Rates will apply to this contract.

2. **SECURING OF, AND COMPLIANCE WITH, BIDDING DOCUMENTS**

   A. Drawings, Specifications, and other bidding documents may be obtained at the time and place indicated on the BID SOLICITATION. Bidders shall comply with all conditions stipulated in these bidding documents.

3. **REQUIREMENTS BEFORE SUBMITTING BIDS**

   A. Thoroughly examine the site and any building located thereon in relation to conditions which might directly or indirectly affect the contract work. The bid sum shall reflect all such affecting conditions. Bidders shall be responsible for verifying conditions and dimensions that may affect the Work.

   B. A Pre-Bid Conference will be held on Thursday, September 7th , 2017, at 2:00 pm at the project site. Although not mandatory, it is strongly recommended that all Prime Bidders attend this Pre-Bid Conference. While the Pre-Con is optional, this will be the bidders only opportunity to perform a site visit prior to bid due date. Interested Subcontractors are also welcome to attend. The Conference will begin in the Authority Board Room of the Transit Authority offices located at 2222 Cuming Street (project site). This Conference will be the only opportunity for bidders to tour the project site unless otherwise modified by addendum in Authority's sole discretion. Minutes of the Pre-Bid Conference are not binding unless issued in an Addendum.

4. **REQUESTS FOR CLARIFICATION**

   A. If any bidder is in need of clarification of any part of the Contract Documents, they may make the request of the Architect by using the "Request for Clarification" form (Sample Form included in this Project Manual).

   B. Architect will promptly review the request and respond by Addendum to all bidders. Verbal instructions or interpretations will have no validity regardless of source.

   C. Requests for clarifications shall be to SRF office by 5:00pm on Wednesday September 13th, 2017. A subsequent addendum will be issued to address the requests and will be the final opportunity for bidders to obtain clarifications.

5. **PRODUCT OPTIONS AND SUBSTITUTIONS**

A. If any bidder desires to request a product substitution to be considered for the Work, they shall make application to the Architect by using the "Request for Substitutions / Approved Equals" form (Sample Form included in this project manual).

B. Architect will promptly review the request and respond by Addendum to all bidders. Verbal instructions or interpretations will have no validity regardless of source.

C. Requests for substitutions shall be to SRF's office by 5:00pm on Wednesday September 13th, 2017. A subsequent addendum will be issued to address the requests and will be the final opportunity for bidders to obtain approvals for substitutions.

6. **PREPARING AND SUBMITTING BIDS**

A. Bids shall be prepared on the bid form included in this Project Manual.
   1. Bids must include the pricing for Base Bid and all Unit Prices noted on the provided form.

B. The Bidder's legal name and business address shall be stated in full.

C. Bids shall bear no information other than that requested on the bid form. Bid form shall bear no other marks, erasures, writing, changes, or interlineations.

D. No verbal, facsimile, telegraphic, or telephonic bids, modifications, or cancellations will be considered.

E. The bidder guarantees there shall be no revisions or withdrawal of the bid amount for a period of 60 days after bid opening.

F. Protest Procedures:

   1. Protests made in connection with this solicitation shall be limited to those allowable by, and made in compliance with, the procedures established by the Authority, copies of which may be obtained from the Executive Director of the Authority upon written request. All protests shall be concise, direct and sufficient to permit the Authority to determine the full and complete basis therefore, fully supported by all current, relevant objective information, documentation or support considered necessary by the protestor that is completely accurate in all material respects. Procedures for appeals from any such decision are set forth in the Authority's protest procedures.
   2. Protest of a denial or approval of any request for clarification or approved equal shall be made in writing received by the Grant Administrator by no later than ten (10) business days before the due date. The Authority shall decide the protest by no later than five (5) business days prior to the due date.
   3. Protest of the award of a contract must be made in writing received by the Executive Director of the Authority not later than ten (10) business days after the earlier of the award of the Contract or the announced intention of the award of the Contract.
   4. The filing or approval of any protest or appeal may result in the extension of the due date, the issuance of an Addendum, the withdrawal of the solicitation or the reconsideration of any award of a contract, in the sole discretion of the Authority.

5. In the event of an appeal from the award of a contract, the award shall not be considered final or binding upon the Authority unless the award is thereafter confirmed in writing by the Executive Director.

6. For information purposes only, the Federal Transit Administration (FTA) will not accept any protest or appeal from any decision of the Authority unless the Authority fails to have any written protest procedures, the Authority fails to follow such procedures or the Authority fails to review a timely protest. An Applicant must exhaust all administrative remedies with the Authority before pursuing a protest with FTA. An appeal to FTA must be received by the appropriate FTA regional or Headquarters Office within five (5) business days of the date the Applicant knew or should have known of the violation.

H. Authority reserves the right in its sole discretion: to amend the solicitation at any time prior to the Bid deadline by Addendum; to reject any and all Bids; to waive minor irregularities contained in any Bid; to rely upon any information obtained through its own investigation of the Applicant or its Bid or that of any department, agency or any other appropriate governmental entity; and to withdraw the solicitation at any time, including after the Bid deadline, without the award of a Contract.

7. **BID DATE & LOCATION**

A. Sealed bids are due on **September 20th, 2017 at 2:00 PM** in the Authority Board Room located in the Transit Authority Offices at 2222 Cuming Street, Omaha, Nebraska, 68102. The bid proposals will be opened and read in alphabetical order at that time.

8. **BID BOND**

A. A Bid Bond in the amount of 5% of the Base Bid is required as part of the submission documents for bidding.

9. **PERFORMANCE BOND**

A. The successful Bidder shall furnish a Performance Bond and Labor & Material Payment Bond, each in the amount of 100% of the contract sum, whether the initial contract or additional contract pursuant to Paragraph 11, written by a surety licensed to do business in the State of Nebraska, and who is acceptable to the Authority.

B. The Bidder shall deliver the required bonds to the Authority not later than the date of execution of the contract, or if the Work is commenced prior thereto in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Authority that such bonds will be furnished.

10. **PERMITS**

A. Contractor shall be responsible to obtain and pay for all required permits, authorizations, and approvals, etc. from authorities having jurisdiction over the project.

11. **TAXES**

A. Do not include sales tax in bid amounts. The Project is tax-exempt. NE Form 13 will be provided to the selected Bidder.

12. **EVALUATION OF BIDS**

A. The Alternates, represent options any one of which may or may not be awarded by the Authority at its sole discretion. In accordance with FTA Circular 4220 1F, the Authority will not evaluate Bids for any Alternate when the Authority determines that the evaluation would not be in the Authority's best interest, as determined in accordance with this Paragraph 12. The Authority shall determine the lowest responsive bidder by aggregating the sum of the base bid plus those bids for Alternates that the Authority anticipates will be awarded assuming the availability of funds, as determined in the Authority's reasonable discretion. Alternates will be so evaluated in the numerical order as set forth in Section 01 1030. The Authority reserves the right to award an initial contract to the lowest responsive bidder for the base bid plus any or all of the Alternates so evaluated; provided, however, Authority further reserves the right to award one or more additional contracts at any time within 120 days after the award of the initial contract to such lowest responsive bidder from among those Alternates so evaluated but not made part of the initial contract.

B. In the event Authority receives only a single responsive Bid, Authority will determine if competition was adequate and if deemed to be adequate, conduct a price and/or cost analysis of the Bid. The Respondent will be required to furnish cost and pricing data to support this analysis. If Authority is unable to determine the bid price is fair and reasonable, Authority reserves the right to enter into negotiations with the Bidder to attempt to establish a different price that can ultimately be determined to be reasonable.

13. **PROJECT DURATION / SCHEDULE**

A. Substantial Completion shall be no later than December 15, 2017 and Final Completion date of all Work associated with the project shall be no later than 31 December, 2017.

B. Project will commence upon Notice to Proceed from the Authority. Extensions beyond this period will require written approval of the Transit Authority.

END OF DOCUMENT

General Information for Proposers

Notification of Federal Participation: This project is financed in part by the FTA. Accordingly, federal requirements apply to this contract. In the event these requirements are revised during the performance of this contract, the proposer shall incorporate those revised provisions mandated by the FTA.

Neither the Contractor, nor any party contracting with the Contractor, shall be deemed to be an agent or employee of Authority. The Contractor is, and shall be, an independent Contractor, and the legal relationship of any person performing services for the Contractor shall be one solely between said parties.

Contractor shall not subcontract any services to be performed by it under this Agreement without the prior written approval of Authority, except for service firms engaged in drawing, production, typing and printing. Contractor shall submit all subcontractor contracts to Authority for review and approval. Contractor shall be solely responsible for reimbursing any sub-Contractors and Authority shall have no obligation to them.

Ownership of Work: All reports, designs, drawings, plans, specifications, schedules and other materials prepared, or in the process of being prepared, for the services to be performed by the proposer for Authority shall be and are the property of Authority. Authority shall be entitled to access during the progress of this work. In the event the work, subject to this agreement, is not completed, for any reason whatsoever, all materials generated under this agreement will be delivered to Authority, as Authority directs.

Any and all rights, title, and interest (including without limitation copyright and any other intellectual-property or proprietary right) to materials prepared under this Agreement are hereby assigned to Authority. The Contractor agrees to execute any additional documents which may be necessary to evidence such assignment. The Contractor represents and warrants that all materials prepared under this Agreement are original or developed from materials in the public domain (or both) and that all materials prepared under, and services provided under, this Agreement do not infringe or violate any copyright, trademark, patent, trade secret, or other intellectual-property or proprietary right of any third party.

Contractor shall indemnify, defend and hold harmless Authority to the maximum extent permitted by law from and against any and all claims, liabilities, losses, damages or expenses (including attorneys' fees and related costs, whether or not litigation has commenced), whether direct or indirect, arising out of, relating to, or in connection with any claim or allegation that the ownership, possession, maintenance, modification, or any other use of any software, equipment, devices, processes, or other materials provided by Contractor directly or indirectly, (including without limitation through any sub-Contractor or supplier) infringe or violate the patent, copyright, trade-secret, or other intellectual-property or proprietary rights of any third party. In case any such software, materials, equipment, devices, processes, or other materials are held to constitute an infringement and their use enjoined, Contractor, at Contractor's sole cost and expense, shall: (a) secure for Authority the right to continue using the materials, equipment, devices or processes by suspension of the injunction or by procuring a royalty-

free license, or licenses, (b) replace such materials, equipment, devices, or processes with non-infringing materials, equipment, devices, or processes, or (c) modify them so that they become non-infringing or remove the enjoined materials, equipment, devices or processes and refund the sums paid for them without prejudice to any other rights of Authority. The option of (a), (b), or (c) in the preceding sentence must be selected in consultation with Authority and with Authority's consent, which shall not be unreasonably withheld. The option may not entail an unreasonable or excessive amount of time or cause undue disruption to Authority's operations.

This IFB shall consist of those documents designated below together with any Addenda that may be issued by the Authority prior to the Due Date. Applicants are responsible for making certain that all materials have been obtained. The following Exhibits must be signed and returned with your submission.

- Exhibit “A” to the General Conditions, Federal Clauses for Procurement of Construction
- Exhibit “B” to the General Conditions, Debarment/Suspension - Prime
- Exhibit “C” to the General Conditions, Debarment/Suspension - Sub
- Exhibit “D” to the General Conditions, Affidavit of Non-Collusion – Prime
- Exhibit “E” to the General Conditions, Lobbying Certification
- Exhibit “F” Request for Clarification
- Exhibit “G” Acknowledgement of Addendum
- Exhibit “H” Conflict of Interrest Disclosure
- Exhibit “I” Buy America Acknowledgement
- Exhibit “J” Davis Bacon Wage Acknowledgement

GENERAL CONDITIONS

1.0 DEFINITIONS. Whenever used in this IFB, the following capitalized and other terms shall have the meaning ascribed to them set out below, and as may otherwise be defined in this IFB.

ADDENDUM	A written amendment or modification to the IFB, issued by the Authority in conformity with the IFB.
APPLICANT	Person who submits a Proposal. The term "Bidder" or "Offeror" is occasionally used in the Laws or Contract Documents to mean the Applicant or the Contractor. Such term shall therefore be construed to apply to Applicant whenever the context shall require.
AUTHORITY	Transit Authority of the Authority of the City of Omaha d/b/a/ Authority.
CONTRACT	The agreement between the Contractor and the Authority to perform the Work for the Project. The Contract shall consist only of the Contract Documents, including: their respective covenants, terms, conditions and other provisions; and any exhibits, schedules, drawings, specifications or other instruments or documents referenced in, by, or otherwise incorporated into, any Contract Documents. To the extent there exists any inconsistency among the Contract Documents, that which is deemed by the Authority to be most advantageous shall apply. The performance of the Contractor, including that of its Subcontractors, shall conform to, and shall be consistent with, the Contract. The Contract shall continue until the completion of the performance of the Work, unless earlier terminated as provided in Section 1.4.
CONTRACT DOCUMENTS	The Contract Documents shall mean and include: the IFB; the Proposal/Bid, including any permitted or negotiated modifications/ amendments thereto; the executed Pricing Schedule; any executed Acknowledgement of Addenda; any Request for Clarification and Approved Equal; any executed Certification required by the IFB; the Contract award; all bonds and policies or evidence of insurance; any separate written agreements between the Authority and the Contractor related to the Project or the Work, including, if required, a duly executed agreement; and any other material or document designated by the Authority as a Contract Document.
CONTRACTOR	The Applicant receiving the award of a Contract. Unless otherwise required by this Contract, references to the Contractor shall include Contractor and Subcontractors, including its and their employees, agents, successors and assigns. The term "Bidder" or "Offeror" is occasionally used in the Laws or Contract Documents to mean the Applicant or the Contractor. Such term shall therefore be construed to apply to Contractor whenever the context shall require. Similarly, the term "installer", "third party contractor", "lower tier participant" shall therefore be construed to apply to Contractor whenever the context shall require.
DAYS	Days shall mean business days unless otherwise expressly provided.
D.O.T.	Department of Transportation.
F.T.A.	Federal Transit Administration.

IFB	Invitation for Bid. This invitation is for Specification No. 08-17 issued August 30, 2017, consisting of those items identified in this document, together with any Addendum
INCLUDING	The term “including” shall mean “including without limitation”, whether or not expressly so provided.
LAW	The laws of the State of Nebraska applicable to the Project and the Work, any local ordinances applicable to the same and, except to the extent prohibited by the laws of the Sate of Nebraska, any existing or future requirement, provision, condition of any federal law, rule, regulation, order, policy, directive, or procedure governing the Project or applicable to the Work, including those federal requirements included, identified or referenced in Exhibit “A” to this IFB. Contractor shall at its own expense secure any and all licenses, permits or certificates that may be required by any Law for the performance of the Work. The Contractor shall observe and comply with all Law in its performance under the Contract and shall assure the same from its Subcontractors. In the event the Laws should be amended, repealed or replaced, or otherwise become applicable, Contractor shall promptly conform its performance and that of its Subcontractors to comply, and the Contract shall continue in full force and effect.
MASTER AGREEMENT	Agreement between the FTA and the Authority.
NDOR	The Nebraska Department of Roads
OPENING DATE	The date designated by Section 1.1.1 of this IFB for the receipt of Proposals, as extended by the Grant Administrator by Addendum.
PARTY(IES)	The Authority or the Contractor individually (or collectively).
PERSON	“Person” shall mean any individual or entity, including any corporation, partnership, sole proprietor or LLC.
PROJECT NO.	Authority Project No. NE-90-X104. All written correspondence from a Party in connection with the Contract Documents, the Contract or the Work shall reference the Specification No. and the Project No.
PROJECT COMPLETION DATE	The date designated in the Contract Documents for completion of the Work, as extended in conformity with the Contract Documents.
PROPOSAL	A timely written response to this IFB that complies in all material respects to this IFB, also referred to as the “Statement of Qualifications”. The Proposal shall include any forms, Certifications or other materials required by the IFB. The term "Bid" or "Offer" is occasionally used in the Laws or Contract Documents to mean the Proposal and shall be so construed whenever the context shall require.
IFB	This Request for Qualifications for Specification No. 08-17 issued August 30**, 2017**, consisting of those items identified in this document, together with any Addendum.
RECIPIENT	The Authority.

SPECIFICATION NO.	Authority Specification No. 08-17. All correspondence from a Party in connection with the Contract Documents, the Contract or the Work shall reference the Specification No. and the Project No.
SPECIFICATIONS	The Project/ Scope of Work Specifications as written in this IFB.
SUBCONTRACTOR	Any Person with whom the Contractor subcontracts any Work, including any Person from whom Contractor may purchase any equipment, materials or services. All agreements between Contractor and Subcontractors shall be in writing, conform to the Laws and shall be assignable, without penalty or modification, to the Authority upon request in the event of termination of the Contract.
SUB-RECIPIENT	A Person to whom the recipient distributes federal funds.
WORK	The work and performance required by the Contract, including all tangible and intangible property (including, unless otherwise expressly provided in Contract Documents or the Specifications, all designs, drawings, photographs, data, specifications, computer records and software, lists, manuals, reports, research, source codes, all related information, intellectual/proprietary property rights therein and thereto), all licenses, purchases, construction, installation, labor, materials, equipment and services contemplated, made, prepared, developed, provided or to be made, prepared, developed, provided by the Contractor, including its Subcontractors. Unless otherwise provided in Contract Documents or the Specifications, all Work, including partially completed Work, shall be the property of the Authority, subject to the rights of the Unites States therein and thereto.

1.1 Responses to IFB

1.1.1 Responsive Proposals.

(a) The Authority will evaluate only those Proposals which are fully responsive to this IFB and which are received by the Authority on or before September 20th, 2017 at 2:00 PM CT, or as extended by Addendum ("Opening Date"). Each Applicant shall submit

- One electronic copy (in a pdf format)
- One (1) hard copy

of its Proposal, to the Authority, addressed as follows:

Authority – 08-17 Snow Melt
2222 Cuming Street
Omaha, Nebraska 68102
Attn: Grant Administrator

All Submitted Proposals become the property of the Authority. **Facsimile or Electronic submissions of proposals will not be accepted**.

(b) The Authority reserves the right in its discretion: to amend the IFB at any time prior to the Opening Date by Addendum; to reject all Proposals; to waive minor irregularities contained in any Proposal; to rely upon any information obtained through its own investigation of the Applicant or its Proposal or that of any department, agency or any other appropriate governmental entity; and to withdraw the IFB at any time, including after the Opening Date, without the award of a Contract.

(c) INTENTIONALLY LEFT BLANK

(d) Proposals may be withdrawn or modified by Applicant upon written request referencing the appropriate Project and Specification numbers addressed to the Grant Administrator prior to the Opening Date. Except as required by Section 1.2.4 of this IFB, modifications will be accepted and considered only if received prior to the Opening Date. All modifications shall clearly identify how and to what extent the Proposal is being modified. Where appropriate, the required number of copies of substitute forms, documentation and other materials shall be included with the modification. Proposals that are withdrawn shall be returned unopened by the Authority.

(e) Notwithstanding Section 1.1.1(d) of this IFB, the Authority may request additional or clarifying information from an Applicant at any time. A detailed cost proposal may be requested. A cost/price analysis and evaluation and/or audit may be performed of the cost proposal to determine fair and reasonable price. All responses from Applicant shall be in writing.

(f) INTENTIONALLY LEFT BLANK

(g) Subject to the negotiation process contemplated by Section 1.1.2 of the IFB, the Proposal shall confirm that all material provisions of the Proposal, including prices, shall remain firm through the Project Completion Date, unless otherwise expressly permitted by the Specifications. The Authority is exempt from payment of federal excise and transportation tax, and Nebraska Sales Tax. These taxes shall not be included in the price for any Proposal.

(h) INTENTIONALLY LEFT BLANK

(i) No Proposal shall be considered compliant or responsive unless it materially complies with the IFB in its entirety, completely and accurately responds to all parts of the IFB and includes all information requested. Without limitation to the generality of the preceding sentence or any other provision of this IFB, Proposals may be found not to be compliant or responsive if Applicant:

- Misrepresents any material fact.
- Attempts to evade any material provision or requirement of this IFB.
- Fails to indicate in numbers and words, any amounts required to be identified.
- Fails to timely submit a duly authorized and executed Proposal.
- Submits a conditional Proposal, or a Proposal that takes exception to the Specifications, the IFB or any other Contract Document.
- Fails to adequately demonstrate its ability to perform or timely perform the Project and the Work in compliance with the Contract.
- Fails to fully execute or complete any forms, schedules or exhibits required by this IFB to be executed or completed.
- Otherwise fails to comply with any material provision or condition of this IFB.

(j) Copies of responsive competing Proposals shall not be made available to Applicants until 60 days after board approval. Applicants requesting copies of the Proposals shall do so in writing accompanied by a certified or cashier's check in the amount of $25.00. Applicants should be aware that the Authority is a public body to which the public records laws of the State of Nebraska may apply. The Authority shall take reasonable steps to notify the Person designated by the Applicant in the Proposal of any request by any Applicant or other Person to obtain copies of, or to otherwise review information, clearly identified in the Proposal as "Confidential Information". The Authority expressly disclaims any further obligation or undertaking to otherwise protect the confidential nature of any information contained in any Proposal.

1.1.2 **Preliminary/Other Conferences**. **A Pre-Submission Conference shall be held at Authority's Administrative Facility, 2222 Cuming Street, Omaha, NE, at 2:00 pm Central Standard timeSeptember 7th, 2017.** This solicitation is intended to be a competitive proposal procurement. Following the Opening Date, the Authority may hold a conference with some or all Applicants for the purpose of facilitating the Authority's review of the Applicant's Proposal, including further negotiation of the price or other material provisions of the Proposal to the extent permitted by the Laws. The appropriate Applicant will be notified in writing of the time and date of any such conference. Applicant's failure to attend any scheduled conference may disqualify the Applicant and its Proposal from further consideration.

1.1.3 Requests/Specified Parts and "Approved Equals".

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(b) INTENTIONALLY LEFT BLANK

(c) INTENTIONALLY LEFT BLANK

(d) The Authority shall not be responsible should any such Person fail to receive such Addendum.

(e) The Authority shall not be obligated to extend the Opening Date in the event of

an approved request for clarification, substitutes or proposed equal, but may do so in its absolute discretion.

(f) The Authority may reject any request for a substitute or qualified equal made by any Contractor following the award of the Contract, in its absolute discretion.

1.1.4 Protests.

(a) Protests made in connection with this IFB, including the protest of a denial or approval of any request made pursuant to Section 1.1.3 shall be made in writing received by the Grant Administrator by no later than ten (10) days before the Opening Date. Protests shall be limited to those allowable by, and made in compliance with, the procedures established by the Authority, copies of which may be obtained from the Executive Director of the Authority upon written request. All protests shall be concise, direct and sufficient to permit the Authority to determine the full and complete basis therefor, fully supported by all current, relevant objective information, documentation or support considered necessary by the Applicant that is completely accurate in all material respects. The Authority shall decide the protest by no later than five (5) days prior to the Opening Date. Procedures for appeals from any such decision are set forth in the Authority's protest procedures.

(b) Appeals from the award of a Contract must be made in writing received by the Executive Director of the Authority not later than ten (10) days after the earlier of the award of the Contract or the announced intention of the award of the Contract. Appeals shall be limited to those allowable by, and made in compliance with, the procedures established by the Authority, copies of which may be obtained from the Executive Director of the Authority. All appeals shall be concise, direct and sufficient to permit the Authority to determine the full and complete basis therefor, fully supported by all current, relevant objective information, documentation or support considered necessary by the Applicant that is completely accurate in all material respects. Procedures for appeals from any such decision are set forth in the Authority's protest procedures.

(c) The filing or approval of any protest or appeal may result in the extension of the Opening Date, the issuance of an Addendum, the withdrawal of the IFB or the reconsideration of any award of a Contract, in the sole discretion of the Authority.

(d) In the event of an appeal from the award of a Contract, the award shall not be considered final or binding upon the Authority unless the award is thereafter confirmed in writing by the Executive Director.

(e) For information purposes only, each Applicant should understand that the FTA will not accept any protest or appeal from any decision of the Authority unless the Authority fails to have any written protest procedures, the Authority fails to follow such procedures or the Authority fails to review a timely protest. An Applicant must exhaust all administrative remedies with the Authority before pursuing a protest with FTA. An appeal to FTA must be received by the appropriate FTA regional or Headquarters Office within five (5) working days of the date the Applicant knew or should have known of the violation.

1.2 Applicant's Identification.

1.2.1 Responsible Individuals. Whenever the identification of any individual is required by this

IFB, Applicant shall provide full and complete identification, including the individual's full name and current business address.

1.2.2 Other Responsible Persons. Whenever the identification of any Person, other than an individual, is required by this IFB, the Applicant shall provide full and complete identification, including the Person's full name and current business address.

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1.2.4 Continued Identity. Applicant shall, in the form of written supplements to its Proposal addressed to the Grant Administrator, keep continuously current through the award of the Contract all information provided pursuant to Section 1.2 of this IFB, including Sections 1.2.1 and 1.2.2.

1.2.5 Designated Recipient of Notice. Applicant shall designate a Person to receive copies of any correspondence, approvals or notice contemplated by the Contract from the Authority. Identification shall include a telephone number, telefax number, address, e-mail address, and any other information appropriate to enable the Authority to provide any notice.

1.2.6 Designated Authorized Representative. Applicant shall identify the individual(s) who shall have authority to bind the Applicant/Contractor in any matter related to the Proposal, Contract or Work.

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1.4 Termination.

1.4.1 Termination for Convenience by Authority.

(a) Any Contract, or any part thereof, awarded by the Authority pursuant to this IFB shall be subject to termination at any time by the Authority upon notice in writing to be effective as of the date of receipt of such notice. Upon receipt of such notice, Contractor shall, unless otherwise specified in the notice, immediately stop all Work and, to the extent permitted under each applicable subcontract or agreement, give prompt written notice to Subcontractors to cease all related Work. In the event this Agreement is terminated by application of this Section 1.4., Contractor shall have no claim, right, remedy or entitlement for damages, compensation or equitable relief for early termination other than as provided in Section 1.4.1(b). Contractor waives any other right, remedy or recourse of any nature whatsoever it may have now or at any other time against the Authority and the FTA.

(b) In the event of termination for convenience pursuant to Section 1.4.1, Authority shall be responsible to pay the Contractor only for all authorized Work performed up to the date of termination and conforming to the Contract, without allocation of profit for unperformed, remaining or incomplete Work. In no event shall the aggregate charges to be paid by Authority pursuant to the preceding sentence exceed resulting from the percentage of the completed Work to that remaining multiplied by the aggregate Contract price. In the event of such termination, Contractor shall have no recourse against Authority except as earlier stated in this Section 1.4.1(b) and as follows: Contractor shall be entitled to receive reimbursement from Authority an amount equal to the sum of: (i) the reasonable out-of-pocket costs actually and necessarily incurred by Contractor in withdrawing its equipment and personnel from the Work and otherwise demobilizing; (ii) the actual, reasonable and necessary costs reasonably incurred by Contractor in terminating those contracts, not

assumed by Authority, for Subcontractors; (iii) provided, however, Contractor shall not be paid for any Work after receipt of such notice or for any costs incurred by Subcontractors after receipt of Customer's termination notice, or for Work which Contractor could reasonably have avoided Contractor. Contractor shall document any cost claimed by it to Authority's reasonable satisfaction and shall supply Authority with copies of all invoices for Subcontractors covering the amounts claimed as costs for such purpose. Contractor shall submit an invoice to Authority for the amount of reimbursement claimed by Contractor with all supporting information and requisite documents. Unless disputed in good faith by the Authority, Customer shall be paid such amounts within thirty (30) business days after Customer delivers all Work, completed or not completed, in its then current form, free and clear of all liens and assigns to Authority together with any subcontracts, duly assigned, that Authority is willing to assume.

1.4.2 Suspension by Authority. Upon seven (7) days' prior notice, the Authority may suspend, delay, or interrupt for up to six (6) months the Work or the Project for the convenience of the Authority. Nothing in this Section 1.4.2 shall be construed to apply to any such suspension, delay or interruption caused by an event of force majeure (as defined by the Contract Documents). In the event such suspension, delay, or interruption causes a change in Contractor's cost or time required for performance of the Work, the Parties will agree on an equitable adjustment through a written amendment to the Contract to be signed by Authority and Contractor. A suspension may be withdrawn by Authority upon five (5) days' written notice to Contractor. Any suspension, delay or interruption that exceeds six (6) months shall be deemed to be a termination by Authority and Contractor shall be compensated by Authority as if this were a termination for convenience under Section 1.4.1.

1.4.3 Termination for Default by Authority. Without prejudice to any other remedy or recourse, including its right to seek damages, the Authority may:

(a) Terminate the Contract effective immediately upon Contractor's receipt of written notice from Authority specifying any of the following events:

(i) Insolvency of Contractor.
(ii) The filing of a meritorious petition of bankruptcy by or against Contractor or the filing of any petition by Contractor seeking protection under Chapters 7, 11 or 13 of the United States Bankruptcy Code.
(iii) The conviction of Contractor of a felony in connection with the Work.
(iv) Except as provided in Section 1.4.3(b)(i), the failure to materially comply with any of the Laws.
(v) Any attempt to evade any material provision of the Contract or to practice any fraud or deceit upon Authority.
(vi) The failure of Contractor or any of its Subcontractor's to fully comply with the lawful directives or cooperate with requests of Authority inspectors or other officials administering or monitoring Work, including any federal, state or other public authority.
(vii) The failure to provide any required bond within ten (10) days of notice of the award of the Contract.
(viii) Any material misrepresentation by Contractor made at any time.
(ix) Contractor improperly assigns or attempts to assign the Contract or any of the Work.
(x) The failure to properly maintain, provide or permit Authority access to any books, records, bank accounts or documentation related to the Contract.

(b) Terminate the Contract, if any of the following (which shall also constitute a material default or breach of the Contract) is not cured to the satisfaction of the Authority within the earlier of thirty (30) days or the time prescribed therefor, in either event from the receipt of written notice from the Authority specifying such breach or default:

(i) Contractor fails to conform operations which are in violation of the Laws because of a change in the Laws within 30 days following the effective date of such change.
(ii) The failure to promptly pay any sums due to Authority within 5 days of notice.
(iii) Contractor refuses or fails to timely commence or perform the Work.
(iv) Contractor refuses or fails to supply enough properly skilled workers, or proper materials or Subcontractors to timely perform the Work.
(v) Contractor fails to comply promptly with rejection notices or notices to correct defects in the Work.
(vi) Contractor causes or permits any repudiation, lapse or cancellation of performance or other security required by Section 1.1.5.
(vii) Any other materially breach or default of any covenant, term, condition or provision the Contract, whether or not specified in this Section 1.4.3.

Termination under this Section 1.4.3(b) shall be effective as of the expiration of the period so specified without the necessity of further action by the Authority.

1.4.4 Wrongful Termination by Authority. In the event the Authority shall wrongfully terminate the Contract, unless otherwise agreed by the Parties in writing, to re-instate or otherwise continue the Contract in accordance with its terms, the Authority's termination shall be construed to be a termination for convenience and Section 1.4.1 shall apply.

1.4.5 Future Breach Not Waived. No waiver by Authority of any breach or default by Contractor under the Contract shall operate or be construed to operate as a waiver of any other existing or future breach or default, whether of a similar or different character. Failure of the Authority to insist upon strict performance of any provision under this Agreement shall not constitute a waiver of, or estoppel against asserting the right to require strict performance of any other provision of this Agreement or the same provision in the future, nor shall a waiver or estoppel in any one instance constitute a waiver or estoppel with respect to a later default or breach. No waiver by any Person of any default by any Party in the performance of any provision, condition or requirement herein shall be deemed to be a waiver of, or in any manner release of, said Party from performance of any other provision, condition or requirement herein; nor shall such waiver be deemed to be a waiver of, or in any manner a release of, said Party from future performance of the same provision, condition or requirement. Any delay or omission of any Party to exercise any right hereunder shall not impair the exercise of any such right, or any like right, accruing to it thereafter. No waiver of a right created by this Agreement by one or more Parties shall constitute a waiver of such right by the other Parties except as may otherwise be required by law with respect to Persons not parties hereto. The failure of one or more Parties to perform its or their obligations hereunder shall not release the other Parties from the performance of such obligations.

1.4.6 Contractor's Right to Terminate. Contractor shall not be entitled to terminate the Contract for any reason except as provided in this Section 1.4.6. In the event that the Authority fails to timely pay to Contractor any undisputed amounts due pursuant to the terms of the Contract, Authority shall be in default under this Contract and Authority shall be allowed thirty (30) days from receipt of a written notice of such default from Contractor in which to cure such default, after which Seller

may immediately terminate this Contract by written notice to Buyer. Any amount disputed by Authority to be due under this Contract must be disputed in good faith.

1.4.7 Waiver of Contractor's Other Remedies. Except as provided in Section 1.4.3(b), Contractor waives any claim or other right it may have to proceed in law or equity against Authority or to otherwise obtain any money or any damages under or in respect to this Contract for any wrongful or other termination or for any default or breach in the keeping or performance of any warranty, covenant or obligation under or in respect to this Contract by Authority or for any other act, operation or omission of Authority in respect to the Contract, under any theory whatsoever.

1.4.8 Dispute. Continuing Performance. In the event of any dispute between Authority and Contractor with respect to the interpretation of this Contract, any required payment under or the performance required by this Contract, including any dispute which may result in a claim, (a "Dispute"), the aggrieved Party shall notify the other in writing of the Dispute then existing (the "Dispute Notice"). In order for a Party to proceed under this Section, the Dispute Notice must specifically state that the aggrieved Party is invoking the Dispute procedure of this Section 1.4.8. The Parties shall then make a good faith attempt to resolve the Dispute, first through direct discussions between their respective designated representatives. In the event the designated representatives are unable to reach agreement then upon the written request of either Party, each of the Parties will appoint a designated executive whose task it will be to meet for the purpose of endeavoring to resolve such dispute. The designated executives shall meet in Omaha Nebraska as often as the Parties reasonably deem necessary in order to gather and furnish to the other all information with respect to the matter in issue which the Parties believe to be appropriate and germane in connection with its resolution. Such executives will discuss the problem and/or negotiate in good faith in an effort to resolve the dispute without the necessity of any formal proceeding relating thereto. No action for the resolution of such dispute outside of these procedures shall be taken by either Party until one of the designated executives concludes in good faith that amicable resolution through continued negotiation of the matter in issue does not appear likely and so notifies the other designated executive in writing either party in its sole discretion may invoke litigation, provided that failure to invoke litigation shall not be a waiver of any such Dispute except as otherwise provided in the Contract. During any mediation or litigation which arises out of a Dispute, all parties will continue to perform pursuant to the Contract, without prejudice to the express rights of Authority or Contractor set forth in this Section 1.4 to terminate the Contract. In addition to the specific rights of termination and suspension as set forth in Section 1.4, Authority and Contractor shall have also available the remedy of specific performance to enforce this Section 1.4.8, which may be raised as a defense in any action commenced prior to the Parties' compliance with this Section 1.4.8.

1.5 Warranties of the Parties

1.5.1 Warranties of Applicant/Contractor. In addition to those representations and warranties set forth in the Specifications, or otherwise made in or required by the Contract, for purposes of its Proposal and the Contract, if awarded to Applicant, Applicant hereby warrants and represents that:

(a) It is duly organized and existing under and by virtue of the laws of the state of its organization and has the power and authority to own its properties and to carry on the business as presently conducted and as represented and to do business in the State of Nebraska.

(b) It has all requisite corporate power and authority to execute, deliver and perform the Proposal and Contract; the Proposal and the Contract have been duly authorized, executed and delivered, and as such, constitute its valid and binding obligation, enforceable in accordance with its terms and conditions.

(c) Performance of the Contract will not violate, or be in conflict with, or result in a material breach of, or constitute a default under, any material agreement, order, judgment, or decree to which it is a party or by which it is bound.

(d) It has examined or is familiar with all current Laws and shall undertake its performance under the Contract in conformity with the same.

(e) The representations made in the Contract, including the Certifications made in its Proposal are true, accurate and complete in all respects.

(f) To the best of its knowledge, after due and diligent inquiry, no elected official of the Authority of Omaha, and no member of the Board of Directors of the Authority nor any the Authority's officers or employees is employed by, or has a financial interest, direct or indirect, in the Contract, the Applicant, the Contractor or any Subcontractors.

(g) It shall execute and deliver all such other and additional instruments and documents and to do such other acts and things as may be reasonably necessary more fully to effectuate the Work and the Contract. Without limitation to any of the foregoing, all warranties required by the Contract or otherwise applicable to the Work shall be assignable to the Authority upon the completion of the Work or any termination of the Contract.

(h) In its performance of the Work, Contractor, including its Subcontractors shall use the standard of professional ethics and the degree of skill, care and diligence normally employed by professionals and trades performing the same or similar Work (collectively, the "Standard"). Except as expressly limited by the Specifications or executed agreements, all Work to be furnished under the Contract shall be of highest quality and new, free from faults and defects, suitable for the Authority's purposes and in conformity with the Contract. Any other Work shall be considered defective. Without prejudice to any other recourse available to the Authority, Contractor will re-perform and otherwise remedy any defective Work, including any Work not meeting the Standard without additional compensation.

(i) 1.5.2 Warranties of Authority. The Authority makes no representation of any nature to the Applicant, other than that the information provided in this IFB is true and accurate to the best of its knowledge at the time of its writing.

1.6 Miscellaneous Matters

1.6.1 Severability. The invalidity or unenforceability of any provision of the Contract shall not affect the validity or enforceability of any other provision of the Contract, nor shall the invalidity or unenforceability of a portion of any provision of the Contract affect the validity and enforceability of the balance of such provision. All other provisions and parts of provisions shall remain in full force and effect, provided however, if in the sole opinion of Authority, the removal or inoperative effect of any such provision or part of provision so declared invalid or unenforceable shall materially affect Authority's rights under the Contract, the Authority may terminate the Contract as set forth in Section 1.4.1(a).

1.6.2 Time is of Essence in this Agreement. Whenever the Contract shall set forth any time for any action to be performed by or on behalf of the Contractor, time shall be deemed of the essence and as such shall be deemed a material provision of the Contract.

1.6.3 Complete Agreement. The Contract constitutes the entire agreement between the Authority and Contractor and supersedes any other agreement or understanding between them. Should the Authority determine that any material provision of the Contract is adversely affected by the subsequent action of the state or federal government (as determined by the Authority in its sole and absolute discretion), the Authority shall have the right to modify the provisions of the Contract to such extent as may be necessary to carry out its original full intent and purpose, otherwise the Contract shall be not be amended or otherwise modified except as required by changes in Law, Sections 1.6.1 or by written mutual agreement of the Parties. All modifications shall be effected by Authority only as permitted by its internal control provisions, which shall be made available from the Grant Administrator. Any amendments or modifications to this Agreement shall be binding upon Contractor's guarantor or surety without notice.

1.6.4 Governing Law. The Contract shall be governed by and construed in accordance with the Laws.

1.6.5 Venue. With respect to any claim of any Person arising out of the Contract (i) each Party irrevocably submits to the exclusive jurisdiction of the federal courts located in Douglas County in the State of Nebraska (unless such federal courts lack subject matter jurisdiction, in which case each Party irrevocably submits to the exclusive jurisdiction of the State courts located in Douglas County in the State of Nebraska), and (ii) each Party irrevocably waives any objection which it may have at any time to the venue of any suit, action or proceeding arising out of or relating to the Contract brought in any such courts and irrevocably waives any claim that such suit, action or proceeding is brought in an inconvenient forum, and further irrevocably waives the right to object, with respect to such claim, suit or proceeding brought in any such court, that such court does not have jurisdiction over such Party.

1.6.6 Assignment. Neither the Contract nor any of Contractor's rights, privileges, liabilities or obligations under the Contract may be assigned, subcontracted (other than to Subcontractors identified in the Proposal) or transferred by Contractor without the prior written consent of the Authority, which may be withheld in its discretion.

1.6.7 Survival. All waivers, representations, warranties, indemnities, limitations and remedies provided for in the Contract shall survive the expiration or termination of the Contract.

1.6.8 Notice. Unless otherwise expressly provided in the Contract Documents, any request, protest, notice, response, or approval, required or contemplated by the IFB or the Contract, shall be considered sufficient only if made in writing and hand-delivered or sent by telephone facsimile or certified or registered mail, postage prepaid to the Person designated below, addressed as follows:

(a) To the Authority:

Grant Administrator: 08-17
2222 Cuming Street
Omaha, NE 68102

(b) To the Contractor:

That Person identified in the Proposal for such purposes.

Either party may designate a different Person or address by providing notice of the change to the other.

1.6.9 Requests/Approvals/Consents. Whether or not otherwise so specified in the Contract, all requests and any required consents, notices and approvals shall not be valid unless made in writing.

1.6.10 Headings. The descriptive headings of the Contract are used for convenience only and shall not be deemed to affect the meaning or construction of any such provision.

1.6.11 Relationship of Parties. Nothing in the Contract shall be deemed or construed to create a joint venture, agency or any other relationship by or between the Authority and Contractor other than that of an independent contractor.

1.6.12 Indemnity. For purposes of this Section 1.6.12, "damages" shall mean any and all damages, loss or injury of whatsoever nature, including all claims, demands, suits, proceedings, judgments, recoveries (including any payments by Authority in respect to the foregoing pursuant to a court judgment or good faith settlement by Authority) any fine, penalty, liability, loss, any direct, special, incidental or consequential damages, any damage or injury to Person (including death or bodily injury) or property and causes of action made, asserted, sought or obtained by any private or public third Person from or against, or otherwise sustained by, Authority (including Authority's contractors, employees, licensees, officers, elected or appointed officials and all sums reasonably expended by the Authority for attorney fees in asserting or defending against such damages) whether under theories of breach of contract, tort, negligence, or otherwise. Contractor shall bear sole responsibility and be liable for, and shall hold the Authority harmless and indemnify it from and against, all damages resulting or arising from or out of or in connection with (a) Contractor's operations, including as a result of any act, error or omission of (b) Contractor's and its Subcontractor's (including their respective agents, employees or assigns), performance, non-performance or wrongful performance of or under the Contract or undertaken or made pursuant to the authority of the Contract, (c) any misrepresentation made by Contractor in the Contract Documents, and (d) the breach or default of any warranty. The Authority shall have the right to defend itself (or join in the defense at the cost of Contractor) from and against such liabilities and damages, unless Contractor fails to promptly or competently undertake defense on behalf of the Authority as required.

1.6.13 Contractor's Books and Records. Contractor shall maintain complete and accurate accounting records in accordance with generally accepted accounting practices in connection with all matters related to the Contract and the Work, including to substantiate charges on each invoice. Contractor shall also retain all such records, books, correspondence, instructions, drawings, receipts, subcontracts, agreements, commitments, purchase orders, memoranda, and other data relating to the Contract or the Work normally maintained as part of its established business operations and as may be required by Law. Contractor will permit the Authority and its representatives, at all reasonable times and as otherwise required by the Laws, access to all offices and other facilities and to all such records, to make such reasonable inspections as they may require and will cause its officers promptly to furnish them with such financial and operating data and other information with respect to the business and properties of Contractor relating to the Contract or the Work. Contractor shall preserve all such records for a period required by Law, but in no event less than five (5) years following final payment under the Contract.

1.6.14 Change in Work. Authority shall have the right to request Contractor to make reasonable changes to the Work ("Work Change"). Contractor shall consent to make such requested Work Changes, provided that Contractor is technically capable of making such Work Changes, and further provided that: (a) such Work Changes do not materially, individually, or cumulatively increase Contractor's expenses in providing the Work, or (b) if such Work changes materially increase Contractor's expenses in providing

such Work, Contractor agrees to bear the cost for the Work Changes at standard time and materials rates or a negotiated fixed price amount as determined by the Authority in accordance with the Contract Documents.

1.6.15 Specific Performance. of the Parties recognizes and affirms that in the event of breach by any of them of any of the provisions of this Contract, money damages alone would be inadequate and no adequate remedy at law would exist. Accordingly, each of the Parties agrees that the Authority shall have the right, in addition to any other rights and remedies existing in its favor, to enforce its rights and the obligations of the Contractor under this Contract not only by action or actions for damages, but also by an action or actions for specific performance, injunction and/or other equitable relief in order to enforce or prevent any violations of the provisions of the Contract. In accordance with the above, Contractor waives any claim or defense that the Authority has or may have an adequate remedy at law.

2.0 Submittal Requirements

To be eligible for consideration one electronic (in a pdf form) and one (1) hard copy of the response to the IFB must be received by Authority no later than 2:00 PM CT, September 20, 2017. Late submittals will not be considered and will be returned to submitter unopened. No pricing or cost proposal information shall be included in the submission. The envelope package should be marked:

Authority – 08-17 Snow Melt
2222 Cuming Street
Omaha, Nebraska 68102
Attn: Grant Administrator

Please see Section "Required Submission Documents" for a checklist of forms for submission.

Please submit all questions in writing to procurement@ometro.com utilizing the form found in Exhibit F. Proposers are prohibited from initiating contact with regard to this procurement with anyone else at The FTA, Authority, the City of Omaha or Metropolitan Area Planning Agency (MAPA) except for Authority's Grant Administrator or indicated designee.

Authority will post all questions, answers and clarifications to:
http://www.ometro.com/corporate/contracting-opportunities.

3.0 SCOPE OF WORK

The contractor will provide all necessary and needed labor, tools, supplies, materials, equipment, services and supervision to complete the following:

Connect the existing snow melt piping and make necessary repairs or modifications to the condensing boiler, located at the 21st and 22nd Street doors of the Authority Administration and Maintenance facility, located at 2222 Cuming Street, Omaha, Nebraska. This snow melt piping was previously installed as a portion of a prior project.

Connect the piping to the Authority main boiler system and provide the needed and necessary controls to integrate with and be controlled by the BMAC system, and provide an fully operational snow melt system on the approached named above.

Drawings and technical specifications are available on the Authority website, or physical copies are available at XXXXXX

4.0 PROCUREMENT SCHEDULE

Release IFB		August 30, 2017
Pre-Bid Confrence		September 7, 2017 2:00 pm CT
Requests for Clarifications/Substutitions Due		September 13, 2017 12:00 pm CT
Response to Clarifications/Substutitions Posted		September 15, 2017 4:00 pm CT
Bids Due		September 20th, 2017 2:00 pm CT
Bid Opening		September 20th, 2017 2:00 pm CT
Bid Award		September 28th, 2017
Construction Start Date		October 1, 2017
Sustantial Completion Date	December 15, 2017	Completion Date
December 30, 2017		

5.0 INSURANCE REQUIREMENTS

See Section "Supplmentry Conditions" Items 2

6.0 LABOR AND MATERIAL PAYMENT BOND

1. Pursuant to Nebraska State Statute 52-118, as revised, the successful bidder shall furnish a Payment Bond, in the amount of 100% of the contracted amount. This Bond will be written by a surety licensed to do business in the State of Nebraska, and who is acceptable to the Authority.

2. The bidder shall deliver the required bond to the Authority no later than the date of execution of the contract, or if the work commenced prior thereto in response to a letter of intent, the bidders shall, prior to the commencement of the work, submit evidence satisfactory to the Authority that such bond will be furnished.

BID FORM

The Transit Authority of the City of Omaha
2222 Cuming Street
Omaha, Nebraska 68102

Boiler Repair and Snow Melt System Activation Project
(Authority Project No. NE-90-X104 / Spec #08-17)

-Combined Contract-

We have received bidding documents dated 10 March 2016, on the above-referenced project. We acknowledge receipt of Addenda Nos. _____ through _____.

In submitting this bid, we agree:

1. To hold the bid amount open for 60 days after the receipt of bids.
2. To perform all work required by the Contract Documents – Project Manual & Drawings dated August 30th, 2017 and all applicable Addenda.
3. To comply with the General Conditions of the Contract for Construction and Federal Requirements as stated in the project manual.

In connection with our examination of the bidding documents, we submit the following bid proposal and we agree to perform the above in consideration of the amounts hereinafter scheduled. (All amounts shall be shown in both figures and words.)

BASE BID: $_____

_____Dollars

The undersigned agrees, upon receipt of written notice of award of the contract within thirty (30) days after opening of bids, to enter into an agreement with the Transit Authority for the work described in the Contract Documents, in accordance with all requirements indicated therein.

Dated this _____ day of _____, 2017.

Respectfully submitted,

_____
COMPANY

_____
SIGNATURE

_____
NAME (TYPED OR PRINTED) TITLE

ADDRESS

APPENDIX A

FEDERAL CLAUSES FOR PROCUREMENT OF CONSTRUCTION

NO OBLIGATION BY THE FEDERAL GOVERNMENT

The Purchaser and Contractor acknowledge and agree that, notwithstanding any concurrence by the Federal Government in or approval of the solicitation or award of the underlying contract, absent the express written consent by the Federal Government, the Federal Government is not a party to this contract and shall not be subject to any obligations or liabilities to the Purchaser, Contractor, or any other party (whether or not a party to that contract) pertaining to any matter resulting from the underlying contract.

The Contractor agrees to include the above clause in each subcontract financed in whole or in part with Federal assistance provided by FTA. It is further agreed that the clause shall not be modified, except to identify the subcontractor who will be subject to its provisions.

PROGRAM FRAUD AND FALSE OR FRAUDULENT STATEMENTS OR RELATED ACTS

The Contractor acknowledges that the provisions of the Program Fraud Civil Remedies Act of 1986, as amended, 31 U.S.C. § § 3801 et seq. and U.S. DOT regulations, "Program Fraud Civil Remedies," 49 C.F.R. Part 31, apply to its actions pertaining to this Project. Upon execution of the underlying contract, the Contractor certifies or affirms the truthfulness and accuracy of any statement it has made, it makes, it may make, or causes to be made, pertaining to the underlying contract or the FTA assisted project for which this contract work is being performed. In addition to other penalties that may be applicable, the Contractor further acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification, the Federal Government reserves the right to impose the penalties of the Program Fraud Civil Remedies Act of 1986 on the Contractor to the extent the Federal Government deems appropriate.

The Contractor also acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification to the Federal Government under a contract connected with a project that is financed in whole or in part with Federal assistance originally awarded by FTA under the authority of 49 U.S.C. § 5307, the Government reserves the right to impose the penalties of 18 U.S.C. § 1001 and 49 U.S.C. § 5307(n)(1) on the Contractor, to the extent the Federal Government deems appropriate.

The Contractor agrees to include the above two clauses in each subcontract financed in whole or in part with Federal assistance provided by FTA. It is further agreed that the clauses shall not be modified, except to identify the subcontractor who will be subject to the provisions.

ACCESS TO RECORDS

Where the Purchaser enters into a negotiated contract for other than a small purchase or under the simplified acquisition threshold and is an institution of higher education, a hospital or other non-profit organization and is the FTA Recipient or a sub-grantee of the FTA Recipient in accordance with 49 C.F.R. 19.48, Contractor agrees to provide the Purchaser, FTA Administrator, the Comptroller General of the United States or any of their duly authorized representatives with access to any books, documents, papers and record of the Contractor which are directly pertinent to this contract for the purposes of making audits, examinations, excerpts and transcriptions.

Where any Purchaser which is the FTA Recipient or a sub-grantee of the FTA Recipient in accordance with 49 U.S.C. 5325(a) enters into a contract for a capital project or improvement (defined at 49 U.S.C. 5302(a)1) through other than competitive bidding, the Contractor shall make available records related to the contract

to the Purchaser, the Secretary of Transportation and the Comptroller General or any authorized officer or employee of any of them for the purposes of conducting an audit and inspection.

The Contractor agrees to permit any of the foregoing parties to reproduce by any means whatsoever or to copy excerpts and transcriptions as reasonably needed.

The Contractor agrees to maintain all books, records, accounts and reports required under this contract for a period of not less than three years after the date of termination or expiration of this contract, except in the event of litigation or settlement of claims arising from the performance of this contract, in which case Contractor agrees to maintain same until the Purchaser, the FTA Administrator, the Comptroller General, or any of their duly authorized representatives, have disposed of all such litigation, appeals, claims or exceptions related thereto. Reference 49 CFR 18.39(i)(11).

FTA requires the inclusion of these requirements in all subcontracts.

FEDERAL CHANGES
Contractor shall at all times comply with all applicable FTA regulations, policies, procedures and directives, including without limitation those listed directly or by reference in the current Master Agreement between Purchaser and FTA, as they may be amended or promulgated from time to time during the term of this contract. Contractor's failure to so comply shall constitute a material breach of this contract.

TERMINATION
Termination for Convenience by Authority.

Any Contract, or any part thereof, awarded by the Authority pursuant to this RFCP shall be subject to termination at any time by the Authority upon notice in writing to be effective as of the date of receipt of such notice. Upon receipt of such notice, Contractor shall, unless otherwise specified in the notice, immediately stop all Work and, to the extent permitted under each applicable subcontract or agreement, give prompt written notice to Subcontractors to cease all related Work. In the event this Agreement is terminated by application of this Section, Contractor shall have no claim, right, remedy or entitlement for damages, compensation or equitable relief for early termination other than as provided in Section (2). Contractor waives any other right, remedy or recourse of any nature whatsoever it may have now or at any other time against the Authority and the FTA.

In the event of termination for convenience pursuant to Section (1), Authority shall be responsible to pay the Contractor only for all authorized Work performed up to the date of termination and conforming to the Contract, without allocation of profit for unperformed, remaining or incomplete Work. In no event shall the aggregate charges to be paid by Authority pursuant to the preceding sentence exceed the Contract price. In the event of such termination, Contractor shall have no recourse against Authority except as earlier stated in this Section (b) and as follows: Contractor shall be entitled to receive reimbursement from Authority an amount equal to the sum of: (i) the reasonable out-of-pocket costs actually and necessarily incurred by Contractor in withdrawing its equipment and personnel from the Work and otherwise demobilizing; (ii) the actual, reasonable and necessary costs reasonably incurred by Contractor in terminating those contracts, not assumed by Authority, for Subcontractors; (iii) provided, however, Contractor shall not be paid for any Work after receipt of such notice or for any costs incurred by Subcontractors after receipt of Customer's termination notice, or for Work which Contractor could reasonably have avoided Contractor. Contractor shall document any cost claimed by it to Authority's reasonable satisfaction and shall supply Authority with copies

of all invoices for Subcontractors covering the amounts claimed as costs for such purpose. Contractor shall submit an invoice to Authority for the amount of reimbursement claimed by Contractor with all supporting information and requisite documents. Unless disputed in good faith by the Authority, Customer shall be paid such amounts within thirty (30) business days after Customer delivers all Work, completed or not completed, in its then current form, free and clear of all liens and assigns to Authority together with any subcontracts, duly assigned, that Authority is willing to assume.

Suspension by Authority.
Upon seven- (7) days' prior notice, the Authority may suspend, delay, or interrupt for up to six (6) months the Work or the Project for the convenience of the Authority. In the event such suspension, delay, or interruption causes a change in Contractor's cost or time required for performance of the Work, the Parties will agree on an equitable adjustment through a written amendment to the Contract to be signed by Authority and Contractor. Authority may withdraw a suspension upon five- (5) days' written notice to Contractor. Any suspension, delay or interruption that exceeds six (6) months shall be deemed to be a termination by Authority and Contractor shall be compensated by Authority as if this were a termination for convenience

Termination by Authority. Without prejudice to any other remedy or recourse, including its right to seek damages, the Authority may terminate the Contract effective immediately upon Contractor's receipt of written notice from Authority specifying any of the following events:

(i) Insolvency of Contractor.

(ii) The filing of a meritorious petition of bankruptcy by or against Contractor or the filing of any petition by Contractor seeking protection under Chapters 7, 11 or 13 of the United States Bankruptcy Code.

(iii) The conviction of Contractor of a felony in connection with the Work.

(iv) Failure to materially comply with any of the Laws.

(v) Any attempt to evade any material provision of the Contract or to practice any fraud or deceit upon Authority.

(vi) The failure of Contractor or any of its Subcontractor's to fully comply with the lawful directives or cooperate with requests of Authority inspectors or other officials administering or monitoring Work, including any federal, state or other public authority.

(vii) The failure to provide any required bond within ten (10) days of notice of the award of the Contract.

(viii) Any material misrepresentation by Contractor made at any time.

(ix) Contractor improperly assigns or attempts to assign the Contract or any of the Work.

(x) The failure to properly maintain, provide or permit Authority access to any books, records, bank accounts or documentation related to the Contract.

Terminate the Contract, if any of the following (which shall also constitute a material default or breach of the Contract) is not cured to the satisfaction of the Authority within the earlier of thirty (30) days or the time prescribed therefor, in either event from the receipt of written notice from the Authority specifying such breach or default:

(i) Contractor fails to conform operations, which are in violation of the Laws because of a change in the Laws within 30 days following the effective date of such change.

(ii) The failure to promptly pay any sums due to Authority within 5 days of notice.

(iii) Contractor refuses or fails to timely commence or perform the Work.

(iv) Contractor refuses or fails to supply enough properly skilled workers, or proper materials or Subcontractors to timely perform the Work.

(v) Contractor fails to comply promptly with rejection notices or notices to correct defects in the Work.

(vi) Contractor causes or permits any repudiation, lapse or cancellation of required insurance or bonds.

(vii) Any other materially breach or default of any covenant, term, condition or provision the Contract, whether or not specified in this Section.

Termination under this Section (b) shall be effective as of the expiration of the period so specified without the necessity of further action by the Authority.

Wrongful Termination by Authority. In the event the Authority shall wrongfully terminate the Contract, unless otherwise agreed by the Parties in writing, to re-instate or otherwise continue the Contract in accordance with its terms, the Authority's termination shall be construed to be a termination for convenience.

Future Breach not Waived. No waiver by Authority of any breach or default by Contractor under the Contract shall operate or be construed to operate as a waiver of any other existing or future breach or default, whether of a similar or different character. Failure of the Authority to insist upon strict performance of any provision under this Agreement shall not constitute a waiver of, or estoppel against asserting the right to require strict performance of any other provision of this Agreement or the same provision in the future, nor shall a waiver or estoppel in any one instance constitute a waiver or estoppel with respect to a later default or breach. No waiver by any Person of any default by any Party in the performance of any provision, condition or requirement herein shall be deemed to be a waiver of, or in any manner release of, said Party from performance of any other provision, condition or requirement herein; nor shall such waiver be deemed to be a waiver of, or in any manner a release of, said Party from future performance of the same provision, condition or requirement. Any delay or omission of any Party to exercise any right hereunder shall not impair the exercise of any such right, or any like right, accruing to it thereafter. No waiver of a right created by this Agreement by one or more Parties shall constitute a waiver of such right by the other Parties except as may otherwise be required by law with respect to Persons not parties hereto. The failure of one or more Parties to perform its or their obligations hereunder shall not release the other Parties from the performance of such obligations.

Contractor's Right to Terminate. Contractor shall not be entitled to terminate the Contract for any reason except as provided in this Section. In the event that the Authority fails to timely pay to Contractor any undisputed amounts due pursuant to the terms of the Contract, Authority shall be in default under this Contract and Authority shall be allowed thirty (30) days from receipt of a written notice of such default from Contractor in which to cure such default, after which Seller may immediately terminate this Contract by written notice to Buyer. Any amount disputed by Authority to be due under this Contract must be disputed in good faith.

Waiver of Contractor's Other Remedies. Except as provided in Section (6), Contractor waives any claim or other right it may have to proceed in law or equity against Authority or to otherwise obtain any money or any damages under or in respect to this Contract for any wrongful or other termination or for any default or breach in the

keeping or performance of any warranty, covenant or obligation under or in respect to this Contract by Authority or for any other act, operation or omission of Authority in respect to the Contract, under any theory whatsoever.

CIVIL RIGHTS

Nondiscrimination - In accordance with Title VI of the Civil Rights Act, as amended, 42 U.S.C. § 2000d, section 303 of the Age Discrimination Act of 1975, as amended, 42 U.S.C. § 6102, section 202 of the Americans with Disabilities Act of 1990, 42 U.S.C. § 12132, and Federal transit law at 49 U.S.C. § 5332, the Contractor agrees that it will not discriminate against any employee or applicant for employment because of , Race, Color, Creed, Religion, Sex (including pregnancy), Mental/Physical Disability, Age (40 or over), National Origin, Genetic Information or any other basis prohibited by law. In addition, the Contractor agrees to comply with applicable Federal implementing regulations and other implementing requirements FTA may issue.

Equal Employment Opportunity

In accordance with Title VII of the Civil Rights Act, as amended, 42 U.S.C. § 2000e, and Federal transit laws at 49 U.S.C. § 5332, the Contractor agrees to comply with all applicable equal employment opportunity requirements of U.S. Department of Labor (U.S. DOL) regulations, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor," 41 C.F.R. Parts 60 et seq ., (which implement Executive Order No. 11246, "Equal Employment Opportunity," as amended by Executive Order No. 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," 42 U.S.C. § 2000e note), and with any applicable Federal statutes, executive orders, regulations, and Federal policies that may in the future affect construction activities undertaken in the course of the Project. The Contractor agrees to take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, creed, national origin, sex, or age. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

Age - In accordance with section 4 of the Age Discrimination in Employment Act of 1967, as amended, 29 U.S.C. § § 623 and Federal transit law at 49 U.S.C. § 5332, the Contractor agrees to refrain from discrimination against present and prospective employees for reason of age. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

ADA - In accordance with section 102 of the Americans with Disabilities Act, as amended, 42 U.S.C. § 12112, the Contractor agrees that it will comply with the requirements of U.S. Equal Employment Opportunity Commission, "Regulations to Implement the Equal Employment Provisions of the Americans with Disabilities Act," 29 C.F.R. Part 1630, pertaining to employment of persons with disabilities. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

The Contractor also agrees to include these requirements in each subcontract financed in whole or in part with Federal assistance provided by FTA, modified only if necessary to identify the affected parties.

DISADVANTAGED BUSINESS ENTERPRISE (DBE)

(1) Policy Statement

The Transit Authority of the City of Omaha d/b/a Authority has established a Disadvantaged Business Enterprise (DBE) program in accordance with regulations of the U.S. Department of Transportation (DOT), 49 CFR Part 26. Authority has received Federal financial assistance from the Department of Transportation, and as a condition of receiving this assistance, Authority has signed an assurance that it will comply with 49 CFR Part 26.

It is the policy of Authority to ensure that DBEs as defined in part 26, have an equal opportunity to receive and participate in DOT–assisted contracts. It is also our policy:

- To ensure nondiscrimination in the award and administration of DOT-assisted contracts;
- To create a level playing field on which DBEs can compete fairly for DOT-assisted contracts;
- To ensure that the DBE Program is narrowly tailored in accordance with applicable law;
- To ensure that only firms that fully meet 49 CFR Part 26 eligibility standards are permitted to participate as DBEs;
- To help remove barriers to the participation of DBEs in DOT-assisted contracts;
- To assist the development of firms that can compete successfully in the market place outside the DBE Program.

The Director of Legal/Human Resources has been delegated as the DBE Liaison Officer. In that capacity, the Director of Legal/Human Resources is responsible for implementing all aspects of the DBE program. Implementation of the DBE program is accorded the same priority as compliance with all other legal obligations incurred by Authority in its financial assistance agreements with the Department of Transportation.

The Authority Board of Directors has adopted a formal Operating Policy demonstrating the company's commitment to implementing all aspects of the DBE program which has been disseminated to managers and officials responsible for procurement of goods and services. The Policy Statement is posted on company Bulletin Boards. We have distributed this statement to DBE and non-DBE business communities that perform work for us on DOT-assisted contracts by posting the statement on the company's website and including the Statement of Policy in solicitation documents.

(2) The (Contractor, Sub-recipient, or Sub-contractor) shall not discriminate on the basis of race, color, national origin, or sex in the performance of the (Contract or Agreement). The requirements of 49 C.F.R. Part 26 or at another Part if reissued and the Recipient's U.S. DOT-Approved Disadvantaged Business Enterprise (DBE) Program (where required) are incorporated in this (Contract or Agreement) by reference. Failure by the (Contractor, Sub-recipient, or Sub-contractor) to carry out these requirements is a material breach of the (Contract or Agreement), which may result in the termination of the (Contract or Agreement) or such other remedy as the Recipient deems appropriate.

(2) The prime contractor agrees to pay each sub-contractor under this prime contract for satisfactory performance of its contract within thirty (30) days following satisfactory performance of the sub-contractor's work. The prime contractor further agrees to return any retainage payments to each subcontractor within thirty (30) days upon satisfactory completion of the sub-contractor's work. Any delay or postponement of payment may occur only for good cause following written approval of Authority. This clause applies to both DBE and non-DBE sub-contractors.

INCORPORATION OF FEDERAL TRANSIT ADMINISTRATION (FTA) TERMS

The preceding provisions include, in part, certain Standard Terms and Conditions required by DOT, whether or not expressly set forth in the preceding contract provisions. All contractual provisions required by DOT, as set forth in FTA Circular 4220.1E dated June 19, 2003, are hereby incorporated by reference. Anything to the contrary herein notwithstanding, all FTA mandated terms shall be deemed to control in the event of a conflict with other provisions contained in this Agreement. The Contractor shall not perform any act, fail to perform any act, or refuse to comply with any of The Authorities requests, which would cause The Authority to be in violation of the FTA terms and conditions.

GOVERNMENT-WIDE DEBARMENT AND SUSPENSION

Contractors are required to pass this requirement on to subcontractors seeking subcontracts over $100,000. Thus, the terms "lower tier covered participant" and "lower tier covered transaction" include both contractors and subcontracts and contracts and subcontracts over $100,000.

By signing and submitting this bid or proposal, the prospective lower tier participant is providing the signed certification set out below.

The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, The Authority may pursue available remedies, including suspension and/or debarment.

The prospective lower tier participant shall provide immediate written notice to The Authority if at any time the prospective lower tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "persons," "lower tier covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549 [49 CFR Part 29]. You may contact The Authority for assistance in obtaining a copy of those regulations.

The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized in writing by The Authority.

The prospective lower tier participant further agrees by submitting this proposal that it will include the following clause, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions:

"*Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transaction*"

The prospective lower tier participant certifies, by submission of this bid or proposal, that neither it nor its "principals" [as defined at 49 C.F.R. § 29.105(p)] is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency."

When the prospective lower tier participant is unable to certify to the statements in this certification, such prospective participant shall attach an explanation to this proposal.

A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that it is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the Non-procurement List issued by U.S. General Service Administration.

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

Except for transactions authorized under Paragraph 5 of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to all remedies available to the Federal Government, The Authority may pursue available remedies including suspension and/or debarment.

BUY AMERICA

The Contractor agrees to comply with 49 U.S.C. 5323(j) and 49 C. F.R. part 661, which provide that Federal Funds may not be obligated unless all steel, iron and manufactured products used in FTA funded projects are produced in the United States, unless a waiver has been granted by the FTA or the product is subject to a general waiver. General waivers are listed in 49 C.F.R. 661.7.

DISPUTE / CONTINUING PERFORMANCE

In the event of any dispute between Authority and Contractor with respect to the interpretation of this Contract, any required payment under or the performance required by this Contract, including any dispute which may result in a claim, (a "Dispute"), the aggrieved Party shall notify the other in writing of the Dispute then existing (the "Dispute Notice"). In order for a Party to proceed under this Section, the Dispute Notice must specifically state that the aggrieved Party is invoking the Dispute procedure of this Section. The Parties shall then make a good faith attempt to resolve the Dispute, first through direct discussions between their respective designated representatives. In the event the designated representatives are unable to reach agreement then upon the written request of either Party, each of the Parties will appoint a designated executive whose task it will be to meet for the purpose of endeavoring to resolve such dispute. The designated executives shall meet in Omaha Nebraska as often as the Parties reasonably deem necessary in order to gather and furnish to the other all information with respect to the matter in issue which the Parties believe to be appropriate and germane in connection with its resolution. Such executives will discuss the problem and/or negotiate in good faith in an effort to resolve the dispute without the necessity of any formal proceeding relating thereto. No action for the resolution of such dispute outside of these procedures shall be taken by either Party until one of the designated executives concludes in good faith that amicable resolution through continued negotiation of the matter in issue does not appear likely and so notifies the other designated executive in writing either party in its sole discretion may invoke litigation, provided that failure to invoke litigation shall not be a waiver of any such Dispute except as otherwise provided in the Contract. During any mediation or litigation which arises out of a Dispute, all parties will continue to perform pursuant to the Contract, without prejudice to the express rights of Authority or Contractor set forth in this Section to terminate the Contract. In addition to the specific rights

of termination and suspension as set forth, Authority and Contractor shall have also available the remedy of specific performance, which may be raised as a defense in any action commenced prior to the Parties' compliance with this Section

LOBBYING

Contractors who apply or bid for an award of $100,000 or more shall execute and submit with their bid or offer, the certification required by 49 CFR part 20, "New Restrictions on Lobbying." Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. 1352. Each tier shall also disclose the name of any registrant under the Lobbying Disclosure Act of 1995 who has made lobbying contacts on its behalf with non-Federal funds with respect to that Federal contract, grant or award covered by 31 U.S.C. 1352. Such disclosures are forwarded from tier to tier up to the recipient.

CLEAN AIR

The Contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. §§ 7401 et seq . The Contractor agrees to report each violation to the Purchaser and understands and agrees that the Purchaser will, in turn, report each violation as required to assure notification to FTA and the appropriate EPA Regional Office.

The Contractor also agrees to include these requirements in each subcontract exceeding $100,000 financed in whole or in part with Federal assistance provided by FTA.

CLEAN WATER

The Contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Federal Water Pollution Control Act, as amended, 33 U.S.C. 1251 et seq . The Contractor agrees to report each violation to the Purchaser and understands and agrees that the Purchaser will, in turn, report each violation as required to assure notification to FTA and the appropriate EPA Regional Office.

The Contractor also agrees to include these requirements in each subcontract exceeding $100,000 financed in whole or in part with Federal assistance provided by FTA.

CARGO PREFERENCE

The contractor agrees to use privately owned United States-Flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, material, or commodities pursuant to the underlying contract to the extent such vessels are available at fair and reasonable rates for United States-Flag commercial vessels.

And, to furnish within 20 working days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, "on-board" commercial ocean bill-of -lading in English for each shipment of cargo described in the preceding paragraph to the Division of National Cargo, Office of Market Development, Maritime Administration, Washington, DC 20590 and to the FTA recipient (through the contractor in the case of a subcontractor's bill-of-lading.)

Contractor agrees to include these requirements in all subcontracts issued pursuant to this contract when the subcontract may involve the transport of equipment, material, or commodities by ocean vessel.

FLY AMERICA REQUIREMENTS

The Contractor agrees to comply with 49 U.S.C. 40118 (the "Fly America" Act) in accordance with the General Services Administration's regulations at 41 CFR Part 301-10, which provide that recipients and sub-recipients of Federal funds and their contractors are required to use U.S. Flag air carriers for U.S Government-financed international air travel and transportation of their personal effects or property, to the extent such service is available, unless travel by foreign air carrier is a matter of necessity, as defined by the Fly America Act. The Contractor shall submit, if a foreign air carrier was used, an appropriate certification or memorandum adequately explaining why service by a U.S. flag air carrier was not available or why it was necessary to use a foreign air carrier and shall, in any event, provide a certificate of compliance with the Fly America requirements. The Contractor agrees to include the requirements of this section in all subcontracts that may involve international air transportation.

DAVIS-BACON ACT

Minimum wages

All laborers and mechanics employed or working upon the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR Part 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where the workers can easily see it.

The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

Except with respect to helpers as defined as 29 CFR 5.2(n)(4), the work to be performed by the classification requested is not performed by a classification in the wage determination; and the classification is utilized in

the area by the construction industry; and the proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination; and with respect to helpers as defined in 29 CFR 5.2(n)(4), such a classification prevails in the area in which the work is performed.

If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii) (B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

The contracting officer shall require that any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefor only when the following criteria have been met:

The work to be performed by the classification requested is not performed by a classification in the wage determination; and the classification is utilized in the area by the construction industry; and the proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting

officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination with 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(v) (B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

Withholding

The Authority shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), all or part of the wages required by the contract, The Authority may, after written notice to the contractor, sponsor, applicant, or Authority, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

Payrolls and Basic Records

Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the project). Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to The Authority for transmission to the Federal Transit Administration. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR part 5. This information may be submitted in any form desired. Optional Form WH-347 is available for this purpose and may be purchased from the Superintendent of Documents (Federal Stock Number 029-005-00014-1), U.S. Government Printing Office, Washington, DC 20402. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors.

Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be maintained under 29 CFR part 5 and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the Federal Transit Administration or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency may, after written notice to the contractor, sponsor, applicant, or Authority, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

Apprentices and Trainees

Apprentices - Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of

Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator of the Wage and Hour Division of the U.S. Department of Labor determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

Trainees - Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

Equal employment opportunity - The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

Compliance with Copeland Act requirements - The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

Subcontracts - The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the Federal Transit Administration may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

Contract termination: debarment - A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

Compliance with Davis-Bacon and Related Act requirements - All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

Disputes concerning labor standards - Disputes arising out of the labor standards provisions of this contract shall not be subject to the general dispute clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

Certification of eligibility - By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1). The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

Overtime requirements - No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

Violation; liability for unpaid wages; liquidated damages - In the event of any violation of the clause set forth in paragraph (1) of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1) of this section, in the sum of $ 10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1) of this section.

Withholding for unpaid wages and liquidated damages - The Authority shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such

contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2) of this section.

Subcontracts - The contractor or subcontractor shall insert in any subcontracts the clauses set forth in this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in this section.

Payrolls and basic records - (i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the project). Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

Contract Work Hours and Safety Standards Act - (i) The Contractor agrees to comply with section 107 of the Contract Work Hours and Safety Standards Act, 40 U.S.C. section 333, and applicable DOL regulations, " Safety and Health Regulations for Construction " 29 C.F.R. Part 1926. Among other things, the Contractor agrees that it will not require any laborer or mechanic to work in unsanitary, hazardous, or dangerous surroundings or working conditions.

Subcontracts - The Contractor also agrees to include the requirements of this section in each subcontract. The term "subcontract" under this section is considered to refer to a person who agrees to perform any part of the labor or material requirements of a contract for construction, alteration or repair. A person who undertakes to perform a portion of a contract involving the furnishing of supplies or materials will be considered a "subcontractor" under this section if the work in question involves the performance of construction work and is to be performed: (1) directly on or near the construction site, or (2) by the employer for the specific project on a customized basis. Thus, a supplier of materials which will become an integral part of the construction is a "subcontractor" if the supplier fabricates or assembles the goods or materials in question specifically for the construction project and the work involved may be said to be construction activity. If the goods or materials in question are ordinarily sold to other customers from regular inventory, the supplier is not a "subcontractor." The requirements of this section do not apply to contracts or subcontracts for the purchase of supplies or materials or articles normally available on the open market.

COPELAND ANTI-KICKBACK PROHIBITIONS

Whoever, by force, intimidation, or threat of procuring dismissal from employment, or by any other manner whatsoever induces any person employed in the construction, prosecution, completion or repair of any public building, public work, or building or work financed in whole or in part by loans or grants from the United States, to give up any part of the compensation to which he is entitled under his contract of employment, shall be fined under this title or imprisoned not more than five years, or both.

BONDING

Bidders shall furnish a bid guaranty in the form of a bid bond, or certified treasurer's or cashier's check issued by a responsible bank or trust company, made payable to the RECIPIENT. The amount of such guaranty shall be equal to **5%** of the total bid price.

In submitting this bid, it is understood and agreed by bidder that the RECIPIENT reserves the right to reject any and all bids, or part of any bid, and it is agreed that the Bid may not be withdrawn for a period of [90] days subsequent to the opening of bids, without the written consent of RECIPIENT.

It is also understood and agreed that if the undersigned bidder should withdraw any part or all of his bid within [90] days after the bid opening without the written consent of the RECIPIENT, or refuse or be unable to enter into this Contract as provided above, or refuse or be unable to furnish adequate and acceptable Performance and Payment Bonds, or refuse or be unable to furnish adequate and acceptable insurance, as provided above, it shall forfeit its bid guaranty to the extent RECIPIENT'S damages occasioned by such withdrawal, or refusal, or inability to enter into an agreement, or provide adequate security thereof.

It is further understood and agreed that to the extent the defaulting bidder's bid guaranty shall prove inadequate to fully recompense RECIPIENT for the damages occasioned by default, then the undersigned bidder agrees to indemnify RECIPIENT and pay over to RECIPIENT the difference between the bid guarantee and RECIPIENT'S total damages so as to make RECIPIENT whole.
The undersigned understands that any material alteration of any of the above or any of the material contained herein, other than that requested will render the bid unresponsive

SEISMIC SAFETY

The contractor agrees that any new building or addition to an existing building will be designed and constructed in accordance with the standards for Seismic Safety required in Department of Transportation Seismic Safety Regulations 49 CFR Part 41 and will certify to compliance to the extent required by the regulation. The contractor also agrees to ensure that all work performed under this contract including work performed by a subcontractor is in compliance with the standards required by the Seismic Safety Regulations and the certification of compliance issued on the project.

ENERGY CONSERVATION

The contractor agrees to comply with mandatory standards and policies relating to energy efficiency which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act.

RECYCLED PRODUCTS

These requirements apply to contractors and sub-contractors at all tiers. The Recycled Products requirements apply to all contracts for items designated by the EPA, when the purchaser or contractor

procures $10,000 or more of one of these items during the fiscal year, or has procured $10,000 or more of such items in the previous fiscal year, using Federal funds.

The contractor agrees to comply with all the requirements of Section 6002 of the Resource Conservation and Recovery Act (RCRA), as amended (42 U.S.C. 6962), including but not limited to the regulatory provisions of 40 CFR Part 247, and Executive Order 12873, as they apply to the procurement of the items designated in Subpart B of 40 CFR Part 247.

STATE AND LOCAL LAW DISCLAIMER

All regulations listed in this document apply to the Third Party Contractor in the same manner as they apply to The Authority. Offers will be received and reviewed, but no contract shall be awarded until all applicable Federal, State and Local Government regulations have been complied with.

ADA ACCESS

The contractor agrees to comply with the requirements of 49 U.S.C. § 5301 (d), which states the Federal policy that the elderly and persons with disabilities have the same right as other persons to use mass transportation service and facilities, and that special efforts shall be made in planning and designing those services and facilities to implement that policy. The contractor also agrees to comply with all applicable requirements of section 504 of the Rehabilitation Act of 1973, as amended, 29 U.S.C. § 794, which prohibits discrimination on the basis of handicaps, with the Americans with Disabilities Act of 1990 (ADA), as amended, 42 U.S.C. §§ 12101 *et seq*., which requires that accessible facilities and services be made available to persons with disabilities, including any subsequent amendments to that Act, and with the Architectural Barriers act of 1968, as amended, 42 U.S.C. §§ 4151 *et seq*., which requires that buildings and public accommodations be accessible to persons with disabilities, including any subsequent amendments to that Act. In addition, the contractor agrees to comply with any and all applicable requirements issued by the FTA, DOT, DOJ, U.S. GSA, U.S. EEOC, U.S. FCC, any subsequent amendments thereto and any other nondiscrimination statute(s) that may apply to the Project.

FEDERAL PARTICIPATION

In the announcement of any third party contract award for goods or services (including construction services), having an aggregate value of $500,000 or more, The Authority will specify the amount of Federal assistance to be used in financing that acquisition of goods and services, and to express the amount of that Federal assistance as a percentage of the total cost of that third party contract.

NEW EMPLOYEE WORK ELIGIBILITY STATUS

The Contractor is required and hereby agrees to use a federal immigration verification system to determine the work eligibility status of new employees physically performing services within the State of Nebraska. A federal immigration verification system means the electronic verification of the work authorization program authorized by the Illegal Immigration Reform and Immigrant Responsibility Act of 1996, 8 U.S.C. 1324a, known as the E-Verify Program, or an equivalent federal program designated by the United States Department of Homeland Security or other federal agency authorized to verify the work eligibility status of a newly hired employee.

If the Contractor is an individual or sole proprietorship, the following applies:

1. The Contractor must complete the United States Citizenship Attestation Form, available on the Department of Administrative Services website at www.das.state.ne.us.

2. If the Contractor indicates on such attestation form that he or she is a qualified alien, the Contractor agrees to provide the US Citizenship and Immigration Services documentation required to verify the Contractor's lawful presence in the United States using the Systematic Alien Verification for Entitlements (SAVE) Program.

3. The Contractor understands and agrees that lawful presence in the United States is required and the Contractor may be disqualified or the contract terminated if such lawful presence cannot be verified as required by Neb. Rev. Stat. §4-108.

VETERANS PREFERENCE

Contractors working on a capital project funded using FTA assistance give a hiring preference, to the extent practicable, to veterans (as defined in section 2108 of title 5) who have the requisite skills and abilities to perform the construction work required under the contract. This subsection shall not be understood, construed or enforced in any manner that would require an employer to give a preference to any veteran over any equally qualified applicant who is a member of any racial or ethnic minority, female, an individual with a disability, or a former employee.

SPECIAL PROVISION – TEXT MESSAGING WHILE DRIVING

In accordance with Executive Order No. 13513,Federal Leadership on Reducing Text Messaging While Driving, October 1, 2009, 23 U.S.C.A. § 402 note, and DOT Order 3902.10, Text Messaging While Driving December 30, 2009, the Grantee is encouraged to comply with the terms of the following Special Provision.

a. Definitions - As used in this Special Provision:

1) Driving

Means operating a motor vehicle on a roadway, including while temporarily stationary because of traffic, a traffic light, stop sign, or otherwise. Driving does not include being in your vehicle (with or without the motor running) in a location off the roadway where it is safe and legal to remain stationary.

2) Text Messaging

Means reading from or entering data into any handheld or other electronic device, including for the purpose of short message service texting, e-mailing, instant messaging, obtaining navigational information, or engaging in any other form of electronic data retrieval or electronic data communication. The term does not include the use of a cell phone or other electronic device for the limited purpose of entering a telephone number to make an outgoing call or answer an incoming call, unless the practice is prohibited by State or local law.

b. Safety - The Grantee is encouraged to:

1) Adopt and enforce workplace safety policies to decrease crashes caused by distracted drivers including policies to ban text messaging while driving-

a) Grantee-owned or Grantee-rented vehicles or Government-owned, leased or rented vehicles;

b) Privately-owned vehicles when on official Project related business or when performing any work for or on behalf of the Project; or
c) Any vehicle, on or off duty, and using an employer supplied electronic device.

2) Conduct workplace safety initiatives in a manner commensurate with the Grantee's size, such as:
   a) Establishment of new rules and programs or re-evaluation of existing programs to prohibit text messaging while driving; and
   b) Education, awareness, and other outreach to employees about the safety risks associated with texting while driving.

3) Include this Special Provision in its sub-agreements with its sub-recipients and third party contracts and also encourage its sub-recipients, lessees, and third party contractors to comply with the terms of this Special Provision, and include this Special Condition in each sub-agreement, lease, and third party contract at each tier financed with Federal assistance provided by the Federal Government.

EXHIBIT A

Receipt of Federal Clauses

Project: **Authority – Boiler Repair and Snow Melt System Activation**

Date

Project No. **NE-90-X104**

Specification No. **08-17**

I have reviewed the attached Federal Clauses for Procurement of Construction in conjunction with Authority's procurement of **NE-90-X104 Spec #: 08-17** for which:

_____

_____

has provided qualifications for consideration and hereby affirm that:

_____

_____

shall conform to and abide by all aforementioned requirements as set forth and any amendments thereto.

_____
Authorized Representative

_____
Title

_____ _____
Company Name DUNS/TINS Number

_____
Date

EXHIBIT B

Debarment and Suspension Certification for Prospective Contractor

Primary covered transactions must be completed by Proposer for contract value over $25,000.

Choose one alternative:

□ The Proposer, _____ certifies to the best of its knowledge and belief that it and its principals:

1. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any federal department or agency;
2. Have not within a three-year period preceding this Proposal 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) transaction or Contract under a public transaction; violation of federal or state antitrust statutes or commission or embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
3. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (federal, state, or local) with commission of any of the offenses enumerated in Paragraph 2 of this certification; and
4. Have not within a three-year period preceding this Proposal had one or more public transactions (federal, state or local) terminated for cause or default. OR

□ The Proposer is unable to certify to all of the statements in this certification, and attaches its explanation to this certification. (In explanation, certify to those statements that can be certified to and explain those that cannot.) The Proposer certifies or affirms the truthfulness and accuracy of the contents of the statements submitted on or with this certification and understands that the provisions of Title 31 USC § Sections 3801 are applicable thereto.

Executed in:

_____
Name

_____
Authorized Signature

_____
Title

_____
Date

_____

EXHIBIT C

Debarment and Suspension Certification (Lower-Tier Covered Transaction)

This form is to be submitted by each Subcontractor receiving an amount exceeding $25,000.

–The prospective lower-tier participant (Proposer) certifies, by submission of this Proposal, that neither it nor its "principals" as defined at 49 CFR § 29.105(p) is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any federal department or agency. If the prospective Proposer is unable to certify to the statement above, it shall attach an explanation, and indicate that it has done so by placing an "X" in the following space: _____ THE PROPOSER, _____ CERTIFIES OR AFFIRMS THE TRUTHFULNESS AND ACCURACY OF_____,
EACH STATEMENT OF ITS CERTIFICATION AND EXPLANATION, IF ANY. IN ADDITION, THE PROPOSER UNDERSTANDS AND AGREES THAT THE PROVISIONS OF 31 USC §§ 3801 *ET SEQ*. APPLY TO THIS CERTIFICATION AND EXPLANATION, IF ANY.
Name and title of the Proposer's authorized official:
Name Title
Authorized Signature Date
DUNS/TIN Number:

EXHIBIT D

Non-Collusion Affidavit

This affidavit is to be filled out and executed by the Proposer; if a corporation makes the bid, then by its properly executed agent. The name of the individual swearing to the affidavit should appear on the line marked "Name of Affiant." The affiant's capacity, when a partner or officer of a corporation, should be inserted on the line marked "Capacity." The representative of the Proposer should sign his or her individual name at the end, not a partnership or corporation name, and swear to this affidavit before a notary public, who must attach his or her seal.

– State of _____ , County of

I, _____, being first duly sworn, do hereby state that

(Name of Affiant)

I am _____ of _____

(Capacity) (Name of Firm, Partnership or Corporation)

whose business is and who resides at _____

and that _____

(Give names of all persons, firms, or corporations interested in the bid)

is/are the only person(s) with me in the profits of the herein contained Contract; that the Contract is made without any connection or interest in the profits thereof with any persons making any bid or Proposal for said Work; that the said Contract is on my part, in all respects, fair and without collusion or fraud, and also that no members of the Board of Trustees, head of any department or bureau, or employee therein, or any employee of the Authority, is directly or indirectly interested therein.

Sworn to before me this_____ day of _____, 20____.

– Seal -

Notary Public My Commission Expires

EXHIBIT E

Lobbying Certification

The Proposer certifies, to the best its knowledge and belief, that:

1. No federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of a federal department or agency, a member of the U.S. Congress, an officer or employee of the U.S. Congress, or an employee of a member of the U.S. Congress in connection with the awarding of any federal Contract, the making of any federal grant, the making of any federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment or modification thereof.

2. If any funds other than federal appropriated funds have been paid or will be paid to any person for making lobbying contacts to an officer or employee of any agency, a member of Congress, an officer or employee of Congress, or an employee of a member of Congress in connection with this federal Contract, grant, loan or cooperative agreement, the undersigned shall complete and submit Standard Form LLL, "Disclosure Form to Report Lobbying," in accordance with its instruction, as amended by "Government-wide Guidance for New Restrictions on Lobbying," 61 Fed. Reg. 1413 (1/19/96).

3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants and contracts under grants, loans and cooperative agreements) and that all subrecipients shall certify and disclose accordingly. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31, USC § 1352 (as amended by the Lobbying Disclosure Act of 1995). Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

THE PROPOSER, _____, CERTIFIES OR AFFIRMS THE TRUTHFULNESS AND ACCURACY OF EACH STATEMENT OF ITS CERTIFICATION AND DISCLOSURE, IF ANY. IN ADDITION, THE PROPOSER UNDERSTANDS AND AGREES THAT THE PROVISIONS OF 31 USC §§ 3801 ET SEQ. APPLY TO THIS CERTIFICATION AND DISCLOSURE, IF ANY.

_____
Name of the Bidder or Proposer's Authorized Official

_____
Title:

_____ _____
Signature Date

EXHIBIT F

REQUEST FOR SUBSTITUTIONS/APPROVED EQUALS

Authority Boiler Repair and Snow Melt System Activation

Authority Project NE 09-X104 / Specification # 08-17 Date _____

Use one form per requested equal/per clarification; duplicate as needed.

SPECIFIED ITEM: _____

Section: _____

Drawing Number(s): _____ Detail Number(s): _____

PROPOSED SUBSTITUTION: _____

_____

_____

REASON FOR NOT GIVING PRIORITY TO SPECIFIED ITEMS: _____

_____

_____

Attach product data that includes description, specifications, drawings, photographs, performance and test data adequate for evaluation of request; applicable portions of data are clearly identified.

Attached data also includes a description of changes to Contract Documents that proposed substitution will require for its proper installation.

The undersigned certifies that the following paragraphs, unless modified by attachments, are correct:

1. Proposed Substitution has been fully checked and coordinated with Contract Documents.
2. Proposed Substitution does not affect dimensions shown on Drawings.
3. Proposed Substitution does not require revisions to mechanical or electrical work.
4. The undersigned will pay for changes to building design, including Architectural and Engineering design, detailing, and construction costs caused by requested Substitution.
5. Proposed Substitution will have no adverse affect on other trades, construction schedule, or specified warranty requirements.
6. Maintenance and service parts will be locally available for proposed substitution.

The undersigned further states that the function, appearance, and quality of proposed Substitution are equivalent or superior to specified item.

Submitted by:

_____ By: _____

(Firm) (Signature)

_____

(Address)

_____ Telephone: (____)_____

For use by the Architect/Engineer:

[ ] Approved [ ] Approved as noted [ ] Not Approved [ ] Received too late

_____

Signature Title Date

Remarks:

_____

_____

_____

EXHIBIT G
ACKNOWLEDGMENT OF ADDENDA
Boiler Repair and Snow Melt System Activation Project

--- This form must be submitted as an attachment to the Bid Proposal Form ---

If, in the course of this request for offers, it becomes necessary to modify the original solicitation documents, acknowledged receipt of each addendum must be clearly established and included with the Offer. Failure to acknowledge receipt of all addenda may cause an Offer to be considered non-responsive.

Acknowledgment of Addenda

Project: Authority – Boiler Repair and Snow Melt System Activation Project
Project No. NE-90-X104 Specification No. 08-17

The undersigned acknowledges receipt of the following addenda to the original solicitation documents:

Addendum No. _____, Dated _____

Addendum No. _____, Dated _____

Addendum No. _____, Dated _____

Addendum No. _____, Dated _____

Addendum No. _____, Dated _____

Addendum No. _____, Dated _____

_____
Company

_____
Street Address

_____
City, State, Zip

_____
Signature of Authorized Representative

_____
Title of Authorized Representative

_____
Phone

EXHIBIT H

Conflict of Interest Disclosure Statement

Project Name: **Authority – Boiler Repair and Snow Melt System Activation**

As the Contractor's project manager or approved representative, I, _____ hereby certify that: I am familiar with the attached conflict of interest guidance and the conflict of interest laws including, but not limited to, 49 CFR 18.36, 48 Fed Reg. 34263, 40 CFR 1506 and Nebraska Rev. Stat. §§49-1401 to 1444 and 49-1493 to 14,104.

☐ And to the best of my knowledge and belief, of all relevant facts – concerning past present or currently planned interests or activities (financial, contractual, organizational or otherwise that relate to the proposed work and bear on whether I have or my organization has a possible conflict of interest), determined that, for myself, any owner, partner or employee with my firm or any of my sub-consulting firms providing services for this project, including any family members and personal interests, that for the above referenced project:

☐ No real or potential conflicts of interest exist with respect to (1) be able to render impartial, technically sound, and objective assistance or advice and (2) being given an unfair competitive advantage

☐ Real conflicts of interest or the potential for conflicts of interest exist.

☐ Furthermore, I certify that I have reviewed the proposed scope of work and project area and to the best of my knowledge, determined that, for myself, any owner, partner or employee, with my firm or any of my sub-consulting firms providing services for this project, including family members and personal interests of the above persons that are no financial or other interests in the outcome of the project, including but not limited to work associated with the Bus Rapid Transit Final Design unless described and noted on the attached.

If a real or potential conflict has been identified, describe on the attached sheet the nature of the conflict, including the information requested on the reverse side of this form for the type of conflict being reported, and provide a detailed description of Contractor's proposed mitigation measures (if possible). Complete and sign this form and send it, along with all attachments, to Authority.

Furthermore, I certify that for myself, any owner, partner or employee with my firm or any of my sub-consulting firms providing services for this project, will comply with professional codes of conduct governing participation in the above referenced project and whenever conducting business on behalf of Authority.

I recognize that a conflict of interest disclosure is an ongoing obligation. Should I or my organization become aware of any actual or potential conflicts of interest during the performance of this contract, I or my organization will advise Authority and propose mitigation or explain why none is needed. Conflicts of interest or the failure to disclose conflicts, real or potential, may preclude award of a contract or termination of a contract for cause.

Signature:_____

Printed Name:_____ Organization:_____

Title:_____ Date:_____

EXHIBIT H

Conflict of Interest Disclosure Statement

Project Name: **Authority – Boiler Repair and Snow Melt System Activation**

REAL OR POTENTIAL CONFLICT DESCRIPTION:

EXHIBIT H

Conflict of Interest Disclosure Form

The following Sections are provided as guidance in determining whether a real or potential Conflict of Interest (COI) exists and in disclosing details concerning potential conflicts of interest.

Section 1 – Contractor Officer or Employee COI

Is there anyone in your firm or business who is either; (1) employed by, on a full or part time basis; or (2) a public official or agent of, the local public agency or partner agencies from whom this Request for Qualifications (IFB) has been received?

If yes, please list below: (1) the name, address and phone number of the person(s); (2) the position held by that person(s) with Contractor; (3) the position held by that person(s); and (4) a detailed description of the duties of that person(s) for the local public agency, including whether that person(s) has any duties concerning the negotiating, approving, accepting or administering of any contract or subcontract for the federal-aid transportation project?

_____

_____

_____

_____

_____

Section 2 – Persons Associated with local public agency, Financial or Personal Interest Conflict of Interest

The potential for conflicts of interest extends to persons associated with a local public agency official, employee or agent. There may be a conflict of interest on a federal-aid project if a person associated with an official, employee or agent has a financial or personal interest in a consulting firm or business providing services for a project. These indirect conflicts of interest can extend to the following persons associated with an LPA official, employee, or agent: (a) Any member of his [or her] immediate family; (b) his [or her] partner; or (c) an organization which employs, or is about to employ, any of the above, when that organization has a financial or other interest in the firm selected for award. Is there anyone with a financial or personal interest in your firm or business who is associated with (as listed in the preceding sentence) and responsible for negotiating, approving, accepting or administering any contract or subcontract on behalf of Authority for this project?

If yes, please below: (1) the name, address and phone number of the person(s); (2) the nature of the financial or personal interest in firm; (3) the person's relationship to Authority, including the position held by the official, employee or agent of Authority; and (4) a detailed description of the duties of the official, employee or agent of Authority, including whether that person(s) has any duties for the Authority concerning the negotiating, approving, accepting or administering of any contract or subcontract for Authority's federal-aid transportation project?

Section 3 – Real Estate COI

If Contractor (or sub-Contractor) has an interest in real estate located along or near the project **that might be acquired, in whole or in part,** for this federal-aid transportation project, which interest is either; (1) through anyone in Contractor's organization, including a member of immediate family or a sub-Contractor, having an ownership interest in; or (2) through a client for whom Contractor has been retained to provide professional services to the owner for that tract of land, then Contractor must disclose such interest and abstain from being involved in any aspect of the right-of-way valuation or acquisition process for the federal-aid transportation project.

If either of these situations exist, please provide below: (1) the name of the owner, the address and legal description of the property, and a description of the Contractor's interest in the property; (2) a map or aerial photo identifying the location of the property; (3) a description of the potential need or use of this property for the federal-aid transportation project; and (4) a declaration by Contractor that it will comply with the third sentence of 23 CFR Section 1.33.

Section 4 – Outcome of Project bias/Objectivity

If Contractor, agent or subcontractor because of other activities, financial interests, relationships, or contracts is unable, or potentially unable, to render impartial assistance or advice to the grantee (including the appearance of inability), then the Contractor must disclose such interest.

If any of these situations exist, please list below the nature of any potential partiality or appearance of any potential bias when Contractor, agent or subcontractor has or at any time during the life of the contract, any pecuniary or other interests in the outcomes of the project not listed above.

Section 5 – Unfair Competitive Advantage

Unfair competitive advantage occurs when one contractor has information not available to other contractors in the normal course of business. For example, an unfair competitive advantage would occur when a contractor developing specifications or work statements has access to information that the grantee has paid the contractor to develop, or information which the grantee has furnished to the contractor for its work, when that information has not been made available to the public. Another example where an unfair competitive advantage might arise is where a contractor is allowed to write specifications or statements of work around its own or an affiliate's corporate strengths or products and then compete for a contract based on those specifications. If an individual employee has access to inside information, a possible solution would be to wall off that employee, so he cannot give his employer an unfair competitive advantage.

If any of these conditions exist, describe below (1) the nature of the unfair competitive advantage including the type of information involved, (2) its source, and (3) the dates when such information was obtained or generated.

Section 6 – Supplemental

Do you (or your organization or subcontractor(s)) have or have you ever had any contracts, agreements, special clauses or other arrangements which prohibit you from proposing work to be performed in this solicitation or any portion thereof:

To avoid what you perceive as a possible conflict of interest do you or your organization or subcontractors propose to exclude portions of the proposed work; employ special clauses; or take other measures?

Other relevant information pertaining to a conflict of interest or potential for a conflict of interest:

Section 7 – Mitigation Plan

If applicable, please describe any proposed mitigation measures or plan:

Signature: _____

Printed Name: _____

Organization: _____

Title: _____

Date: _____

EXHIBIT I

Buy America Acknowledgement

The [bidder or offeror] must submit to [Recipient] the appropriate Buy America certification below with its [bid or offer]. Bids or offers that are not accompanied by a completed Buy America certification will be rejected as nonresponsive. In accordance with 49 C.F.R. § 661.6, for the procurement of steel, iron or manufactured products, use the certifications below.

Certificate of Compliance with Buy America Requirements

The bidder or offeror hereby certifies that it will comply with the requirements of 49 U.S.C. 5323(j)(1), and the applicable regulations in 49 C.F.R. part 661.

Date: _____

Signature: _____

Company: _____

Name: _____

Title:_____

Certificate of Non-Compliance with Buy America Requirements

The bidder or offeror hereby certifies that it cannot comply with the requirements of 49 U.S.C. 5323(j), but it may qualify for an exception to the requirement pursuant to 49 U.S.C. 5323(j)(2), as amended, and the applicable regulations in 49 C.F.R. § 661.7.

Signature:_____ Date:_____

Name: _____

Company:_____

Title:_____

EXHIBIT J

Davis Bacon Wage Acknowledgement

Project: Authority – Boiler Repair and Snow Melt System Activation Project Date _____

Project No**. NE-90-X104** **Specification No. 08-17**

I have reviewed the attached Davis-Bacon Preliminary Wage Determination (Attachment 1) in conjunction with Authority's procurement of **Boiler Repair and Snow Melt System Activation Project** for which _____ _____ has provided pricing and hereby affirm that _____ shall conform to and abide by the aforementioned requirements and as set by the Davis-Bacon Act and any amendments thereto.

See Attachmanet A for schedule of Davis Bacon Wages by Profession.

_____
Authorized Representative

_____
Title

_____
Company Name

_____
Date

ATTACHMENT A – SCHEDULE A DAVIS BACON WAGES

General Decision Number: NE170057 06/30/2017 NE57

Superseded General Decision Number: NE20160057

State: Nebraska

Construction Type: Building
BUILDING CONSTRUCTION INCLUDING WORK ON INDUSTRIAL SITES

County: Douglas County in Nebraska.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.20 for calendar year 2017 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.20 (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2017. The EO minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/06/2017
1	02/17/2017
2	02/24/2017
3	04/21/2017
4	05/26/2017
5	06/30/2017

BRNE0001-001 05/31/2016

	Rates	Fringes
BRICKLAYER	$ 27.80	14.74

CARP0427-001 06/01/2016

	Rates	Fringes
CARPENTER (Including Acoustical Ceiling Installation)	$ 25.60	12.36

CARP0427-004 06/01/2016

	Rates	Fringes
CARPENTER (Drywall Hanging,		

Finishing/Taping Only).....$ 25.60 12.36

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* ELEC0022-001 06/01/2017

	Rates	Fringes
ELECTRICIAN.....	$ 35.00	15.19

ELEV0028-001 01/01/2017

	Rates	Fringes
ELEVATOR MECHANIC.....	$ 41.80	31.585+a+b

FOOTNOTE:
a. Vacation Pay: 8% for persons with 5 or more years of service, 6% for persons with less than 5 years of service.
b. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, Friday after Thanksgiving, and Christmas Day.

ENGI0571-004 10/01/2013

	Rates	Fringes
OPERATOR: Crane.....	$ 27.08	10.69
OPERATOR: Forklift.....	$ 21.70	10.69

IRON0021-002 06/01/2016

	Rates	Fringes
IRONWORKER, STRUCTURAL.....	$ 28.61	14.68

LABO1140-003 06/01/2016

	Rates	Fringes
LABORER (Mason Tender, Brick & Hod).....	$ 20.63	9.40

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* PLUM0016-003 05/07/2017

	Rates	Fringes
PLUMBER (Excluding HVAC Pipe Installation).....	$ 33.85	13.31

PLUM0464-006 05/29/2016

	Rates	Fringes
PIPEFITTER (Includes HVAC Pipe Installation and Excludes HVAC System Installation).....	$ 35.04	16.44

SFNE0669-001 04/01/2017

	Rates	Fringes
SPRINKLER FITTER (Fire Sprinklers)	$ 34.75	15.84

SHEE0003-001 07/01/2015

	Rates	Fringes
SHEET METAL WORKER (Including HVAC Duct & System Installation)	$ 32.89	14.93

SUNE2011-031 10/27/2011

	Rates	Fringes
CAULKER	$ 17.13	0.00
CEMENT MASON/CONCRETE FINISHER	$ 18.44	4.08
ELECTRICIAN (Low Voltage Wiring)	$ 21.54	5.99
FORM WORKER	$ 19.07	3.84
GLAZIER	$ 17.67	1.71
LABORER: Common or General	$ 15.47	5.34
OPERATOR: Backhoe/Excavator/Trackhoe	$ 22.55	5.72
OPERATOR: Bobcat/Skid Steer/Skid Loader	$ 23.11	0.91
OPERATOR: Loader	$ 20.76	4.64
PAINTER: Brush, Roller and Spray	$ 14.26	0.00
ROOFER	$ 13.57	0.77
TRUCK DRIVER, Includes Dump and Tandem Truck	$ 14.77	1.41

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours

they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates

the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.

Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

SMALL BUSINESS ENTERPRISE

PARTICIPATION PROGRAM

I. Introduction:

In accordance with regulations of the U. S. Department of Transportation (DOT), 49 CFR Part 26, AUTHORITY has incorporated the following non-discriminatory element into its DBE program, in order to facilitate competition on DOT-assisted projects by small business concerns *(both DBE and non-DBE small businesses)* that is unique to and addresses specific needs within its respective market area.

A. Purpose/Objectives:

The purpose of AUTHORITY's Small Business Participation Program is to foster race-neutral small business participation in Department of Transportation ("DOT") assisted projects. Since small business elements developed by AUTHORITY will be a part of its approved DBE program plan, AUTHORITY will use the definition of "small business concerns" set out in 49 CFR §26.5 in administering its program. This will ensure that all small businesses allowed to participate in the program (DBEs and non-DBEs alike) are subject to the same size standards and, consequently compete with similarly-sized businesses. By facilitating participation for small businesses, AUTHORITY believes that establishing program elements that pull together various ways for reaching out to small businesses, makes it easier for the small businesses to compete for DOT-assisted contracts, thus fostering the objectives of AUTHORITY's DBE program.

B. Definitions*:*

Disadvantaged business enterprise or *DBE* means a for-profit small business concern— (1) That is at least 51 percent owned by one or more individuals who are both socially and economically disadvantaged or, in the case of a corporation, in which 51 percent of the stock is owned by one or more such individuals; and (2) Whose management and daily business operations are controlled by one or more of the socially and economically disadvantaged individuals who own it.

Socially and economically disadvantaged individual means any individual who is a citizen (or lawfully admitted permanent resident) of the United States and who is—

1. Any individual who a recipient finds to be a socially and economically disadvantaged individual on a case-by-case basis.
2. Any individual in the following groups, members of which are rebuttably presumed to be socially and economically disadvantaged:
    - (i) "Black Americans," which includes persons having origins in any of the Black racial groups of Africa;
    - (ii) "Hispanic Americans," which includes persons of Mexican, Puerto Rican, Cuban, Dominican, Central or South American, or other Spanish or Portuguese culture or origin, regardless of race;
    - (iii) "Native Americans," which includes persons who are American Indians, Eskimos, Aleuts, or Native Hawaiians;
    - (iv) "Asian-Pacific Americans," which includes persons whose origins are from Japan, China, Taiwan, Korea, Burma (Myanmar), Vietnam, Laos, Cambodia (Kampuchea), Thailand, Malaysia, Indonesia, the Philippines, Brunei, Samoa, Guam, the U.S. Trust Territories of the Pacific Islands (Republic of Palau), the Commonwealth of the Northern Marianas Islands, Macao, Fiji, Tonga, Kiribati, Juvalu, Nauru, Federated States of Micronesia, or Hong Kong;
    - (v) "Subcontinent Asian Americans," which includes persons whose origins are from India, Pakistan, Bangladesh, Bhutan, the Maldives Islands, Nepal or Sri Lanka;
    - (vi) Women;
    - (vii) Any additional groups whose members are designated as socially and economically disadvantaged by the Small Business Administration, at such time as the Small Business Administration designation becomes effective.

Small Business Administration or *SBA* means the United States Small Business Administration.

Small business concern means, with respect to firms seeking to participate as in DOT-assisted contracts, a small business concern as defined pursuant to section 3 of the Small Business Act and Small Business Administration regulations implementing it [13 CFR part 121] that also does not exceed the cap on average annual gross receipts specified in § 26.65(b).
Race-neutral measure or program is one that is, or can be used to assist all small businesses *(both DBEs and non-DBE small businesses)*. For the purposes of this part, *race-neutral* includes gender-neutrality.

II. Eligibility Standards:

To ensure that a firm is in fact a small business concern and to minimize fraud and abuse, AUTHORITY will take steps to verify eligibility of a firm to participate in the Small Business Participation Program. This means that the program will not allow firms to self-certify/verify as small businesses.

Therefore, *only* those small business firms certified or can be certified by the City of Omaha prior to a contract award are eligible for participation in AUTHORITY's Small Business Participation Program. (Emphasis added). See: http://www.cityofomaha.org/humanrights/contract-compliance for a listing of City of Omaha eligible small business firms.

Certified SBEs should be noted on the Required Subcontractor/Supplier Quote List form.

III. Contract Assurance:

The contractor, subcontractor, or sub-recipient shall not discriminate on the basis of race, color, creed, religion, sex (including pregnancy), disability, age (40 or older), national origin, genetic information, or any other basis prohibited by law in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of the contract or such other remedy that AUTHORITY deems appropriate.

IV. Goal Setting/Reporting Requirements:

AUTHORITY's Small Business Participation Program is intended to facilitate compliance with the twin obligations in 49 CFR §26.51: (1) to meet the maximum feasible portion of AUTHORITY's overall DBE goals by using race-neutral means of obtaining DBE participation and (2) to establish DBE (race-conscious) contract goals to meet any portion of the overall goal AUTHORITY is unable to meet using race-neutral means alone. The use of race-neutral small business goals on the same contracts that have DBE contract goals is difficult to administer. Therefore, AUTHORITY will not establish small business participation project goals in any contract solicitation that has a specified DBE goal.

However, pursuant to 49 CFR §26.11(a), AUTHORITY is required to track and report race-neutral participation achieved through its Small Business Participation Program to the applicable operating administration by DBEs who are currently certified or can be certified prior to a contract award through the Nebraska Unified Certification Program (NUCP).
See: http://www.dor.state.ne.us/letting/certified-dbes.htm ***for a listing of NUCP certified DBEs.***

Therefore, race-neutral participation of DBEs certified through the NUCP achieved through the Small Business Participation Program shall be counted towards attainment of the overall DBE project goal established for any DOT-assisted contracts.

END OF DOCUMENT

REQUIRED SUBMISSION DOCUMENTS

The Transit Authority of the City of Omaha

Authority Boiler Repair & Snow Melt System Activation Connection

The following forms are required to be submitted with the bid proposal and can be found on the pages following.

_____ Bid Form

_____Exhibit “A” to the General Conditions, Federal Clauses for Procurement of Construction

_____Exhibit “B” to the General Conditions, Debarment/Suspension - Prime

_____Exhibit “C” to the General Conditions, Debarment/Suspension - Sub

_____Exhibit “D” to the General Conditions, Affidavit of Non-Collusion – Prime

_____Exhibit “E” to the General Conditions, Lobbying Certification

_____Exhibit “F” Request for Clarification

_____Exhibit “G” Acknowledgement of Addendum

_____Exhibit “H” Conflict of Interrest Disclosure

_____Exhibit “I” Buy America Acknowledgement

_____Exhibit “J” Davis Bacon Wage Acknowledgement

Please ensure all forms are signed and dated and all requeste infromation is assigned.

GENERAL & SUPPLEMENTARY CONDITIONS

Authority Boiler Repair and Snow Melt System Activation

GENERAL CONDITIONS

A. The AIA Document A201, "General Conditions of the Contract for Construction", 2007 Edition, as provided by the American Institute of Architects, is hereby made a part of the Contract Documents.

1. The above-mentioned document is hereinafter referred to as the General Conditions.
2. The General Conditions are available for examination at the office of the Architect. Copies may be purchased by contacting the AIA Nebraska office in Lincoln, Nebraska at (402) 472-1456.

B. The agreement which the General Contractor will be required to sign is AIA Document A101, "Standard Form of Agreement Between Owner and contractor", 2007 Edition, a standard form of the American Institute of Architects.

1. If Bidders would like to review the agreement prior to bidding, the form is available for examination at the office of the Coordinating Professional. Copies may also be purchased by contacting the AIA Nebraska office in Lincoln, Nebraska at (402) 472-1456.
2. Once terms of agreement have been reached between the Authority and the selected bidder, the Coordinating Professional will prepare the form of agreement.

SUPPLEMENTARY CONDITIONS

The following are hereby made a part of the General Conditions for the work of this project:

ITEM 1 - RETENTION APPLIED TO CONTRACTOR PAYMENTS:

1. Owner will withhold and retain 10% of payments made to Contractor. Release of this retained amount will be considered at completion of all punch list items.

ITEM 2 - CONTRACTOR'S INSURANCE REQUIREMENTS:

The Contractor shall be required to have in continuous effect insurance written for not less than the following, or greater if required by law:

1. Worker's Compensation:

State:	Statutory
Applicable Federal:	Statutory
Employer's Liability:	$100,000

2. Comprehensive General Liability (including, but not limited to, Premises Operation; Independent Contractor's Protection; Products and Completed Operations; and Broad Form Property Damage):

Bodily Injury:	$5,000,000	Each Occurrence
	$5,000,000	Each Person
Property Damage:	$5,000,000	Each Occurrence

Products and Completed Operations to be maintained for one year after final payment.

3. Contractual Liability

Bodily Injury:	$5,000,000	Each Person
	$5,000,000	Each Occurrence
Property Damage:	$5,000,000	Each Occurrence

4. Personal Injury, with Fellow Employee Exclusion deleted: $1,000,000 Each Person.

5. Comprehensive Automobile Liability (including hired and non-owned vehicles):

Bodily Injury:	$5,000,000	Each Person
	$5,000,000	Each Occurrence
Property Damage:	$5,000,000	Each Occurrence

6. General Liability Insurance must include an environmental liability insurance endorsement, sometimes called environmental impairment liability insurance or pollution liability insurance, with limits of no less than $2,000,000 per occurrence / $4,000,000 aggregate whose primary purpose is to manage pollution-related loss exposures. This coverage must include coverage for all associated environmental remediation expenses.

7. For informational purposes - the Nebraska Political Sub-Division Tort Claims Act, to which Authority is bound, requires an Aggregate of $5,000,000.

The types and levels of insurance stated herein shall provide coverage for this job only, i.e. *Project Specific*. Consult your insurance agent for details.

Certificates of Insurance shall evidence Authority as an additional insured (for all above listed insurance requirements including environmental liability insurance) and shall be due to Authority within 10 business days after receipt of the Notice to Proceed. Failure to comply shall result in Termination for Default by Authority.

ITEM 3 - CONTRACTOR'S REQUEST FOR CHANGES IN THE WORK:

A. The Contractor's claim to an adjustment in the Contract Sum as a result of an instruction by the Authority or Architect shall be submitted as a change order proposal and shall include the following:

1. Complete breakdown of material, labor, profit, and overhead costs by General Contractor in sufficient detail (including proposed insurance/bond costs) so as to allow the Authority to determine any increase or decrease in Direct Costs as a result of the direction given.
2. Similar breakdown of costs relative to each applicable Subcontractor including profit and overhead charges.
3. Profit and overhead amounts subject to the following maximum limitations:
    a. Subcontractor profit and overhead shall not exceed ten (10) percent of its Direct Costs.
    b. Contractor's profit and overhead mark up on work performed by its own forces shall not exceed ten (10) percent of its Direct Costs.

c. Contractor's profit and overhead mark up on work performed by its Subcontractors shall not exceed seven (7) percent of the Subcontractor's charges for the work.

d. Are fully inclusive of all costs to administer the change (no additional fees shall be applied).

4. Labor rates cannot exceed rates used in the Bid and reflected in the submitted Schedule of Values unless otherwise documented for and approved by Authority.

B. The Contractor's claim to an adjustment in the Contract Time as a result of an instruction by the Authority or Architect shall be submitted with supporting information to justify its claim.

END GENERAL & SUPPLEMENTARY CONDITIONS

SCHEDULE OF DRAWINGS

Dated: August 30, 2017

The Transit Authority of the City of Omaha

Boiler Repair and Snow Melt System Activation Project

C0	Title Sheet / Drawing Index / Work Summary
M0.0	Mechanical Symbols and Abbreviations
M1.0	Mechanical Floor Plans
E0.0	Electrical Symbols and Abbreviations
E1.0	Electrical Floor Plans

End of Schedule of Drawings

SECTION 01 1000

SUMMARY OF WORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Work covered by Contract Documents.
   2. Contractor use of premises.
   3. Authority furnished materials and services.

B. Related Documents:
   1. The Contract Documents, as defined within this Section, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
   2. All Division 01 Sections.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The Authority Boiler Repair and Snow Melt System Activation Project includes the connection of the existing snow melt system piping and boiler modifications as shown on drawings.

B. Provide and pay for all materials, labor, services, equipment, permits, licenses, applicable taxes, and other items necessary for the execution, installation and completion of Work indicated in Contract Documents.

C. Contractor will be required to accommodate work by Authority's own staff adjacent to and in proximity throughout the period of construction.

1.3 CONTRACTORS USE OF PREMESIS

A. During construction Contractor shall have access to and use of the Project Site. Contractor will be limited to areas relevant to the Work of the project, however, Authority will designate staging areas as deemed necessary.
   1. Authority is a 24/7 facility and Contractor must coordinate with Authority to schedule their work around our operational constraints.

B. Contractor will have access to the relevant portions of the interior of the Facility if needed during the project. However, any interior access to the building will require security clearances (provided by Authority) for each employee of the Contractor or its subcontractors requiring access.

C. The Contractor will be respectful of Authority patrons and employees using the building. Contractor shall

ensure that its employees, subcontractors (and their employees) comply with the following:
   1. Refrain from loud or vulgar language.

2. Do not allow any music except for personal devices- unless authorized by Authority's representative.
3. Do not allow use of alcoholic beverages, illegal drugs, or persons under their influence on the site.
4. Do not allow firearms to be carried onto the premises.
5. Refrain from parking in areas prohibited by Authority staff
6. Authority is a smoke-free facility
7. Contractor must abide by all OSHA standards.
8. Contractors and sub-contractors must wear reflecftive clothing at all times while on the job site.
9. Contractor must schedule in advance any deliveries related to this project with Authority.

1.4 AUTHORITY FURNISHED MATERIALS & SERVICES

A. Where applicable, the Contractor shall be responsible for assisting in the coordination of any Authority-furnished materials.

PART 2 PRODUCTS Not Used.

PART 3 EXECUTION Not Used.

END OF SECTION

SECTION 01 2500

CONTRACT MODIFICATION PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Documentation of change in Contract Sum/Price and Contract Time.
2. Requests for Information.
3. Change procedures.
4. Change Orders.

B. Related Documents: The Contract Documents, as defined in Section 01 1000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 DOCUMENTATION OF CHANGE IN CONTRACT SUM/PRICE AND CONTRACT TIME

A. Maintain detailed records of work completed on a time and material basis. Provide full information required for evaluation of proposed changes, and to substantiate costs of changes in Work.

B. Document each quotation for a change in cost or time with sufficient data to allow evaluation of quotation.

C. Provide additional data to support computations:
1. Quantities of products, labor, and equipment.
2. Insurance and bonds.
3. Overhead and profit.
4. Justification for change in Contract Time.
5. Credit for deletions from Contract, similarly documented.

D. Support each claim for additional costs or Contract Modification Proposal, with additional information:
1. Origin and date of claim.
2. Dates and times work was performed, and by whom.
3. Time records and wage rates paid.
4. Invoices and receipts for products, equipment, and subcontracts, similarly documented.

E. Refer to General and Supplementary Conditions of the Contract for additional requirements for submitting requests for changes in the Work.

1.3 REQUESTS FOR INFORMATION

A. Definition: Requests for Information (RFI), is a formal process used during construction to facilitate communication between Contractor and Architect with regard to requests for information, interpretation and clarification of the intent of Contract Documents.

B. Procedure:
   1. Conditions Requiring Clarification of Contract Documents: Submit a Request for Information to Architect.
      a. Submit Requests for Information from Contractor's office or field office only. Requests for Information submitted directly from subcontractors or suppliers will not be accepted.
      b. Generate Requests for Information by one source per project and number accordingly.
      c. Submit one request for information per form.

   2. Architect will review formal requests from Contractor with reasonable promptness and Contractor will be notified in writing of decisions made, via the RFI form.
      a. Architect response shall not be considered as a Change Order or Change Directive, nor does it authorize changes in Contract Sum or Contract Time.
   3. Maintain log of Requests for Information sent to, and responses from Architect.

C. RFI Form: Submit requests for information on Contractor's standard Request for Information form. Form shall include, but is not limited to, RFI number, date, specific purpose of request, response time required, and space for response.

1.4 CHANGE PROCEDURES

A. Architect will advise of minor changes in Work not involving an adjustment to Contract Sum/Price or Contract Time by issuing supplemental instructions on RFI form.

B. Architect may issue a Proposal Request which includes a detailed description of a proposed change with supplementary or revised Drawings and Specifications, a change in Contract Time for executing the change the period of time during which the requested price will be considered valid. Contractor shall prepare and submit an estimate within 5 days.

C. The Contractor may propose a change by submitting a Proposal Request for change to the Architect, describing the proposed change and its full effect on the Work, with a statement describing reason for the change, and effect on Contract Sum/Price and Contract Time with full documentation and a statement describing effect on Work by separate or other contractors. Document requested substitutions submitted to Architect in accordance with Section 01 6000 - Product Requirements.

1.5 CHANGE ORDERS

A. Changes in the Work that require Contract Modifications will comply with the Transit Authority's established procedures outlined in document attached at the end of this Section entitled, "Contract Modifications".
   1. See General & Supplementary Conditions for additonal requirements relative to Contractor's preparation of Change Order requests.

B. Based on Proposal Request and Contractor's fixed price quotation or Contractor's request for a Contract Modification as approved by Architect, the Architect will prepare a Change Order.

C. Form AIA G701, as published by the American Institute of Architects will be the Change Order format.

1. Architect will prepare three original copies of AIA G701 Change Order for signatures, and distribution to Authority, Architect, and Contractor.

PART 2 PRODUCTS Not Used.

PART 3 EXECUTION Not Used.

END OF SECTION

The Transit Authority of the City of Omaha

CONTRACT MODIFICATIONS

To define and establish a policy for processing and authorizing Contract Modifications, including Change Orders to contracts to which FTA C4220.1F applies. All Contract Modifications shall be in writing and shall be authorized by the Contracting Officer or the Executive Director in accordance with this policy except as provided in section 2(e).

Policy:

1. DEFINITIONS:

Contracting Officer – The Grant Administrator (Authority)

Technical Officer – The Architect/Engineer

Contract Modification – Any change in the terms of the contract.

Bilateral Contract Modification – A modification, which is signed by the Contractor and the Contracting Officer, also referred to as a supplemental agreement. They are used to (1) make negotiated equitable adjustments to the contract price, delivery schedule and other contract terms resulting from the issuance of a change order, and (2) reflect other agreements of the parties modifying the terms of the contract.

Unilateral Contract Modification – A contract modification that is signed only by the Contracting Officer, to make administrative changes, issue change orders, make changes authorized by clauses other than a Changes clause (e.g., Options clause), and issue termination notices.

Administrative Change – A unilateral contract change, in writing, that does not affect the substantive rights of the parties (e.g., changes of address for submittals of documents, reports, etc.).

Changes Clause – A clause which permits the Contracting Officer to make unilateral changes, in designated areas, w*ithin the general scope of the contract,* to be followed by such equitable adjustments in the price and delivery schedule as the change makes necessary.

Change Order – A written order signed by the Contracting Officer, directing the Contractor to make a change that the *Changes clause* authorizes the Contracting Officer to order without the Contractor's consent.

Cardinal Change – A contract modification which is "outside the scope" of the original contract.

Constructive Contract Change – A change to a contract resulting from the conduct of Authority officials (e.g., acts either written or oral, omissions, etc.) that has the effect of requiring the Contractor to perform additional work.

Deductive Change – A change resulting in a reduction in the contract price because of a net reduction in the Contractor's work.

Equitable Adjustment – An adjustment in the contract price, delivery schedule or other terms of the contract arising out of the issuance of a change order.

Within the general scope – If the function or nature of the work as changed is generally the same as the work originally called for.

Emergency Changes / Field Changes for Construction – Contract Modifications which shall be limited to those situations where time is critical and where there is insufficient time to process the change through the Contracting Officer.

2. ADMINISTRATION AND POLICY IMPLEMENTATION:

(a) The Contracting Officer shall authorize contract modifications following review of the modification in accordance with the Purchasing Policy thresholds, adopted by the Authority Board of Directors and any amendments thereto; provided, however, the Contracting Officer is hereby authorized to make all unilateral contract changes that do not affect the substantive rights of the parties following review of the Executive Director.

(b) The Technical Officer shall be responsible for providing the required Cost/Price Analysis of Changes for all contract modifications.

(c) Changes in quantity / additions or deletions of work –

- An increase in the quantity of subsidiary items or the addition of work that is within the general scope is allowed unless the total of any one increase or addition exceeds the original contract amount by ten percent (10%). Any increase or addition, which exceeds the original contract amount by ten percent (10%), shall be processed as *a new competitive procurement*.

- A decrease in the quantity of subsidiary items or the deletion of work that is within the general scope is allowed unless the total of any one decrease or deletion reduces the original contract amount by ten percent (10%). Any decrease of deletion, which reduces the original contract amount by ten percent (10%), shall be processed according to the *Termination for Convenience clause*.

Exception:

Circumstances may arise wherein a necessary change in quantity or additional or deleted work exceeds the ten percent (10%) threshold. Such changes shall be allowed, at the discretion of the Executive Director, if the change is not the result of a Constructive Change and the following conditions are present:

- Clear and concise evidence that the change is necessary, reasonable and practical.
- The change falls within the scope of work and is therefore not a cardinal change.

(d) Non-emergency changes –

The Technical Officer

- Obtains a cost and technical proposal from the contractor *before the change is issued*,

- Conducts a Cost/Price Analysis.

The Contracting Officer

- Negotiates an equitable adjustment,
- Issues bi-lateral supplemental agreement.

(e) Emergency changes / Field Changes for Construction – shall be authorized by Field Personnel and as otherwise designated in the contract for such purposes.

The Authorized Personnel

- Obtains a "not-to-exceed" price, in writing, from the Contractor *before the change occurs*.
- Conducts a Cost/Price Analysis.

The Contracting Officer

- Issues a bi-lateral contract Change Order, which defines the changed work, and includes a maximum ceiling price, which is to be negotiated at a later date, but *downward only*,
- Negotiates the formal proposal, which is submitted within thirty days by the Contractor,
- Issues a bi-lateral supplemental agreement.

(f) Cardinal Changes – shall not be permitted by contract modification. Cardinal Changes shall be undertaken in accordance with the Purchasing Policy and any amendments thereto.

(g) Constructive Change – Actions giving rise to constructive changes shall be avoided and include but are not limited to:

- Specifications or contract provisions that are "impossible to perform."
- Specifications that are ambiguous.
- Drawings that contain errors, omissions or inconsistencies.
- Information provided by the Authority that is late, defective, etc.
- Technical direction by personnel that modifies the expressed terms of the contract.
- Acceleration of work, where the Authority insists that the contract delivery schedule be met despite the Contractor's valid claims of excusable delays.
- An inspector's interpretations of test specifications, procedures, methods, conditions and results that go beyond a reasonable interpretation of the specification.

End

SECTION 01 2900

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements to prepare and process Applications for Payments.

1.2 PAYMENT REQUESTS

A. Use American Institute of Architect s (AIA) standard Payment Application forms, including associated sheets indicating schedule of values.

B. Each Payment Application will be consistent with previous requests and payments certified by Architect and paid for by Authority.

C. Request Preparation:
   1. Complete every entry on Payment Request form.
   2. Entries will match data on approved schedule of values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.
   3. Submit signed Payment Request to Architect with current Construction Schedule.

D. Provide following submittals before or with submittal of Initial Payment Application:
   1. List of Subcontractors.
   2. Initial progress report.
   3. Contractor's Construction Schedule.
   4. Submittal Schedule.

E. Provide Affidavit of Contractor and Consent of Surety with Payment Request following Substantial Completion.

1.3 SCHEDULE OF VALUES

A. Submit initial schedule of values to Architect 20 days minimum before submission of Initial Payment Application as a necessary condition before payment will be processed. Coordinate preparation of schedule of values with preparation of Contractor's Construction Schedule. Correlate line items in Schedule of Values with other required administrative schedules and forms, including:
   1. Contractor's Construction Schedule.
   2. Payment Application form.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 3100

PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Administrative and supervisory personnel.
2. Submittals.
3. Contractor quality control.
4. Coordination.
5. Project coordination.
6. Preconstruction meeting.
7. Progress meetings.
8. Preinstallation meetings.
9. Schedule of values.

B. Related Documents: The Contract Documents, as defined in Section 01 1000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. Project Coordination Administrator: Experienced in administration, supervision, and quality control of building expansion and alteration construction, similar to Work of this Project, including mechanical and electrical work.

B. Project Field Superintendent:
1. Experienced in general field supervision of building construction, similar to Work of this Project, including mechanical and electrical work, to supervise, direct, inspect and coordinate Work of Contractor, subcontractors, suppliers and installers, and expedite Work to assure compliance with Construction Schedules.

1.3 SUBMITTALS

A. Submit list of Contractor's principal staff assignments, including Project Coordination Administrator, Project Field Superintendent, Quality Control Representative, and other personnel in attendance at site; identify their duties and responsibilities.

B. Submit shop drawings, product data, and other required submittals, in accordance with Section 01 3300 - Submittal Procedures, for review and compliance with Contract Documents, for field dimensions and clearances, for relation to available space, and for relation to Work by Authority or separate Contracts.

C. Submit Requests for Information and interpretation of Contract Documents in a timely manner and obtain replies from Architect in accordance with Section 01 2500 - Contract Modification Procedures.

1.4 CONTRACTOR QUALITY CONTROL

A. Perform project quality control in accordance with requirements specified Section 01 4500 - Quality Control.

B. Coordinate scheduling of inspection and testing required by individual specification Sections and in accordance with Section 01 4500 - Quality Control.

C. Coordinate schedule for required testing to be performed by the Authority under separate contract.

1.5 COORDINATION DRAWINGS

A. Prepare and distribute coordination drawings where close coordination is required for installation of Products and materials fabricated off-site by separate entities, and where limited space availability requires maximum utilization of space for efficient installation of different components. Show interrelationship of components shown on separate shop drawings. Indicate required installation sequences.
   1. Where required, Architect will assist in preparing information for coordination drawings.

1.6 PROJECT COORDINATION

A. Coordinate construction activities and work of all trades under various Sections of these Specifications and Work of Contract to facilitate orderly installation of each part of Work. Coordinate construction operations included under different Sections of Specifications and Contract that are dependent upon each other for proper installation, connection, and operation.
   1. Special consideration is required for coordination with electrical wiring through structural elements. Contractor shall be responsible for and ensure such coordination.

B. Where installation of one part of Work is dependent on installation of other components, either before or after that part of Work, schedule construction activities in sequence required to obtain uninterrupted installation.

C. Obtain drawings, manufacturer's product data, instructions, and other data to provide a complete and proper installation.
   1. Check field dimensions prior to installing products. Verify necessary clearances and means of access from equipment storage to final position.
   2. Make data and information available to all trades involved.

D. Ensure that utility requirements of operating equipment are compatible with building utilities. Coordinate Work of various specification Sections for installation and final connection of equipment.
   1. Assure that mechanical, plumbing, and electrical rough-ins have been properly located.

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

F. Where availability of space is limited, coordinate installation of different components to ensure maximum accessibility for required maintenance, service, and repair.

G. Where indicated or required, provide for installation of items scheduled for future installation.

H. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Prepare memoranda for separate contractors where coordination of their work is required.

I. In finished areas, conceal pipes, ducts, conduits, and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.

J. Coordinate completion and clean up of Work of separate Sections in preparation for Substantial Completion and for portions of Work designated for Authority partial occupancy after Final Acceptance of the Work.

K. After Authority re-occupancy of Project, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Authority activities.

1.7 PRE-CONSTRUCTION MEETING

A. Attendance: Authority, Contractor's Field and Office representatives, Subcontractors, Architect, Engineers, and others as may be invited.

B. Agenda:
1. Submission of executed bonds and insurance certificates.
2. Distribution of Contract Documents.
3. Submission of schedule of values including all applicable labor rates.
4. Submission of Unit Prices as defined in Section 01 2700.
5. Designation of personnel representing the parties in Contract.
6. Procedures and processing of Requests for Information, field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and contract closeout procedures.
7. Scheduling.
8. Construction facilities and temporary controls.
9. Notice to proceed.

C. Architect will record minutes and distribute copies to participants, and those affected by decisions made.

1.8 PROGRESS MEETINGS

A. Attendance: Architect/Engineers, Authority, Job Superintendent, Contractor's Project Manager, and major Subcontractors and suppliers, and others as appropriate to agenda topics for each meeting.

B. Agenda:
1. Review minutes of previous meetings.
2. Review of Work progress and/or payment 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 progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on progress schedule and coordination.
13. Other business relating to Work.

C. Architect will record minutes and distribute copies to participants, and those affected by decisions made.

1.9 PREINSTALLATION MEETINGS

A. When required in individual specification sections or as determined necessary by Architect, convene a preinstallation meeting at work site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect seven days in advance of meeting date.

D. Prepare agenda and preside at meeting:
1. Review conditions of installation, preparation and installation procedures.
2. Review coordination with related work.
3. Agenda items listed in individual specification Sections.

E. Architect will record minutes and distribute copies to participants, and those affected by decisions made.

1.10 SCHEDULE OF VALUES

A. Submit a construction cost breakdown on a Schedule of Values form to the Architect, using AIA Form G702/G703.

B. Submit Schedule of Values as part of all payment applications.

PART 2 PRODUCTS Not Used.

PART 3 EXECUTION Not Used.

END OF SECTION

SECTION 01 3250

CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Format.
   2. Content.
   3. Revisions to schedule.
   4. Submittals.

B. Related Documents: The Contract Documents, as defined in Section 01 1000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 FORMAT

A. Prepare schedules as a horizontal bar chart with separate bar for each major portion of Work or operation, identifying first work day of each week.

B. Prepare network analysis system using typical critical path method.

C. Sequence of Listings: The chronological order of the start of each item of Work.

1.3 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Identify work of separate stages and other logically grouped activities.

D. Provide sub-schedules to define critical portions of the entire schedule.

E. Include conferences and meetings in schedule.

F. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

G. Provide separate schedule of submittal dates for shop drawings, product data, and samples, including Authority furnished Products, and dates reviewed submittals will be required from Architect as specified in Section 01 3300 - Submittal Procedures.

H. Coordinate content with schedule of values.

1.4 REVISIONS TO SCHEDULE

A. Indicate progress of each activity to date of submittal, and projected completion date of each activity.

B. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.

C. Provide narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect including effect of changes on schedules of separate Contractors.

1.5 SUBMITTALS

A. Submit initial schedules to Architect within 10 days after date established in Notice to Proceed. After review, resubmit required revised data within 5 days.

B. Submit revised Construction Progress Schedule with each Application for Payment.

1.6 DISTRIBUTION

A. Distribute copies of reviewed schedules to Project Site file, subcontractors, suppliers, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

PART 2 - **PRODUCTS** Not Used.

PART 3 - **EXECUTION** Not Used.

END OF SECTION

SECTION 01 3300

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Section Includes:
   1. Submittals and Submittal procedures.
   2. Product Data, Shop Drawings, and Samples.
   3. Assurance/Control submittals.

B. Related Documents: The Contract Documents, as defined in Section 01 1000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 SUBMITTALS

A. Submit proposed Schedule of Submittals to Architect within 30 days after receipt of Notice to Proceed. List all items require submittal for review and approval by Architect/Engineer.

B. Schedule of Submittals: Include the following.
   1. Indicate type of submittal; product data, shop drawing, sample, certificate, or other submittal.
   2. Identify by Specification Section number, Specification paragraph number where item is specified, and description of item being submitted.
   3. Indicate scheduled date for initial submittal, date for approval, and date for possible resubmittal for each submittal.

C. Coordinate Schedule of Submittals with Construction Schedule. Revise and update Schedule of Submittals when required by changes in the Construction Schedule.

1.3 SUBMITTAL PROCEDURES

A. Transmit each submittal with accepted form. Submit either hard copies (minimum 4 copies) or electronically to Architect.
   1. Use Contractor’s standard transmittal form.
   2. Sequentially number transmittals. Revise submittals with original number and a sequential alphabetic suffix.
   3. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate.
   4. Apply Contractor's stamp, signed or initialed certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information, is in accordance with the requirements of the Work and Contract Documents.
      a. Submittals forwarded without Contractor’s review are subject to immediate rejection.
   5. Schedule submittals to comply with scheduling requirements of Construction Schedule.

6. For each submittal for review, allow 10 days excluding delivery time to and from the Contractor.
7. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.
8. Provide space for Contractor and Architect/Engineer review stamps.
9. For submittals returned, marcked Revise and resubmit- resubmittal shall identify all changes made since previous submission.
10. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with provisions.
11. Submittals not requested will not be recognized or processed.

1.4 PRODUCT DATA

A. Product data includes printed information such as catalog cuts, manufacturer's published instructions, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, performance curves and other similar items.
   1. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this Project.
   2. Indicate Product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

1.5 SHOP DRAWINGS

A. Produce copies and distribute in accordance with the SUBMITTAL PROCEDURES article above.
   1. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
   2. Include all applicable field-verified dimensions.

1.6 SAMPLES

A. Submit samples to illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. Include identification on each sample, with full Project information.
   2. Submit the number of samples specified in individual specification sections; one of which will be retained by the Architect.

1.7 CERTIFICATES

A. When specified in individual specification sections, submit certification by manufacturer, in quantities specified for Product Data.

B. Indicate material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

1.8 MANUFACTURER INSTALLATION INSTRUCTIONS

A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, adjusting, and finishing

1. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

PART 2 PRODUCTS Not Used.

PART 3 EXECUTION Not Used.

END OF SECTION

SECTION 01 4200

REFERENCES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Specification format and content.
   2. Quality assurance.
   3. Reference standards.
   4. Abbreviations.
   5. Definitions.

B. Related Documents: The Contract Documents, as defined in Section 01 1000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 SPECIFICATION FORMAT AND CONTENT

A. Specification Format: Specifications are organized into Divisions and Sections based on Construction Specifications Institute (CSI) expanded format and MasterFormat numbering system.

B. Specification Content: This Specification uses certain conventions in use of language and intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:
   1. Abbreviated Language: Language used in Specifications and other Contract Documents is abbreviated type. Words and meanings shall be interpreted as appropriate. Words that are implied, but not stated shall be interpolated as the sense required. Singular words will be interpreted as plural and plural words interpreted as singular where applicable and context of Contract Documents so indicates.
   2. Imperative and streamlined language is used generally in Specifications. Requirements expressed in imperative mood are to be performed by Contractor. At certain locations in text, for clarity, subjective language is used to describe responsibilities that must be fulfilled indirectly by Contractor, or by others when so noted.
      a. The words "shall be" shall be included by inference wherever a colon (:) is used within a sentence or phrase.

1.3 QUALITY ASSURANCE

A. For Products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes. Such standards are made a part of Contract Documents by reference.

B. Conform to reference standard by date of issue current on original date of issue indicated on Contract Documents.

C. Obtain copies of standards when required by Contract Documents.

D. Maintain copy at Project Site during submittals, planning, and progress of specific Work, until Final Acceptance.

E. Should specified reference standards conflict with Contract Documents, request clarification from the Architect before proceeding.

1.4 REFERENCE STANDARDS

A. Conflicting Requirements: Where compliance with two or more standards is specified, and the standards may establish different or conflicting requirements for minimum quantities or quality levels. Refer requirements that are different, but apparently equal, and uncertainties to Architect for decision before proceeding.
   1. Minimum Quantity or Quality Levels: Quantity or quality level shown or specified shall be minimum provided or performed. Actual installation may comply exactly with minimum quantity or quality specified, or it may exceed minimum within reasonable limits. In complying with these requirements, indicated numeric values are minimum or maximum, as appropriate for context of requirements. Refer uncertainties to Architect for decision before proceeding.

B. Copies of Standards: Each entity engaged in construction on Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with Contract Documents.
   1. Where copies of standards are needed for performance of a required construction activity, Contractor shall obtain copies directly from publication source.

1.5 ABBREVIATIONS

A. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in Specifications or other Contract Documents, they mean the recognized name of trade association, standards generating organization, authority having jurisdiction, or other entity applicable to context of text provision.

1.6 TERMINOLOGY

A. Basic Contract definitions are included in Definitions Section and Section 01 1000 Summary. Definitions specified herein are included in order to further clarify terms for which the Authority may have supplemental definitions and expectations specific to this Project.

B. Acceptable: Satisfactory to and approved by the Architect.

C. Approve: The term “approved,” when used in conjunction with the Architect’s or Engineer’s action on the contractor’s submittals, applications, and requests, is limited to the Architect’s or Engineer’s duties and responsibilities as stated in the Contract.

D. Change Order: A modification to the contract in either contract amount or contract time.

E. Clarification Drawing: A graphic interpretation of the Drawings or other Contract Documents issued by the Architect.

F. Construction Operations: Activites of the Contractor at the Project Site.

G. Directed: Instructed by the Architect.

H. Experienced (Qualified): When used to describe the “installer”, “fabricator”, or similar terms; a person, firm or corporation skilled through observation or of participation in the particular activities required to complete the Work or a portion of the Work to the degree of the quality specified.

I. Final Connections: Complete plumbing, mechanical, and electrical connections as required and recommended by manufacturer for optimum operation of equipment.

J. Indicated: The term “indicated” refers to graphic representations, notes or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as “shown,” “noted,” “scheduled,” and “specified” are used, it is to help the reader locate the reference. Location is not limited.

K. Install: Operations at the Project Site including the actual unloading, unpacking, assembly, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
   1. Final connections: Complete plumbing, mechanical, and electrical connections as required and recommeded by manufacturer for optimum operation of equipment.

L. Mobilization: To establish and commence work activity at the Project Site.

M. Partial Occupancy: Partial Occupancy occurs when the Authority begins to occupy parts of the project for its own purposes, such as early fixture set-up, merchandising, etc. Partial Occupancy shall not constitute acceptance of Work not in accordance with the Contract Documents.

N. Premises: Space or property made available to the Contractor for constructing the Work.

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

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

Q. Reviewed: Examined and found acceptable by the Architect.

R. Substantial Completion: 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 the Authority can occupy or utilize the Work for its intended use.

S. Substitution: A product that is exchanged for another of the same function.

T. Supply: To supply and deliver, unload, inspect for damage (same as furnish).

U. Unacceptable: Determined not satisfactory by the Architect or Authority.

PART 2 PRODUCTS Not Used.

PART 3 EXECUTION Not Used.

END OF SECTION

SECTION 01 4500

QUALITY CONTROL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Contractor quality control.
2. Architect quality control.
3. Quality control procedures.
4. Testing and inspection laboratory services.
5. Contractor field inspection and testing.

B. Related Documents: The Contract Documents, as defined in Section 01 1000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. ASTM C 802 - Practice for Conducting and Interlaboratory Test Program to Determine the Precision of Test Methods for Construction.
2. ASTM E 329 - Practice for Use in the Evaluation of Inspection and Testing Agencies as Used in Construction.
3. ASTM E 543 - Practice for Determining the Qualification of Nondestructive Testing Agencies.
4. ASTM E 548 - Practice for Preparation of Criteria for Use in the Evaluation of Testing Laboratories and Inspection Bodies.
5. ASTM E 699 - Practice for Criteria for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating Building Components in Accordance with Test Methods Promulgated by ASTM Committee E6.

1.3 CONTRACTOR QUALITY CONTROL

A. Contractor is responsible for overal quality of Work performed by Contractor or subcontractors working under this Contract. Quality of any part of Work must not be less than that required by Contract Documents. If Architect determines that quality of work does not conform to Contract Documents, Architect will notify Contractor, in writing, areas of non-conformance. Contractor must correct identified deficiencies and advise Architect of corrective action taken within 7 days of date of notification.

B. Failure of Contractor to comply with requirements indicated herein may be cause for termination for default.

1.4 ARCHITECT QUALITY CONTROL

A. Architect or authorized representative will inspect quality of Work being installed, review and verify accuracy of changes in Work, receive and distribute Contractor submittals, determine compliance with Contract Documents, observe field quality control testing, and preside at progress and coordination meetings.

1.5. QUALITY CONTROL PROCEDURES

A. Monitor quality control over Contractor staff, subcontractors, suppliers, manufacturer's, products, services, site conditions, and workmanship.

B. Comply fully with manufacturer's published instructions, including each step in sequence of installation.

C. Should manufacturer's published instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as a minimum quality for Work, except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform Work by persons who are thoroughly qualified and trained in their respective trade, to produce workmanship of specified quality.

F. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

G. Perform tests required by governing authorities having jurisdiction and utilities having jurisdition.

1.6 TESTING AND INSPECTION LABORATORY SERVICES

A. Selection and Payment:
   1. Independent Testing and Inspection Laboratory to perform specified testing and inspections and shall be coordinated by the Contractor.
   2. Testing Agency shall be selected and compensated directly by Authority.
      a. Payments for re-testing of failed tests shall be borne by Contractor.

1.7 CONTRACTOR FIELD INSPECTION AND TESTING

A. Contractor: Test and Inspect Work provided under this Contract to ensure Work is in compliance with Contract requirements. Required tests and inspections are indicated in each individual Specification Section.

PART 2 PRODUCTS Not Used.

PART 3 EXECUTION Not Used.

END OF SECTION

SECTION 01 5000

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Temporary Utilities.
2. Sanitary facilities.
3. Barriers and Enclosures.
4. Progress cleaning.
5. Project Identification and Signs.
6. Field Office.
7. Removal of Construction Facilities and Temporary Controls.
8. Security.

B. Related Documents: The Contract Documents, as defined in Section 01 1000 – Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 COORDINATION AND APPROVAL

A. Coordinate with and obtain approval of Authority for each temporary facility and control, location, sequence, and schedule before starting work.

1.3 TEMPORARY POWER

A. Permanent power may be utilized during construction, and will be paid by Authority.

1.4 TEMPORARY LIGHTING

A. Provide and maintain lighting for construction operations to achieve a minimum lighting level average of 10 footcandles and minimum lighting level of 2 footcandles.

B. Ensure adequate lighting to exterior staging and storage areas after dark for securilty purposes.

C. Permanent building and parking lot lighting may be utilized during construction.

1.5 WATER SERVICE

A. Permanent water service may be utilized during construction operations, and will be paid by Authority.

1.6 TEMPORARY SANITARY FACILITIES

A. Contractor shall provide portable restroom facilities as required.

1.7 BARRIERS AND ENCLOSURES

A. Provide fencing to protect pedestrians and to prevent unauthorized entry to construction areas and to protect existing facilities.
   1. Fencing to be chain link (minimum height of 6 feet) and shall entirely surround all construction operations.

B. Protect adjacent properties from damage from construction operations and demolition in accordance with OSHA and governing authorities having jurisdiction.

C. Provide protection for plant life designated to remain. Replace damaged plant life in addition to requirements for landscaping and sod replacement.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.8 PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Keep all areas broom clean at the end of each work day.

D. Collect and remove waste materials, debris, and rubbish from site weekly, daily if necessary or as directed by Architect, and dispose off-site.

1.9 PROJECT IDENTIFICATION AND SIGN

A. General Contractor is allowed to provide one (1) 4’ x 8’ plywood or vinyl sign as directed by Architect indicating project name, as well as Contractor and Architect names.

B. Erect on site at location as directed by Authority.

C. No other signs are allowed except those required by law.

1.10 FIELD OFFICE

A. Contractor will be provided a space as designated by the Authority for use as a temporary field office. Contractor shall provide all desired amenities such as computer, printer, etc.

B. Maintain copies of all Contract Documents and submittals within the field office.

C. Staging of materials shall be in coordiantion with the Authority.

1.11 REMOVAL OF CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.

B. Clean and repair damage caused by installation or use of temporary work.

C. Restore existing and permanent facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

1.12 SECURITY

A. All workmen requiring entrance into the building is required to obtain photo identification from Authority staff.
1. Do not compromise building security (e.g. leaving exterior doors unattended) without the knowledge of
the Authority's representative.

B. The Contractor shall store tools and equipment at the project site in lockable containers during the period of construction. Authority will designate areas for such storage containers. Contractors and subs are not allowwed to park personal or company owned vehicles inside Authority without prior approval.

PART 2 PRODUCTS Not Used.

PART 3 EXECUTION Not Used.

END OF SECTION

SECTION 01 6000

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Products.
   2. Product options.
   3. Product substitution procedures.
   4. Authority furnished products.
   5. Product delivery requirements.
   6. Product storage and handling requirements.

B. Related Documents: The Contract Documents, as defined in Section 01 1000 – Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 PRODUCTS

A. Provide Products that comply with Contract Documents, are undamaged, and new at time of installation.
   1. All products for use in the project shall be as specified or shall have been approved according to the prescribed process of substitutions prior to bidding.

B. Provide Products complete with accessories, trim, finish, safety guards, and other devices and details needed for complete installation and intended use and effect.

C. Provide Products of the same kind from a single source. When specified Products are available only from sources that do not, or cannot, produce a quantity adequate to complete Project requirements in compliance with project schedule, contact Architect, in writing, to determine most important product qualities before proceeding. Qualities may include attributes, such as visual appearance, strength, durabiliy, or compatibility. When Architect makes determination, select Products from sources producing Products that posses those qualities to fullest extent possible.

D. Certain products have been ordered prior to the project and will be assigned to the Contractor for payment. See Section 01 1000 for additional information.

1.3 PRODUCT OPTIONS

A. Products: Throughout Contract Documents, types of Products may be specified by manufacturer's name and catalog number to establish standards of quality and performance, not for the purpose of limiting competition. Substitute methods and Products may be submitted to Architect for consideration in conformance with article entitled "Product Substitution Procedures" contained within this Section.

Substitutions may not be permitted where the Authority requires a particular product for a specific purpose.

B. Products Specified by Reference Standards or by Description Only: Any Product meeting those standards or description.

C. Products Specified by Naming One or More Manufacturers: Products of manufacturers named and meeting specifications. Substitutions may or may not be permitted, as identified in the particular paragraph specifying the product.

D. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named in accordance with article entitled "Product Substitution Procedures."

1.4 PRODUCT SUBSTITUTION PROCEDURES

A. Substitutions must be submitted prior to bidding using the approriate process and form provided in this Project Manual.
   1. Substitutions after bidding may be considered only when a Product becomes unavailable through no fault of Contractor. Notify Architect prior to making any substitution of matterials or products.

B. If a product substition becomes necessary, submit each Request for Substitution with complete data substantiating compliance of proposed Substitution with Contract Documents.

C. A request constitutes a representation that the Contractor:
   1. Has investigated proposed Product and determined that it meets or exceeds quality level of specified Product.
   2. Will provide same warranty for Substitution as for specified Product.
   3. Will coordinate installation and make changes to other Work which may be required for Work to be complete with no additional cost to Authority.
   4. Architect will notify Contractor, in writing, of decision to accept or reject request.

D. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, with out separate written request, or when acceptance will require revision to Contract Documents.

E. Substituion Submittal Procedure (post-bid):
   1. Submit request for substitution on Contractor's standard form for consideration. Limit each request to one proposed substitution.
   2. Submit shop drawings, product data, and certified test results attesting to the proposed Product equivalence. Burden of proof is on proposer.
   3. Architect will notify Contractor, in writing, of decision to accept or reject request.

1.5 AUTHORITY FURNISHED PRODUCTS

A. When products are specified as "Authority-furnished", the Authority's Responsibilites are to:

1. Arrange for and deliver Authority reviewed Shop Drawings and Product Data to Contractor.
2. Arrange and pay for Product delivery to site.
3. Submit claims for transportation damage and replace damaged, defective or deficient items.
4. Arrange for manufacturers' warranties, inspections, and service.

B. When products are specified as "Authority-furnished", the Contractor's Responsibilites are to:
1. Review Authority reviewed Shop Drawings and Product Data.
2. Receive and unload products at site; inspect for completeness or damage. Report discrepancies to Architect immediately, and in writing.
3. Unload, handle, protect, store, and install Products indicated as Contractor installed.
4. Unload, handle, protect, and store Products indicated as Authority installed, ready for Authority to take possesion and install.
5. Repair or replace items damaged after receipt.

1.6 PRODUCT DELIVERY REQUIREMENTS

A. Transport and handle Products in accordance with manufacturer's instructions, using means and methods that will prevent damage, deterioration, and loss, including theft.

B. Schedule Product delivery to minimize long-term storage at Project site and prevent overcrowding of construction spaces.

C. Coordinate Product delivery with installation schedule to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, therft, and other losses.

D. Deliver Products to Project site in undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

E. Promptly inspect shipments to ensure that Products comply with project requirements, quantities are correct, Products are undamaged, and properly protected.

F. Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

1.7 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Store and protect Products in accordance with manufacturers' published instructions, with seals and labels intact and legible.

B. Store Products subject to damage by elements above ground, under cover in weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity with in range required by manufacturer's published instructions.

C. For exterior storage of fabricated Products, place on sloped supports, above ground.

D. Provide off-site storage and protection when Project site does not permit on-site storage or protection.

E. Cover Products subject to deteriation with impervious sheet covering. Provide ventilation to avoid condensation or potential degradation of Product.

F. Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.

G. Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

PART 2 PRODUCTS Not Used.

PART 3 EXECUTION Not Used.

END OF SECTION

SECTION 01 7000

EXECUTION REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Examination.
2. Preparation.
3. Execution.
4. Cleaning.
5. Starting and adjusting.
6. Closeout procedures.

B. Related Documents: The Contract Documents, as defined in Section 01 1000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 EXAMINATION

A. Visit Project Site to determine existing conditions.
1. Take field measurements and verify field conditions, compare field measurements, conditions, locations of survey benchmarks, and other information known to Contractor, with Contract Documents before starting Work.
2. Be responsible for determining conditions of Project Site, including all existing improvements, paving, above and below ground utilities, and existing construction.
3. Contact local utility companies and make arrangements to obtain utility company location and marking service before start of Work.

B. Review Bidding and Contract Documents.
1. Carefully study and compare Contract Documents with each other.
2. Be responsible for thorough knowledge of Contract Documents and their relationship to each other, Authority Furnished Products, and Project Site conditions.
3. Report errors, inconsistencies, or omissions discovered to Architect. Architect will investigate and advise Contractor of any measures to be taken relating to reported errors, inconsistencies, or omissions.
4. If Contractor performs Work knowing it involves a recognized error, inconsistency, or omission in Contract Documents without notice to Architect, Contractor assumes responsibility for such performance of Work and is responsible for costs of correction of Work.

C. Verify that existing conditions and substrate surfaces are acceptable and meet manufacturer's requirements for application or installation of Work.

D. Verify that substrate is capable of structural attachment of Work being applied or installed.

E. Examine and verify specific conditions described in individual specification Sections.

F. Verify that utility services are available, of correct characteristics, and in correct location for installation of Work.

1.3 PREPARATION

A. Construction Layout:
   1. Be responsible for accuracy of measurements, elevations, lines, and grades of Work.
   2. Do not scale Drawings. Use dimensions indicated on Drawings for laying out Work.
   3. Errors in construction caused by Contractor scaling Drawings to obtain measurements for laying out Work is responsibility of Contractor. By scaling, Contractor assumes responsibility for such performance of Work and is responsible for costs of correction of Work.
   4. Perform field work necessary to lay out and maintain Work to dimensions indicated on Contract Documents.

B. Field Engineering:
   1. Establish permanent benchmarks on Project Site referenced to established control points indicated on Drawings. Record locations, with horizontal and vertical data, on Project Record Drawings.
   2. Establish elevations, lines, and levels, for Work using survey instrumentation:
      a. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
      b. Locations of existing utilities necessary to adjust, move, or relocate existing structures, utility poles, lines, services, or other items located in Project Site or affected by Work.
   3. Periodically verify layouts by same means.

C. Preparation for Product Installation:
   1. Conduct a Pre-Installation Meeting when specified in individual specification Sections.
   2. Obtain, read, and understand applicable reference standard and manufacturer's published instructions regarding erection, application, or installation of Product.
   3. Clean substrate surfaces before applying Product.
   4. Seal cracks or openings of substrate before applying Product.
   5. Apply manufacturer required or recommended substrate primer, sealer, or conditioner before applying Product in contact or bond.

1.4 EXECUTION

A. Cutting and Patching:
   1. Employ skilled and experienced installer to perform cutting and patching.
   2. Submit written request in advance of cutting or altering elements which affect:
      a. Structural integrity of element.
      b. Integrity of weather-exposed or moisture-resistant elements.
      c. Efficiency, maintenance, or safety of element.
      d. Visual or historic qualities of sight exposed elements.
      e. Work of Authority or separate contractor.

3. Execute cutting, fitting, and patching to complete Work, and to:
    a. Fit the several parts together, to integrate with other Work.
    b. Uncover Work to install or correct ill-timed Work.
    c. Remove and replace defective and non-conforming Work.
    d. Remove samples of installed Work for testing.
    e. Provide openings in elements of Work for penetrations of mechanical and electrical Work.
4. Execute work by methods to avoid damage to other Work, and will provide proper surfaces to receive patching and finishing.
5. Cut masonry and concrete materials using masonry saw or core drill.
6. Restore Work with new Products in accordance with requirements of Contract Documents.
7. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
8. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.
9. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.
10. Identify any hazardous substance or condition exposed during Work to Architect for decision or remedy.

B. Installation:
1. Refer to installation requirements included in individual specification Sections.
2. For each Product, inspect substrate and conditions that Work will be performed. Do not proceed until unsatisfactory conditions have been corrected.
3. By starting Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable or unsatisfactory conditions encountered at no additional cost to the Authority.
4. Comply with manufacturer's published installation instructions and recommendations, to extent that instructions and recommendations are more explicit or stringent than requirements in Contract Documents.
5. Inspect Products immediately upon delivery to Project Site ready for installation.
    a. Inspect Products immediately before start of application, installation, or erection.
    b. Reject damaged and defective Products.
6. Verify and check dimensions and measurements before start of installation or erection.
7. Coordinate closing-in of Work with required inspections and tests.
    a. Do not cover Work until inspected and approved by appropriate person or entity.
    b. Uncover Work that has not been inspected as directed by Architect.
8. Provide fasteners, attachments, connection devices, and methods as indicated on Drawings or as specified.
    a. Where not indicated or specified provide appropriate methods necessary for securing Work.
    b. Secure Work plumb, true to line and level.
    c. Provide for expansion and building movement.

1.5 CLEANING

A. Cleaning During Construction: Specified in Section 01 5000 - Temporary Facilities and Controls.

B. Final Cleaning:

1. Use cleaning materials and agents recommended by manufacturer or fabricator of surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property, or that might damage finished surfaces.
2. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer's published instructions.
3. Complete following cleaning operations before requesting Architect inspection for Substantial Completion for Final Acceptance or a portion of Project.
    a. Clean Project Site, yard and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste materials, litter and foreign substances. Sweep paved areas broom clean. Remove petro-chemical spills, stains and other foreign deposits. Rake grounds that are neither planted nor paved, to a smooth even-textured surface.
    b. Remove tools, construction equipment, machinery and surplus material from Project Site.
    c. When applicable, remove snow and ice to provide safe access to building.
    d. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    e. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics and similar spaces.
    f. Broom clean concrete floors in unoccupied spaces.
    g. Vacuum clean carpet and similar soft surfaces, removing debris and excess nap. Shampoo if required.
    h. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
    i. Remove labels that are not permanent labels.
    j. Touch-up and otherwise repair and restore marred exposed finishes and surfaces. Replace finishes and surfaces that can not be satisfactorily repaired or restored, or that show evidence of repair or restoration. Do not paint over "UL" and similar labels, including mechanical and electrical name plates.
    k. Wipe surfaces of mechanical and electrical equipment, and other similar equipment. Remove excess lubrication, paint and mortar droppings and other foreign substances.
    l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
    m. Replace air disposable filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills. Clean ducts, blowers, and coils if units were operated without filters during construction.
    n. Clean light fixtures, lamps, globes and reflectors to function with full efficiency. Replace burned out bulbs, and defective and noisy starters in fluorescent and mercury vapor fixtures.
    o. Leave Project clean and ready for occupancy.
5. Remove temporary protection and facilities installed during construction to protect previously completed installations during remainder of construction.

6. Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from Project Site and dispose of in accordance with requirements of local authorities having jurisdiction.

1.6 STARTING AND ADJUSTING

A. Refer to applicable Sections for starting and adjusting requirements.

1.7 CLOSEOUT PROCEDURES

A. At completion of Work of each subcontract or designated division of Work, conduct an initial inspection to verify completion of Work; prepare list of Work to be completed or corrected, and conduct follow-up inspection to verify that corrections have been made.

B. Inspect mechanical and electrical equipment start-up operations, observe testing and balancing, and record start-up results including time and date of start-up.

C. Substantial Completion:
   1. When Contractor considers Work, or a portion of Work which Authority agrees to accept separately, is substantially complete, submit written certification to Architect indicating Contract Documents have been reviewed, Work has been inspected, and Work is complete in accordance with Contract Documents and ready for Architect inspection.
      a. Submit list of items to be completed or corrected.
      b. Complete and correct items on list.
      c. Failure to include an item on list does not change Contractor responsibility to complete Work in accordance with Contract Documents.
      d. Submit Closeout Submittals to Architect.
   2. Architect will review list and make inspection to determine if Work, or designated portion of Work, is substantially complete.
      a. Contractor will be notified by Architect of items identified during inspection as not in accordance with Contract Documents, whether they were included in Contractor list or not included on list.
      b. Complete and correct items on list.
      c. Notify Architect that items have been corrected and request inspection.
   3. Architect will make inspection to determine if Work, or designated portion of Work, is substantially complete.
   4. Provide certificate of acceptance by local authorities.
   5. When Work, or designated portion of Work, is substantially complete, Architect will notify Contractor and document Date of Substantial Completion.

D. Final Acceptance:
   1. Submit written certification Contract Documents have been reviewed, Work has been inspected, and Work is complete in accordance with Contract Documents and ready for Architect final inspection.
   2. Architect will make inspection to determine if Work of this Contract is complete.
      a. Contractor will be notified by Architect of items identified during inspection as not in accordance with contract documents and not ready for final acceptance.

b. Complete and correct items on list.
c. Notify Architect that items have been corrected and request inspection.

3. When Work is complete, as determined by Architect, Architect will notify Contractor and document Date of Final Acceptance.

PART 2 PRODUCTS Not Used.

PART 3 EXECUTION Not Used.

END OF SECTION

SECTION 01 7800

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Operation and maintenance data.
   2. Product warranties.
   3. Project record documents.
   4. Extra materials.

B. Related Documents: The Contract Documents, as defined in Section 01 1000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 OPERATION AND MAINTENANCE DATA

A. Prepare instructions and data by personnel experienced in maintenance and operation of described products. Refer to applicable Sections for specific requirements.

B. Format:
   1. Prepare data in the form of an instructional manual.
   2. Provide 3-ring binder format with tabbed dividers for each separate product or system.

1.3 PRODUCT WARRANTIES

A. Submit Warranties required for specific Products or Work as specified in each individual Section.
   1. Include in Operations and Maintenance Manuals.

1.4 PROJECT RECORD DOCUMENTS

A. Project Record Documents (As-Builts) required include:
   1. Marked-up copies of Contract Drawings (indicating graphically field records for concealed conditions).
   2. Marked-up copies of Shop Drawings and Product Data Submittals.
   3. Marked-up copies of Specifications, addenda and Contract Modifications.

B. Maintenance of Documents: Store record documents in field office apart from Contract Documents used for construction. Do not permit Project Record Documents to be used for construction purposes. Maintain and protect record documents from damage in a clean, dry, legible condition. Make documents available at all times for inspection by Architect.

C. Additional Record Submittals:
   1. Refer to other specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Immediately prior to Final Acceptance, complete additional records and place in order, properly identified and bound or filed, ready for use and reference. Submit to Architect for Authority records.
      a. Categories of requirements resulting in miscellaneous records include, but are not limited to the following:
         1) Field records on underground construction and similar Work.
         2) Survey showing locations and elevations of underground lines.
         4) Ambient and substrate condition tests.
         5) Load and performance testing.
         6) Inspections and certifications by governing authorities.
         7) Leakage and water-penetration tests.
         8) Final inspection and correction procedures.

1.6 EXTRA MATERIALS

A. Provide Products, spare parts, maintenance, and extra materials in quantities specified in individual specification Sections.

B. Deliver to Project Site and place in location as directed by Authority; obtain receipt prior to final payment.

PART 2 PRODUCTS Not Used.

PART 3 EXECUTION Not Used.

END OF SECTION

TABLE OF CONTENTS

SECTION 23 0400

COMMON REQUIREMENTS FOR HVAC

PART 1 - GENERAL

8/30/17

1.1 SUMMARY

A. This section describes the general requirements of these specifications and shall apply to all phases of the work specified, shown on the drawings, or required to provide for complete installation of all systems for this project.

B. This Section includes the following basic materials and methods to complement other Division 23 Sections.

1.2 WARRANTIES

A. Warrant all materials, workmanship and equipment against defects for a period of one year after the date of substantial completion.

B. Certain equipment shall be warranted beginning at the time of final acceptance or for longer periods of time as specified in those divisions of the Project Manual.

C. Repair or replace, at no additional cost to the Authority, any item which may become defective within the warrant period.

D. Any manufacturers' warranties concerning any item installed will run to the benefit of the Authority.

E. The Contractor agrees not to void or impair, or to allow Sub-Contractors to void or impair, any warranties regarding products or items installed as part of this project.

F. The repair of faulty workmanship shall be considered to be included in the contract.

1.3 QUESTIONS OF INTERPRETATION DURING BIDDING PHASE

A. If questions arise during the bidding process regarding the meaning of any portion of the contract documents, the prospective bidder shall submit the questions to the Architect/Engineer for clarification.

B. Any definitive interpretation or clarification of the contract documents will be published by addenda, properly issued to each person holding documents, prior to the bid date.

C. Verbal interpretation or explanation not issued in the form of an addendum shall not be considered part of the bidding documents.

D. When submitting questions for clarification, adequate time for issuance and delivery of addenda must be allowed.

E. The Architect/Engineer shall be the sole judge regarding interpretations of conflicts within contract documents.

1.4 CONTRACT DOCUMENT DISCREPANCIES

A. If any ambiguities should appear in the contract documents, request clarification from the Architect/Engineer before proceeding with the work.

B. If the Contractor fails to make such request, no excuse will thereafter be entertained for failure to carry out the work in a manner satisfactory to the Architect/Engineer.

C. Should a conflict occur within the contract documents, the Contractor is deemed to have estimated the more expensive way of doing the work unless a written clarification from the Architect/Engineer was requested and obtained before submission of proposed methods or materials.

D. The Architect/Engineer shall be the sole judge regarding interpretations of conflicts within contract documents.

1.5 DEFINITIONS

A. The following definitions shall apply throughout the contract documents:
   1. Architect/Engineer: Architect or Engineer
   2. Code: All applicable national, state and local code
   3. Mechanical: All plumbing, HVAC, & fire protection work required by the Contract Documents
   4. Electrical: All electrical and fire alarm work required by the Contract Documents
   5. Contractor: Any Contractor performing work required by the Contract Documents
   6. Indicated: Noted, scheduled or specified
   7. Selected: Selected by the Architect or Engineer
   8. Provide: Furnish, install, connect and tested complete and ready for use
   9. Furnish: Supply and deliver to the site ready for installation
   10. Install: Install complete, per Contract Documents and manufacturer's requirements.
   11. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
   12. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
   13. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
   14. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
   15. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
   16. Dry Locations: A location not normally subject to dampness or wetness. A location classified as dry may be temporarily subject to dampness or wetness, as in the case of a building under construction.
   17. Damp Locations: Locations protected from weather and not subject to saturation with water or other liquids but subject to moderate degrees of moisture.
      a. Examples of such locations include partially protected locations under canopies, marquees, roofed open porches, and like locations, and interior locations subject to moderate degrees of moisture, such as some basements, some barns, and some cold storage warehouses.
   18. Wet Locations: Installations underground or in concrete slabs or masonry in direct contact with the earth; in locations subject to saturation with water or other liquids, such as vehicle washing areas; and in unprotected locations exposed to weather.

1.6 SYMBOLS

A. Items of equipment and materials are indicated on the drawings in accordance with the symbols shown on the plans.

1.7 ABBREVIATIONS

A. Refer to abbreviations list shown on the Drawings.

B. The following abbreviations apply throughout the Contract Documents:
1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. ADA: Americans with Disabilities Act
3. AHJ: Authority Having Jurisdiction
4. AMCA: Air Moving Council of America
5. ANSI: American National Standards Institute
6. ARI: American Refrigeration Institute
7. ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers
8. ASME: American Society of Mechanical Engineers
9. ASTM Specification: Standard specifications of the American Society for Testing Materials
10. CPVC: Chlorinated polyvinyl chloride plastic.
11. CR: Chlorosulfonated polyethylene synthetic rubber.
12. EPDM: Ethylene propylene diene terpolymer rubber.
13. FM: Factory Mutual Engineering Corporation
14. IRI: Industrial Risk Insurers
15. NEC: National Electrical Code, latest edition
16. NEMA: National Electrical Manufacturers Association
17. NFPA: National Fire Protection Association
18. NP: Nylon plastic.
19. NPS: Nominal Pipe Size
20. PE: Polyethylene plastic.
21. PVC: Polyvinyl chloride plastic.
22. SMACNA: Sheet Metal and Air Conditioning Contractors National Association
23. UL or Underwriters: Underwriters Laboratories, Inc.

1.8 CODES

A. The work shall be performed by persons skilled in the trade involved and shall be done in a manner consistent with normal industry standards.

B. All work shall conform to all applicable sections of currently adopted editions of the following codes, standards, and specifications:
1. International Building Code (IBC)
2. International Fire Code (IFC)
3. International Energy Conservation Code (IECC)
4. International Fuel Gas Code (IFGC)
5. Omaha Plumbing Code
6. International Mechanical Code (IMC)
7. Safety and Health Regulations for Construction
8. Occupational Safety and Health Standards (OSHA), National Consensus Standards and Established Federal Standards
9. National Electrical Code (NEC)
10. National Fire Protection Association (NFPA)
11. Life Safety Code (NFPA 101)

12. American Gas Association (AGA)
13. Underwriters' Laboratories, Inc. (UL)
14. National Electrical Safety Code (NESC)
15. All applicable national, state and local codes and amendments.

1.9 PERMITS

A. The Contractors shall familiarize themselves with all requirements regarding all permits, fees, etc., and shall comply with them.

B. All permits, licenses, inspections and arrangements required for the work shall be obtained by the Contractor at his expense.

C. All utilities shall be installed in accordance with the local rules and regulations and all charges shall be paid by the Contractor.

1.10 CODE COMPLIANCE

A. Work shall be in accordance with all applicable codes. Where the codes and drawings do not agree, the code shall take precedence; however, code shall take precedence over what is shown only when it is more stringent than that indicated. Items that are allowed by codes which are less stringent than that shown on the drawings shall not be substituted.

B. Drawings, plans, and schematics and diagrams indicate the general location and the arrangement of systems. Wherever practical, install systems as indicated.

C. Where the National Electrical Code or applicable codes require controllers to be marked with a Short Circuit Current Rating (SCCR), the equipment shall be manufactured as required such that the SCCR of the equipment meets or exceeds the available short circuit current at the equipment.

1.11 MATERIALS AND EQUIPMENT MANUFACTURERS

A. Options in selecting materials and equipment are limited by requirements of the contract documents and governing regulations. They are not controlled by industry traditions or procedures experienced on previous construction projects.

B. Materials and equipment shall be provided in accordance with the following:
1. Primary Design Products: Primary design products are those products around which the project was designed in terms of capacity, performance, physical size and quality.
2. Primary design products are indicated by use of a single manufacturer's name, model number or similar data on drawings or schedules or within the specifications.
3. Provide primary design products unless substitutions are made in accordance with the following paragraphs.
4. Acceptable Equivalent Substitutions: Acceptable equivalent substitutions are products of manufactures other than those listed for the primary design products. Equivalent acceptable substitutions shall meet each of the following requirements:
   a. The product shall be manufactured by one of the acceptable manufacturers listed in the Project Manual, drawings, or addenda.
   b. The product shall meet or exceed the requirements of the contract documents in terms of quality, performance, suitability, appearance, and physical characteristics.

c. The Contractor providing the substitution shall bear the total cost of all changes due to substitutions. These costs may include additional compensation to the Architect/Engineer for redesign and evaluation services, increased cost of work by the Authority or other Contractors, and similar considerations.

d. Performance Requirements: Where the contract documents list performance requirements or describe a product or assembly generically, provide products that comply with the specific requirements indicated and that are recommended by the manufacturer for the respective application.

e. Compliance with Standards, Codes and Regulations: Where the specifications require only compliance with an imposed standard, code or regulation, the Contractor has the option of selecting a product that complies with specification requirements, including the standards, codes and regulations.

f. Proposed substitutions will be judged on the basis of quality, performance, appearance and on the governing space limitations. The reputation of the manufacturer, delivery time requirements, and the availability of repair or replacement parts may also be considered.

g. The Architect/Engineer shall be the sole and final judge as to the suitability of substitution items.

1.12 SUBMITTALS

A. Shop Drawings, Product Data and Samples:

1. Other section in the Project Manual shall be adhered to if more stringent than the following paragraphs.
2. When required by other sections of this Project Manual, submit shop drawings, product data or samples to the Architect/Engineer for review.
3. Submittals deemed unnecessary by the Architect/Engineer shall be returned indicating “No Action Taken”.
4. A completed copy of the transmittal form included with the Project Manual shall accompany each submittal.
5. Submittals shall be numbered consecutively.
6. Unless otherwise noted, submit one copy electronically of shop drawings and product data for review. Review comments will be returned electronically. A hard copy of the electronic submittal will be returned if requested.
   a. Shop drawings and product data shall be in original searchable PDF format.
7. Shop drawings are drawings, diagrams, schedules and other data specifically prepared for this project by the Contractor, Manufacturer, Supplier, or Distributor to illustrate some portion of the work. Shop Drawings shall also detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.
   a. Shop drawings shall be drawn to accurate scale and of adequate size to illustrate required details.
8. Product data are illustrations, standard schedules, performance charts, instruction brochures, diagrams and other information furnished by the Contractor, Manufacturer, Supplier, or Distributor to illustrate a material, product or system for some portion of the work.
9. All submittals shall clearly indicate proposed items, capacities, characteristics and details in conformance with contract documents. All equipment items shall be marked with the same item number as used on drawings or schedules. Capacities, dimensions and special features required shall be certified by the manufacturer.

10. Submittals shall indicate manufacturer's delivery time for the item after review by the Architect/Engineer.
11. The Architect/Engineer shall review or take other appropriate action upon the Contractor's submittals such as shop drawings, product data and samples, but only to determine conformance with the design concept of the work and the information given in the contract documents.
12. Contractor shall not be relieved of responsibility for any deviation from the requirements of the contract documents by the Architect/Engineer's review of shop drawings, product data or samples.
13. Contractor shall not be relieved from responsibility for errors or omissions in the shop drawings, product data or samples by the Architect/Engineer's review of those drawings.

B. Specification Compliance Review:
1. When required by other sections of this Project Manual, the Contractor shall submit a Specification Compliance Review consisting of a paragraph-by-paragraph review of the specifications and addenda with the following marked for each paragraph. Markings may be made in the margins of the original specification or addenda. Unless a deviation or exception is specifically noted in the Specification Compliance Review, it is assumed that the equipment, product, or material is in complete compliance with the contract documents. Submit Specification Compliance Review with shop drawings and product data.
   a. "C": Comply with no exceptions.
   b. "D": Comply with minor deviations. For each deviation, provide the reasons for the deviation and how the intent of the specification can be satisfied.
   c. "E": Exception. Equipment, product, or material does not comply. For each exception, provide reasons for the exception, and suggest possible alternatives for the Authority's consideration.
   d. "N/A": The paragraph does not apply to the proposed equipment, product, or material.

C. Operation and Maintenance Manuals:
1. Prepare three (3) operation and maintenance manuals for the equipment furnished. Manuals shall be submitted to the Architect/Engineer for review and distribution to the Authority not less than 30 days prior to substantial completion of the project. Manuals not meeting the following requirements may be rejected by the Architect/Engineer.
2. Each manual shall be assembled in a three-ring binder with hard cover and plastic finish. Binders shall not exceed a 3-inch thickness. Where more than one binder is required, the manuals shall be separated into a logical grouping, i.e., "Mechanical", "Electrical", "Maintenance", "Operation", "Parts", Shop Drawings", etc. Where loose-leaf inserts are used, the sheets shall be reinforced to prevent tearing from continuous usage. Each binder shall have the following information clearly printed on its front cover:
   a. Project name and address.
   b. Portion of the work covered by each volume (if more than one volume in the set). Where more than one volume is required, label each volume as "Volume _____ of _____".
   c. Name, address and telephone number of Contractor and all Sub-Contractors including night or emergency number.
3. Manual shall include, but shall not be limited to, the following:
   a. A Complete Index. Contractor may submit the index to the Architect/Engineer for review prior to submittal of complete manuals if desired.

b. Identify equipment included in the O&M manuals by the equipment mark used in the contract drawings.
c. Names, Addresses and Telephone Numbers. This list shall include the manufacturer and local representative who stocks or furnishes repair parts for all items of equipment and shall be typed on a single page in front of the binder.
d. Startup, Operation and Shutdown Procedures. Provide a written description of procedures for startup, operation and shutdown of each mechanical item or system. This description shall include motors to start, valves to open, etc., in proper sequence, and the location of switches, starters, pushbuttons and valves. Description shall include item references or labels used in the contract documents unless otherwise instructed in advance by the Authority.
e. Seasonal Changeover Procedure. Provide a written description of the procedure for necessary seasonable changeover from heating to cooling and vice versa.
f. Equipment Accessory Schedule. Upon completion of the work, furnish the Authority with a complete equipment accessory schedule listing each piece of equipment and the related size, type, number required and the manufacturer of all renewable items.
g. Lubrication Schedule. Provide a chart listing each piece of equipment, the proper type of oil or grease required, and recommended frequency of lubrication.
h. Manufacturer's Operation and Maintenance Manuals and Parts Lists.
i. Emergency Procedures. Provide a written description of emergency operating procedures or a list of service organizations (including addresses and telephone numbers) capable of rendering emergency services to the various parts of the system.
j. One copy of all shop drawings and product data, clearly marked for each item furnished using the designation label specified or indicated on Drawings.
k. Signed letters of certification of inspection and similar information.
l. All manufacturers' warranty information.
m. Provide documentation that training was performed for each item specified to include Authority training. Include name of Authority’s representative(s) present, date and time of training.
n. Normal Maintenance Schedule. Include a listing of work to be performed at various time intervals; i.e., 30, 90, 180 days and yearly.
o. Provide documentation that Extra Materials were received by the Authority for each section requiring Extra Materials.
p. Motor List. The list shall indicate motor location, equipment served (using labels indicated on drawings), horsepower, electrical characteristics, motor type, and rpm. Motors less than 1/2 horsepower need not be included.

D. Division 23 Specific Submittals
1. Product Data: For the following:
a. Transition fittings.
b. Dielectric fittings.
c. Escutcheons.
d. Access doors.
2. Welding certificates.
3. Coordination Drawings: For access panel and door locations.

1.13 OPERATING TRAINING

A. Complete operating instructions for each system and item of equipment shall be provided to the Authority's designated personnel.

B. Operation and Maintenance Manuals must be reviewed and accepted by the Architect/Engineer and provided to the Authority prior to operating training.

C. Training shall be scheduled at the convenience of the Authority. A minimum of 8 hours of training shall be provided.

D. Training shall include instructions on the following:
   1. Startup and shutdown procedures
   2. Seasonal changeover
   3. Periodic maintenance
   4. Emergency operation
   5. Safety

E. In addition to the instructions required above, wherever possible perform the operations being described in order to fully illustrate system operation.

F. At the completion of training, turn over to the Authority all required keys and special tools for installed equipment. Each key or tool shall be labeled with its use.

1.14 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, “Structural Welding Code-Steel”.

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, “Welding and Brazing Qualifications”.
   1. Comply with provisions in ASME B31 Series, “Code for Pressure Piping”.
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.15 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.16 COORDINATION

A. Drawings, plans, and schematics and diagrams indicate the general location and the arrangement of systems. Wherever practical, install systems as indicated.

B. Provide offsets and elevation changes in piping, conduit and ductwork as required to complete the Layout and Coordination Process. Offsets and elevation change information shall be indicated in the coordination process documentation and must be submitted for review.

C. Arrange for spaces, chases, slots, and openings in building structure during progress of construction to allow for system installations.

D. Coordinate arrangement, mounting, and support of equipment.
   1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. To allow right of way for piping and conduit installed at required slope.

E. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the installations that follow.
   1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

F. Sequence, coordinate, and integrate installing materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

G. Coordinate service connections to components furnished by utility companies.
   1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for metering components.
   2. Comply with requirements of authorities having jurisdiction and of utility company providing water, gas, electrical power and other services.

H. Coordinate location of access panels and doors for items that are concealed by finished surfaces.

I. Coordinate testing of items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

1.17 STRUCTURAL COORDINATION

A. In cases where the Contractor determines that superimposed loads such as suspended or floor mounted mechanical, electrical, plumbing system or equipment exist which exceed design loads indicated on structural contract documents, Contractor shall submit load data to Design Professionals for review prior to proceeding with work.

B. Distribute the maximum load hung from any structural member for mechanical, electrical, plumbing, ductwork, piping, etc. over the member's tributary area in a way that the design superimposed dead loads listed in structural contract documents are not exceeded. The Contractor shall coordinate the loads and provide additional support or distribution framing as required achieving the allowable load distribution.

C. Connections of systems designed by Contractor's engineer such as, but not limited to mechanical, electrical, plumbing loads are assumed to impose vertical and/or horizontal loads on the base building structural members without generating torsion in the supporting structural members. Contractor is responsible for designing, furnishing and installing all supplementary bracing members as required to prevent torsion on the base building structure.

D. Coordinate locations of new fire suppression, plumbing and HVAC penetrations through existing structure and construction. Utilize all existing documentation of conditions for coordination. Verify penetrations utilizing GPR (Ground Penetrating Radar) as necessary to confirm penetration locations.

PART 2 - PRODUCTS

2.1 PERFORMANCE, CAPACITIES AND CHARACTERISTICS

A. See Drawings for Equipment Schedules with Equipment Performance Requirements when capacities and characteristics are not indicated in the specifications.

2.2 EQUIPMENT SHORT CIRCUIT CURRENT RATING

A. Where the National Electrical Code or applicable codes require equipment to be marked with a Short Circuit Current Rating (SCCR), the equipment shall be manufactured as required such that the SCCR of the equipment meets or exceeds the available short circuit current at the equipment. Acceptable methods of complying with this requirement are as follows:
   1. Provide SCCR rating at the equipment that meets or exceeds the available short circuit current at the switchboard or panelboard where the equipment circuit originates.
   2. Provide calculations, based on the available short circuit current at the switchboard or panelboard where the equipment circuit originates, that document the actual short circuit current available at the equipment. The SCCR rating of the equipment shall meet or exceed this calculated value.

2.3 MATERIALS

A. Unless otherwise specified, all materials and equipment shall be new, unused and undamaged. Materials and equipment shall be the current and standard designs of manufacturers regularly engaged in their production.

2.4 MATERIALS AND EQUIPMENT FURNISHED BY OTHERS

A. Where materials and equipment are indicated as furnished by others and installed or connected under this contract, it shall be the Contractor's responsibility to verify installation details and requirements.

2.5 QUANTITY OF SPECIFIED ITEMS REQUIRED

A. Wherever in these specifications an article, device or piece of equipment is referred to in the singular number; such reference shall apply to as many such articles as are shown on the drawings or required to complete the installation.

2.6 PIPE AND PIPE FITTINGS

A. Refer to individual piping Sections for pipe and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

C. Fusion-weld joints shall be made in accordance with the pipe and fitting manufacturer’s specifications and product standards.
   1. Fusion-weld tooling, welding machines, and electrofusion devices shall be as specified by the pipe and fittings manufacturer.
   2. Pipe and fittings shall be prepared in accordance with ASTM F 2389 and the manufacturer’s specifications.
   3. Joint preparation, setting and alignment, fusion process, cooling times and working pressure shall be in accordance with the pipe and fitting manufacturer’s specifications.

2.7 JOINING MATERIALS

A. Refer to individual piping sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, unless thickness or specific material is indicated.
      a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
   2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements: Manufacturer's standard solvent cements for the following:
   1. ABS Piping: ASTM D 2235.
   2. CPVC Piping: ASTM F 493.
   3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
   4. PVC to ABS Piping Transition: ASTM D 3138.

I. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.

J. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.

K. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.
   1. Sleeve: ASTM A 126, Class B, gray iron.
   2. Followers: ASTM A 47 malleable iron or ASTM A 536 ductile iron.
   3. Gaskets: Rubber.
   4. Bolts and Nuts: AWWA C111.
   5. Finish: Enamel paint.

2.8 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
   1. Manufacturers:
      a. Cascade Waterworks Mfg. Co.
      b. Dresser Industries, Inc.; DMD Div.
      c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
      d. JCM Industries.
      e. Smith-Blair, Inc.
      f. Viking Johnson.
   2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting our coupling.

3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
4. Aboveground Pressure Piping: Pipe fitting.

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

C. Manufacturers:
1. Eslon Thermoplastics.

D. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
1. Manufacturers:
a. Thompson Plastics, Inc.

E. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
1. Manufacturers:
a. NIBCO, Inc.
b. NIBCO, Inc.; Chemtrol Div.

F. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.
1. Manufacturers:
a. Cascade Waterworks Mfg. Co.
b. Fernco, Inc.
c. Mission Rubber Company
d. Plastic Oddities, Inc.

2.9 DIELECTRIC FITTINGS

A. General: Fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion. Dielectric unions shall not be used.

B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.

C. Insulating Material: Suitable for system fluid, pressure, and temperature.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
1. Manufacturers:
a. Central Plastics Co.
b. Watts Industries, Inc.; Water Products Div.

E. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
1. Manufacturers:
a. Calpico, Inc.
b. Central Plastics Co.

2. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure as required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 degrees F.
1. Manufacturers:
a. Calpico, Inc.
b. Lochinvar Corp.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 degrees F.
1. Manufacturers:
a. Grinnell Corp.; Grinnell Supply Sales Co.
b. Victaulic Co. of America.

2.10 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated “wall pipe” equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
1. Underdeck Clamp: Claming ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.11 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast Brass Type: With set screw.
1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.12 GROUT

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

2.13 SEALANTS AND FIRESTOPPING

A. Manufacturers:
1. Sealants:
a. Dow Corning
b. Pecora
c. Sonneborn
d. Tremco
2. Firestopping Materials and Systems:
a. A/D Fire Protection Systems Inc: www.adfire.com.
b. 3M Fire Protection Products: www.3m.com/firestop.
c. Hilti, Inc: www.us.hilti.com.
d. Nelson FireStop Products: www.nelsonfirestop.com.
e. Specified Technologies, Inc: www.stifirestop.com.
f. Tremstop Fyre-Sil Sealant - Tremco Sealants & Coatings

B. Silicone Sealant: Single component, air curing, non-staining, non-bleeding, capable of continuous water immersion, non-sagging type for application in vertical joints and in horizontal joints, color as selected.

C. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

D. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

E. Joint Backing: ANSI/ASTM D1056; round, closed cell, polyethylene foam rod; oversized 30% to 50% larger than joint width.

F. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

G. Firestopping Materials and Systems:
1. Subject to compliance with the requirements of Division 07 Fire and Smoke Protection.

2.14 ACCESS DOORS

A. Manufacturers:
1. Access Doors:
a. J. L. Industries
b. Karp Associates, Inc.
c. Larsons Mfg. Co.
d. Milcor, Inc.
e. Miller Limited Partnership
f. Nystrom, Inc.

B. Prime coated 14 gauge steel, flush, with screwdriver operated cam lock, frame to accommodate construction type; size as indicated.

2.15 ELECTRICAL WIRE

A. All wiring materials covered by this section shall be in accordance with the latest revision of the National Electrical Code and applicable local codes and shall carry the UL label where applicable.

B. All wiring running exposed in return air plenums shall be plenum-rated cable for fire and smoke spread.

2.16 LOW VOLTAGE CONTROL WIRE AND CABLE

A. All wiring materials section shall be in accordance with the latest revision of the National Electrical Code and applicable local codes and shall carry the UL label where applicable.

B. Analog Input, Analog Output, Binary Input, Binary Output, 24 VAC, and General Purpose Cabling:
1. Cable shall consist of copper conductors not less than #18 AWG stranded.
2. Cable shall be two- or three-conductor twisted cable with a drain wire.
3. Cable shall have a 100 percent overall shield.
4. Cable shall be plenum rated.
5. Cable shall meet or exceed NEC voltage rating of 300 volts.
6. Cable shall be NEC type CMP.
7. Cable shall meet or exceed UL temperature rating of +60 deg C.
8. Cable shall be labeled at a minimum of every 18 inches with the DDC system manufacturer's name and the type of signal carried within the cable, i.e., analog input, analog output, binary input, binary output, 24 VAC.

C. Primary and Secondary Communications Network Cabling:
1. Cable shall be of type recommended by the DDC system manufacturer.
2. Cable shall be shielded.
3. Cable shall be plenum rated.
4. Cable shall meet or exceed NEC voltage rating of 150 volts.
5. Cable shall meet or exceed UL temperature rating of +60 deg C.

PART 3 - EXECUTION

3.1 GENERAL

A. Fabrication, erection, and installation of the complete mechanical system shall be done by qualified personnel experienced in such work and shall proceed in an orderly manner so as not to hold up the progress of the project.

B. The Contractor shall check all areas and surfaces where mechanical equipment or materials are to be installed and report any unsatisfactory conditions before starting work.

C. Commencement of work signifies the Contractor's acceptance of the conditions as fit and proper for the execution of the mechanical work.

D. Equipment and systems shall be installed in accordance with manufacturer's instructions, requirements, or recommendations.

3.2 DELIVERY AND STORAGE OF MATERIALS

A. Take provisions for the delivery and safe storage of materials and shall make the required arrangements with other Contractors for the introduction into the building of equipment too large to pass through finished openings.

B. Materials shall be delivered at such stages of the work as will expedite the work as a whole and shall be marked and stored in such a way as to be easily checked and inspected.

C. Contractor shall be responsible for adequately protecting all supplies and equipment during cold weather.

D. All items subject to cold weather damage shall be protected by covering, insulating, or storing in a heated space.

3.3 COOPERATION WITH OTHER CONTRACTORS

A. Perform the work in conformance with the construction called for by other trades and afford other Contractors reasonable opportunity for the execution of their work.

B. Properly connect and coordinate the mechanical work with the work of other Contractors at such time and in such a manner as not to delay or interfere with their work.

C. Examine the contract documents for the General, Mechanical, and Electrical work and the work of other trades. Coordinate work accordingly.

D. Promptly report to the Architect/Engineer any delay or difficulties encountered in the installation of the mechanical work which might prevent prompt and proper installation of work required from other trades.

E. Systems Test and Balance Contractors or personnel shall coordinate their work with the contractors who installed the systems being tested or balanced.

F. The Temperature Control Contractor or personnel shall be present during systems test and balance.

3.4 COORDINATION OF WORK

A. The list below is the precedence of assigned work items for space priority in descending order. Items not listed shall have the same precedence as similar items.
   1. Reflected ceiling with all light fixtures, access above light fixtures required for maintenance, sprinkler head locations, and all ceiling fixtures and devices.
   2. Space designed for future utility placement.
   3. Gravity flow plumbing waste, roof drainage, and other systems that rely upon gravity for flow.
   4. Ductwork and appurtenances, except that external bracing shall be relocated to accommodate local interference.
   5. Fire sprinkler piping.
   6. Bus duct.
   7. Cable tray with access identification 8 inches horizontal to 6 inches above tray.
   8. Electrical conduit over 2 inches in diameter.
   9. HVAC piping except for pressurized domestic water piping.
   10. Refrigerant safety relief piping.
   11. Plumbing vents.
   12. Electrical conduit under 2 inches in diameter.

B. Plan all work so it proceeds with a minimum of interference with other trades.

C. It shall also be the responsibility of the Mechanical Contractor to inform the Contractor of all openings required in the building construction for the installation of the mechanical work.

D. The Contractor shall cooperate with all other contractors in furnishing material and information, in proper sequence, for the correct location of all sleeves, inserts, foundations, wiring, etc.

E. Provisions shall be made for all special frames, openings, and sleeves as required.

F. The Contractor shall pay for extra cutting and patching made necessary by his failure to properly direct such work at the correct time.

3.5 ELECTRICAL WIRING

A. Install wiring in accordance with National Electric Code, ANSI/NFPA 70.

B. All wiring materials covered by this section shall be in accordance with the latest revision of the National Electrical Code and applicable local codes and shall carry the UL label where applicable. All wiring running exposed in air plenums shall be plenum cable.

C. Install wiring (low and line voltage) in metal raceways or conduit unless inside control cabinet or unit enclosures.
   1. For concealed and accessible areas, plenum-rated wiring and cabling may be used.

D. Low voltage wiring not installed in conduit shall be supported every five feet from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements. Exposed wiring shall only be allowed in concealed accessible locations.

E. Low voltage control wiring and 24 VAC can be run in the same conduit. Power wiring 120 VAC and greater must be in a separate conduit.

F. Fastening shall be secured to walls or ceilings by means of appropriate screws, expansion screws anchors, toggle bolts, hollow wall screw anchors, nylon expansion anchors, or expansion shields. All-purpose plastic anchors are not acceptable.

G. Control panels shall be mounted on vibration-free walls or freestanding structural supports. Panels shall be located as indicated or approved by the Authority's Representative.

H. Locate circuits, relays, transformers, or other equipment that contains or must be connected to voltages exceeding 130 volts, in separate cabinets, which may be adjacent to control panels; permanently label "DANGER 277 VOLTS" or appropriate volts.

I. All wiring in mechanical rooms shall be in conduit. Minimum control wiring conduit size shall be 3/4 inch.

J. Provide with 120v AC, 20 amp dedicated emergency power circuit to each programmable control unit, panel and transformer.

K. Provide extension of 120v, 20 amp circuits and circuit breakers from emergency power panels for all BMCS equipment, transformers and panel power. Provide and install local UPS power supplies for all BMCS system panels and equipment.

3.6 CONTROL WIRING AND POWER CONNECTIONS

A. Provide all incidental control wiring required to make the equipment or systems fully operational. Coordinate with equipment manufacture incidental wiring requirements.

B. Incidental control wiring includes but not limited to:
   1. Equipment Motors Starters
   2. HVAC Controls (Including but not limited to):
      a. Control panels, control transformers, and any required 120 volt control power connections not shown on the electrical drawings.
         1) Include 120 volt connection from dedicated circuit in nearest general power panel or as indicated.
         2) Include 120 volt connection from dedicated circuit in nearest emergency power panel.
      b. Control Relays
      c. Control Dampers and Valves
      d. Temperature, Flow and Occupancy Sensors
      e. Flow and BTU Meters
      f. Current Sensors
      g. Transmitters
   3. Loose Motor Starters
   4. Manual Multi-Speed Switches (Furnished as an Accessory to Mechanical Equipment)
   5. Motor Control Centers
   6. Pushbutton Stations and Emergency Stop Switches
   7. Pumps
   8. Remote Monitoring and Control Panels (Provided by Equipment Manufacturers)
   9. Unit Mounted Motor Starters, Contactors, Disconnect Switches, Thermal Overloads and Heaters
   10. Variable Frequency Controls.

3.7 LAYING OUT WORK

A. Carefully lay out all work in advance of installation using data and measurements from the site, the appropriate architectural and structural drawings, and shop drawings.

B. Equipment layout and all system layouts shall confirm adequate clearances for installation, operation, maintenance, and code-required clearances from the structure or other equipment and systems. Provide offsets and elevation changes in piping, conduit and ductwork as required to complete the Layout and Coordination Process. Offsets and elevation change information shall be indicated in the coordination process documentation and must be submitted for review.

C. The layout shall not cause problems of operation, maintenance, or clearance for items installed by other Contractors.

D. Prior to installation of any work, make certain the location does not conflict with other items in or near the same location.

E. If the layouts so prepared indicate that the required conditions cannot be met in the space provided, inform the Architect/Engineer prior to installation and shall request clarification.

F. Failure to properly coordinate and lay out the work will require correction by the Contractors at their own expense.

3.8 DATA AND MEASUREMENTS

A. Mechanical and electrical drawings are diagrammatic or schematic. Do not scale drawings.

B. The data given herein and on the drawings is as accurate as could be secured; absolute accuracy is not guaranteed.

C. Obtain exact locations, measurements, levels, etc., at the site and shall adapt their work to actual conditions.

D. Examine the general construction, mechanical, electrical, and other applicable drawings and the Specifications.

E. Only architectural drawings, structural drawings, and site measurements may be utilized in calculations.

F. Layout and coordinate all work prior to installation to provide clearances for operation, maintenance and codes. Verify non-interference with other work.

3.9 POSITION OF DEVICES

A. Locate devices mounted on finished surfaces with regard to paneling, furring, trim, etc. Where several devices occur in a room, they shall be symmetrically arranged as reviewed by the Architect/Engineer.

B. Devices improperly located or installed shall be repaired, replaced or relocated at the Contractor's expense.

C. Devices shall be set plumb or horizontal and shall extend to the finished surface of the wall, ceiling, or floor without projecting beyond the surface.

D. Devices shown on wood trim, cases, or other fixtures shall be installed symmetrically and, where necessary, shall be set with the long dimension of the plate horizontal.

E. Coordinate their respective devices so as not to destroy the aesthetic effect of the surface in which the devices are mounted.

F. Coordinate the locations of all mechanical items with work furnished by other trades to avoid interference.

G. If the required coordination is not done, the outlets or devices shall be removed and relocated if so directed by the Architect/Engineer and the damaged surfaces repaired at the Contractor's expense.

H. Devices shall be installed at the height shown below unless otherwise noted. All heights of devices are measured from finished floor to centerline of device.

I. Heights may be adjusted to correspond to nearest masonry course or as necessary to clear wall-mounted cabinets, fin tube convectors, unit heaters, etc.

1. Temperature control panels: 60 inches
2. Thermostats: 48 inches

3.10 PROTECTION OF APPARATUS

A. Take such precautions as necessary to properly protect all apparatus, fixtures, appliances, material, equipment, and installations from damage of any kind.

B. Failure to provide such protection to the satisfaction of the Architect/Engineer shall be sufficient cause for the rejection of any particular piece(s) of material, apparatus, equipment, etc., concerned.

3.11 ACCESS TO EQUIPMENT

A. All motors, terminal boxes, valves, control devices, specialties, etc., shall be located to provide for easy access for operation, repair and maintenance; if concealed, access doors shall be provided.

B. Access doors required for access to equipment requiring inspection or service shall be provided.

C. Provide all access doors not already furnished by other Contractors but which are required for access to mechanical equipment.

D. Doors shall be 12 inches by 12 inches unless shown otherwise.

E. Person access doors shall be 18 inches by 18 inches minimum.

3.12 EXAMINATION OF PREMISES

A. Examine the premises and all conditions thereon and/or therein. The bid proposal shall take into consideration all such conditions which may affect the work under this contract.

3.13 ROADWAYS, CURBS, AND WALKS

A. Use every possible precaution to prevent injuries to roadways, curbs, and walks on or adjacent to the site of the work.

B. Any damage shall be repaired at the Contractor's own expense. This shall also include damage necessary for installation of the mechanical work.

3.14 WORK IN EXISTING BUILDINGS

A. General: All work in the existing building, indicated on the drawings or specified herein, shall be executed with a minimum amount of interference with the normal activities of the occupants of the building.

B. All work shall be scheduled in advance with the Authority and shall not proceed without the Authority's written approval.

C. Utilities: Utilities shall not be interrupted without the Authority's prior written approval regarding the time and duration of such interruptions.
   1. Utilities to existing facilities shall not be disconnected until new or temporary facilities are installed except for short periods of interruption which are necessary for the performance of the new work and which are approved by the Authority.

D. Storm water may be temporarily diverted to surface drainage provided such drainage is arranged to prevent flooding of structures, basements, and excavations for construction.

E. Fire Alarm System: The existing fire alarm system shall remain functional throughout construction.
   1. As a minimum, the existing degree of protection shall be maintained for all areas.
   2. All required outages shall be coordinated with the Authority and the Fire Marshal.

F. Welding: The Authority shall be notified before starting welding or cutting.
   1. Fire extinguishers shall be immediately accessible when welding or cutting with an open flame or arc.

2. Welding or cutting with an open flame or arc shall be stopped not less than one hour before leaving the premises.

G. Noisy Operations: Noisy operations such as those involving use of air hammers, etc., in demolition, or cutting of openings shall be scheduled with the Authority.

H. Occupancy:
1. The Authority will continue to occupy the building and carry on normal activity. Each Contractor shall protect the occupied areas from dust, smoke, etc., by a method reviewed by the Architect/Engineer.

I. Authority's Right to Direct Work: The Authority shall have the right to direct the places of beginning work, its prosecution, and the manner in which all work under this contract is to be conducted, insofar as may be necessary to secure the safe and proper progress and quality of the work.

J. Coordinate locations of new fire suppression, plumbing and HVAC penetrations through existing structure and construction. Utilize all existing documentation of conditions for coordination. Verify penetrations utilizing GPR (Ground Penetrating Radar) as necessary to confirm penetration locations.

K. Cutting and Patching:
1. Each Contractor shall be responsible for all cutting and patching required for the work.
2. Patching shall be done by persons skilled in the trade involved and shall be prepared to receive paint.
3. Openings through floors may be drilled up to 1 inch but shall be core drilled over 1 inch.
4. Whenever the building surfaces (walls, floors, etc.) and openings are modified, removed and/or replaced to accommodate the new work or to introduce into or remove items from the building, such surfaces or openings shall be carefully reinstalled in conformance with the applicable code to protect the integrity of the building.

L. Existing Piping, Ductwork, or Mechanical Equipment:
1. If any existing piping, ductwork or mechanical equipment is encountered which would interfere with the proper installation of new work, it shall be removed or relocated as required or as directed by the Architect/Engineer.
2. Where existing work is to be modified, it shall be done in conformance with these specifications.
3. Materials used shall be the same as for new work unless otherwise specified.

3.15 FRAMES

A. Ducts passing through masonry walls shall be installed in steel angle iron frames and sleeves.

B. All sleeves and frames shall be securely fastened to the walls. Provide for structural lintels in masonry wall openings.

C. Ducts passing through openings in poured concrete walls and floors need not have frames.

3.16 FINISHED SURFACES PENETRATIONS

A. All piping and ductwork penetrations of finished surfaces shall have escutcheons and/or closure plates.

B. Openings shall be cut only as large as required for the installation, sleeves, and/or frames installed flush with finished surfaces and grouted in place.

C. Surfaces around openings shall be left smooth and finished to match surrounding surface.

D. Duct frames and pipe sleeves through floors in concealed locations and in unfinished spaces such as mechanical rooms, etc., shall extend 2 inches above finished floor level and shall be caulked watertight.

E. All other sleeves shall extend approximately 1/4 inch above finished floor but shall allow placement of escutcheons.

3.17 FIRESTOPPING PENETRATIONS IN FIRE-RATED WALL/FLOOR ASSEMBLIES

A. Subject to compliance with the requirements of Division 07 Fire and Smoke Protection.

B. Provide proper sizing when providing sleeves or core-drilled holes to accommodate their work through penetrating items.

C. All voids between sleeve or core-drilled hole and pipe passing through shall be firestopped to meet the requirements of ASTM E814.

D. Install all materials complete, attached securely and permanently in place in accordance with manufacturers' printed directions.

E. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

F. Do not cover installed firestopping until inspected by authority having jurisdiction.

G. Install labeling required by code.

3.18 SEALING OF EXTERIOR OPENINGS

A. Openings around pipes, ducts, conduits, etc., in exterior walls above grade shall be sealed with polyurethane sealant.

B. Preparation:
1. Clean and prepare joints in accordance with manufacturer's instructions.
2. Remove loose materials and foreign matter which might impair adhesion of sealant.
3. Verify that joint backing and release tapes are compatible with sealant.
4. Perform preparation in accordance with ASTM C804 for solvent release sealants.
5. Protect elements surrounding the work of this Section from damage or disfiguration.

C. Installation:
1. Perform installation in accordance with ASTM C804 for solvent release sealants.
2. Install sealant in accordance with manufacturer's instructions.
3. Measure joint dimensions and size materials to achieve required width/depth ratios.
4. Install joint backing to achieve a neck dimension no greater than 1/3 the joint width.
5. Install bond breaker where joint backing is not used.
6. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

7. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
8. Tool joints concave.

3.19 PIPING AND/OR DUCTWORK SYSTEMS - COMMON REQUIREMENTS

A. General: Install as described below, unless individual Sections specify otherwise. Individual Sections specify unique installation requirements.

B. General Locations and Arrangements:
1. Drawing plans, schematics, and diagrams indicate general, diagrammatic location and arrangement of systems.
2. Indicated locations and arrangements were used to size pipe or ductwork and calculate friction loss, expansion, pump and fan sizing, and other design considerations.
3. Install systems as indicated, unless deviations to layout are approved on Coordination Drawings.
4. Provide offsets and elevation changes in ductwork, piping and conduit as required to complete the Layout and Coordination Process. Offsets and elevation change information shall be indicated in the coordination process documentation and must be submitted for review.
5. Refer to architectural reflected ceiling plans for exact diffuser, register, grille, and ceiling mounted device locations.
6. Do not run ductwork and piping above electrical panels or in code required clearance spaces.
7. Coordinate location of ductwork and piping with electrical cable tray. Provide a minimum of 6" of clear access above cable tray for installation of cables.
8. Install all horizontal ductwork and piping in mechanical rooms at a minimum of 7'-6" above finished floor.
9. Install all wall mounted equipment at a minimum 7'-0" above finished floor or as required for service per manufacturers' recommendations.
10. Install exposed interior and exterior piping and ductwork at right angles or parallel to building walls.
    a. Diagonal runs are prohibited, unless otherwise indicated.
11. Conceal ductwork and piping in walls, pipe chases, utility chases, above ceilings, below grade or floors, unless otherwise noted, except in mechanical rooms or service areas.
12. Install piping free of sags or bends with ample space between piping to permit proper insulation applications.
13. Install ductwork and piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building unless otherwise indicated.
    a. Allow sufficient space above ceiling panels to allow for ceiling panel removal.
14. Install ductwork and piping to allow for expansion and contraction without stressing pipe, adjacent building structure or connecting equipment.
    a. Install expansion loops or compensators where indicated.
15. Do not use ceiling support system to bear weight of devices or systems unless ceiling support system is certified as suitable to do so.
16. During construction, avoid any undue loads, forces or strains on valves, equipment, pumps flanges, or building elements with piping connections or piping systems.

C. All insulation shall meet the energy code's installed R value requirements.

D. Contractor is responsible for any cutting and patching needed for mechanical installation. Patching must match existing.

E. Size and route refrigerant piping per manufacturers' recommendations.

F. Install piping at indicated slope and as required by code.

G. Install components with pressure rating equal to or greater than system operating pressure.

H. Install exposed interior and exterior piping and ductwork at right angles or parallel to building walls.
   1. Diagonal runs are prohibited, unless otherwise indicated.

I. Install piping and ductwork to allow application of insulation plus 1-inch clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit insulation and valve servicing.

K. Install fittings for changes in direction and branch connections.

L. Keep all pipe, duct, and equipment openings closed during construction except when actual work is being performed on that item or system.

M. Conceal piping and ductwork in walls, pipe chases, utility chases, above ceilings, below grade or floors, unless otherwise noted, except in mechanical rooms or service areas.

N. Install piping and ductwork free of sags or bends with ample space between piping to permit proper insulation applications.

O. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building unless otherwise indicated.
   1. Allow sufficient space above ceiling panels to allow for ceiling panel removal.

P. Install piping to allow for expansion and contraction without stressing pipe, adjacent building structure or connecting equipment.
   1. Install expansion loops or compensators where indicated.

Q. During construction, avoid any undue loads, forces or strains on valves, equipment, pumps flanges, or building elements with piping connections or piping systems.

R. Piping branch takeoffs shall be fabricated using standard manufactured welding or threaded tees.
   1. Branch welds reinforced with welding saddles or by forged steel reinforcement fittings such as weldolets, threadolets and sockolets will be allowed on 2 inch and smaller branch connections.
   2. On 3 inch and larger pipes, main lines two or more pipe sizes larger than the branch must be for forged steel reinforcement fitting connections.

S. Leaking pipe and duct joints shall be remade using new materials.

T. Drill and deburr all openings which are made after erection of the piping system.
   1. Joints in steel pipe 2 inches and smaller shall be threaded in accordance with ANSI B1.1.
   2. Ream threaded ends to remove burrs and restore full inside diameter.
   3. Utilize pipe joint lubricant or sealant suitable for the service for which the pipe is intended on the male threads at each joint.
   4. Tighten joints to leave not more than three threads exposed.

U. Pipe joints and steel pipe larger than 2 inches shall be welded in accordance with ASME Code for Pressure Piping B31.

V. Flanges on steel pipe larger than 2 inches shall be welded in accordance with ASME B31. Clean flange faces and install gaskets.
   1. Tighten bolts to torques specified by the manufacturer of the flange and flange bolts to provide uniform compression of gaskets.

W. Joints in non-ferrous pipe shall be brazed or soldered.
   1. Braze joints in accordance with ANSI B31.9 or B31.5.
   2. Thoroughly clean tube surface and inside surface of the fitting using emery cloth. Clean tube and fittings and apply flux.
   3. Flux shall not be used for cleaning tube and fitting surfaces.

X. Joints for other piping systems are specified within the respective piping system specifications.

Y. Pipe hangers for insulated pipe with vapor barrier jackets shall be installed around the outside of the insulation and a metal insulation support shield provided to prevent crushing of the insulation.

Z. Install couplings according to manufacturer's written instructions.

AA. Piping Penetrations:
   1. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:
      a. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish. Use split-casting escutcheons if required, for existing piping.
      b. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
      c. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
      d. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.
      e. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.

AB. Sleeves are not required for core drilled holes.

AC. Permanent sleeves are not required for holes formed by PE removable sleeves. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.
   1. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
   2. Build sleeves into new walls and slabs as work progresses.
   3. Install sleeves large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
      a. Steel Pipe or 16 Gauge Welded Sleeves: For pipes penetrating fire-rated walls and floors.
      b. Steel, 22 Gauge, Sheet-Metal Sleeves: For pipes penetrating non-fire-rated walls and floors.
      c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.

1) Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants.
5. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

AD. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe and duct penetrations. Seal pipe and duct penetrations with firestopping materials in accordance with manufacturer's written instructions and applicable codes.

AE. Verify final equipment locations for roughing-in of all systems.

AF. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.20 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings as follows and as specifically required in individual piping specification Sections:
1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Soldered Joints: Construct joints according to AWS's "Soldering Manual", Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook".
4. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
c. Align threads at point of assembly.
d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
e. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
6. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
8. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:
a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
b. ABS Piping: ASTM D 2235 and ASTM D 2661.
c. CPVC Piping: ASTM D 2846 and ASTM F 493.

d. PVC Pressure Piping: ASTM D 2672.
e. PVC Nonpressure Piping: ASTM D 2855.
f. PVC to ABS Nonpressure Transition Fittings: Procedure and solvent cement according to ASTM D 3138.

9. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657 procedures and manufacturer's written instructions.
a. Plain-End Pipe and Fittings: Use butt fusion.
b. Plain-End Pipe and Socket Fittings: Use socket fusion.

B. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D3139.

C. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D3212.

3.21 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping 2-inch NPS and smaller, adjacent to each control valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
2. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
3. Dry Piping Systems: Install dielectric flanges and nipples to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric flanges and nipple fittings to connect piping materials of dissimilar metals.

3.22 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

B. Install equipment according to manufacturer's requirements and submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect/Engineer.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components.

E. Connect equipment for ease of disconnecting, with minimum interference to other installations.

F. Extend grease fittings to accessible locations.

G. Install equipment giving right of way to piping installed at required slope.

H. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.23 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to applicable seismic codes.
1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete.
8. Pads poured on reinforced concrete slabs shall have 6 x 6 x 10/10 welded wire fabric and shall be doweled to the slab. Self-supporting isolating pads shall have #4 reinforcing bars at 12 inches center to center each way and shall have an expansion joint around the perimeter of the adjoining slab.

3.24 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.25 GROUTING

A. Install nonmetallic, non-shrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placing of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases to provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's written instructions.

3.26 ADJUSTING

A. Align pulleys and install belts according to manufacturer's written instructions.

B. Tension according to manufacturer's written instructions.

3.27 LUBRICATION

A. Run in all bearings and, after they are run in, drain and flush bearings and refill with a new oil charge.

B. Equipment shall be so arranged that tools (screwdrivers, wrenches, etc.) will not be required to make lubrication points accessible.

C. Extensions on grease or oil fittings shall be provided where required for access to lubricate.

3.28 INCIDENTAL WORK

A. The following incidental work shall be furnished by the designated contractor under the supervision of the Temperature Control Contractor:

1. The Piping Contractor shall install automatic valves and separable wells that are specified to be furnished by the Temperature Control Contractor.
2. The Piping Contractor shall provide all necessary valved pressure taps, water, drain, and overflow connections and piping.
3. The Piping Contractor shall provide all necessary piping connections required for flow devices, valve position indicators, etc.
4. The Electrical Contractor shall provide power wiring to the variable frequency drives.

END OF SECTION

SECTION 23 0513

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single phase electric motors.

B. Three phase electric motors.

1.2 SUBMITTALS

A. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

B. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

C. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.3 QUALITY ASSURANCE

A. Conform to NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.4 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.

1.5 WARRANTY

A. Provide five year manufacturer warranty for motors larger than 20 horsepower.

PART 2 PRODUCTS

2.1 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Construction:
1. Open drip-proof type except where specifically noted otherwise.
2. Design for continuous operation in 40 degrees C environment.
3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
4. Motors with frame sizes 254T and larger: Energy Efficient Type.

B. Explosion-Proof Motors: UL approved and labelled for hazard classification, with over temperature protection.

C. 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.

D. 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.

E. Efficiency: Premium efficiency as defined in NEMA MG 1 for all available sizes. Provide highest efficiency option when premium efficiency is not available.

2.2 SINGLE PHASE POWER - SPLIT PHASE MOTORS

A. Starting Torque: Less than 150 percent of full load torque.

B. Starting Current: Up to seven times full load current.

C. Breakdown Torque: Approximately 200 percent of full load torque.

D. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.

E. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.3 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

A. Starting Torque: Exceeding one fourth of full load torque.

B. Starting Current: Up to six times full load current.

C. Multiple Speed: Through tapped windings.

D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.4 SINGLE PHASE POWER - CAPACITOR START MOTORS

A. Starting Torque: Three times full load torque.

B. Starting Current: Less than five times full load current.

C. Pull-up Torque: Up to 350 percent of full load torque.

D. Breakdown Torque: Approximately 250 percent of full load torque.

E. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.

F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.

G. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.5 SINGLE PHASE POWER - ELECTRONICALLY COMMUTATED MOTORS (ECM)

A. Starting Torque: Exceeding one fourth of full load torque.

B. Soft start and soft speed change ramps.

C. Breakdown Torque: Approximately 250 percent of full load torque.

D. Motors: Synchronous rotation. Variable speed direct current brushless. Permanent magnet type. Near zero rotor losses. Permanently lubricated ball bearings. Integrated controller/inverter operates the wound stator and senses rotor position to electronically commutate the stator.

E. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.6 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.

E. Insulation System: NEMA Class B or better.

F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

H. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter; refer to Section 26 2913.

I. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

J. Sound Power Levels: To NEMA MG 1.

K. Part Winding Start Above 254T Frame Size: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.

L. Weatherproof Epoxy Sealed Motors: Epoxy seal windings using vacuum and pressure with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.

M. Nominal Efficiency: NEMA MG 1-2006 Premium.

N. Inverter Duty: NEMA MG 1 Part 31.4.4.2.

2.7 SHAFT GROUNDING

A. Manufacturers:
   1. AEGIS SGR
   2. Helwig Carbon Products

B. Shaft grounding system for each three-phase AC motor to prevent electrical damage to motor bearings and to extend motor life by safely channeling harmful shaft currents to ground.

C. Provide shaft grounding on all motors controlled by variable frequency controllers and as indicated.

D. Electrographite construction. Integral shunt with quick disconnect terminal and mount.

E. Continuous spring loaded brush holder, conductive carbon brush or carbon fiber ring technology.

F. Replaceable without motor removal or uncoupling..

G. Internal:
   1. Integral to motor housing.

H. External:
   1. Bolted to motor exterior.
   2. Slide ring over the end of the motor shaft and locking it in place with screw on mounting brackets.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

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

C. Provide shaft grounding on all motors controlled by variable frequency controllers and as indicated.

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

END OF SECTION

SECTION 23 0519

METERS AND GAGES FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pressure gages and pressure gage taps.

B. Thermometers and thermometer wells.

1.2 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers.

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.

1.3 SUBMITTALS

A. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

B. Project Record Documents: Record actual locations of components and instrumentation.

1.4 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 PRESSURE GAGES

A. Manufacturers:
1. Dwyer Instruments, Inc: www.dwyer-inst.com.
2. Moeller Instrument Company, Inc: www.moellerinstrument.com.
3. Omega Engineering, Inc: www.omega.com.
4. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
5. Ernst Gage Co.
6. Marsh Bellofram.
7. Miljoco.
8. Trerice, H.O. Co.
9. Weiss Instruments, Inc.
10. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
11. WIKA Instrument Corporation.

B. Pressure Gages: ASME B40.100, UL 393 rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
1. Case: Steel with brass bourdon tube.
2. Size: 3-1/2 inch diameter.
3. Mid-Scale Accuracy: One percent.
4. Scale: Psi.

2.2 PRESSURE GAGE TAPPINGS

A. Needle Valve: Brass, 1/4 inch NPT for minimum 150 psi.

B. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections.

C. Syphon: Steel, Schedule 40, 1/4 inch angle or straight pattern.

2.3 STEM TYPE THERMOMETERS

A. Manufacturers:
1. Dwyer Instruments, Inc: www.dwyer-inst.com.
2. Omega Engineering, Inc: www.omega.com.
3. Weksler Glass Thermometer Corp: www.wekslerglass.com.
4. Miljoco.
5. Trerice, H.O. Co.
6. Weiss Instruments, Inc.
7. WIKA Instrument Corp.

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: 9 inch scale.
2. Window: Clear Lexan.
3. Stem: 3/4 inch NPT brass.
4. Accuracy: 2 percent, per ASTM E77.
5. Calibration: Degrees F.

2.4 DIAL THERMOMETERS

A. Manufacturers:
1. Dwyer Instruments, Inc: www.dwyer-inst.com.
2. Omega Engineering, Inc: www.omega.com.
3. Weksler Glass Thermometer Corp: www.wekslerglass.com.

B. Thermometer: ASTM E1, stainless steel case, adjustable angle with front recalibration, bimetallic helix actuated with silicone fluid damping, white with black markings and black pointer hermetically sealed lens, stainless steel stem.
1. Size: 3 inch diameter dial.
2. Lens: Clear glass.
3. Accuracy: 1 percent.

2.5 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

2.6 TEST PLUGS

A. Manufacturers:
1. Peterson Equipment Company.
2. Sisco Manufacturing Co.
3. Trerice, H.O. Co.
4. Flow Design Inc.
5. Watts Industries, Inc., Water Products Div.

B. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

C. Test Kit: Carrying case, internally padded and fitted containing one 3-1/2 inch diameter pressure gages, two gage adapters with 1/8 inch probes, two 1-1/2 inch dial thermometers.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide a flow straightener upstream of meters, if required to meet the manufacturer's minimum upstream straight pipe run requirement.

C. Provide lateral and horizontal supports as required to minimize vibration at the meter location.

D. Provide one pressure gage per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gage.

E. Install pressure gages with pulsation dampers. Provide gage cockneedle valve to isolate each gage. Extend nipples to allow clearance from insulation.

F. 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.

G. Install thermometer sockets for all thermometers and adjacent to controls systems thermostat, transmitter, or sensor sockets. Refer to Section 23 0923.

H. Locate duct mounted thermometers minimum 10 feet downstream of mixing dampers, coils, or other devices causing air turbulence.

I. Coil and conceal excess capillary on remote element instruments.

J. Provide instruments with scale ranges selected according to service with largest appropriate scale.

K. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

L. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

M. Locate test plugs where indicated.

3.2 SCHEDULE

A. Pressure Gages, Location and Scale Range:
   1. Pumps, 0 to 100 psi.
   2. Pressure reducing valves, 0 to 100 psi.

B. Pressure Gage Tappings, Location:
   1. Where shown on drawings or details.

C. Stem Type and Digital Thermometers, Location and Scale Range:
   1. Water zone supply and return, 0 to 200 degrees F.

END OF SECTION

SECTION 23 0553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe Markers.

1.2 SUBMITTALS

A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

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.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

E. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Automatic Controls: Tags. Key to control schematic.

B. Control Panels: Nameplates.

C. Instrumentation: Tags.

D. Major Control Components: Nameplates.

E. Piping: Pipe markers.

F. Pumps: Nameplates.

G. Relays: Tags.

H. Small-sized Equipment: Tags.

I. Tanks: Nameplates.

J. Valves: Tags .

2.2 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.

B. Champion America, Inc: www.Champion-America.com.

C. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.

D. Seton Identification Products: www.seton.com/aec.

2.3 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch.
   3. Background Color: Black.
   4. Plastic: Conform to ASTM D709.
   5. 3 x 1 1/2 inches.

2.4 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch octagonal.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch octagonal with smooth edges.

C. Valve Tag Schedule: In Valve and Equipment Binder.

2.5 PIPE MARKERS

A. Color: Conform to ASME A13.1.

B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

C. Color code as follows:
   1. Heating, Cooling, and Boiler Feedwater: Green with white letters.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Use tags on piping 3/4 inch diameter and smaller.
   1. Identify service, flow direction, and pressure.
   2. Install in clear view and align with axis of piping.
   3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

F. Identify pumps, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.

G. Identify control panels and major control components outside panels with plastic nameplates.

H. Identify valves in main and branch piping with tags.

I. Identify all duct access doors.

3.3 TAGS

A. Install tags with corrosion-resistant chain.

B. Identify valves in main and branch piping with tags.

C. Identify air terminal units and coil valves with numbered tags.

D. Tag automatic controls, instruments, and relays. Keep to control schematic.

E. Identify small devices such as in-line pumps with tags.

F. Identify pipe 1 inch and smaller with tags.

3.4 PIPE MARKERS

A. Install plastic pipe markers in accordance with manufacturer's instructions.

B. Install plastic tape pipe markers complete/around pipe in accordance with manufacturer's instructions.

C. Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure and at each obstruction.

3.5 NAME PLATES

A. Install plastic name plates with stainless steel screws.

B. Identify pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates.

C. Identify control panels and major control components outside panels with plastic nameplates.

3.6 VALVE AND EQUIPMENT SCHEDULE BINDER

A. Provide 3-ring binder for all valve and equipment schedules with tabs and plastic page protectors for each system. Schedules to be on standard - size bond paper with following information:
   1. Valve Schedules:
      a. Valve number
      b. Piping system
      c. System abbreviation (as shown on valve tag)
      d. Location of valve (room or space)
      e. Area served
      f. Normal operating position (opened, closed, modulating)
      g. Indicate emergency shutoff or similar special uses.
   2. Equipment Schedules:
      a. Authority’s equipment label
      b. Location

c. All data from manufacturer's equipment label including Model No., Serial No., Electrical data, etc.
d. Pump water flow and pressure
e. Fan air flow and pressure
f. Motor data and measured amps at balancing

3. As-Built Record Building Plans:
   a. Indicate all valve and equipment locations
   b. Provide in electronic format, .pdf or .dwg

END OF SECTION

SECTION 23 0593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of hydronic systems and components.

B. Measurement of final operating condition of HVAC systems.

1.2 DEFINITIONS

A. Adjust: To regulate fluid flow rate patterns at the terminal equipment, such as to reduce pump speed or adjust a valve.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.

C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.

D. NC: Noise criteria.

E. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

F. RC: Room criteria.

G. Report Forms: Test data sheets for recording test data in logical order.

H. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

I. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

J. TAB: Testing, adjusting, and balancing.

K. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

L. Test: A procedure to determine quantitative performance of systems or equipment.

M. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.3 REFERENCE STANDARDS

A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council.

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems.

C. TABB - Testing, Adjusting, and Balancing Bureau.

1.4 SUBMITTALS

A. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

B. Contract Documents Examination Report: Within 15 days from Contractor's Notice to Proceed, submit 2 copies of Contract Documents review report as specified in Part 3.

C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Submit to Architect/Engineer.
   2. Submit six weeks prior to starting the testing, adjusting, and balancing work.
   3. Strategies and Procedures Plan: Within 30 days from Contractor's Notice to Proceed, submit 2 copies of TAB strategies and step-by-step procedures as specified below and in Part 3.
   4. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with the Architect/Engineer and other installers to sufficiently understand the design intent for each system.
   5. Include at least the following in the plan:
      a. Preface: An explanation of the intended use of the control system.
      b. List of all water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      c. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      d. Identification and types of measurement instruments to be used and their most recent calibration date.
      e. Discussion of what notations and markings will be made on the piping drawings during the process.
      f. Final test report forms to be used.
      g. Detailed step-by-step procedures for TAB work for each system and issue, including:
         1) Terminal flow calibration (for each terminal type).
         2) Diffuser proportioning.
         3) Branch/submain proportioning.
         4) Total flow calculations.
         5) Rechecking.
         6) Diversity issues.
      h. Expected problems and solutions, etc.
      i. Criteria for using water flow straighteners or relocating flow stations and sensors.
      j. Details of how TOTAL flow will be determined; for example:
         1) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.
      k. Specific procedures that will ensure that equipment is operating at the lowest possible pressures and methods to verify this.
      l. Methods for making coil or other system plant capacity measurements, if specified.
      m. Time schedule for TAB work to be done in phases (by floor, etc.).
      n. Description of TAB work for areas to be built out later, if any.
      o. Time schedule for deferred or seasonal TAB work, if specified.
      p. False loading of systems to complete TAB work, if specified.

q. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
r. Procedures for formal progress reports, including scope and frequency.
s. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

E. Progress Reports.

F. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
1. Revise TAB plan to reflect actual procedures and submit as part of final report.
2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect/Engineer and for inclusion in operating and maintenance manuals.
3. Provide reports in electronic, word searchable, .pdf format binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with equipment identified to correspond with data sheets, and indicating thermostat locations.
4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
6. Units of Measure: Report data in I-P (inch-pound) units only.
7. Include the following on the title page of each report:
a. Name of Testing, Adjusting, and Balancing Agency.
b. Address of Testing, Adjusting, and Balancing Agency.
c. Telephone number of Testing, Adjusting, and Balancing Agency.
d. Project name.
e. Project location.
f. Project Architect/Engineer.
g. Project Engineer.
h. Project Contractor.
i. Project altitude.
j. Report date.
k. Certification sheet signed and sealed by the certified testing and balancing engineer.

G. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.
1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

H. Project Record Documents: Record actual locations of balancing valves and rough setting.

I. As-Balanced Record Pump Curves: Record actual balanced points on the manufacture's submitted pump curves.
1. Record system curves, actual RPM and final impeller diameter for all pumps.

J. Final Report Contents: In addition to certified field report data, include the following:
1. Pump curves.

2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.

1.5 PROJECT CONDITIONS

A. The entire TAB process shall be completed prior to Authority occupancy.

1.6 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Provide seven days' advance notice for each test. Include scheduled test dates and times.

C. Perform TAB after leakage and pressure tests on water distribution systems have been satisfactorily completed.

1.7 WARRANTY

A. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:
1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

B. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:
1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 PRODUCTS

2.1 PRESSURE/TEMPERATURE TEST FITTING (PTT)

A. Brass fitting with EPDM core to allow access for thermometer or pressure gage. Provide threaded cap and strap. Provide length required to accommodate insulation.

B. Provide test kit to include thermometer, pressure gage, access fittings, and carrying case.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
1. AABC MN-1, AABC National Standards for Total System Balance.
2. Maintain at least one copy of the standard to be used at project site at all times.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:
      a. AABC, Associated Air Balance Council: www.aabchq.com; upon completion submit AABC National Performance Guaranty.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.2 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.3 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Pressure/Temperature test fittings are installed on each pump.
   5. Hydronic systems are flushed, filled, and vented.
   6. Pumps are rotating correctly.
   7. Proper strainer baskets are clean and in place.
   8. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper or complete system balance.

C. Examine equipment performance data including pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory.

D. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.

E. Examine system and equipment test reports.

F. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves, and fittings are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

G. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

H. Examine HVAC equipment to ensure that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

I. Examine strainers for clean screens and proper perforations.

J. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

K. Examine system pumps to ensure absence of entrained air in the suction piping.

L. Examine equipment for installation and for properly operating safety interlocks and controls.

M. Examine automatic temperature control and building automation system components to verify the following:
   1. Check the sequence of operation of control devices are according to the Contract Documents.. Note the speed of response to input changes.
   2. Valves and other controlled devices are operated by the intended controller.
   3. Valves are in the position indicated by the controller.
   4. Integrity of valves for free and full operation and for tightness of fully closed and fully open positions.
   5. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
   6. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
   7. Sensors are located to sense only the intended conditions.
   8. Controller set points are set at indicated values. Controllers are calibrated and commissioned. Record controller settings and note variances between set points and actual measurements.
   9. Changeover from heating to cooling mode occurs according to indicated values.
   10. Transmitter and controller locations and note conditions that would adversely affect control functions.
   11. Operation of limiting controllers (i.e., high- and low-temperature controllers).
   12. Free travel and proper operation of control devices such as valve operators.
   13. Interaction of electrically operated switch transducers.
   14. Interaction of interlock and lockout systems.
   15. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.
   16. Note operation of electric actuators using spring return for proper fail-safe operations.

N. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

O. Beginning of work means acceptance of existing conditions.

3.4 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
   1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

C. Provide additional balancing devices as required to complete the balancing process.

D. Provide pressure/temperature test fitting (PTT) on suction and discharge connection of each pump to allow pump performance testing.

3.5 ADJUSTMENT TOLERANCES

A. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.6 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating and Air Conditioning Systems" and this Section.

B. Cut insulation on pipes and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including valve position indicators, and similar controls and devices, to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.7 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   3. Contract interpretation requests.
   4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on the drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Authority.

H. Check and adjust systems approximately six months after final acceptance and submit report.

3.8 HYDRONIC SYSTEM PROCEDURE

A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
   1. Open all manual valves for maximum flow.
   2. Check expansion tank liquid level.
   3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
   4. Check flow-control valves for specified sequence of operation and set at indicated flow.
   5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
   6. Set system controls so automatic valves are wide open to heat exchangers.
   7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
   8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

C. Adjust water systems to provide required or design quantities.

D. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

E. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing.

F. Effect system balance with automatic control valves fully open to heat transfer elements.

G. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

H. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

I. Set calibrated balancing valves, if installed, at calculated presettings.

J. Measure flow at all stations and adjust, where necessary, to obtain first balance.
   1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

K. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

L. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
1. Determine the balancing station with the highest percentage over indicated flow.
2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
3. Record settings and mark balancing devices.

M. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

N. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

O. Balance variable volume systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.9 SCOPE

A. Test, adjust, and balance the following:
1. HVAC Pumps
2. Snow Melt Zones

3.10 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
1. Manufacturer
2. Model/Frame
3. HP/BHP
4. Phase, voltage, amperage; nameplate, actual, no load
5. RPM
6. Service factor
7. Starter size, rating, heater elements
8. Sheave Make/Size/Bore
9. Motors Driven by Variable-Frequency Controllers:
a. Test for proper operation at speeds varying from minimum to maximum.
b. Test the manual bypass for the controller to prove proper operation.
c. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

B. Pumps:
1. Identification/number
2. Manufacturer
3. Size/model
4. Impeller
5. Service
6. Design flow rate, pressure drop, BHP
7. Actual flow rate, pressure drop, BHP
8. Discharge pressure
9. Suction pressure
10. Total operating head pressure

11. Shut off, discharge and suction pressures
12. Shut off, total head pressure

C. Snow Melt Zones:
1. Identification/number
2. Location
3. Service
4. Primary water entering temperature, design and actual
5. Primary water leaving temperature, design and actual
6. Primary water flow, design and actual
7. Primary water pressure drop, design and actual

D. Instrument Calibration Reports:
1. Report Data:
a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

E. Control System Verification/Validation Reports

3.11 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 0719

HVAC PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

1.2 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section and approved by manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.5 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

E. Products shall be certified by UL GREENGUARD GOLD or Indoor Advantage Gold.

F. Products shall certified to meet or exceed UL Standard 2818 -2013 Gold Standard for Chemical Emissions for Building Materials, Finishes and Furnishings

2.2 GLASS FIBER

A. Manufacturers:
   1. CertainTeed Corporation: www.certainteed.com.
   2. Johns Manville Corporation: www.jm.com.
   3. Knauf Insulation; 1000-degree Pipe Insulation: www.knaufusa.com.
   4. Owens Corning Corporation: www.ocbuildingspec.com.
   5. Mason Insulation.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. 'K' Value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 850 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive: Compatible with insulation.
   1. Manufacturers:
      a. Childers Products CP-127.
      b. Foster Products 85-20/85-60.
      c. Eagle Bridges - Marathon Industries, Inc.
   2. Shall meet ASTM C916 Type I/II

F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

G. Fibrous Glass Fabric:
   1. Manufacturers:
      a. Fosters Mast a Fab.
      b. Childers Chil Glas #10.
   2. Cloth: Untreated; 9 oz/sq yd min. weight.
   3. Blanket: 1.0 lb/cu ft density.
   4. Weave: 10x10.

H. Indoor Vapor Barrier Finish:
   1. Manufacturers:
      a. Childers Products, Chil Out, CP-33.
      b. Foster Products Vapor Out. 30-33.
      c. Eagle Bridges - Marathon Industries, Inc.
   2. Cloth: Untreated; 9 oz/sq yd min. weight.
   3. Vinyl emulsion type acrylic, compatible with insulation, white color.
   4. Permeance shall be 0.07 perms or less at 45 mils dry tested by ASTM E96.

I. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
   1. Manufacturers:
      a. Childers Products Chil Low CP-38.
      b. Foster Products Vapor Safe 30-80.
      c. Eagle Bridges - Marathon Industries, Inc.
   2. Permeance shall be 0.03 perms or less at 45 mils dry tested by ASTM E96.

J. Outdoor Breather Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
   1. Manufacturers:
      a. Childers Products CP-10-2/CP-11-2.
      b. Foster Products Weatherite 46-51.
      c. Eagle Bridges - Marathon Industries, Inc.

K. Insulating Cement: ASTM C449.

2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. Aeroflex USA, Inc: www.aeroflexusa.com.
   2. Armacell International; Armaflex: www.armacell.com.
   3. K-Flex USA LLC: www.kflexusa.com.
   4. RBX Corp.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 3; use molded tubular material wherever possible.
   1. Minimum Service Temperature: Minus 40 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.
   1. Manufacturers:
      a. Childers Products Chil Stik CP-82.
      b. Foster Products Drion 85-75.
      c. Eagle Bridges - Marathon Industries, Inc.

2.4 STEEL PIPE SADDLES:

A. Designed for high temperature service or where heat losses are to be kept at a minimum and to protect insulation against damage at the point of support

B. Conforms with Federal Specification WW-H-171 (Type 40A or 40B), Manufacturers Standardization Society ANSI®/MSS-SP-58 (Type 39)

2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:
   1. Buckaroo.
   2. ERICO/Michigan Hanger Co.
   3. Shaw Pipe Shields, Inc.
   4. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with vapor barrier or urethane.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass or urethane.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Size:
1. Thickness: Match to adjoining insulation.
2. Length:
a. Piping Operating Below Ambient Temperature: Extend 2 inches beyond sheet metal shield.
b. Piping Operating Above Ambient Temperature: Flush with ends of sheet metal shield.

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.

D. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

E. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

F. 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 insulation of like material and thickness as adjoining pipe. Finish with PVC fitting covers.

G. Inserts and Shields:
1. Application: Piping 2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Shield shall span an arc of 180 degrees.
4. Match diameter of shield to OD of insulation.
5. Shield dimensions shall not be less than the following:
a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
b. NPS 4: 12 inches long and 0.06 inch thick.
c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
6. Insert location: Between support shield and piping and under the finish jacket.
7. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
8. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

9. Steel Pipe Saddles:
    a. Provide on all steam and steam condensate piping 3" and larger.
    b. Provide on all heating hot water piping, operating above 200 degrees F, 3" and larger.
10. Thermal-Hanger Shield Inserts: Install according to manufacturer's written instructions.

H. Insulated Piping: Attach hangers and supports to piping as follows:
1. Piping Operating Above Ambient Temperature:
    a. Where piping is not supported on rollers or trapeze, hangers may project through insulation.
    b. For straight runs of piping, at points of support more than 100 feet from elbow or anchor point, use roller type supports.
    c. Where piping is supported on rollers or trapeze, support piping at outside diameter of insulation.
        1) NPS Smaller than 4: Provide MSS SP-58, Type 40, protective shield.
        2) NPS 4 and Larger: Provide thermal-hanger shield insert and weight-distribution plate.
2. Piping Operating Below Ambient Temperature: Support piping at outside diameter of insulation. Do not penetrate vapor barrier.
    a. NPS Smaller than 4: Provide MSS SP-58, Type 40, protective shield.
    b. NPS 4 and Larger: Provide thermal-hanger shield insert and weight-distribution plate.

I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.

J. Pipe insulation exposed in Mechanical Equipment Rooms or Finished Spaces: Finish with vapor barrier jacket suitable for painting.

3.3 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

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

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

3.4 PIPING INSULATION

A. Insulation thickness based on 2009 International Energy Conservation Code minimum requirements.

B. If more than one material is listed, selection from materials is Contractor's option.

3.5 INSULATION AND JACKET SCHEDULE

A. INDOOR PIPING

1. Heating Hot Water/Glycol Supply and Return, 200 Degrees F and below:

a. 1-1/2 Inches and Smaller: Insulation shall be any of the following:

1) Glass Fiber, Preformed Pipe, Type I: 2 inches thick.

b. 2 Inches and Larger: Insulation shall be any of the following:

1) Glass Fiber, Preformed Pipe, Type I: 2 inches thick.

END OF SECTION

SECTION 23 0913

INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Control panels.

B. Control valves.

C. Control valve operators.

D. Miscellaneous accessories.

E. Controllers.

F. Sensors and input devices.

G. Output devices.

H. Power supplies and transformers.

I. Low-voltage cable.

J. Control Wiring and Power Connections

1.2 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.3 SUBMITTALS

A. Specification Compliance Review.

B. Shop drawings and product data shall be in original searchable PDF format.

C. Product data shall be presented according to an included table of contents.

D. 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.
   1. Manufacturer's printed data sheets for all control system components clearly identify data by component.
   2. General catalog sheets, including details of construction, ratings, and dimensions for each component.

E. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences.
   1. Show complete details of interconnections between temperature control systems and control specified with equipment or systems.
   2. Control drawings shall have a completed system architecture. Controllers and components inclusive to the control system as well as 3rd party controllers and components to be integrated and/or communicated with.
   3. All components and controllers inclusive or 3rd party shall have a points list for each. Deviation from contract documents shall be reported to design team with alternates and/or a reason for deviation.

4. Provide valve schedules indicating size, type, design flow, valve capacity, pressure drop and CV value, identification, and part number.
5. Control panel locations indicated on plans.
6. Control panel interior layout drawings indicating the following:
    a. Overall panel size.
    b. Device loactions and labeling within panel.
    c. Spare and space locations.
    d. Power supplies and transformers.
    e. Wiring and cabeling pathways.

F. Clearly note the proposed deviations from specified sequences and equipment, and substantiate with written explanation.

G. Design Data: Provide design data for sizing of power supplies and transformers.

H. Manufacturer's Instructions: Provide for all manufactured components.

I. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

J. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.
1. Revise shop drawings to reflect actual installation and operating sequences.

1.4 SUBMITTALS AT CLOSEOUT

A. Project Record Documents: Maintain documents at site during construction and submit at Contract Closeout.

B. Operation and Maintenance Data include:
1. Red-mark "Record" control system drawings and then turn them over to the Authority's Representative.
2. Provide directions for calibration, adjustment, and maintenance instructions for each type of component.
3. Complete Index of Contents.
4. Shop drawings of control system showing devices, interconnections between devices, and connections to items provided by others.
5. Specifications data sheets on each device.

C. Warranty: Submit manufacturer’s warranty and ensure forms have been filled out in Authority s name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this work and licensed at the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section documented experienceapproved by manufacturer.

D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.6 WARRANTY

A. Correct defective Work within a two year period after Substantial Completion.

B. The scope of work included in this section shall be guaranteed to be free from original defects in both material and workmanship for the period as indicated in the contract terms.

PART 2 PRODUCTS

2.1 PERFORMANCE, CAPACITIES AND CHARACTERISTICS

A. See Drawings for Equipment Schedules with Equipment Performance Requirements when capacities and characteristics are not indicated in the specifications.

2.2 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.3 CONTROL PANELS

A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pilot lights, push buttons and switches flush on cabinet panel face.

B. Control panels shall meet the following minimum requirements:
   1. Control panels located in bus storage shall comply with NEMA 3X requirements.
   2. Mechanical Rooms: Control panels located in mechanical or electrical rooms shall comply with NEMA 4 requirements.
   3. Control panels shall be constructed of steel or extruded aluminum with hinged door and keyed lock, with baked enamel finish of manufacturer's standard color.
   4. Provide panels of adequate size to accommodate instruments for future expansion of approximately 25% beyond space required for this scope of work.
   5. Cabling shall be terminated on rugged and easily accessible terminal strips. Each termination shall be clearly marked and shall be as detailed in the shop and record drawings.
   6. Panels mounted on vibrating equipment, such as on heat pumps, shall have vibration isolation protection that ensures their satisfactory operation.

C. NEMA 250, general purpose utility enclosures with enamelled finished face panel.

D. Provide common keying for all panels.

2.4 CONTROL VALVES

A. General:
   1. Fully proportioning, true equal percentage flow characteristic and provide near linear heat transfer control.
   2. Control valves shall be sized by the control and controlled equipment manufacturer, and shall be guaranteed to meet the loads, as specified.
   3. Control valves shall be suitable for the system flow conditions and close against pump shut off head.
   4. Hydronic Systems:
      a. Rate for service pressure of 125 psig at 250 degrees F.

b. Replaceable plugs and seats of brass.
c. Two way valves shall have equal percentage characteristics, three way valves linear characteristics.

5. Hydronic Sizing:
a. Two-Position: Line size or size using a pressure differential of 1 psi.
b. Two-Way Modulating: 3 psid or twice the load pressure drop, whichever is more.
c. Three-Way Modulating: Twice the load pressure drop, but not more than 3 psid

B. Ball Pattern:
1. Up to 2 Inches:
a. Brass two piece body, full port, chrome plated brass ball, teflon seats and stuffing box ring, lever handle , solder ends with union.
2. Over 2 Inches:
a. Ductile iron body, full port, stainless steel ball, teflon seat and stuffing box seals, , grooved ends.

C. Globe Pattern:
1. Up to 2 inches: Bronze body, bronze trim, rising stem, renewable composition disc, screwed ends with backseating capacity repackable under pressure.
2. Over 2 inches: Iron body, bronze trim, rising stem, plug-type disc, flanged ends, renewable seat and disc.

D. Butterfly Pattern:
1. Iron body, aluminum bronze disc, resilient replaceable seat for service to 180 degrees F lug ends, extended neck.

2.5 CONTROL VALVE OPERATORS

A. The manufacturer shall warrant all components for a period of 5 years from the date of production, with the first two years unconditional.

B. Fail-Safe Operation: Mechanical, spring-return mechanism.
1. Control Valve, Normal Fail-Safe, positions:
a. Snow Melt Piping: Bypass

C. UL and CSA listed, manufactured under ISO 9001 International Quality Control Standards. Operators shall have reversing and manual override and be protected from overload at all angles of rotation. Provide required accessories for application.

D. Valves shall spring return to normal position as indicated on freeze, fire, or temperature protection.

E. Size for torque required for valve close off at 150 percent of total system (head) pressure for two-way valves; and 100 percent of pressure differential across the valve or 100 percent of total system (pump) head differential pressure for three-way valves.

F. Select operator for full shut off at maximum pump differential pressure.

G. Coupling: Directly couple end mount to stem, shaft, or ISO-style direct-coupled mounting pad.

H. Mounting: Actuators shall be capable of being mechanically and electrically paralleled to increase torque if required.

I. Overload Protection: Electronic overload or digital rotation-sensing circuitry without the use of end switches to deactivate the actuator at the end of rotation.

J. Power Requirements: Maximum 10 VA at 24-V ac or 8 W at 24-V dc.

K. Maximum 1 VA at 24-V ac or 1 W at 24-V dc.

L. Temperature Rating: -22 to +122ºF.

M. Housing: Minimum requirement NEMA type 2 / IP54 mounted in any orientation.

N. Product:
1. Belimo.
2. Siemens.

2.6 INPUT/OUTPUT SENSORS

A. Temperature Sensors:
1. Use thermistor or RTD type temperature sensing elements with characteristics resistant to moisture, vibration, and other conditions consistent with the application without affecting accuracy and life expectancy.
2. Sensors and transmitters shall be provided as outlined in the input/output summary and sequence of operations.
3. Construct RTD of nickel or platinum with base resistance of 1000 ohms at 70 degrees F.
4. Temperature sensing device must be compatible with project DDC controllers.

B. Equipment Operation Sensors:
1. Status Inputs for Pumps: Differential pressure switch piped across pump with adjustable pressure differential range of 8 to 60 psi.
2. Status Inputs for Electric Motors: Current sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.

C. Status and Safety Switches:
1. Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the BMCS when a failure or abnormal condition occurs. Safety switches shall be provided with two sets of contacts and shall be interlock-wired to shut down respective equipment.
2. Current Sensing Switches:
a. The current sensing switch shall be self powered with solid-state circuitry and dry contact output. It shall consist of a current transformer, a solid-state current sensing unit, adjustable trip point, solid-state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept overcurrent up to twice its trip point range.
b. Current sensing switches shall be used for run status for pumps and other miscellaneous motor loads.
c. Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.
d. Product:
1) Veris Industries.

D. Current Sensing Relay:
1. Rated for the applicable load.
2. Accessible trip adjustment over its complete operating range.
3. LED indication of relay status.
4. Long-term drift shall not exceed 5% of full range per 6 months.

5. Current transformer and relay shall have over current and over voltage protection.
6. Split core or solid core shall be sized for the application.
7. Relay shall be in a dustproof housing.
8. Accuracy: +/-2% of reading from 10% to 100% of full scale range, +/-2% full scale from 0 to 7.
9. 10% of full scale range.
10. Temperature range of 5 degrees F to 140 degrees F.
11. Product:
    a. Kele Model (S)CS1150A.
    b. Veris Hawkeye

E. Water Differential Pressure Sensor:
1. Cast aluminum NEMA 1 enclosure.
2. Output of 4-20 mA proportional to the pressure sensed.
3. Over pressure protection of five times the rated input.
4. Easily accessible, integral non-interacting zero and span adjustment.
5. Operating range of 0 to 30 psig.
6. Accuracy of +/- 2% of full scale reading.
7. Three valve by-pass and pressure test ports.
8. Product:
    a. Mamac series PR-282.
    b. Setra, Model 228-1.
    c. Veris Industries Alta Labs PW series.

F. Water Differential Pressure Switch:
1. 316 stainless steel body.
2. Local display gauge.
3. End to end accuracy not to exceed +/-1.0% over entire range.
4. Easily accessible, integral non-interacting zero an span adjustment.
5. Over pressure input protection to a minimum of five times rated input.
6. The differential pressure transducer shall be rated to withstand the maximum rated pressure of the system in which it is installed.
7. Three valve by-pass and pressure test ports.
8. Product:
    a. Orange Research, Model 1203PS.

G. Water Pressure Sensor:
1. Input range of 0 to 200 psi.
2. 4-20 mA output proportional to water pressure.
3. 0.5% accuracy of range.
4. Temperature range of 32 degrees F to 100 degrees F.
5. Easily accessible, integral non-interacting zero and span adjustment.
6. Over pressure input protection of two times rated input.
7. NEMA-4 rated fittings.
8. Stainless steel wetted parts.
9. Burst pressure of 5 times rated input
10. Long-term stability of .25 percent of full scale.
11. Shall be ANSI 300 rated.
12. Three valve by-pass and pressure test ports.
13. Product:
    a. Fisher/Rosemount.
    b. Precise Sensor.

2.7 TRANSMITTERS

A. Pressure Transmitters:
1. One pipe direct acting indicating type for gas, liquid, or steam service, range suitable for system, proportional electronic output.
2. Manufacturers:
   a. Veris Industries PW Series with AA14A/AA16A 3-valve manifold
   b. Sentra Sensing Solutions Model 231 with 3-valve manifold.
3. Proportial output adjustable, 0-10vdc, 2-10vdc, 4-20ma. Selectable supply voltage 24vdc, 24vac.If wiring exceeds 300 ft, 4-20ma signal must be used.
4. Configuration selections shall include, port swapping, unidirectional, bidirectional, with multilevel pressure range selection.
5. Dual sensor.
6. Bypass manifold or 3-valve manifold for service and commissioning.

B. Temperature Transmitters:
1. One pipe, directly proportional output signal to measured variable, linearity within plus or minus 1/2 percent of range for 200 degree F span and plus or minus 1 percent for 50 degree F span, with 50 degrees F temperature range, compensated bulb, averaging capillary, or rod and tube operation on 20 psig input pressure and 3 to 15 psig output.

2.8 CONTROLLERS

A. Local Control Panels:
1. Factory constructed, incorporating the FMS manufacturer's standard designs and layouts.
2. UL inspected and listed as an assembly and carry a UL 508 label listing compliance.
3. Fully enclosed, with subpanel, hinged door, and slotted flush latch.
4. Control panels shall consist of the DDC controller(s), display module, and I/O devices - such as relays, transducers, etc. - that are not required to be located external to the control panel due to function.
5. Display module shall be flush mounted in the panel face unless otherwise noted.
6. All I/O connections shall be extended to a numbered, color-coded, and labeled terminal strip for ease of maintenance and expansion. Wiring to I/O devices shall be made from this terminal strip.
7. All other wiring in the panel, internal and external, shall be made to additional line or low-voltage, color-coded, and labeled terminal strips.
8. Low and line voltage wiring shall be segregated.
9. Terminal strips and wiring shall be UL listed, 300-volt service, and provide adequate clearance for field wiring.
10. Wiring for every control panel shall follow a common color-coded format. All terminal strip color coding and numbering shall follow a common format.
11. All wiring shall be neatly installed in plastic trays or tie-wrapped.
12. A convenience 120 VAC duplex receptacle, fused on/off power switch, and required transformers shall be provided in each enclosure.

B. Control Relays:
1. Control pilot relays shall be of a modular plug-in design with retaining springs or clips.
2. Mounting bases shall be snap mount.
3. DPDT, 3PDT, or 4PDT relays shall be provided, as appropriate for application.
4. Contacts shall be rated for 10 amps at 120 VAC.
5. Relays shall have an integral indicator light and check button.

2.9 POWER SUPPLIES AND TRANSFORMERS

A. DC Power Supplies:
1. DC power supplies shall be sized for the connected device load. Total rated load shall not exceed 75 percent of the rated capacity of the power supply.
2. Input: 120 VAC +10 percent, 60 Hz.
3. Output: 24 VDC.
4. Line Regulation: +0.05 percent for 10 percent line change.
5. Load Regulation: +0.05 percent for 50 percent load change.
6. Ripple and Noise: 1 mV rms, 5 mV peak to peak.
7. An appropriately sized fuse and fuse block shall be provided and located next to the power supply.
8. A power disconnect switch shall be provided next to the power supply.

B. Transformers:
1. Sized to provide volts and amps as required for connected load.
2. Input voltage shall be as required for the specific application.

C. Uninterruptable Emergency Power Supplies (UPS):
1. Output:
a. Output Power Capacity: 1920 Watts / 1920 VA
b. Max Configurable Power: 1980 Watts / 2200 VA
c. Nominal Output Voltage: 120V
d. Output Voltage Distortion: Less than 5%
e. Output Frequency (sync to mains): 50/60Hz +/- 3 Hz
f. Topology: Line Interactive
g. Waveform Type: Sine wave
h. Output Connections: (8) NEMA 5-15R, (2) NEMA 5-20R
2. Input:
a. Nominal Input Voltage: 120V
b. Input Frequency: 50/60 Hz +/- 3 Hz (auto sensing)
c. Input Connections: NEMA 5-20P
d. Cord Length: 6 feet (1.83 meters)
e. Input voltage range for main operations: 82 - 144V
f. Input voltage adjustable range for mains operation: 75 - 154V
3. Batteries & Runtime:
a. Battery Type: Maintenance-free sealed Lead-Acid battery with suspended electrolyte : leakproof
b. Typical recharge time: 3 hour(s)
4. Energy Use/Efficiency:

	Load	Efficiency
a.		
b.	25%	97.4%
c.	50%	98.2%
d.	75%	98.2%
e.	100%	98.1%

5. Communications & Management:
a. Interface Port(s): (1) SmartSlot
b. Control panel: Multi-function LCD status and control console
c. Audible Alarm: Alarm when on battery : distinctive low battery alarm : configurable delays
d. Emergency Power Off (EPO)

6. Surge Protection and Filtering:
    a. Surge energy rating: 530 Joules
    b. Filtering: Full time multi-pole noise filtering : 0.3% IEEE surge let-through : zero clamping response time : meets UL 1449
7. Environmental:
    a. Operating Environment: 32 - 104 °F
    b. Operating Relative Humidity: 0 - 95%
    c. Operating Elevation: 0-10000 feet
    d. Storage Temperature: 5 - 113 °F
    e. Storage Relative Humidity: 0 - 95%
    f. Storage Elevation: 0-50000 feet
    g. Audible noise at 1 meter from surface of unit: 45.00 dBA
    h. Online Thermal Dissipation: 275.00 BTU/h
8. Conformance:
    a. Regulatory Approvals: CSA, ENERGY STAR (USA), FCC Part 15 Class A, UL 1778
    b. Standard Warranty: 3 years repair or replace (excluding battery) and 2 year for battery, optional on-site warranties available, optional extended warranties available
9. Accessories:
    a. CD with software, Documentation CD, Smart UPS signalling RS-232 cable, USB cable
10. Product:
    a. APC Smart-UPS 2200VA LCD 120V

2.10 LOW VOLTAGE CONTROL WIRE AND CABLE

A. All wiring materials section shall be in accordance with the latest revision of the National Electrical Code and applicable local codes and shall carry the UL label where applicable.

B. Analog Input, Analog Output, Binary Input, Binary Output, 24 VAC, and General Purpose Cabling:
1. Cable shall consist of copper conductors not less than #18 AWG stranded.
2. Cable shall be two- or three-conductor twisted cable with a drain wire.
3. Cable shall have a 100 percent overall shield.
4. Cable shall be plenum rated.
5. Cable shall meet or exceed NEC voltage rating of 300 volts.
6. Cable shall be NEC type CMP.
7. Cable shall meet or exceed UL temperature rating of +60 deg C.
8. Cable shall be labeled at a minimum of every 18 inches with the DDC system manufacturer's name and the type of signal carried within the cable, i.e., analog input, analog output, binary input, binary output, 24 VAC.

C. Primary and Secondary Communications Network Cabling:
1. Cable shall be of type recommended by the DDC system manufacturer.
2. Cable shall be shielded.
3. Cable shall be plenum rated.
4. Cable shall meet or exceed NEC voltage rating of 150 volts.
5. Cable shall meet or exceed UL temperature rating of +60 deg C.

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.

G. Coordinate installation of devices, wiring, and other items with other trades.

H. Locate thermostat/sensors where they will not be affected by heat from other sources, such as direct rays of sun, pipes or ducts in wall, convectors, direct air currents from diffusers, light dimmers, and similar items.

I. Current sensing relay trip levels shall be set to indicate the motor running under load versus no load.

J. Verify wiring terminations at all devices and correct as required. Provide identification label for each termination.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.

C. Provide thermowells for liquids and flanges for air bulb elements.

D. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

E. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.

F. 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.

3.3 CONTROL PANELS

A. Control panel for each system where more than one control device requires field mounting, (miscellaneous control systems including pump controls, heat exchanger controls, etc.). Single devices may be mounted on piping or wall. Install local control panel where indicated on Drawings or suitable location adjacent to system served.

B. Mount panels on wall with suitable brackets or on self-supporting stand. Mount top of panels no higher than 5 ft above floor. Install panels so front cover door can swing fully open without interference.

C. Panels mounted on vibrating equipment, such as on heat pumps, shall have vibration isolation protection that ensures their satisfactory operation.

D. All control panels located in accessible areas be provided with keyed locks. Locks shall utilize a single master key. Provide 2 spare key sets to Authority.

E. Panel Layout:
   1. Locate controllers in lower half of panel first and upper half second.
   2. Locate terminal strips either horizontally in upper half of back panel or vertically. Do not locate terminal strips below 2'-0" or above 6' above finished floor.
   3. Separate 24 VDC and 120 VAC, wire, cable, and devices by 6" minimum space.
   4. Enclose wire and cable in wireways or bundle w/ wire ties and secure to back-panel. This does not apply to wire exiting wireways to terminal strips or panel mounted devices.
   5. Space controllers according to manufacturer's requirements with 3" minimum between controllers and other devices on panel and 6" between controller front and door mounted devices. Ensure adequate space is allowed for device heat dissipation.

3.4 SENSORS AND INPUT/OUTPUT DEVICES

A. All input and output devices shall be installed per the manufacturer's recommendation.

B. Outside Air Humidity Sensors: Outside air relative humidity sensors shall be installed with a rain-proof, perforated cover. The transmitter shall be installed in a NEMA 3R enclosure with seal-tight fittings and stainless steel bushings.

C. Outside Air Sensors: Outside air sensors shall be mounted on the north wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outside air temperatures accurately. Sensors exposed to solar radiation must be installed with solar shields. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate surrounding the sensor element.

D. Water Pressure Sensors: Install water pressure sensors and differential pressure sensors with three-valve by-pass and pressure test ports for use in calibration and testing.

3.5 ELECTRICAL WIRING

A. Install wiring in accordance with National Electric Code, ANSI/NFPA 70.

B. All wiring materials covered by this section shall be in accordance with the latest revision of the National Electrical Code and applicable local codes and shall carry the UL label where applicable. All wiring running exposed in air plenums shall be plenum cable.

C. Install wiring (low and line voltage) in metal raceways or conduit unless inside control cabinet or unit enclosures.
   1. For concealed and accessible areas, plenum-rated wiring and cabling may be used.

D. Low voltage wiring not installed in conduit shall be supported every five feet from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements. Exposed wiring shall only be allowed in concealed accessible locations.

E. Low voltage control wiring and 24 VAC can be run in the same conduit. Power wiring 120 VAC and greater must be in a separate conduit.

F. Fastening shall be secured to walls or ceilings by means of appropriate screws, expansion screws anchors, toggle bolts, hollow wall screw anchors, nylon expansion anchors, or expansion shields. All-purpose plastic anchors are not acceptable.

G. Control panels shall be mounted on vibration-free walls or freestanding structural supports. Panels shall be located as indicated or approved by the Authority's Representative.

H. Locate circuits, relays, transformers, or other equipment that contains or must be connected to voltages exceeding 130 volts, in separate cabinets, which may be adjacent to control panels; permanently label "DANGER 277 VOLTS" or appropriate volts.

I. All wiring in mechanical rooms shall be in conduit. Minimum control wiring conduit size shall be 3/4 inch.

J. Provide with 120v AC, 20 amp dedicated emergency power circuit to each programmable control unit, panel and transformer.

K. Provide extension of 120v, 20 amp circuits and circuit breakers from emergency power panels for all BMCS equipment, transformers and panel power. Provide and install local UPS power supplies for all BMCS system panels and equipment.

3.6 CONTROL WIRING AND POWER CONNECTIONS

A. Provide all incidental control wiring required to make the equipment or systems fully operational. Coordinate with equipment manufacture incidental wiring requirements.

3.7 POWER SUPPLIES AND TRANSFORMERS

A. DC Power Supplies:
1. DC power supplies shall be sized for the connected device load. Total rated load shall not exceed 75 percent of the rated capacity of the power supply.
2. An appropriately sized fuse and fuse block shall be provided and located next to the power supply.
3. A power disconnect switch shall be provided next to the power supply.

B. Transformers:
1. Sized to provide volts and amps as required for connected load.
2. Input voltage shall be as required for the specific application.

C. Uninterruptable Emergency Power Supplies (UPS):
1. Provide UPS as required to maintain control system programming for a minimum of 20 minutes.

3.8 START-UP SERVICES

A. Verify proper location of each device and point-to-point system integrity. Correct as needed.

B. When installation is complete and automatic control system is placed in operation, adjust and calibrate all instruments and devices in system and ensure that system is operating in accord with specified sequences.

C. Diagnose component and system problems. Communicate irregularities to the appropriate contractor for correction.

D. Attend construction meetings as required to coordinate with other contractors and provide input during problem resolution.

3.9 IDENTIFICATION STANDARDS

A. Field Devices: All field devices shall be identified by a typed (not handwritten) securely attached tag label.

B. Controller Identification: All controllers shall be identified by typed (not handwritten) securely attached tag label.

C. Panel Identification: All local control panels shall be identified by a plastic engraved nameplate securely fastened to the outside of the controller enclosure.

D. Panel Devices: All panel devices shall be identified by a typed label securely fastened to the back plate of the local control panel.

E. Raceway Identification: All the covers to junction and pull boxes of the control system raceways shall be painted blue or have identification labels stating "Control System Wiring" affixed to the covers. Labels shall be typed, not handwritten.

F. Wire Identification: All low and line voltage control wiring shall be identified by a number or name, as referenced to the associated control diagram, at each end of the conductor cable. Identification number or name shall be permanently secured to the conductor or cable and shall be typed.

END OF SECTION

SECTION 23 0913.53

VARIABLE-FREQUENCY MOTOR CONTROLLERS FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Variable frequency controllers.

1.2 SUBMITTALS

A. 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.

B. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.

C. Specification Compliance Review.

D. Test Reports: Indicate field test and inspection procedures and test results.

E. Manufacturer's Field Reports: Indicate start-up inspection findings.

F. 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.

G. Maintenance Data: NEMA ICS 7.1. Include routine preventive maintenance schedule.

1.3 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience and with service facilities within 100 miles of Project.

C. Products: Listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

D. Coordinate features of VFCs and accessory devices with pilot devices and control circuits to which they connect.

E. Coordinate features, accessories, and functions of each VFC and each installed unit with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

1.4 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.

PART 2 PRODUCTS

2.1 PERFORMANCE, CAPACITIES AND CHARACTERISTICS

A. See Drawings for Equipment Schedules with Equipment Performance Requirements when capacities and characteristics are not indicated in the specifications.

2.2 MANUFACTURERS

A. ABB Inc.; www.abb.us/drives

B. Danfoss: www.danfossdrives.com

C. Reliance Electric/Rockwell Automation: www.rockwellautomation.com/relianceelectricdrives

D. Yaskawa America Inc.: www.yaskawa.com

2.3 DESCRIPTION

A. Variable Frequency Controllers: Enclosed HVAC 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.
   3. Design for ability to operate controller with motor disconnected from output.
   4. Design to attempt five automatic restarts following fault condition before locking out and requiring manual restart.
   5. Provide unit suitable for operation of premium-efficiency motor as defined by NEMA MG 1.

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.

2.4 OPERATING REQUIREMENTS

A. Rated Input Voltage: As indicted on drawings.

B. Input Frequency Tolerance: 60 Hz, plus or minus 6 percent.

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

D. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.

E. Minimum Short-Circuit Current (Withstand) Rating: 100 kA.

F. Operating Ambient: 0 degrees C to 40 degrees C.

G. Minimum Efficiency at Full Load: 96 percent.

H. Starting Torque: 100 percent of rated torque or as indicated.

I. Speed Regulation: Plus or minus 1 percent.

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

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

L. Acceleration Rate Adjustment: 0.5 to 30 seconds.

M. Deceleration Rate Adjustment: 1 to 30 seconds.

N. Input Signal: 4 to 20 mA DC.

O. Adjustable carrier frequency.

2.5 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. HAND-OFF-AUTOMATIC selector switch and manual speed control.

D. Self-Protection and Reliability Features:
1. Input transient protection by means of surge suppressors.
2. Undervoltage and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.
3. Motor Overload Relay: Adjustable and capable of NEMA 250, Class 20 performance.
4. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
5. Phase failure protection.
6. Phase reversal protection.
7. Short-circuit protection.
8. Motor overtemperature fault

E. Input Line Conditioning: DC link reactor or 3 percent impedance line reactor to minimize power line harmonics.

F. VFC Output Filtering: Dampened, low pass KLC output filter manufactured by TCI of Milwaukee, Wisconsin. Filter amperage shall match drive amperage. Provide for each VFC which exceeds the manufacturer's maximum recommended lead length from its controlled motor.

G. Control Power Source: Separate circuit.

H. Control Signal Interface:
1. Electric Input Signal Interface: A minimum of 2 analog inputs (0 to 10 V or 0/4-20 mA) and 6 programmable digital inputs.
2. Output Signal Interface:
   a. A minimum of 1 analog output signal (0/4-20 mA), which can be programmed to any of the following:
      1) Output frequency (Hz).
      2) Output current (load).
      3) DC-link voltage (VDC).
      4) Motor torque (percent).
      5) Motor speed (rpm).
      6) Set-point frequency (Hz).
   b. User Interlock Terminal Strip: Connections for life safety functions, freeze, and external start/stop. All interlocks and start/stop contacts shall remain fully functional whether drive is in auto or bypass position.

I. Historical Logging Information and Displays:
   1. Real-time clock with current time and date.
   2. Running log of total power versus time.
   3. Total run time.
   4. Fault log, maintaining last four faults with time and date stamp for each.

J. 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.

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

L. Control Interlocks: Furnish terminals for remote contact to allow starting in automatic mode.

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

N. Disconnecting Means: Include integral fused disconnect switch or circuit breaker on the line side of each controller.

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

2.6 SOURCE QUALITY CONTROL

A. Shop inspect and perform standard productions tests for each controller.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surface is suitable for controller installation.

B. Do not install controller until building environment can be maintained within the service conditions required by the manufacturer.

3.2 INSTALLATION

A. Install in accordance with NEMA ICS 7.1 and manufacturer's instructions.

B. Install each VFC in accordance with manufacturer’s recommendations. Installation shall be the responsibility of the Contractor supplying the controller.

C. Do not mount VFCs on vibrating equipment. Provide supplementary supports as required.

D. Install free-standing VFCs on concrete bases.

E. Tighten accessible connections and mechanical fasteners after placing controller.

F. Provide fuses in fusible switches; refer to Section 26 2813 for product requirements.

G. Select and install overload heater elements in motor controllers to match installed motor characteristics.

H. Provide engraved plastic nameplates; refer to Section 26 0553 for product requirements and location.

I. Clean VFCs internally, on completion of installation, according to manufacturer’s written instructions. Vacuum dirt and debris; do not use compressed air.

3.3 FIELD QUALITY CONTROL

A. Provide the service of the manufacturer's field representative to prepare and start controllers.

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.

B. Set overload relay to correspond to the full load amps of the connected motor.

C. Lock out critical speeds as required to avoid noise and vibration.

3.5 CLOSEOUT ACTIVITIES

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

B. Provide a minimum of two hours of on-site instruction for the Authority’s designated representative regarding the proper operation of each drive. Instruction shall be done at the convenience of the Authority. Instruction shall include a description of the functions of all indicators and controls and a demonstration of the following:
   1. Normal operating procedures - automatic mode.
   2. Normal starting, stopping and speed control procedures - manual mode.
   3. Bypass mode operation.
   4. Emergency shutdown.

END OF SECTION

SECTION 23 0923

DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. System Description

B. Operator Interface

C. Controllers

D. Power Supplies and Line Filtering

E. System Software

F. Controller Software

G. HVAC Control Programs

1.2 REFERENCE STANDARDS

A. MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests.

B. NFPA 70 - National Electrical Code.

1.3 DEFINITIONS

A. BMCS: The complete building management and direct-digital control system described in this specification section.

B. Provide: Furnish, install, commission, test, and warrant.

C. Furnish: Purchase and deliver to the appropriate installing Contractor, complete with every appurtenance, document, commission, and warranty.

1.4 SUBMITTALS

A. Specification Compliance Review.

B. Shop drawings and product data shall be in original searchable PDF format.

C. Product data shall be presented according to an included table of contents.

D. Product Data: Provide data for each system component and software module.

E. Shop Drawings:
   1. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.
   2. List connected data points, including connected control unit and input device.
   3. All components and controllers inclusive or 3rd party shall have a points list for each. Deviation from contract documents shall be reported to design team with alternates and/or a reason for deviation.
   4. Control drawings shall have a completed system architecture. Controllers and components inclusive to the control system as well as 3rd party controllers and components to be integrated and/or communicated with.

5. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations. Provide demonstration diskette containing graphics.
6. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
7. Indicate description and sequence of operation of operating, user, and application software.

F. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.

G. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
1. Revise shop drawings to reflect actual installation and operating sequences.
2. Include submittals data in final "Record Documents" form.
3. All wiring pathways, connections, junctions, transformers, etc. shall be as-built of a floor plan drawings and included with record drawings.

H. Operation and Maintenance Data:
1. Include interconnection wiring diagrams complete field installed systems 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.

I. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Authority s name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 year’s experience approved by manufacturer.

D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

E. Comply with ASHRAE 135 for DDC system control components. BTL listed.

1.6 WARRANTY

A. Correct defective Work within a 2 year period after Substantial Completion.

B. Provide five year manufacturer's warranty for field programmable micro-processor based units.

1.7 CONTRACTOR QUALIFICATIONS

A. The BMCS contractor shall:
1. Have a local staff in the area of trained personnel capable of giving instructions and providing routine and emergency maintenance on the BMCS, all components and software/firmware, and all other elements of the BMCS.

2. Have a proven record of experience in the supply and installation of equivalent systems over a minimum period of five years. Document at least three and no more than six projects of equal or greater size and complexity.
3. Have been a factory-certified representative for the BMCS manufacturer for a minimum of three years for design, installation, and maintenance of the proposed systems.
4. Have comprehensive local service and support facilities for the total BMCS as provided.
5. Maintain local, or have approved local contracted access to, supplies of essential expendable parts.

1.8 PROTECTION OF SOFTWARE RIGHTS

A. Prior to delivery of software, the Authority and the party providing the software will enter into a software license agreement with provisions for the following:
1. Limiting use of software to equipment provided under these specifications.
2. Limiting copying.
3. Preserving confidentiality.
4. Prohibiting transfer to a third party.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Honeywell: www.honeywell.com.

B. Johnson Controls, Inc.: www.johnsoncontrols.com.
1. Metasys.

C. Siemens Industry, Inc.: www.usa.siemens.com.
1. Siemens Building Technologies:
a. Talon

D. Schneider Electric: www.schneider-electric.com.
1. Andover Continuum.
2. TAC.

2.2 SYSTEM DESCRIPTION

A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units which are controlled by the existing Siemens building management control system. New devices and controllers must seamlessly integrate with the existing BMCS and software.

B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

C. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

D. Controls for radiation and the like when directly connected to the control units. Individual terminal unit control is specified in Section 23 0913.

E. Provide control systems consisting of thermostats, control valves, operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

F. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

2.3 CONTROLLERS AND PANELS

A. Building Controllers
1. General:
a. All controllers must be of open protocol.
b. All binary/digital outputs must have LED status.
c. Manage global strategies by one or more, independent, standalone, microprocessor based controllers.
d. Provide sufficient memory to support controller's operating system, database, and programming requirements.
e. Share data between networked controllers.
f. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
g. Utilize real-time clock for scheduling.
h. Continuously check processor status and memory circuits for abnormal operation.
i. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
j. Communication with other network devices to be based on assigned protocol.
k. Monitor, control, or address data points. Mix shall include analog inputs, analog outputs, pulse inputs, pulse outputs and discrete inputs/outputs, as required.
l. Provide control units with minimum 20 percent spare capacity.
m. Point Scanning: Set scan or execution speed of each point to operator selected time from 1 to 250 seconds.
n. Upload/Download Capability: Download from or upload to operator station. Upload/Download time for entire control unit database maximum 10 seconds on hard wired LAN, or 60 seconds over voice grade phone lines.
o. Controller perform in stand-alone mode:
1) Start/stop.
2) Duty cycling.
3) Automatic Temperature Control.
4) Demand control via a sliding window, predictive algorithm.
5) Event initiated control.
6) Calculated point.
7) Scanning and alarm processing.
8) Full direct digital control.
9) Trend logging.
10) Global communications.
11) Maintenance scheduling.
p. Controller Input/Output Capability:
1) Discrete/digital input (contact status).
2) Discrete/digital output.
3) Analog input.
4) Analog output.
5) Pulse input (5 pulses/second).
6) Pulse output (0-655 seconds in duration with 0.01 second resolution).

q. Controller Test Mode Operation: Place input/output points in test mode to allow testing and developing of control algorithms on line without disrupting field hardware and controlled environment. In test mode:
   1) Inhibit scanning and calculation of input points. Issue manual control to input points (set analog or digital input point to operator determined test value) from work station.
   2) Control output points but change only data base state or value; leave external field hardware unchanged.
   3) Enable control actions on output points but change only data base state or value.

r. Controller local display and adjustment panel: Portable control unit, containing digital display, and numerical keyboard. Display and adjust:
   1) Input/output point information and status.
   2) Controller set points.
   3) Controller tuning constants.
   4) Program execution times.
   5) High and low limit values.
   6) Limit differential.
   7) Set/display date and time.
   8) Control outputs connected to the network.
   9) Automatic control outputs.
   10) Perform control unit diagnostic testing.
   11) Points in "Test" mode.

2. Communication:
   a. Controller to reside on a BACnet network using ISO 8802-3 (ETHERNET) Data Link/Physical layer protocol.
   b. Perform routing when connected to a network of custom application and application specific controllers.
   c. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
3. Anticipated Environmental Ambient Conditions:
   a. Outdoors and/or in Wet Ambient Conditions:
      1) Mount within waterproof enclosures.
      2) Rated for operation at 40 to 150 degrees F.
   b. Conditioned Space:
      1) Mount within dustproof enclosures.
      2) Rated for operation at 32 to 120 degrees F.
4. Provisions for Serviceability:
   a. Diagnostic LEDs for power, communication, and processor.
   b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
6. Power and Noise Immunity:
   a. Maintain operation at 90 to 110 percent of nominal voltage rating.
   b. Perform orderly shutdown below 80 percent of nominal voltage.
   c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

B. Custom Application Controllers
1. General:
   a. Provide sufficient memory to support controller's operating system, database, and programming requirements.
   b. Share data between networked, microprocessor based controllers.

c. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
d. Utilize real-time clock for scheduling.
e. Continuously check processor status and memory circuits for abnormal operation.
f. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
g. Communication with other network devices to be based on assigned protocol.

2. Communication:
a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.
b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.

3. Anticipated Environmental Ambient Conditions:
a. Outdoors and/or in Wet Ambient Conditions:
1) Mount within waterproof enclosures.
2) Rated for operation at 40 to 150 degrees F.
b. Conditioned Space:
1) Mount within dustproof enclosures.
2) Rated for operation at 32 to 120 degrees F.

4. Provisions for Serviceability:
a. Diagnostic LEDs for power, communication, and processor.
b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.

5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.

6. Power and Noise Immunity:
a. Maintain operation at 90 to 110 percent of nominal voltage rating.
b. Perform orderly shutdown below 80 percent of nominal voltage.
c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

C. Application Specific Controllers

1. General:
a. Not fully user programmable, microprocessor based controllers dedicated to control specific equipment.
b. Customized for operation within the confines of equipment served.
c. Communication with other network devices to be based on assigned protocol.

2. Communication:
a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.
b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.

3. Anticipated Environmental Ambient Conditions:
a. Outdoors and/or in Wet Ambient Conditions:
1) Mount within waterproof enclosures.
2) Rated for operation at 40 to 150 degrees F.
b. Conditioned Space:
1) Mount within dustproof enclosures.
2) Rated for operation at 32 to 120 degrees F.

4. Provisions for Serviceability:
    a. Diagnostic LEDs for power, communication, and processor.
    b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
6. Power and Noise Immunity:
    a. Maintain operation at 90 to 110 percent of nominal voltage rating.
    b. Perform orderly shutdown below 80 percent of nominal voltage.
    c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

D. Input/Output Interface
1. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.
2. All Input/Output Points:
    a. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.
    b. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.
3. Binary Inputs:
    a. Allow monitoring of On/Off signals from remote devices.
    b. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.
    c. Sense dry contact closure with power provided only by the controller.
4. Pulse Accumulation Input Objects: Conform to all requirements of binary input objects and accept up to 10 pulses per second.
5. Analog Inputs:
    a. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).
    b. Compatible with and field configurable to commonly available sensing devices.
6. Binary Outputs:
    a. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.
    b. Outputs provided with three position (On/Off/Auto) override switches.
    c. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.
7. Analog Outputs:
    a. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.
    b. Provide status lights and two position (AUTO/MANUAL) switch for building and custom application controllers with manually adjustable potentiometer for manual override on building and custom application controllers.
    c. Drift to not exceed 0.4 percent of range per year.
    d. Adjust range of analog output to match range of end device, valves actuator, VFC, etc.
    e. Program all PID loop control to match range and stroke of end device. For example if a VFC has a minimum speed of 20% output should be configure to start at 20% to eliminate spooling of PID outside actual operating range of end device.

f. Graphics shall represent actual range of end device. If VFC range is from 20% to 100%, graphical reference should match.

8. Tri State Outputs:
   a. Coordinate two binary outputs to control three point, floating type, electronic actuators without feedback.
   b. Limit the use of three point, floating devices to the following zone and terminal unit control applications:
   c. Control algorithms run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.
9. System Object Capacity:
   a. System size to be expandable to twice the number of input output objects required by providing additional controllers, including associated devices and wiring.
   b. Hardware additions or software revisions for the installed operator interfaces are not to be required for future, system expansions.

2.4 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 1 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 3 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.
2. Minimum surge protection attributes:
   a. Dielectric strength of 1000 volts minimum.
   b. Response time of 10 nanoseconds or less.
   c. Transverse mode noise attenuation of 65 dB or greater.
   d. Common mode noise attenuation of 150 dB or greater at 40 to 100 Hz.

C. Control Unit Battery Back-up:
1. For minimum of 48 hours for complete system including RAM without interruption, with automatic battery charger.

2.5 LOCAL AREA NETWORK (LAN)

A. Provide communication between control units over local area network (LAN).

B. LAN Capacity: Not less than 60 stations or nodes.

C. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.

D. LAN Data Speed: Minimum 19.2 Kb.

E. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.

F. Transmission Median: Fiber optic or single pair of solid 24 gauge twisted, shielded copper cable.

G. 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.

2.6 CONTROLLER SOFTWARE

A. All applications reside and operate in the system controllers and editing of all applications occurs at the operator workstation.

B. System Security:
1. User access secured via user passwords and user names.
2. Passwords restrict user to the objects, applications, and system functions as assigned by the system manager.
3. User Log On/Log Off attempts are recorded.
4. Automatic Log Off occurs following the last keystroke after a user defined delay time.

C. Object or Object Group Scheduling:
1. 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. Output summary: Listing of programmed function points, associated program times, and respective day of week programmed points by software groups or time of day.
5. Weekly Schedules Based on Separate, Daily Schedules:
   a. Include start, stop, optimal stop, and night economizer.
   b. 10 events maximum per schedule.
   c. Start/stop times adjustable for each group object.
6. Exception Schedules:
   a. Based on any day of the year.
   b. Defined up to one year in advance.
   c. Automatically discarded and replaced with standard schedule for that day of the week upon execution.
7. Holiday or Special Schedules:
   a. Capability to define up to 99 schedules.
   b. Repeated annually.
   c. Length of each period is operator defined.

D. Provide standard application for equipment coordination and grouping based on function and location to be used for scheduling and other applications.

E. Alarms:
1. Verify the following with the authority: degree of alarming, event log - item is entered into event with no warning or notification, system alarm - entered into

event log with local alarm or warning message, no notification, critical alarm - enters event log, alarms at local machines, and a notification is sent, event "delays" - inform secondary recipients if primary does not acknowledge, "round robin" if required by the authority, if alarm is not acknowledged by primary, secondary is notified after delay, if secondary does not acknowledge, primary will be notified again, not stopping until acknowledged.

2. Alarm acknowledgment may be accompanied by note by operator to be entered into event log for archive and information sharing with operators.
3. Off normal condition: Cause alarm and appropriate message, including time, system, point descriptor, and alarm condition. Select alarm state/value and which alarms shall cause automatic dial-out.
4. Critical alarm or change-of-state: Display message, stored on disk for review and sort, or print.
5. Display multiple alarms in order of occurrence.
6. Define time delay for equipment start-up or shutdown.
7. Continue to indicate unacknowledged alarms after return to normal.
8. Binary object is set to alarm based on the operator specified state.
9. Analog object to have high/low alarm limits.
10. All alarming is capable of being automatically and manually disabled.
11. Alarm Messages:
    a. Assign alarm messages to system messages including point's alarm condition, point's off-normal condition, totalized point's warning limit, hardware elements advisories.
    b. Operator commands include define, modify, or delete; output summary listing current alarms and assignments; output summary defining assigned points.
12. Alarm Reporting:
    a. Operator determines action to be taken for alarm event.
    b. Alarms to be routed to appropriate workstation.
    c. Reporting Options:
        1) Start Programs.
        2) Print.
        3) Logged.
        4) Custom messaging.
        5) Graphical displays.
        6) Dial out to workstation receivers via system protocol.

F. Maintenance Management: System monitors equipment status and generates maintenance messages based upon user-designated run-time limits.
1. Maintenance scheduling targets with automatic annunciation, scheduling and shutdown.
2. Equipment safety targets.
3. Display of maintenance material and estimated labor.
4. Target point reset, per point.

G. Advisories:
1. Summary which contains status of points in locked out condition.
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.

H. Sequencing: Application software based upon specified sequences of operation in Section 23 0993.

I. PID Control Characteristics:
   1. Direct or reverse action.
   2. Anti-windup.
   3. Calculated, time-varying, analog value, positions an output or stages a series of outputs.
   4. User selectable controlled variable, set-point, and PED gains.

J. Staggered Start Application:
   1. Prevents all controlled equipment from simultaneously restarting after power outage.
   2. Order of equipment startup is user selectable.

K. Energy Calculations:
   1. Accumulated instantaneous power or flow rates are converted to energy use data.
   2. Algorithm calculates a rolling average and allows window of time to be user specified in minute intervals.
   3. Algorithm calculates a fixed window average with a digital input signal from a utility meter defining the start of the window period that in turn synchronizes the fixed-window average with that used by the power company.

L. Anti-Short Cycling:
   1. All binary output objects protected from short-cycling.
   2. Allows minimum on-time and off-time to be selected.

M. On-Off Control with Differential:
   1. Algorithm allows binary output to be cycled based on a controlled variable and set-point.
   2. Algorithm to be direct-acting or reverse-acting incorporating an adjustable differential.

N. Run-Time Totalization:
   1. Totalize run-times for all binary input objects.
   2. Provides operator with capability to assign high run-time alarm.

O. Trend Point:
   1. Sample up to 10 points, real or computed, with each point capable of collecting 1440 samples at intervals specified in minutes, hours, days, or month.
   2. Output trend logs as line graphs or bar graphs. 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.

P. Interlocking:
   1. Permit events to occur, based on changing condition of one or more associated master points.
   2. 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.

Q. Input/Output Capability From Operator Work 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 two printer operations.
    a. Alarm printer: Print alarms, operator acknowledgements, action messages, system alarms, operator sign-on and sign-off.
    b. Data printer: Print reports, page prints, and data base prints.
13. Select daily, weekly or monthly as scheduled frequency to synchronize time and date in digital control units. Accommodate daylight savings time adjustments.
14. Print selected control unit data base.

R. 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.

S. Operator Station:
1. Accept data from LAN as needed without scanning entire network for updated point data.
2. Interrogate LAN for updated point data when requested.
3. Allow operator command of devices Without the purchase of additional software from any pc via web interface..
4. Allow operator to place specific control units in or out of service.
5. Allow parameter editing of control units.
6. Store duplicate data base for every control unit and allow down loading while system is on line.
7. Control or modify specific programs.
8. Develop, store and modify dynamic color graphics.
9. Provide data archiving of assigned points and support overlay graphing of this data utilizing up to four (4) variables.

T. 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.

U. Automatic Restart: Automatically restart field equipment on restoration of power. Provide time delay between individual equipment restart and time of day start/stop.

V. 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.

W. Reports:
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.

X. Parameter Save/Restore: Store most current operating system, parameter changes, and modifications on disk or diskette.

Y. Data Collection:
1. Automatically collect and store in disk files.
2. Daily electrical energy consumption, peak demand, and time of peak demand for up to electrical meters over 2 year period.
3. Daily billable electrical energy consumption and time for up to 1024 zones over a 10 year period.
4. Provide archiving of stored data for use with system supplied custom reports.
5. Generate, store, and retrieve library symbols.
6. Single or double height characters.
7. Sixty (60) dynamic points of data per graphic page.
8. Animated graphics for discrete points.
9. Analog bar graphs.
10. Display real time value of each input or output line diagram fashion.

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. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.2 INSTALLATION

A. Install control units and other hardware in position on permanent walls where 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 0993.

C. Provide with 120v AC, 20 amp dedicated emergency power circuit to each programmable control unit, panel and transformer.

D. Provide extension of 120v, 20 amp circuits and circuit breakers from emergency power panels for all BMCS equipment, transformers and panel power. Provide and install local UPS power supplies for all BMCS system panels and equipment.

E. 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.

3.3 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 basic operator training for 2 persons on data display, alarm and status descriptors, requesting data, execution of commands and request of logs. Include a minimum of 12 hours dedicated instructor time. Provide training on site.

3.4 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate complete and operating system to Authority.

END OF SECTION

SECTION 23 0993

SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

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.

B. Sequence of operation for:
   1. Heating water system for snow melt.

1.2 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.

1.3 SUBMITTALS

A. Specification Compliance Review.

B. Sequence of Operation Documentation: Submit written sequence of operation for entire HVAC system and each piece of equipment.
   1. State each sequence in small segments and give each segment a unique number for referencing in Functional Test procedures; provide a complete description regardless of the completeness and clarity of the sequences specified in the contract documents.
   2. Include at least the following sequences:
      a. System off.
      b. Start-up.
      c. Warm-up mode.
      d. Normal operating mode.
      e. Unoccupied mode.
      f. Shutdown.
      g. Capacity control sequences and equipment staging.
      h. Temperature and pressure control, such as setbacks, setups, resets, etc.
      i. Detailed sequences for all control strategies, such as economizer control, optimum start/stop, staging, optimization, demand limiting, etc.
      j. Effects of power or equipment failure with all standby component functions.
      k. Sequences for all alarms and emergency shut downs.
      l. Seasonal operational differences and recommendations.
      m. Interactions and interlocks with other systems.
   3. Include initial and recommended values for all adjustable settings, setpoints and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.
   4. For packaged controlled equipment, include manufacturer's furnished sequence of operation amplified as required to describe the relationship between the packaged controls and the control system, indicating which points are adjustable control points and which points are only monitored.

5. Include schedules, if known.

C. Control System Diagrams: Submit graphic schematic of the control system showing each control component and each component controlled, monitored, or enabled.
   1. Label with settings, adjustable range of control and limits.
   2. Include flow diagrams for each control system, graphically depicting control logic.
   3. Include the system and component layout of all equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
   4. Include draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.
   5. Include all monitoring, control and virtual points specified in elsewhere.
   6. Include a key to all abbreviations.

D. Points List: Submit list of all control points indicating at least the following for each point.
   1. Name of controlled system.
   2. Point abbreviation.
   3. Point description; such as dry bulb temperature, airflow, etc.
   4. Display unit.
   5. Control point or setpoint (Yes / No); i.e. a point that controls equipment and can have its setpoint changed.
   6. Monitoring point (Yes / No); i.e. a point that does not control or contribute to the control of equipment but is used for operation, maintenance, or performance verification.
   7. Intermediate point (Yes / No); i.e. a point whose value is used to make a calculation which then controls equipment, such as space temperatures that are averaged to a virtual point to control reset.
   8. Calculated point (Yes / No); i.e. a “virtual” point generated from calculations of other point values.

E. 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 OPERATING SEQUENCES - GENERAL

A. Sequence of Control indicated illustrates basic control function only. Provide all control devices required for controlling air handling units, exhaust fans, physical plant equipment, terminal equipment, and all related items.

B. The Control Contractor shall perform the initial input of all required operational data for each point that is to be used based on information supplied to the Contractor by the Authority. The Contractor shall assist the Authority's staff in developing the schedule and shall demonstrate the operation of the system using the data.

C. Provide adequate English language notation in the software to assist the operator in understanding the intent of the programmed sequences.

D. The Control Contractor shall be responsible for the stable operation of all control loops. If the Control Contractor has not provided self-tuning PID control algorithms then the

Control Contractor shall manually tune all control loops. Verify all control loops are stable whether or not they are self-tuning.

E. The Control Contractor shall provide any modifications to the operating sequences as requested by the Authority without additional costs until the final acceptance of the entire control system.

F. All outputs using PID control shall be adjusted to the actual range of end device. If VFC range is from 20% to 100%, output PID loop shall run from 20%-100% to eliminate spooling of PID outside actual operating range of end device.

G. Graphics shall represent actual range of outputs.

3.2 EQUIPMENT RUN TIME TOTALIZATION

A. Provide a software package that will accumulate the operating times for motors as selected by the operator using an interactive procedure. Any piece of equipment that has its status monitored by the building management control system (BMCS) shall be selectable for inclusion in this feature. It shall be possible to concurrently monitor the accumulated operating time for every item of equipment monitored and/or controlled by the BMCS.

B. The operator shall be able to establish on-line, using an interactive procedure, a value for the accumulated operating time at which a suitably worded message shall be output to the operator advising that the reporting limit has been reached for a specific motor. The message shall be output at the designated alarm printer.

C. The operator shall be able to change the accumulated total for any motor to any value.

D. The accumulated operating times shall be updated at least every 15 minutes.

E. The operator shall be able to obtain on demand or on a scheduled basis a report detailing the accumulated operating times.

F. Operating time software shall be used as the basis for equipment operating selection and standby status. Changeover of units based on operating times shall not take place more than an operator-defined period, initially set at once per week.

3.3 HEATING WATER SYSTEM - SNOW MELT

A. System Off - When the system is off:
1. The boilers shall be disabled.
2. The heating water pumps shall be off.
3. Valves shall be closed.

B. Initiation of System Start-Up - The system shall be started:
1. Manually initiated by operator through BMCS.
2. Automatically by the BMCS base on a time schedule or whenever there is a requirement for heating.

C. System Operation - After system start-up has been initiated the following shall occur:
1. Condensing Boiler (B-3) Control:
   a. The existing boiler sequence shall remain. It shall be modified to add in sequence for snow melt control.
   b. When in snow melt control, the valves to the main heating water system shall close so that the snow melt system is the only area being served by the boiler.
   c. The control system shall provide monitoring of all alarms.

2. Snow Melt System Control:
    a. The snow melt controller shall enable the snow melt system based on temperature and moisture sensors.
    b. The snow melt controller shall determine the control sequence for pump operation.
    c. The snow melt controller shall modulate valve(s) to maintain discharge temperature setpoint.

D. System Shutdown - Shall be initiated as follows:
1. Manually initiated by operator through BMCS.
2. Automatically by the BMCS base on a time schedule or whenever there is not a requirement for heating.

E. System Setpoints - The setpoints shall be operator changeable and initially set as follows:
1. Snow melt water supply temperature setpoint shall be 120 degrees F.
2. The heating water pump differential pressure setpoint shall be 15 psi.
3. The high/low temperature alarm setpoint shall be set initially at 10 degrees F above/below the temperature setpoint.

F. Alarms - The BMCS shall generate an alarm for the following conditions:
1. Boiler or pump failure.
2. High/low heating water supply temperature.

G. Failure Positions - The following shall occur upon component failure or loss of power:
1. Pumps shall remain in the last commanded state.
2. Boilers shall remain in the last commanded state.
3. Control valves shall fail open.

H. Points List:
1. Analog Inputs:
    a. Heating water return temperature.
    b. Heating water supply temperature.
    c. Heating water system differential pressure.
2. Digital Inputs:
    a. Snow melt water pump status (Typ 1).
3. Analog Outputs:
    a. Snow melt water pump VFC speed (Typ 1).
    b. Snow melt 3-way valve position.
4. Digital Outputs:
    a. Snow melt water pump start/stop (Typ 1).

END OF SECTION

SECTION 23 2113

HYDRONIC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Hydronic system requirements.

B. Heating water and glycol piping, above grade.

C. Pipe hangers and supports.

D. Unions, flanges, mechanical couplings, and dielectric connections.

E. Valves:
1. Gate valves.
2. Globe or angle valves.
3. Ball valves.
4. Butterfly valves.
5. Check valves.

1.2 CODE AND PERMIT COMPLIANCE

A. Work shall be in accordance with all applicable codes. Where the codes and drawings do not agree, the code shall take precedence; however, code shall take precedence over what is shown only when it is more stringent than that indicated. Items that are allowed by codes which are less stringent than that shown on the Drawings shall not be substituted.

B. Contractors shall familiarize themselves with all requirements as to permits, fees, etc., and shall comply. All permits, licenses, inspections, and arrangements required for the work shall be provided by the Contractors at their expense.

C. All utilities shall be installed in accordance with utility company rules and regulations.

D. Drawings, plans, and schematics and diagrams indicate the general location and the arrangement of piping systems. Wherever practical, install piping as indicated.

1.3 REFERENCE STANDARDS

A. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications.

B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300.

C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

E. ASME B31.9 - Building Services Piping.

F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

G. ASTM A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.

H. ASTM A183 - Standard Specification for Carbon Steel Track Bolts and Nuts.

I. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

J. ASTM A536 - Standard Specification for Ductile Iron Castings.

K. ASTM B32 - Standard Specification for Solder Metal.

L. ASTM B88 - Standard Specification for Seamless Copper Water Tube.

M. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric).

N. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications.

O. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

P. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

Q. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society.

R. AWS D1.1/D1.1M - Structural Welding Code - Steel.

S. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings.

T. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

U. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast.

V. AWWA C606 - Grooved and Shouldered Joints.

W. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

1.4 SUBMITTALS

A. Welders Certificate: Include welders certification of compliance with ASME BPVC-IX.

B. Product Data:
1. Include data on pipe materials, pipe fittings, valves, and accessories.
2. Provide manufacturers catalogue information.
3. Indicate valve data and ratings.
4. Show grooved joint couplings, fittings, valves, and specialties on drawings and product submittals, specifically identified with the manufacturer's style or series designation.

C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

D. Project Record Documents: Record actual locations of valves.

E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

F. Grooved joint couplings, fittings, valves, and specialties shall be shown on shop drawings and product submittals, and shall be specifically identified with the manufacturer’s style or series designation.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum 5 years of experience.

C. Welder Qualifications: Certify in accordance with ASME BPVC-IX.
   1. Provide certificate of compliance from authority having jurisdiction, indicating approval of welders.

D. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer.
   1. Grooving tools shall be of the same manufacturer as the grooved components.
   2. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers and supports as required, as indicated, and as follows:
   1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
   2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
   3. Grooved mechanical joints may be used in any location.
      a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Architect/Engineer.
      b. Grooved mechanical connections and joints comply with AWWA C606. Couplings shall be rigid pattern, two-piece, ductile-iron housing cast with offsetting angle-pattern bolt pads.
         1) Ductile Iron: Comply with ASTM A536, Grade 65-45-12.
         2) Steel: Comply with ASTM A106/A106M, Grade B or ASTM A53/A53M.
      c. Couplings to be bolt pad to bolt pad assembly, central cavity pressure-responsive design.
      d. Installation-Ready, for direct stab installation without field disassembly or loose parts.
      e. Use rigid joints unless otherwise indicated.

f. Use flexible joints at vibrating or rotating equipment.
g. Three (or four, depending on pipe size), flexible joints may be used in lieu of a flexible connector.
h. Use gaskets of molded grade EHP synthetic rubber with central cavity, pressure responsive configuration and complying with ASTM D2000, Grade 2CA615A15B44F17Z for circulating medium up to maximum 230 degrees F or Grade M3BA610A15B44Z for circulating medium up to maximum 200 degrees F.
i. Provide steel coupling nuts and bolts complying with ASTM A183.

4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.
1. Where grooved joints are used in piping, provide grooved valve/equipment connections if available; if not available, provide flanged ends and grooved flange adapters.

D. Valves: Provide valves where indicated:
1. Provide drain valves where indicated, and if not indicated provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch gate valves with cap; pipe to nearest floor drain.
2. On discharge of condenser water pumps, use spring loaded check valves.
3. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings.
4. For throttling, bypass, or manual flow control services, use globe, ball, or butterfly valves.
5. In heating water, chilled water, or condenser water systems, butterfly valves may be used interchangeably with gate and globe valves.
6. For shut-off and to isolate parts of systems or vertical risers, use ball or butterfly valves.

E. Welding Materials and Procedures: Conform to ASME BPVC-IX.

2.2 HEATING WATER AND GLYCOL PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:
1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.
2. Threaded Joints: ASME B16.3, malleable iron fittings.
3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

B. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn, using one of the following joint types:
1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
b. Braze: AWS A5.8/A5.8M BCuP copper/silver alloy.
2. Grooved Joints: AWWA C606 grooved tube, fittings of same material, and copper-tube-dimension mechanical couplings.

3. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
4. Mechanical Press Sealed Fittings: Double pressed type complying with ASME B16.22, utilizing EPDM, nontoxic synthetic rubber sealing elements.

2.3 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

B. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Carbon steel, adjustable swivel, split ring.

C. Hangers for Cold Pipe Sizes 2 Inches and Greater: Carbon steel, adjustable, clevis.

D. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.

E. Hangers for Hot Pipe Sizes 6 Inches and Greater: Adjustable steel yoke, cast iron roll, double hanger.

F. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

G. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Greater: Steel channels with welded spacers and hanger rods, cast iron roll.

H. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

I. Wall Support for Pipe Sizes 4 Inches and Greater: Welded steel bracket and wrought steel clamp.

J. Wall Support for Hot Pipe Sizes 6 Inches and Greater: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.

K. Vertical Support: Steel riser clamp.

L. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

M. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

N. Floor Support for Hot Pipe Sizes 6 Inches and Greater: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.

O. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

P. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

Q. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

R. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

S. Steel Pipe Saddles:
1. Designed for high temperature service or where heat losses are to be kept at a minimum and to protect insulation against damage at the point of support

2. Conforms with Federal Specification WW-H-171 (Type 40A or 40B), Manufacturers Standardization Society ANSI®/MSS-SP-58 (Type 39)

2.4 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe 2 Inches and Less:
1. Ferrous Piping: 150 psig malleable iron, threaded.
2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe 2 Inches and Greater:
1. Ferrous Piping: 150 psig forged steel, slip-on.
2. Copper Piping: Bronze.
3. Gaskets: 1/16 inch thick preformed neoprene.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
1. Dimensions and Testing: In accordance with AWWA C606. Couplings shall comply with ASTM F1476 “Standard Specification for the Performance of Gasketed Mechanical Couplings for use in Piping Applications”.
2. Mechanical Couplings: Comply with ASTM F1476.
3. Housing Material: Ductile iron, galvanized complying with ASTM A536.
4. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
5. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel. ASTM A449.
6. When pipe is field grooved, provide coupling manufacturer's grooving tools.
7. Manufacturers:
   a. Grinnell Products, a Tyco Business: www.grinnell.com.
   b. Shurjoint Piping Products, Inc., a Tyco Business: www.shurjoint.com.
   c. Victaulic Company: www.victaulic.com.
8. Grooved Copper Tube Fittings:
   a. Grooved-End Copper Fittings: ASME B16.22 wrought copper and ASTM B 75, copper tube or ASME B 16.18 and ASTM B 584, bronze casting.
   b. Grooved-End-Tube Couplings: Rigid pattern, ductile-iron housing cast with offsetting angle-pattern bolt pads, prelubricated Grade EHP gasket rated for maximum 250 deg F for use with housing, and steel bolts and nuts. Installation-Ready, for direct stab installation without field disassembly or loose parts. Couplings to be bolt pad to bolt pad assembly.
9. Grooved Steel Pipe and Fittings:
   a. Grooved Mechanical-Joint Fittings and Coupling
      1) Fittings: ASTM A 536, Grade 65-45-12 ductile iron;-ASTM A 53/A 53M, Type F, E, or S, Grade B factory-fabricated steel; or ASTM A 234, Grade WPB steel fittings with grooves or shoulders constructed to accept grooved-end couplings.
      2) Couplings: Two piece ductile-iron housing and synthetic EHP rubber gasket of central cavity pressure-responsive design.
      3) Installation-ready, for direct stab installation without field disassembly.
      4) Rigid Type Couplings: Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with ANSI B3 1.1 and B31.9. Couplings shall be fully installed at visual pad-to-pad offset contact.

5) Flexible Type Couplings: Used in locations where vibration attenuation and stress relief are required.

6) Piping 14-Inches and Larger: Couplings, consisting of two ductile iron housings with lead-in chamfer on the housing key, a wide-width flush seal gasket, and ASTM A449 zinc-electroplated steel bolts and nuts.

b. Coupling manufacturer's factory-trained representative shall provide on-site training for the contractor's field personnel in the proper use of grooving tools and installation of grooved joint products. The representative shall periodically visit the job site to ensure best practices in grooved joint installations are being followed.

D. Dielectric Connections:

1. Waterways:
   a. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
   b. Dry insulation barrier able to withstand 600 volt breakdown test.
   c. Construct of galvanized steel with threaded end connections to match connecting piping.
   d. Suitable for the required operating pressures and temperatures.
2. Flanges:
   a. Dielectric flanges with same pressure ratings as standard flanges.
   b. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
   c. Dry insulation barrier able to withstand 600 volt breakdown test.
   d. Construct of galvanized steel with threaded end connections to match connecting piping.
   e. Suitable for the required operating pressures and temperatures.
3. Dielectric unions are not allowed.

2.5 GATE VALVES

A. Manufacturers:

1. Apollo Valves: www.apollovalves.com.
2. Conbraco Industries: www.apollovalves.com.
3. Milwaukee Valve Company: www.milwaukeevalve.com.
4. Nibco, Inc: www.nibco.com.
5. Victaulic Company: www.victaulic.com.

B. Up To and Including 2 Inches:

1. Bronze body, bronze trim, screwed bonnet, non-rising stem, lockshield stem, inside screw with backseating stem, solid wedge disc, alloy seat rings, solder ends.
2. MSS-SP-80, Class 125, ASTM B62, integral seat, union bonnet.

C. 2-1/2 Inches and Larger:

1. Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged or grooved ends.
2. MSS-SP-70, Class 125. OS&Y.

D. Install chainwheel operators on valves 4 inches and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor elevation.

2.6 GLOBE OR ANGLE VALVES

A. Manufacturers:

1. Apollo Valves: www.apollovalves.com.
2. Milwaukee Valve Company: www.milwaukeevalve.com.
3. Nibco, Inc: www.nibco.com.
4. Victaulic Company: www.victaulic.com.

B. Up To and Including 2 Inches:
1. MSS-SP-80, Class 125, bronze body, bronze trim, union bonnet, rising stem and handwheel, inside screw with backseating stem, renewable composition disc and bronze seat, solder or threaded ends.

C. Over 2 Inches:
1. MSS-SP-85, Class 125, iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, rotating plug-type disc with renewable seat ring and disc, flangedor grooved ends.

D. Install chainwheel operators on valves 4 inches and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor elevation.

2.7 BALL VALVES

A. Manufacturers:
1. Apollo Valves: www.apollovalves.com.
2. Milwaukee Valve Company: www.milwaukeevalve.com.
3. Nibco, Inc: www.nibco.com.
4. Victaulic Company: www.victaulic.com.
5. Watts: www.watts.com.

B. Up To and Including 2 Inches:
1. Bronze two piece body, full port, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.
2. MSS-SP-10

C. Over 2 Inches:
1. Ductile iron body, full port, chrome plated stainless steel ball, teflon or Virgin TFE seat and stuffing box seals, lever handle or gear operated, grooved ends, rated to 800 psi.
2. MSS-SP-72, gear drive operator 6 inches and over.

D. Install chainwheel operators on valves 4 inches and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor elevation.

2.8 BUTTERFLY VALVES

A. Manufacturers:
1. Apollo Valves: www.apollovalves.com.
2. Milwaukee Valve Company: www.milwaukeevalve.com.
3. Victaulic Company: www.victaulic.com.
4. Nibco, Inc: www.nibco.com.
5. Watts: www.watts.com.

B. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck.

C. Disc: Construct of aluminum bronze, chrome plated ductile iron, stainless steel, ductile iron with EPDM encapsulation, or Buna-N encapsulation.

D. Stem: Stainless steel with stem offset from the centerline to provide full 360 degree circumferential setting.

E. MSS-SP-67, Type 1, 200 CWP.

F. Operator: 10 position lever handle. Handwheel and gear drive 4 inches and larger.

G. Install chainwheel operators on valves 4 inches and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor elevation.

H. Grooved End Copper Butterfly Valves:
1. Maximum pressure rating of 300 psi with CTS sized grooved ends. Cast bronze body to UNS C87850 stamped into valve body. Elastomer encapsulated ductile iron disc to ASTM A-536, Grade 65-45-12, with integrally cast stem. Bubble tight, dead end, bidirectional service to full working pressure.

I. Grooved End Steel IPS Butterfly Valves:
1. Maximum pressure rating of 300 psi with grooved ends. Body to be ductile iron conforming to ASTM A536. Disc shall be offset from centerline for full 360 degree seating, and nickel plated ductile iron with blowout proof 416 stainless steel stem. Valve shall be complete with ISO flange for actuation mounting.

2.9 SWING CHECK VALVES

A. Manufacturers:
1. Apollo Valves: www.apollovalves.com.
2. Milwaukee Valve Company: www.milwaukeevalve.com.
3. Nibco, Inc: www.nibco.com.
4. Victaulic Company: www.victaulic.com.
5. Watts: www.watts.com.

B. Up To and Including 2 Inches:
1. MSS-SP-80, Class 125, Y-pattern, grooved, threaded or soldered.

C. 2-1/2 Inches and Larger:
1. Iron body, bronze trim, stainless steel, bronze, or bronze faced rotating swing disc, renewable disc and seat, flanged or grooved ends.
2. MSS-SP-71, Type I, Class 125.

2.10 SPRING LOADED CHECK VALVES

A. Manufacturers:
1. Apollo Valves: www.apollovalves.com.
2. Milwaukee Valve Company: www.milwaukeevalve.com.
3. Victaulic Company: www.victaulic.com.
4. Watts: www.watts.com.

B. Ductile iron body, stainless steel or bronze trim, single disc or split plate, hinged with stainless steel spring, welded-in nickel seat with elastomer coated disc or resilient seal bonded to disc or body, grooved, wafer, or threaded lug ends.

2.11 PRESSURE/TEMPERATURE TEST FITTING (PTT)

A. Brass fitting with EPDM core to allow access for thermometer or pressure gage. Provide threaded cap and strap. Provide length required to accommodate insulation.

B. Provide test kit to include thermometer, pressure gage, access fittings, and carrying case.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare piping connections to equipment using jointing system specified.

E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

F. After completion, fill, clean, and treat systems. Refer to Section 23 2500 for additional requirements.

3.2 INSTALLATION

A. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

B. Provide drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

C. Install piping at a uniform grade of 0.2 percent (1 inch in 40 feet) upward in direction of flow.

D. Reduce pipe sizes using eccentric reducer fitting installed with straight side up.

E. Mechanically formed tees in copper pipe may be formed per ANSI A40 by workers certified after factory authorized training. Branch lines shall be formed with two dimple/depth stops in line with the run of the tube.
   1. Fabricate mechanically formed tees/outlets according to manufacturer's standard written procedure.
   2. Mechanically formed outlets shall have a collar with a height not less than three times the thickness of the branch tube wall.
   3. The branch shall be notched to conform to the inner curve of the run and shall be dimpled or otherwise impeded from penetrating the run pipe/tube to a depth that would obstruct the flow of fluid through the run pipe/tube.
   4. The branch tube shall also be dimpled or otherwise marked to indicate the location of the notches with respect to the run.
   5. Such marking shall be at a sufficient distance from the face of the joint to allow for a visual point of inspection after the joint is brazed.
   6. All joints constructed using this method shall be brazed.

F. Provide non-conducting dielectric connections wherever joining dissimilar metals. Dielectric unions are not allowed.

G. Install in accordance with manufacturer's instructions.

H. Install and test heating water and glycol piping to ASME B31.9 requirements.

I. Route piping in orderly manner, parallel to building structure, and maintain gradient.

J. Install piping to conserve building space and to avoid interfere with use of space.

K. Group piping whenever practical at common elevations.

L. Sleeve pipe passing through partitions, walls and floors.

M. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

N. Slope piping and arrange to drain at low points.

O. Unless otherwise indicated, install branch connections to mains using tee fittings in main pipe, with the takeoff coming off the top of the main pipe. For up-feed risers, install the takeoff coming out the top of the main pipe.

P. Provide strainers on supply side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Provide NPS 3/4 nipple and ball valve with hose end and brass cap and chain in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

Q. Anchor piping for proper direction of expansion and contraction.

R. Install automatic control valves, separable wells and taps, furnished or required by this or other contractors. Installation shall be in accordance with valve manufacturer/supplier.

S. Provide temperature and pressure test fitting (PTT) in accordance with the contract documents and as required to test and balance all equipment.
   1. Provide a pressure/temperature test fitting (PTT) at each water sensor that is an input point to the control system.

T. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 0516.
   1. Flexible couplings may be used in header piping to accommodate thermal growth, thermal contraction in lieu of expansion loops.
   2. Use flexible couplings in expansion loops.

U. Grooved Joints:
   1. Install in accordance with the manufacturer's latest published installation instructions.
   2. Gaskets to be suitable for the intended service, molded, and produced by the coupling manufacturer.
   3. Gaskets shall be molded and produced by the coupling manufacturer.
   4. The coupling manufacturer’s factory-trained representative shall provide on-site training for the contractor’s field personnel in the proper use of grooving tools and installation of grooved joint products. The representative shall periodically visit the job site to ensure best practices in grooved joint installations are being followed.
   5. Flexible type couplings can be used in locations where vibration attenuation and stress relief are required. Use three flexible couplings in lieu of a flexible connector.

V. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

W. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.
   2. Support horizontal piping as scheduled.
   3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.
   5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   8. Provide copper plated hangers and supports for copper piping.
   9. Prime coat exposed steel hangers and supports. Refer to Section 09 9123. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
   10. Steel Pipe Saddles:
      a. Provide on all heating hot water piping, operating above 200 degrees F, 3" and larger.

X. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 23 0719.

Y. Provide access where valves and fittings are not exposed.

Z. Use eccentric reducers to maintain top of pipe level.

AA. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

AB. Install valves with stems upright or horizontal, not inverted.

3.3 VALVE APPLICATIONS

A. General-Duty Valve Applications: Unless otherwise indicated, use the following valve types:
   1. Shutoff Duty: Gate, ball, and butterfly valves.
   2. Throttling Duty: Globe, ball, and butterfly valves.

B. Provide shutoff duty valves at each branch connection to supply mains, at supply connection to each piece of equipment, unless only one piece of equipment is connected in the branch line. Provide throttling duty valves at each branch connection to return mains, at return connections to each piece of equipment, and elsewhere as indicated.

C. Provide calibrated balancing valves in the return water line of each heating or cooling element and elsewhere as required to facilitate system balancing.

D. Provide check valves at each pump discharge and elsewhere as required to control flow direction.

E. Provide safety valves on hot-water generators and elsewhere as required by the ASME Boiler and Pressure Vessel Code. Provide safety-valve discharge piping, without valves, to floor. Comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, for installation requirements.

F. Provide pressure-reducing valves on hot-water generators and elsewhere as required to regulate system pressure.

G. Provide automatic cold water fill assembly on each separate hydronic system unless hydronic system contains an automatic glycol feed system.

3.4 INCIDENTAL WORK

A. The following incidental work shall be furnished by the Contractor under the supervision of the Temperature Control Contractor:
   1. The Piping Contractor shall install automatic valves and separable wells that are specified to be furnished by the Temperature Control Contractor.
   2. The Piping Contractor shall provide all necessary valved pressure taps, water, drain and overflow connections and piping.
   3. The Piping Contractor shall provide all necessary piping connections required for flow devices, valve position indicators, etc.

3.5 SAFETY VALVE INSTALLATIONS

A. Provide safety valves according to ASME B31.1. Pipe safety valve discharge without valves to floor near floor drain or over mop sink.

3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Provide manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Provide automatic air vents in mechanical equipment rooms only at high points of system piping, at heat-transfer coils, and elsewhere as required for system air venting.

C. Provide expansion tanks above air separator. Provide gage glass and cocks on end of tank. Provide tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.
   1. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, and fittings, plus weight of a full tank of water. Do not overload building components and structural members.

D. Provide centrifugal separator as indicated. Install purge assembly and pipe discharge to drain. Provide pressure gauges on inlet and outlet.

E. Check expansion tanks to determine that they are not air bound and that the system is completely full of water or glycol solution.

3.7 SNOW MELT SYSTEM

A. Food grade propylene glycol required for ground coupled systems.

B. Fill heat pump system with inhibited, FDA approved, food grade propoylene glycol/water solution to provide freeze protection to 40% by volume.

C. System shall be cleaned as required by the chemical manufacturer.

D. Dilution water shall be deionized. Coordinate with existing glycol/water solution. Do not provide dissimilar glycol/water solution.

3.8 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:
   1. Leave joints, including welds, uninsulated and exposed for examination during test.

2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush system with clean water. Clean strainers.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Provide blinds in flanged joints to isolate equipment.
5. Provide safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:
1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. Provide relief valve set at pressure no more than 1/3 higher than test pressure to protect against damage by expansion of liquid or other source of overpressure during the test.
3. While filling system, use vents installed at high points of system to release trapped air. Use drains installed at low points for complete draining of liquid.
4. Check expansion tanks to determine that they are not air bound and that system is full of water.
5. Subject piping system to a hydrostatic test pressure which, at every point in the system, is not less than 1-1/2 times the design pressure assuming 125 psi minimum design pressure. The test pressure shall not exceed the maximum pressure for any vessel, pump, valve or component on the system under the test.
6. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, "Building Services Piping."
7. After hydrostatic test pressure has been applied for at least 4 hours, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
8. Prepare written report of testing.

3.9 ADJUSTING

A. Mark calibrated nameplates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.

B. Perform these adjustments before operating the system:
1. Open valves to fully open position. Close coil bypass valves.
2. Check pump for proper direction of rotation.
3. Set automatic fill valves for required system pressure.
4. Check air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Check operation of automatic bypass valves.
7. Check and set operating temperatures of boilers, chillers, and cooling towers to design requirements.
8. Lubricate motors and bearings.

3.10 CLEANING OF PIPING

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

3.11 SCHEDULES

A. Hanger Spacing for Copper Tubing.
   1. 1/2 inch and 3/4 inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.
   2. 1 inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
   3. 1-1/2 inch and 2 inch: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   4. 2-1/2 inch: Maximum span, 9 feet; minimum rod size, 3/8 inch.
   5. 3 inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
   6. 4 inch: Maximum span, 12 feet; minimum rod size, 1/2 inch.

B. Hanger Spacing for Steel Piping.
   1. 1-1/4 inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   2. 1-1/2 inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
   3. 2 inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
   4. 2-1/2 inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
   5. 3 inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
   6. 4 inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.

END OF SECTION

SECTION 23 2114

HYDRONIC SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Expansion tanks.

B. Air vents.

C. Air separators.

D. Strainers.

E. Pressure-temperature test plugs.

1.2 REFERENCE STANDARDS

A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels.

1.3 SUBMITTALS

A. Specification Compliance Review.

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. Certificates: Inspection certificates for pressure vessels from authority having jurisdiction.

D. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

E. Project Record Documents: Record actual locations of flow controls.

F. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 DIAPHRAGM/BLADDER-TYPE EXPANSION TANKS

A. Manufacturers:
1. Amtrol Inc: www.amtrol.com.
2. ITT Bell & Gossett: www.bellgossett.com.
3. Taco, Inc: www.taco-hvac.com.
4. Armstrong Pumps, Inc.
5. Wheatley

B. Construction: Welded steel, tested and stamped in accordance with ASME (BPV VIII, 1); supplied with National Board Form U-1, rated for working pressure of 125 psi, with flexible EPDM diaphragm sealed into tank, and steel support stand.

C. Accessories: Pressure gage and air-charging fitting, tank drain; precharge to 12 psi.

D. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure back flow preventer, test cocks, strainer, vacuum breaker, and valved by-pass.

2.2 AIR VENTS

A. Manufacturers:
1. Armstrong International, Inc: www.armstronginternational.com.
2. ITT Bell & Gossett: www.bellgossett.com.
3. Taco, Inc: www.taco-hvac.com.

B. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

C. High Capacity Float Type:
1. 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. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

D. Washer Type:
1. Brass with hygroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

2.3 AIR SEPARATORS

A. Coalescing Air/Dirt Separators:
1. Manufacturers:
a. Armstrong International, Inc: www.armstronginternational.com.
b. ITT Bell & Gossett: www.bellgossett.com.
c. Spirotherm, Inc: www.spirotherm.com.
d. Taco, Inc..
2. Tank: Fabricated steel tank; tested and stamped in accordance with ASME BPVC-VIII-1; for 150 psi operating pressure and 270 degrees F maximum operating temperature; subject to the requirements of the application and the manufacturer's standard maximum operating conditions.
3. Manufactured with a removable top or bottom cover to facilitate removal, inspection, and cleaning of the coalescing devices. The entire basket shall be constructed of stainless steel.

4. The air and dirt removal device shall remove air down to 18 microns and shall remove dirt/debris down to 35 microns. The unit shall be 100% efficient at removing dirt down to 90 microns in 100 passes or less.
5. Coalescing Medium: Provide stainless steel medium filling the entire vessel to suppress turbulence and provide air elimination efficiency of 100 percent free air, 100 percent entrained air, and 99.6 percent dissolved air at the installed location.
6. Air Vent: Integral float actuated air vent at top fitting of tank rated at 150 psi, threaded to the top of the separator.
7. Conical shaped air venting chamber designed to minimize system fluid from fouling the venting assembly. The air vent shall be able to be closed to allow flushing and purging of dirt via side port without dirt passing through vent on initial system fill.
8. Inlet and Outlet Connections: Threaded for 2 NPS and smaller; Class 150 flanged connections for 2-1/2 NPS and larger.
9. Inlet and outlet connections to be inline with piping system.
10. Blowdown Connection: Threaded.
11. A blow down valve shall be provided by the unit manufacturer on the bottom of each unit to allow blow down and cleaning. On units 2 ½" and smaller the valve and all of its fittings shall be 1". On units three 3" and larger the valve and all openings shall be 2".
12. A brass flushing cock shall be located on the side of each separator to facilitate system fast-fill and removal of the floating impurities from the air system interface within the separator.
13. Size: Match system flow capacity.
14. Maximum entering velocity: 10 feet per second.
15. Maximum water pressure drop shall not exceed 7 feet TDH.

2.4 STRAINERS

A. Manufacturers:
1. Armstrong International, Inc: www.armstronginternational.com.
2. The Metraflex Company: www.metraflex.com.
3. Milwaukee Valve Company: www.milwaukeevalve.com.
4. Nexus Valve.
5. Nibco Inc.: www.nibco.com.

B. Size 2 inch and Under:
1. Class 125, screwed brass or iron body for 175 psi working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

C. Size 2-1/2 inch to 4 inch:
1. Provide Class 250, flanged or grooved iron body for 175 psi working pressure, Y pattern with 1/16 inch, or 3/64 inch stainless steel perforated screen.

2.5 PRESSURE-TEMPERATURE TEST PLUGS (PTT)

A. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F.

B. Application: Use extended length plugs to clear insulated piping.

C. Provide test kit to include thermometer, pressure gage, access fittings, and carrying case.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Where large air quantities can accumulate, provide enlarged air collection standpipes.

C. Provide manual air vents at system high points and as indicated.

D. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

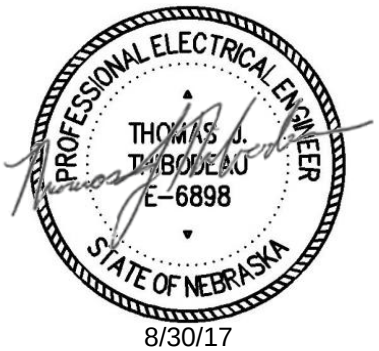
E. Provide air separator on suction side of system circulation pump and connect to expansion tank.

F. Provide valved drain and hose connection on strainer blow down connection.

G. Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks.

END OF SECTION

8/30/17



SECTION 26 0400

COMMON REQUIREMENTS FOR ELECTRICAL

8/30/17

PART 1 GENERAL

1.1 SUMMARY

A. This section describes the general requirements of these specifications and shall apply to all phases of the work specified, shown on the drawings, or required to provide for complete installation of all systems for this project.

B. This Section includes basic materials and methods to complement other Division 26 Sections.

1.2 WARRANTIES

A. Warrant materials, workmanship and equipment against defects for a period of one year after the date of substantial completion.

B. Certain equipment shall be warranted beginning at the time of final acceptance or for longer periods of time as specified in those divisions of the Project Manual.

C. Repair or replace, at no additional cost to the Authority, any item which may become defective within the warrant period.

D. Any manufacturers' warranties concerning any item installed will run to the benefit of the Authority.

E. The Contractor agrees not to void or impair, or to allow Sub-Contractors to void or impair, any warranties regarding products or items installed as part of this project.

F. The repair of faulty workmanship shall be considered to be included in the contract.

1.3 ALTERNATES

A. Alternates, if required, shall be as described in the “Alternates” section of this Project Manual, as described on the proposal form, or as indicated on the drawings.

1.4 QUESTIONS OF INTERPRETATION DURING BIDDING PHASE

A. If questions arise during the bidding process regarding the meaning of any portion of the contract documents, the prospective bidder shall submit the questions to the Architect/Engineer for clarification.

B. Any definitive interpretation or clarification of the contract documents will be published by addenda, properly issued to each person holding documents, prior to the bid date.

C. Verbal interpretation or explanation not issued in the form of an addendum shall not be considered part of the bidding documents.

D. When submitting questions for clarification, adequate time for issuance and delivery of addenda must be allowed.

E. The Architect/Engineer shall be the sole judge regarding interpretations of conflicts within contract documents.

1.5 CONTRACT DOCUMENT DISCREPANCIES

A. If any ambiguities should appear in the contract documents, request clarification from the Architect/Engineer before proceeding with the work.

B. If the Contractor fails to make such request, no excuse will thereafter be entertained for failure to carry out the work in a manner satisfactory to the Architect/Engineer.

C. Should a conflict occur within the contract documents, the Contractor is deemed to have estimated the more expensive way of doing the work unless a written clarification from the Architect/Engineer was requested and obtained before submission of proposed methods or materials.

D. The Architect/Engineer shall be the sole judge regarding interpretations of conflicts within contract documents.

1.6 DEFINITIONS

A. The following definitions shall apply throughout the contract documents:
   1. Architect/Engineer: Architect or Engineer
   2. Code: Applicable national, state and local codes
   3. Mechanical: Plumbing, HVAC, & fire protection work required by the Contract Documents
   4. Electrical: Electrical and fire alarm work required by the Contract Documents
   5. Contractor: Any Contractor performing work required by the Contract Documents
   6. Indicated: Noted, scheduled or specified
   7. Selected: Selected by the Architect/Engineer.
   8. Provide: Furnish, install, connect and tested complete and ready for use
   9. Furnish: Supply and deliver to the site ready for installation
   10. Install: Install complete, per Contract Documents and manufacturer's requirements.
   11. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
   12. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
   13. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
   14. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
   15. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.7 SYMBOLS

A. Items of equipment and materials are indicated on the drawings in accordance with the symbols on the plans.

1.8 ABBREVIATIONS

A. Refer to abbreviations list on the Drawings.

B. The following abbreviations apply throughout the Contract Documents:
   1. ADA: Americans with Disabilities Act
   2. ANSI: American National Standards Institute
   3. ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers
   4. ASME: American Society of Mechanical Engineers
   5. ASTM Specification: Standard specifications of the American Society for Testing Materials
   6. FM: Factory Mutual Engineering Corporation
   7. IRI: Industrial Risk Insurers
   8. NEC: National Electrical Code, latest edition
   9. NEMA: National Electrical Manufacturers Association
   10. NFPA: National Fire Protection Association
   11. UL or Underwriters: Underwriters Laboratories, Inc.

1.9 CODES

A. The work shall be performed by persons skilled in the trade involved and shall be done in a manner consistent with normal industry standards.

B. The work shall conform to all applicable sections of currently adopted editions of the following codes, standards, and specifications:
   1. International Building Code (IBC)
   2. International Fire Code (IFC)
   3. International Energy Conservation Code (IECC)
   4. Safety and Health Regulations for Construction
   5. Occupational Safety and Health Standards (OSHA), National Consensus Standards and Established Federal Standards
   6. National Electrical Code (NEC)
   7. National Electrical Safety Code (NESC)
   8. National Fire Protection Association (NFPA)
   9. Life Safety Code (NFPA 101)
   10. Factory Mutual Global Engineering (FMG)
   11. Underwriters' Laboratories, Inc. (UL)
   12. National Electrical Safety Code (NESC)
   13. National Electrical Manufacturers Association (NEMA)
   14. Institute of Electrical and Electronics Engineers (IEEE)
   15. Insulated Power Cable Engineers Association (IPCEA)
   16. Applicable national, state and local codes

C. Where there is a conflict between the code and the Contract Documents, the code shall have precedence only when it is more stringent than the Contract Documents.
   1. Items that are allowed by the code but are less stringent than those specified shall not be substituted.

1.10 PERMITS

A. The Contractors shall familiarize themselves with requirements regarding permits, fees, etc., and shall comply with them.

B. Permits, licenses, inspections and arrangements required for the work shall be obtained by the Contractor at his expense.

C. Utilities shall be installed in accordance with the local rules and regulations. Charges shall be paid by the Contractor.

1.11 MATERIALS AND EQUIPMENT MANUFACTURERS

A. Options in selecting materials and equipment are limited by requirements of the contract documents and governing regulations. They are not controlled by industry traditions or procedures experienced on previous construction projects.

B. Materials and equipment shall be provided in accordance with the following:
   1. Primary Design Products: Primary design products are those products around which the project was designed in terms of capacity, performance, physical size and quality.
   2. Primary design products are indicated by use of a single manufacturer's name, model number or similar data on drawings or schedules or within the specifications.
   3. Provide primary design products unless substitutions are made in accordance with the following paragraphs.
   4. Acceptable Equivalent Substitutions: Acceptable equivalent substitutions are products of manufacturers other than those listed for the primary design products. Equivalent acceptable substitutions shall meet each of the following requirements:
      a. The product shall be manufactured by one of the acceptable manufacturers listed in the Project Manual, drawings, or addenda.
      b. The product shall meet or exceed the requirements of the contract documents in terms of quality, performance, suitability, appearance, and physical characteristics.
      c. The Contractor providing the substitution shall bear the total cost of changes due to substitutions. These costs may include additional compensation to the Architect/Engineer for redesign and evaluation services, increased cost of work by the Authority or other Contractors, and similar considerations.
   5. Performance Requirements: Where the contract documents list performance requirements or describe a product or assembly generically, provide products that comply with the specific requirements indicated and that are recommended by the manufacturer for the respective application.
   6. Compliance with Standards, Codes and Regulations: Where the specifications require only compliance with an imposed standard, code or regulation, the Contractor has the option of selecting a product that complies with specification requirements, including the standards, codes and regulations.

C. Proposed substitutions will be judged on the basis of quality, performance, appearance and on the governing space limitations. The reputation of the manufacturer, delivery time requirements, and the availability of repair or replacement parts may also be considered.

D. The Architect/Engineer shall be the sole and final judge as to the suitability of substitution items.

1.12 SUBMITTALS

A. Shop Drawings, Product Data and Samples:
   1. Other sections in the Project Manual shall be adhered to if more stringent than the following paragraphs.
   2. When required by other sections of this Project Manual, submit shop drawings, product data or samples to the Architect/Engineer for review.
   3. Submittals deemed unnecessary by the Architect/Engineer shall be returned indicating “No Action Taken”.
   4. A completed copy of the transmittal form included with the Project Manual shall accompany each submittal.

5. Submittals shall be numbered consecutively.
6. Unless otherwise noted, submit one copy electronically of shop drawings and product data for review. Review comments will be returned electronically. A hard copy of the electronic submittal will be returned if requested.
7. Where samples are required, submit one (1) sample of each required item.
8. Product data are illustrations, standard schedules, performance charts, instruction brochures, diagrams and other information furnished by the Contractor, Manufacturer, Supplier, or Distributor to illustrate a material, product or system for some portion of the work.
9. Samples are physical examples furnished by the Contractor, Manufacturer, Supplier, or Distributor to illustrate materials, equipment or workmanship and to establish the standards by which the work will be performed.
10. Each submittal shall clearly indicate proposed items, capacities, characteristics and details in conformance with contract documents. Equipment items shall be marked with the same item number as used on drawings or schedules. Capacities, dimensions and special features required shall be certified by the manufacturer.
11. The Architect/Engineer shall review or take other appropriate action upon the Contractor's submittals such as shop drawings, product data and samples, but only to determine conformance with the design concept of the work and the information given in the contract documents.
12. Contractor shall not be relieved of responsibility for any deviation from the requirements of the contract documents by the Architect/Engineer's review of shop drawings, product data or samples.
13. Contractor shall not be relieved from responsibility for errors or omissions in the shop drawings, product data or samples by the Architect/Engineer's review of those drawings.
14. No portion of the work requiring submission of a shop drawing, product data or sample shall be commenced until the submittal has been reviewed by the Architect/Engineer. Such portions of the work shall be in accordance with reviewed submittals.

1.13 QUALITY ASSURANCE

A. Conform to the requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.14 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment.
1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

C. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

D. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

PART 2 PRODUCTS

2.1 PERFORMANCE, CAPACITIES AND CHARACTERISTICS

A. See Drawings for Equipment Schedules for Equipment Performance Requirements when capacities and characteristics are not indicated in the specifications.

2.2 EQUIPMENT SHORT CIRCUIT CURRENT RATING

A. Where the National Electrical Code or applicable codes require equipment to be marked with a Short Circuit Current Rating (SCCR), the equipment shall be manufactured as required such that the SCCR of the equipment meets or exceeds the available short circuit current at the equipment. Acceptable methods of complying with this requirement are as follows:

1. Provide SCCR rating at the equipment that meets or exceeds the available short circuit current at the switchboard or panelboard where the equipment circuit originates.
2. Provide calculations, based on the available short circuit current at the switchboard or panelboard where the equipment circuit originates, that document the actual short circuit current available at the equipment. The SCCR rating of the equipment shall meet or exceed this calculated value.

2.3 MATERIALS

A. Unless otherwise specified, all materials and equipment shall be new, unused and undamaged. Materials and equipment shall be the current and standard designs of manufacturers regularly engaged in their production.

2.4 MATERIALS AND EQUIPMENT FURNISHED BY OTHERS

A. Where materials and equipment are indicated as furnished by others and installed or connected under this contract, it shall be the Contractor's responsibility to verify installation details and requirements.

2.5 QUANTITY OF SPECIFIED ITEMS REQUIRED

A. Wherever in these specifications an article, device or piece of equipment is referred to in the singular number; such reference shall apply to as many such articles as are shown on the drawings or required to complete the installation.

PART 3 EXECUTION

3.1 GENERAL

A. Fabrication, erection, and installation of the complete electrical system shall be done by qualified personnel experienced in such work and shall proceed in an orderly manner so as not to hold up the progress of the project.

B. Check areas and surfaces where electrical equipment or materials are to be installed and report any unsatisfactory conditions before starting work.

C. Commencement of work signifies the Contractor's acceptance of the conditions as fit and proper for the execution of the electrical work.

D. Install equipment and systems in accordance with manufacturer's instructions, requirements, or recommendations.

E. Comply with NECA 1.

F. Unless otherwise noted, measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

G. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

H. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

I. Right of Way: Give to raceways and piping systems installed at a required slope.

J. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

3.2 DELIVERY AND STORAGE OF MATERIALS

A. Make provisions for the delivery and safe storage of materials. Make the required arrangements with other contractors for the introduction into the building of equipment too large to pass through finished openings.

B. Materials shall be delivered at such stages of the work as will expedite the work as a whole and shall be marked and stored in such a way as to be easily checked and inspected.

C. Adequately protect supplies and equipment during cold weather.

D. Protect items subject to cold weather damage by covering, insulating, or storing in a heated space.

3.3 COOPERATION WITH OTHER CONTRACTORS

A. Perform the electrical work in conformance with the construction called for by other trades and afford other contractors reasonable opportunity for the execution of their work.

B. Properly connect and coordinate the electrical work with the work of other contractors at such time and in such a manner as not to delay or interfere with their work.

C. Examine the contract documents for the General, Mechanical, and Electrical work and the work of other trades. Coordinate work accordingly.

D. Promptly report to the Architect/Engineer any delay or difficulties encountered in the installation of the electrical work which might prevent prompt and proper installation of work required from other trades.

3.4 COORDINATION OF WORK

A. Plan work so it proceeds with a minimum of interference with other trades.

B. Inform the General Contractor of all openings required in the building construction for the installation of the electrical work.

C. Cooperate with other contractors in furnishing material and information, in proper sequence, for the correct location of sleeves, inserts, foundations, wiring, etc.

D. Make provisions for special frames, openings, and sleeves as required.

E. The Electrical Contractor shall pay for extra cutting and patching made necessary by his failure to properly direct such work at the correct time.

3.5 LAYING OUT WORK

A. Carefully lay out work in advance of installation using data and measurements from the site, the appropriate architectural and structural drawings, and shop drawings.

B. Confirm code required clearances.

C. Do not infringe upon space required for operation, maintenance, or clearance for items installed by other contractors.

D. Prior to installation of any work, make certain the location does not conflict with other items in or near the same location.

E. If the layouts so prepared indicate that the required conditions cannot be met in the space provided, inform the Architect/Engineer prior to installation and request clarification.

F. Failure to properly coordinate and lay out work will require correction by the Contractor at the Contractor's expense

3.6 DATA AND MEASUREMENTS

A. Mechanical and electrical drawings are diagrammatic or schematic. Do not scale drawings.

B. The data given herein and on the drawings is as accurate as could be secured; absolute accuracy is not guaranteed.

C. Obtain exact locations, measurements, levels, etc., at the site and adapt their work to actual conditions.

D. Examine the general construction, mechanical, electrical, and other applicable drawings and the Specifications.

E. Utilize only architectural drawings, structural drawings, and site measurements in calculations.

F. Layout and coordinate work prior to installation to provide clearances for operation, maintenance and codes. Verify non-interference with other work.

G. Locate outlets and devices mounted on finished surfaces with regard to paneling, furring, trim, etc.

H. Install outlets and devices with vertical edges of plates plumb.

I. Install boxes or plaster rings such that the front edge extends to the finished surface of the wall, ceiling or floor without projecting beyond the surface.

J. Install receptacles, switches, etc., on wood trim, cases, or other fixtures symmetrically and, where necessary, install with the long dimension of the plate horizontal.

K. Coordinate locations of outlets and devices with other contractors so as not to destroy the aesthetic effect of the surface in which the outlets and devices are mounted. Coordinate the locations of electrical items with work furnished by other trades to avoid interference.

L. Heights of outlets are measured from finished floor to centerline of device.

M. Adjust heights as necessary to clear wall-mounted cabinets, fin tube convectors, unit heaters, etc.

N. Mounting heights shall be in compliance with ADA requirements.

O. Install outlets at the heights indicated below unless otherwise noted.
1. Wall switches: 46 inches.
2. Receptacle outlets (general): 18 inches.
3. Receptacle outlets (kitchen, utility room, workbenches, etc.): 46 inches.
4. Communications outlets: 18 inches.
5. Communications outlets (wall phones): 46 inches.
6. TV outlets: 18 inches.
7. Pushbuttons: 46 inches.
8. Clock outlets: 98 inches when possible Allow space below ceiling to service or replace. Above doors, center between door trim and ceiling.
9. Bells, buzzers, chimes: 8 inches below ceiling (field verify with Architect/Engineer unless noted otherwise).
10. Fire alarm station: 46 inches.
11. Fire alarm visual signals and audible/visual signals, wall-mounted: 80 inches to the bottom of the lens unless local code or ADA requirement mandates a lower mounting height.
12. Fire alarm audible signals, wall-mounted: Match height of audible/visual signals.
13. Exit lights: 4 inches between top of door frame and bottom of exit sign where possible.

P. The mounting heights of disconnect switches, circuit breakers, motor controllers, pushbutton stations and other similar devices and equipment may vary depending upon location and whether individually or group mounted.

Q. For convenience and safety, mount equipment with the center of operating levers, handles or buttons no more than 72 inches above the finished floor.

R. Locate individual devices or pieces of equipment, unless otherwise specified, so the operating handle, lever or button is located approximately 5 feet above finished floor. Coordinate heights of electrical items with work furnished by other trades to avoid interferences.

S. Improperly located devices or outlets shall be relocated by the Contractor at the Contractor’s expense including necessary patching.

3.7 PROTECTION OF APPARATUS

A. Take necessary precautions to properly protect apparatus, fixtures, appliances, material, equipment, and installations from damage.

B. Failure to provide such protection to the satisfaction of the Architect/Engineer shall be sufficient cause for the rejection of any particular piece(s) of material, apparatus, equipment, etc., concerned.

3.8 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to maintain fire-resistance rating of assembly.

3.9 WORK IN EXISTING BUILDINGS

A. Execute work in the existing building, indicated on the drawings or specified herein, with a minimum amount of interference with the normal activities of the occupants of the building.

B. Schedule work in advance with the Authority and proceed only with the Authority's written approval.

C. Utilities:
   1. Do not interrupt utilities without the Authority's prior written approval regarding the time and duration of such interruptions.

D. Fire Alarm System:
   1. As a minimum, maintain the existing degree of protection for all areas throughout construction.
   2. Coordinate required outages with the Authority and the Fire Marshal.
   3. After any additions or modifications to the fire alarm system, a re-acceptance test shall be performed by a licensed party in accordance with NFPA 72.

E. Welding:
   1. Notify the Authority before starting welding or cutting.
   2. Fire extinguishers shall be immediately accessible when welding or cutting with an open flame or arc.
   3. Stop operations involving welding or cutting with an open flame or arc not less than one hour before leaving the premises.

F. Noisy Operations:
   1. Schedule noisy operations, such as those involving use of air hammers, etc., in demolition or cutting of openings, with the Authority.

G. Occupancy:
   1. The Authority will continue to occupy the building and carry on normal activity.
   2. Protect the occupied areas from dust, smoke, etc., by a method reviewed by the Architect/Engineer.

H. Authority's Right to Direct Work: The Authority shall have the right to direct the places of beginning work, its prosecution, and the manner in which all work under this contract is to be conducted, insofar as may be necessary to secure the safe and proper progress and quality of the work.

I. Existing Conduits or Electrical Equipment:
   1. Remove or relocate, as required, or as directed by the Architect/Engineer, existing conduit or electrical equipment which would interfere with the proper installation of new work.
   2. Modify existing work in conformance with these specifications.
   3. Use the same materials as for new work unless otherwise specified.

3.10 DEMOLITION AND REMODEL

A. Protect existing electrical equipment and installations indicated to remain.

B. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

C. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.

D. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.

E. Remove demolished material from Project site.

F. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

G. Remove existing lights, receptacles, switches, etc., indicated on plans or which are not indicated but must be removed to accommodate demolition or new remodeling.

H. Where existing walls are indicated to be removed, disconnect power to electrical devices and associated appurtenances relating to the walls.

I. Maintain circuit continuity up and downstream from removed outlets.

J. Extend circuiting to up and downstream devices and reconnect as required.

K. Where existing site lighting fixtures are removed, verify the routing of existing circuits. Maintain circuit continuity between existing fixtures which remain.

L. In areas which are remodeled, replace existing wire with new wire. No existing wire is permitted to remain unless noted.

M. Existing concealed conduit and boxes may be reused.

N. Verify existing conditions in field prior to bid date.

3.11 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations.

B. Perform cutting by skilled mechanics of trades involved.

C. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces.

D. Install new fireproofing where existing firestopping has been disturbed.

E. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.12 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work. Repair as necessary.

3.13 CLEANING AND PROTECTION

A. Remove burrs, dirt, paint spots, and construction debris from electrical items.

B. Protect electrical items so that finishes are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 26 0519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single conductor building wire.

B. Wiring connectors.

C. Electrical tape.

D. Heat shrink tubing.

E. Wire pulling lubricant.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   3. Notify Architect/Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.3 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductor Material:
1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B 787M unless otherwise indicated.

H. Minimum Conductor Size:
1. Branch Circuits: 12 AWG.
2. Control Circuits: 14 AWG.

I. Conductor Color Coding:
1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
3. Color Code:
a. 480Y/277 V, 3 Phase, 4 Wire System:
1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.
4) Neutral/Grounded: Gray.
b. 208Y/120 V, 3 Phase, 4 Wire System:
1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
4) Neutral/Grounded: White.
c. Equipment Ground, All Systems: Green.
d. For control circuits, comply with manufacturer's recommended color code.

2.2 SINGLE CONDUCTOR BUILDING WIRE

A. Description: Single conductor insulated wire.

B. Conductor Stranding:
1. Feeders and Branch Circuits:
a. Size 10 AWG and Smaller: Solid.
b. Size 8 AWG and Larger: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation:
1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2.

2.3 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Wiring Connectors for Splices and Taps:
1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.

2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

C. Wiring Connectors for Terminations:
1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
2. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.

D. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

E. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

F. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

G. Mechanical Connectors: Provide bolted type or set-screw type.

H. Compression Connectors: Provide circumferential type or hex type crimp configuration.

2.4 WIRING ACCESSORIES

A. Electrical Tape:
1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as shown on the drawings.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.3 INSTALLATION

A. Circuiting Requirements:
   1. When circuit destination is indicated and routing is not shown, determine exact routing required.
   2. Arrange circuiting to minimize splices.
   3. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
   4. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
   5. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are shown as separate, combining them together in a single raceway is permitted, under the following conditions:
      a. Provide no more than 6 #12 AWG current-carrying conductors in 1/2 inch conduit; 9 #12 AWG current-carrying conductors in 3/4 inch conduit.
      b. Provide no more than 6 #10 AWG current-carrying conductors in 3/4 inch conduit; 9 #10 AWG current-carrying conductors in 1 inch conduit.
      c. Provide no more than 4 #8 AWG current-carrying conductors in 3/4 inch conduit; 6 #8 AWG current-carrying conductors in 1 inch conduit; 9 #8 AWG current-carrying conductors in 1-1/4 inch conduit.
   6. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.

C. Install conductors and cable in a neat and workmanlike manner in accordance with NECA 1.

D. Installation in Raceway:
   1. Pull all conductors and cables together into raceway at same time.
   2. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   3. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

E. Install conductors with a minimum of 6 inches of slack at each outlet.

F. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

G. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

H. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies.
   2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
   3. Do not remove conductor strands to facilitate insertion into connector.

4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

I. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
1. Dry Locations: Use insulating covers specifically designed for the connectors or heat shrink tubing.
2. Damp Locations: Use insulating covers specifically designed for the connectors or heat shrink tubing.
   a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
3. Wet Locations: Use heat shrink tubing.

J. Insulate ends of spare conductors using vinyl insulating electrical tape.

K. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

L. Identify conductors and cables in accordance with Section 26 0553.

M. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

END OF SECTION

SECTION 26 0526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Notify Architect/Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.3 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

D. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.

2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
1. Use insulated copper conductors unless otherwise indicated.

C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use mechanical connectors or compression connectors for accessible connections.
3. Manufacturers - High-Pressure Compression Connectors:
a. Burndy: www.burndy.com; Hyground System
b. Thomas & Betts: www.tnb.com.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as shown on the drawings.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install grounding and bonding system components in a neat and workmanlike manner in accordance with NECA 1.

C. Make grounding and bonding connections using specified connectors.
1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.

4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

D. Identify grounding and bonding system components in accordance with Section 26 0553.

END OF SECTION

SECTION 26 0529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify Architect/Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Do not use products for applications other than as permitted by NFPA 70 and product listing.

5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
    a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
1. Conduit Straps: One-hole or two-hole type; steel.
2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Comply with MFMA-4.
2. Channel Material:
    a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

F. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts or expansion anchors.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install support and attachment components in a neat and workmanlike manner in accordance with NECA 1.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Architect/Engineer, do not provide support from roof deck.

E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

F. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Install surface-mounted cabinets and panelboards with minimum of four anchors.

G. Secure fasteners according to manufacturer's recommended torque settings.

H. Remove temporary supports.

END OF SECTION

SECTION 26 0534

CONDUIT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flexible metal conduit (FMC).

B. Liquidtight flexible metal conduit (LFMC).

C. Electrical metallic tubing (EMT).

D. Conduit fittings.

E. Accessories.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
5. Notify Architect/Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.3 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Dry Locations:
1. Concealed: Use electrical metallic tubing.
2. Exposed: Use electrical metallic tubing.

C. Connection to Motors: Use liquid-tight flexible metal conduit, except use flexible metal conduit in air plenums.

D. Connection to Vibrating Equipment (including transformers):
   1. Indoors: Use flexible metal conduit.

2.2 CONDUIT REQUIREMENTS

A. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuits: 1/2 inch (16 mm) trade size.

D. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.3 FLEXIBLE METAL CONDUIT (FMC)

A. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel, malleable iron, or die cast zinc.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.

2.5 ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

B. Colored EMT:
   1. Manufacturer: Allied Tube and Conduit.

C. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel, malleable iron, or die cast zinc.
   3. Connectors and Couplings: Use compression (gland) or set-screw type.
      a. Do not use indenter type connectors and couplings.
   4. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.

2.6 ACCESSORIES

A. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in a neat and workmanlike manner in accordance with NECA 1.

C. Conduit Routing:
1. Unless dimensioned, conduit routing indicated is diagrammatic.
2. When conduit destination is indicated and routing is not shown, determine exact routing required.
3. Conceal all conduits unless specifically indicated to be exposed.
4. Conduits in the following areas may be exposed, unless otherwise indicated:
   a. Electrical rooms.
   b. Mechanical equipment rooms.
5. Unless otherwise approved, do not route conduits exposed:
   a. Across floors.
   b. Across roofs.
   c. Across top of parapet walls.
   d. Across building exterior surfaces.
6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
7. Arrange conduit to maintain adequate headroom, clearances, and access.
8. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
9. Maintain minimum clearance of 12 inches between conduits and hot surfaces.
10. Group parallel conduits in the same area together on a common rack.

D. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Connections and Terminations:
1. Use suitable adapters where required to transition from one type of conduit to another.

2. Provide insulated bushings on box connectors 1-inch and larger, on conduits stubbed above an accessible ceiling, and on conduits used for telecommunications pathways.
3. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

F. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
4. Install firestopping to preserve fire resistance rating of partitions and other elements.

G. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where conduits are subject to earth movement by settlement or frost.

H. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

I. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

J. Provide grounding and bonding in accordance with Section 26 0526.

K. Identify conduits in accordance with Section 26 0553.

3.3 FIELD QUALITY CONTROL

A. Correct deficiencies and replace damaged or defective conduits.

3.4 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.5 PROTECTION

A. Immediately after installation of conduit, use suitable caps to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 26 0537

BOXES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect/Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.3 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for floor boxes.

1.4 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.1 BOXES

A. General Requirements:
1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.

4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use raised covers suitable for the type of wall construction and device configuration where required.
4. Do not use "through-wall" boxes designed for access from both sides of wall.
5. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
6. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
7. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
8. Minimum Box Size, Unless Otherwise Indicated:
a. Wiring Devices: 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
3. Junction and Pull Boxes Larger Than 100 cubic inches:
a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
b. Include cable supports if any dimension of the box is greater than 48 inches.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

E. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

F. Box Locations:
   1. Locate boxes to be accessible. Provide access panels as required where approved by the Architect.
   2. Unless dimensioned, box locations indicated are approximate.
   3. Locate boxes as required for devices installed under other sections or by others.
   4. Locate boxes so that wall plates do not span different building finishes.
   5. Locate boxes so that wall plates do not cross masonry joints.
   6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
   7. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0534.
   8. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
      a. Within joists in unfinished areas with no ceiling.
      b. Electrical rooms.
      c. Mechanical equipment rooms.

G. Box Supports:
   1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.

H. Install boxes plumb and level.

I. Install boxes as required to preserve insulation integrity.

J. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

K. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified.

L. Close unused box openings.

M. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

N. Provide grounding and bonding in accordance with Section 26 0526.

O. Identify boxes in accordance with Section 26 0553.

P. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.

3.3 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

END OF SECTION

SECTION 26 0553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Identification for conductors.

1.2 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

A. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.

B. Identification for Boxes:
1. Use handwritten text using indelible marker to identify circuits enclosed.
a. For exposed boxes in public areas, provide identification on inside face of cover.

2.2 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Materials:
a. Indoor Clean, Dry Locations: Use plastic nameplates.
2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
a. Color: White text on black background.

B. Identification Labels:
1. Manufacturers:
a. Brady Corporation: www.bradyid.com.
b. Brother International Corporation: www.brother-usa.com.
c. Panduit Corp: www.panduit.com.
2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
a. Use only for indoor locations.
3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
1. Minimum Size:
a. Plastic Nameplates: 1 inch by 2.5 inches.
b. Identification Labels: 0.5 inch by 2.5 inches.

2. Legend:
    a. Equipment designation or other approved description.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
    a. Equipment Designation: 3/8 inch.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: inside of equipment door when installed in a finished location.
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Boxes: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws or self-adhesive backing and to interior surfaces using self-adhesive backing.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Mark all handwritten text, where permitted, to be neat and legible.

3.3 FIELD QUALITY CONTROL

A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 26 2717

EQUIPMENT WIRING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical connections to equipment.

1.2 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.3 COORDINATION

A. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

B. Determine connection locations and requirements.

C. Sequence rough-in of electrical connections to coordinate with installation of equipment.

D. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

C. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

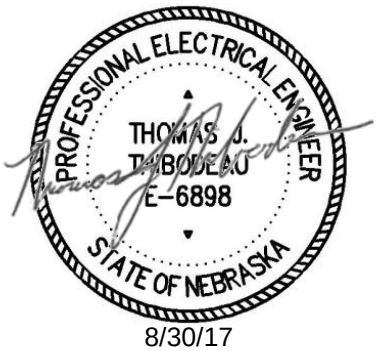
D. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

E. Provide final power and control connections for equipment furnished under other Divisions of this specification and for Authority-furnished equipment. Where not specified in mechanical sections of this specification, connect motor controls and associated mechanical equipment as required for a complete and functional control system.

F. Provide interlocks and wiring to and between controls for Authority-furnished equipment, energy management system and snow melting system.

G. Verify control wiring requirements with manufacturer certified shop drawings for each piece of equipment or control system and install accordingly. Install control wiring in conduit.

END OF SECTION



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