



**USC Lancaster Gregory Pool Water  
Heater**

**Project # H37-I316**

March 19, 2012

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Project Number: H37-I316

Project Name: USC Lancaster Gregory Pool Water Heater

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## SE-311

## Invitation for Minor Construction Quotes

**SCBO NOTES 2, 4 and 5 APPLY TO THIS INVITATION FOR QUOTES**

PROJECT NAME: USC Lancaster Gregory Pool Water Heater

PROJECT NUMBER: H37-I316 PROJECT LOCATION: Lancaster, South Carolina

BID SECURITY REQUIRED? Yes ☐ No ☒

PERFORMANCE BOND REQUIRED? Yes ☐ No ☒

PAYMENT BOND REQUIRED? Yes ☐ No ☒ CONSTRUCTION COST RANGE: \$41,000 - \$48,000

DESCRIPTION OF PROJECT:  
Redesign and install a new pool water heater. Small and minority business participation is encouraged.

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A/E NAME: Mechanical Design, Inc A/E CONTACT: Danny Wilds

ADDRESS: 4403 Broad River Road PHONE: 803-731-9834 Fax: 803-731-9837

CITY: Columbia STATE: sc ZIP: 29210 E-MAIL: danny@mdi9834.com

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PLANS ON FILE AT: AGC: \_\_\_\_\_  
DODGE: \_\_\_\_\_  
OTHER: \_\_\_\_\_

PLANS MAY BE OBTAINED FROM: http://purchasing.sc.edu - see Facilities/Construction Solicitations & Awards

PLAN DEPOSIT AMOUNT: NONE IS DEPOSIT REFUNDABLE? Yes ☐ No ☐

PRE-QUOTE CONFERENCE? ☒ Yes ☐ No MANDATORY ATTENDANCE? ☐ Yes ☒ No

DATE: 4/05/2012 TIME: 2:00 PM PLACE: 476 Hubbard Dr., Lancaster, SC, Bradley Hall, Rm. 111

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AGENCY: University of South Carolina Lancaster

NAME AND TITLE OF AGENCY COORDINATOR: Glen Jackson, Project Manager

ADDRESS: 476 Hubbard Drive PHONE: 803-313-7040 Fax: 803-313-7106

CITY: Lancaster STATE: SC ZIP: 29720 E-MAIL: gjackson@fmc.sc.edu

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IFQ CLOSING DATE: 4/12/2012 TIME: 10:00 AM LOCATION: 743 Greene St., Columbia, SC, CR57

IFQ DELIVERY ADDRESSES:

<b>HAND-DELIVERY:</b> University of South Carolina 743 Greene Street, Columbia, SC 29208 Attn: Kay Keisler	<b>MAIL SERVICE:</b> University of South Carolina 743 Greene Street, Columbia, SC 29208 Attn: Kay Keisler
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IS PROJECT WITHIN AGENCY CONSTRUCTION CERTIFICATION? (Agency MUST check one) ☒ YES ☐ NO

APPROVED BY: \_\_\_\_\_ (State Engineer) \_\_\_\_\_ (Date)

# SE-331

## Quote Form

2011 Edition

*Quotes shall be submitted only on SE-331*

QUOTE SUBMITTED BY: \_\_\_\_\_  
(Offeror's Name)

QUOTE SUBMITTED TO: \_\_\_\_\_ University of South Carolina  
(Agency Name)

FOR PROJECT: H37-I316 USC Lancaster Gregory Pool Water Heater  
(Number) (Name)

### OFFER

1. In response to the Form SE-311, *Request for Minor Construction Quotes*, and in compliance with the *Instructions to Bidders* for the above-named Project, the undersigned **OFFEROR** proposes and agrees, if this Quote is accepted, to enter into a Contract with the **AGENCY** in the form included in the Solicitation Documents, and to perform all Work as specified or indicated in the Solicitation Documents, for the prices and within the time frames indicated in the Solicitation and in accordance with the other terms and conditions stated.

2. Pursuant to Section 11-32-3030(1) of the SC Code of Laws, as amended, **OFFEROR** has submitted Bid Security as follows in the amount and form required by the Solicitation Documents:

☐ Bid Bond with Power of Attorney ☐ Electronic Bid Bond ☐ Cashier's Check  
(OFFEROR check one, if Bid Security is required)

3. **OFFEROR** acknowledges the receipt of the following Addenda to the Solicitation documents and has incorporated the effects of said Addenda into its Quote:

ADDENDUM No: \_\_\_\_\_

4. **OFFEROR** agrees that this Quote, including all bid alternates, if any, may not be revoked or withdrawn after the opening of bids, and shall remain open for acceptance for a period of 30 Days following the Quote Date, or for such longer period of time that **OFFEROR** may agree to in writing upon request of the **AGENCY**.

5. **OFFEROR** agrees that from the compensation to be paid, the **AGENCY** shall retain as Liquidated Damages the amount of for each calendar day the actual construction time required to achieve Substantial Completion exceeds the specified or adjusted Contract Time for Substantial Completion, as provided in the Contract Documents.

6. **OFFEROR** herewith submits its offer to provide all labor, materials, equipment, tools of trades and labor, accessories, appliances, warranties and guarantees, and to pay all royalties, fee, permits, licenses and applicable taxes necessary to complete the following items of construction work:

6.1 BASE BID \_\_\_\_\_  
(enter BASE BID in figures only)

6.2 ALTERNATE NO. 1 \_\_\_\_\_ N/A \_\_\_\_\_ to be ADDED/DEDUCTED from BASE BID.  
(circle one)

6.3 ALTERNATE NO. 2 \_\_\_\_\_ N/A \_\_\_\_\_ to be ADDED/DEDUCTED from BASE BID.  
(circle one)

FEIN/SSN: \_\_\_\_\_

SC Contractor's  
License Number: \_\_\_\_\_

Address: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Telephone/Fax \_\_\_\_\_

E-mail \_\_\_\_\_

This Quote is hereby submitted on behalf of the Offeror  
named above.

BY: \_\_\_\_\_  
(Signature of Offeror's Representative)

\_\_\_\_\_  
(Print or Type Name of Offeror's Representative)

ITS: \_\_\_\_\_

SE-331

USC SUPPLEMENTAL GENERAL CONDITIONS  
FOR CONSTRUCTION PROJECTS

1. Contractor's employees shall take all reasonable means not to interrupt the flow of student traffic in building corridors, lobbies and stairs. All necessary and reasonable safety precautions shall be taken to prevent injury to building occupants while transporting materials and equipment through the building to the work area. Providing safe, accessible, plywood pedestrian ways around construction may be required if a suitable alternative route is not available.
2. Fraternization between Contractor's employees and USC students, faculty or staff is strictly prohibited-zero tolerance!
3. USC will not tolerate rude, abusive or degrading behavior on the job site. Heckling and cat-calling directed toward students, faculty or staff or any other person on USC property is strictly prohibited. Any contractor whose employees violate this requirement will be assessed a fine of up to \$500 per violation.
4. Contractor's employees must adhere to the University's policy of maintaining a drug-free and smoke-free/tobacco free workplace.
5. Contractor must sign a Contractor Key Receipt/Return form before any keys are issued. Keys must be returned immediately upon the completion of the work. The Contractor will bear the cost of any re-keying necessary due to the loss of or failure to return keys.
6. A welding permit must be issued by the University Fire Marshall before any welding can begin inside a building. Project Manager will coordinate.
7. Contractor must notify the University immediately upon the discovery of suspect material such as those potentially containing asbestos or other such hazardous materials. These materials **must not** be disturbed until approved by the USC Project Manager.
8. At the beginning of the project, the USC Project Manager will establish the Contractors lay-down area. This area will also be used for the Contractors work vehicles. No personal vehicles will be allowed in this area, or in any areas surrounding the construction site that are not regular or authorized parking lots. Personal vehicles must be parked in the perimeter parking lots. Parking permits can be obtained at the USC Parking Office located in the Pendleton Street parking garage. The lay down area will be clearly identified to the contractor by the PM, with a sketch or drawing provided to Parking. In turn, the contractor will mark off this area with a sign containing the project name, PM name, Contractor name and contact number, and end date. Where this area is subject to foot traffic, protective barriers will be provided as specified by the PM. The area will be maintained in a neat and orderly fashion. Vehicles parked in the lay down area (or designated parking areas) will be clearly marked or display a CPC furnished placard for identification.

9. Contractor will be responsible for providing its own temporary toilet facilities, unless prior arrangements are made with the USC Project Manager.
10. Use of USC communications facilities (telephones, computers, etc.) by the Contractor is prohibited, unless prior arrangements are made with the USC Project Manager.
11. For all projects over \$100,000, including IDC's, an SE-395, Contractor Performance Evaluation, will be completed by the USC Project Manager and reviewed with the GC at the beginning of the project and a copy given to the GC. At the end of the project the form will be completed and a Construction Performance rating will be established.
12. Contractor is responsible for removal of all debris from the site, and is required to provide the necessary dumpsters which will be emptied at least 1 times per week. Construction waste must not be placed in University dumpsters. THE CONSTRUCTION SITE MUST BE THOROUGHLY CLEANED WITH ALL TRASH PICKED UP AND PROPERLY DISPOSED OF ON A DAILY BASIS AND THE SITE MUST BE LEFT IN A SAFE AND SANITARY CONDITION EACH DAY. THE UNIVERSITY WILL INSPECT JOB SITES REGULARLY AND WILL FINE ANY CONTRACTOR FOUND TO BE IN VIOLATION OF THIS REQUIREMENT AN AMOUNT OF UP TO \$1,000 PER VIOLATION.
13. **Contractor must provide all O&M manuals, as-built drawings, and training of USC personnel on new equipment, controls, etc. prior to Substantial Completion. Final payment will not be made until this is completed.**
14. Tree protection fencing is required to protect existing trees and other landscape features to be preserved within a construction area. The limits of this fence will be evaluated for each situation with the consultant, USC Arborist and USC Project Manager. The tree protection fence shall be 5' high chain link fence unless otherwise approved by USC Project Manager. No entry or materials storage will be allowed inside the tree protection zone. A 4" layer of mulch shall be placed over the tree protection area to maintain moisture in the root zone.
15. Where it is necessary to cross walks, tree root zones (i.e., under canopy) or lawns the following measures shall be taken: For single loads up to 9,000 lbs., a 3/4" minimum plywood base shall be placed over areas impacted. For single loads over 9,000 lbs., two layers of 3/4" plywood is required.
16. For projects requiring heavy loads to cross walks tree root zones or lawns. A construction entry road consisting of 10' X 16' oak logging mates on 12" coarse, chipped, hardwood base. Mulch and logging mats shall be supplemented throughout the project to keep matting structurally functional.
17. Any damage to existing landscaping (including lawn areas) will be remediated before final payment is made.
18. Orange safety fence to be provided by the contractor. (USC Arborist, Kevin Curtis may be contacted at 777-0033 or 315-0319)

## **Campus Vehicle Expectations**

1. All motorized vehicles on the University campus are expected to travel and park on roadways and/or in parking stalls.
2. All motorized vehicle traffic on USC walkways must first receive the Landscape Managers authorization. Violators may be subject to fines and penalties.
3. All motorized vehicles that leak or drip liquids are prohibited from traveling or parking on walks or landscaped areas.
4. Contractors, vendors, and delivery personnel are required to obtain prior parking authorization before parking in a designated space. Violators may be subject to fines and/or penalties. See Item 10 below.
5. Drivers of equipment or motor vehicles that damage university hardscape or landscape will be held personally responsible for damages and restoration expense.
6. Vehicle drivers who park on landscape or drives must be able to produce written evidence of need or emergency requiring parking on same.
7. All vehicles parked on landscape, hardscape, or in the process of service delivery, must display adequate safety devices, i.e. flashing lights, cones, signage, etc.
8. All drivers of equipment and vehicles will be respectful of University landscape, equipment, structures, fixtures and signage.
9. All incidents of property damage will be reported to Parking Services or the Work Management Center.
10. Parking on campus is restricted to spaces designated by Parking Services at the beginning of the project. Once the project manager and contractor agree on how many spaces are needed, the project manager will obtain a placard for each vehicle. This placard must be hung from the mirror of the vehicle, otherwise a ticket will be issued and these tickets cannot be "fixed". Parking spaces are restricted to work vehicles only; no personal vehicles.

Project Name: USC Lancaster Gregory Pool Water Heater

Project Number: H37-I316

University of South Carolina

**CONTRACTOR'S ONE YEAR GUARANTEE**

STATE OF \_\_\_\_\_

COUNTY OF \_\_\_\_\_

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

Defects or failures resulting from abuse by Owner.

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

\_\_\_\_\_  
[Name of Contracting Firm]

\*By \_\_\_\_\_

Title \_\_\_\_\_

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

SWORN TO before me this \_\_\_\_\_ day of \_\_\_\_\_, 2\_\_\_\_ (seal)

\_\_\_\_\_ State

My commission expires \_\_\_\_\_



SECTION 15000 - MECHANICAL, GENERAL

PART 1 - GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to the work under Division 15 the same as if incorporated herein.
- 1.2 All materials and work shall comply with the 2009 International Mechanical (IMC), 2009 International Plumbing Code (IPC), 2009 Building Codes (IBC), 2009 International Energy Code (IECC), National Electrical Code (NEC), and National Fire Protection Association (NFPA).
- 1.3 CONTRACT DOCUMENTS
  - A. Drawings for work under Division 15 indicate generally the location, arrangement and intent of the systems to be installed. They are diagrammatic and indicate reasonable arrangements.
  - B. It is not the intent of these documents to be used as installation drawings nor to include all related services or accessories to place systems in operation. They are not intended to be coordination documents for detail adaption to building construction, or for coordination with other trades. Installation of equipment shall be in strict accordance with the respective manufacturer's recommended instructions. Obtain certified drawings and installation instructions before starting work.
  - C. After thorough examination of contract documents, bring to attention of Owner prior to bid time any discrepancies, errors or omissions in Division 15. If a conflict exists, the greater quantity or better quality, in the opinion of the Engineer, governs.
  - D. It is the intent of these drawings and specifications to describe complete and working mechanical system(s) and to prescribe for the complete installation and testing of the equipment and devices specified under other sections of the specifications or on the drawings. Work under Division 15 includes all work necessary to make equipment and systems operational while following the details of the drawings and specifications as close as possible. When additional items are required to make systems operational, and are not specifically specified, then items shall be in accordance with the manufacturer's recommendations for the applicable conditions encountered.
  - E. Drawings and specifications are complimentary; work called for in either shall be provided as if called for by both.
- 1.4 Temperature and equipment control wiring are included under Division 15. All power sources, breakers, wiring, conduits, relays, contactors, and any power wiring required for the automatic temperature control system shall be provided by Division 15. All power wiring shall comply with the latest edition of the National Electric Code.
- 1.5 Motor starters or variable frequency drives shall be furnished under Division 15. Mounting and wiring of starters or variable frequency drives including wiring to equipment shall be provided by others. Disconnect switches when required shall be provided under Division 16. Combination starter/disconnect switches shall be furnished under Division 15. Provide all wiring, conduits, breakers, transformers, etc. required to power all control components requiring a power source.

1.6 SEISMIC REQUIREMENTS

- A. All HVAC materials shall comply with the 2009 International Building Code with the latest revisions for seismic requirements, see other sections in Division 15.
- B. See other sections in Division 15 for more specific specifications. Generally, the seismic requirements are covered in the sections where they apply (example: Seismic restraints for piping are in section 15310 Pipe and Pipe Accessories).
- C. Provide seismic submittals including calculations to determine restraint loads resulting from seismic forces presented in local building code or 2009 IBC. Seismic calculations shall be certified & stamped by an engineer in the employ of the seismic equipment manufacturer with a minimum 5 years experience and licensed in the project's jurisdiction. Provide calculations for all floor or roof mounted equipment, and all suspended or wall mounted equipment 20lbs or greater.
- D. Calculations and restraint device submittal drawings shall specify anchor bolt type, embedment, concrete compressive strength, minimum spacing between anchors, and minimum distances of anchors from concrete edges. Concrete anchor locations shall not be near edges, stress joints, or an existing fracture. All bolts shall be ASTM A307 or better.
- E. The isolators and seismic restraint systems listed herein are as manufactured by Amber / Booth, Mason Industries, Kinetics, or approved equal. Manufacturer must be a member of the Vibration Isolation and Seismic Control Manufacturers Association (VISCMA).
- F. Steel components shall be cleaned and painted with industrial enamel. All nuts, bolts and washers shall be zinc-electroplated. Structural steel bases shall be thoroughly cleaned of welding slag and primed with zinc-chromate or metal etching primer.
- G. All isolators, bases and seismic restraints exposed to the weather shall utilize cadmium plated, epoxy coat or PVC coated springs and hot dipped galvanized steel components. Nuts, bolts and washers may be zinc-electroplated. Isolators for outdoor mounted equipment shall provide adequate restraint for the greater of either wind loads required by local codes or withstand a minimum of 30 lb. / sq. ft. applied to any exposed surface of the equipment.
- H. Provide shop drawings indicating location of all cable restraints required for pipe and ductwork. Drawings must be stamped by manufacturer's registered professional engineer. Equipment manufacturers shall provide certification that their equipment is capable of resisting expected seismic loads without failure. Equipment manufacturers shall provide suitable attachment points and/or instructions for attaching seismic restraints.
- I. Provide acceptance letter from the manufacturer's agent prior to project closeout indicating manufacturer review of installed seismic piping restraint systems throughout project.

1.7 SITE VISIT

All bidders shall visit the site and become familiar with all existing conditions before submitting a bid. Submission of a bid will be considered as evidence that the Contractor has visited the site of work. No extra payments will be allowed the Contractor because of extra work made necessary by his failure to do so.

## 1.8 DEMOLITION ITEMS

The Owner reserves the right to keep any items called for to be removed in the construction documents. Items not kept by the Owner shall be carried away from the site of work. Coordinate with Owner on each item to be removed.

## PART 2 - PRODUCTS

### 2.1 SUBSTITUTIONS

- A. All requests for substitutions shall be submitted in writing so as to be received by the Engineer at least ten (10) calendar days prior to bid date and must be granted permission to quote before award of contract.
- B. Requests for substitution shall be submitted in the form of a letter (with one copy minimum) on letterhead of submitting firm. Letter to be addressed to the Engineer and referenced to this job.
- C. Permission to substitute items shall not be construed as authorizing any deviations from the contract documents, unless such deviations are clearly indicated in letter form. Contractor shall be responsible for verifying all dimensions with available space conditions (with provisions for proper access, maintenance, part replacement and for coordination of other trades) for proper services and construction requirements. Contractor to bear any additional costs for required changes in associated items which are directly or indirectly related to a substituted item.

### 2.2 MATERIAL AND EQUIPMENT SUBMITTALS

- A. The Engineer will review and take appropriate action on equipment submittals, product data, samples, and other submittals required by the Contract Documents. Such review shall be only for general compliance with the design and with the information given in the Contract Documents.
- B. Prior to submittal of equipment submittals to the Engineer, review and approve equipment submittals. Equipment submittals which have not been reviewed and approved in writing by the Contractor will not be reviewed by the Engineer.
- C. Submit for review by the Engineer detailed drawings of all equipment and all material listed in this section. All submittal data shall be bound in a hardback binder. Partial submittals will not be reviewed by the Engineer. Furnish six (6) copies of equipment submittals.
- D. Equipment submitted for review shall be detailed, dimensioned drawings or catalog pages showing construction, size, arrangement, operating clearances, performance characteristics and capacities.
- E. Review rendered on equipment submittals shall not be considered as a guarantee of measurements of building conditions. **Where drawings are reviewed, said review does not mean that drawings have been checked in detail; said review does not in any way relieve the contractor from his responsibility or necessity of furnishing materials or performing work as required by the contract documents.**

F. Submit equipment submittals for the materials and equipment for review by the Engineer:

- Pipe Insulation,
- Seismic submittals,
- Pipe Thermometers,
- Pressure Gauges,
- Flexible Pipe Connectors,
- Automatic Temperature Controls.

2.3 Furnish to Architect color chart, etc. as required for him to select finishes for any piece of exposed equipment, grilles and diffusers. Color charts shall be furnished with submittal data. All finishes shall be equivalent to baked enamel unless otherwise indicated.

2.4 ELECTRICAL CONNECTIONS

It shall be the sole responsibility of the Mechanical Subcontractor to verify and ensure equipment ordered for this project matches the voltage and phase per existing conditions. No extra payments will be allowed because of the contractor's failure to do so.

PART 3 - EXECUTION

3.1 Deliver to owner a complete, fully operational system. All items to be properly lubricated and operate to their full extent upon completion of the project.

3.2 Deliver to Owner any certificates, permits and licenses as required to comply with all City, County and State applicable laws, ordinances, codes, rules and regulations, including any certificates required by fire department. If any of these items are requested, such items shall be furnished prior to final inspection.

3.3 All work included in this contract shall be performed by skilled people under competent supervision employing the latest and best practices of the various trades involved. All materials and equipment hereinafter specified shall be new and free from flaws and defects of any nature. Work that is not of good quality will require removal and reinstallation.

3.4 COORDINATION

- A. No work shall be performed on this project before thoroughly coordinating all space requirements for equipment, sleeves, and pipes. Establish necessary tie-ins for each trade.
- B. Prior to starting installation, furnish to all trades concerned copies of reviewed material and equipment submittals, and location of equipment, sleeves, and pipes.
- C. The responsibility for obtaining, cutting and patching for work under Division 15 is included under this section of the specifications.
- D. Coordinate the exact size and location of all construction openings with the proper trades preparing the openings and be responsible for obtaining sizes as required. Supports for equipment shall be in accordance with the manufacturer's certified drawings.

E. Temperature and equipment control wiring are included under Division 15.

- F. Contractor shall be responsible for the protection and cleanliness of equipment installed under Division 15.
- 3.5 Notify the Architect/Engineer at least three (3) days in advance prior to covering up or concealing any work under Division 15. Any work covered or concealed without consent or review of the Architect/Engineer shall be exposed for examination at the Contractor's expense.
- 3.6 Any costs of repairing any damages caused by this contractor, to the building, building contents, and/or site during construction and warranty period shall be included in Division 15.
- 3.7 Provide all cutting and patching necessary to install the work specified in Division 15. Provide all inserts, sleeves, supports and hanger rods. Lay out work in advance and establish locations of sleeves.
- 3.8 PROJECT CLOSEOUT
  - A. Provide all initial balancing that season conditions will allow prior to final inspection.
  - B. For final inspection, all construction filters shall be replaced with new filters. All items shall be cleaned thoroughly inside and outside of all dust, dirt, plaster or other foreign material. Repainting of scratched equipment shall be completed.
  - C. Notify the Architect, Engineer and or construction manager in writing that he has complied with the above items prior to final inspection.
  - D. A mechanic shall be present at final inspection with all tools and instruments required to completely inspect and check measurements required under "Testing and Balancing." Provide a stepladder and keys for control instruments.
  - E. Contractor shall indicate in red ink on prints all changes to underground services. Submit print along with other submittals required prior to final inspection.
- 3.9 OWNER INSTRUCTION
  - A. Instruct the Owner's representative in complete detail as to proper operation of the overall system.
  - B. Provide a hard back three-ring file folder containing all warranties, catalog data and the manufacturer's standard operating and maintenance instructions for each item of the controls system.
- 3.10 WARRANTY
  - A. See General Conditions, and Supplementary Conditions Part I, for Division 15 warranty requirements.
  - B. Warrant all work and materials specified under Division 15 for a period of one (1) year from the date of project acceptance. Upon failure of any part(s) of the system during the warranty period, the affected part(s) shall be repaired or replaced promptly by and at the expense of the Contractor.
- 3.11 IDENTIFICATION

- A. Identify each piece of equipment and control component. Items shall be identified by name and numerical sequence (Chiller, etc.). Nameplates shall be 1/16" thick plates with 1/2" high white letters on black background. Nameplates shall be attached securely with screws, not glued.
- B. Provide standard bronze identification tags equal to Seton Nameplate Company for each valve to identify type of service as applicable. Bronze tags shall be attached to the valve by the use of brass S-hooks. Tag identification shall be by service and each valve shall be numbered.
- C. All new pipe shall be labeled. Markers shall comply with ANSI and OSHA specifications. All wording shall be capital letters. All wordings, colors, text size and number of occurrences shall comply with standard ANSI/OSHA specifications. All markers shall include flow direction arrows. Markers shall meet 25/50 flame and smoke spread ratings. Markers shall be designed for applicable pipe wall temperatures.

### 3.12 PAINTING

- A. Pipes in mechanical room shall be painted under Division 15. All pipes shall be color coded to match the USC color coding system. Color coding chart may be obtained from the USC Project Manager.
- B. Provide color stenciling of piping for identification of flow.
- C. Provide two coats of black rust preventative on all exposed support metal and hangers mounted in mechanical room.
- D. Paint all new equipment and materials in Division 15 (except factory-painted equipment) exposed to view. Where factory paint has been scratched on new equipment, completely sand, prime and repaint scratched areas. Paint shall be as recommended by equipment manufacturer. Pipes shall be color coded with colors selected by the Engineer. Devco, Sherwin Williams, Pittsburgh, Glidden or approved equal paints may be used.
- E. Paintings, Coatings, and Primers shall not exceed the VOC content limits established in Green Seal Standard GS-11, Paints, First Edition, May 20, 1993.

### 3.13 UTILITY INTERRUPTIONS:

Obtain Owner's approval for utility interruptions at least five (5) working days in advance of all scheduled interruptions. Contractor shall arrange work so that interruptions are minimized in number and duration.

### 3.14 RECORD DRAWINGS

- A. Maintain on the job site one complete set of drawings for this project. All changes authorized by the Owner as to locations, sizes and routing of equipment, ductwork, piping and other material shall be indicated in red ink on the drawings as work progresses.
- B. Before Substantial Completion, Contractor shall obtain a set of drawings on which he shall indicate the information outlined above. Drawings (including schedules, details, and sections) shall be corrected to depict all substituted materials and equipment. Contractor, the original drawings of the work, to be used to make the reproducible mylar drawings noted above. The final, annotated,

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USC - Lancaster

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plastic producible (mylar) drawings shall be turned over to the Owner at the time of Substantial Completion.

END OF SECTION 15000

## SECTION 15050 - TESTING AND BALANCING

### PART 1 - GENERAL

- 1.1 Section 15000 Mechanical, General applies to the work specified in this section of the specifications.

#### 1.2 SCOPE

Work under this section includes the testing, adjusting and balancing of all new chilled water modifications. The results of all tests, adjustments and balancing shall be submitted for approval.

#### 1.3 OTHER SECTIONS

Other sections of the specification are a part of this section. Refer to all other sections for a complete description of the work.

#### 1.4 TESTING AND BALANCING AGENCY

- A. All work shall be performed by an independent Test and Balance Agency. The agency shall be certified by AABC or NEBB and shall perform testing, adjusting and balancing for commercial projects as its sole source of income. All work shall be under the direct supervision of a principal of the agency who is qualified for testing and balancing the hydronic and air performance of heating, air conditioning, and ventilating systems.
- B. The Balancing Agency shall provide all labor, equipment, engineering and test equipment required to test, adjust and balance all components associated with the chilled water and condenser water modifications as specified herein.

#### 1.5 INSTRUMENTS

Instruments used shall be of high quality and as recommended by AABC or NEBB for the application. Instruments shall be properly calibrated and certified within the last six months.

- 1.6 The tests, balancing and adjusting shall be performed as many times as required to prove project requirements have been met. If requested by the Engineer, tests shall be performed in his presence.

#### 1.7 ACCURACY

The balancing firm shall warrant, solely that the system will be set to within 10% of the values as established by the drawings and specifications and also adjust to minimize drafts in all areas.

#### 1.8 CHANGES

Any changes that are required for the final balancing results as determined by the contractor shall be provided under this section of the specifications.

### PART 2 - PRODUCTS

#### 2.1 SUBMITTALS



- A. Prior to acceptance of the systems by the Owner, submit to the Design Consultant for his review, a written testing, adjusting and balancing report, in triplicate, contained in a hard-backed three ring notebook.
- B. All reports, forms and data sheets shall generally be the standards of AABC or NEBB.

### PART 3 - EXECUTION

#### 3.1 WATER BALANCING PROCEDURE

- A. Before starting water balance, check the following items:
  - 1. Cleanliness of system water
  - 2. Cleanliness of all system strainers
  - 3. Manual air vents
  - 4. Pump and motor lubrication
  - 5. Motor overload protectors or heaters for proper size
  - 6. Proper pump rotation
- B. Measure pump capacities by venturi, orifices or flow meters if installed or by differential pressure measurements, amperage and brake horsepower method using pump manufacturer's capacity curve. Position all automatic valves, hand valves and circuit setters for full flow through coils, tube bundles, etc. during pump adjustment. Use only calibrated test gauges for pump adjustment; the use of pressure gages installed within the system will not be permitted.

#### 3.2 Adjust, balance, record and submit as previously specified, for each of the following:

- 1. Hot Water Pump:
  - a. Final Water Flow rate, GPM
  - b. Wide Open Water Pressure Differential, Ft. of Water
  - c. No Flow Water Pressure Differential, Ft. of Water
  - d. Pump Off Pressure, Ft. of Water
  - e. Motor Amperage and Voltage
- 2. Hot Water Boiler:
  - a. Hot Water Flow rate, GPM
  - b. Hot Water Entering and Leaving Temperatures
  - c. Hot Water Pressure Drop, Ft. of Water
- 3. By-pass for 3-way valve at Heat Exchanger
  - a. Flow rate, GPM.

END OF SECTION 15050

## SECTION 15100 - MECHANICAL, INSULATION

### PART 1 - GENERAL

- 1.1 Section 15000 Mechanical, General applies to the work specified in this section of specifications.
- 1.2 All insulation material shall have a fire hazard classification not to exceed flame spread of 25 and smoke developed rating of 50, as listed by Underwriters Laboratories and acceptable under NFPA standards. This is to apply to the complete system and to the composite insulation with jacket or facings, vapor barrier, joint sealing tapes, mastic and fittings.
- 1.3 All insulation work shall be performed by a franchised insulation firm. The insulation firm shall perform insulation of mechanical systems as its sole source of income. All insulation shall be installed in a workmanlike manner by qualified workers in the regular employ of the insulation firm.

### PART 2 - PRODUCTS

#### 2.1 PIPE INSULATION

- A. Rigid pipe insulation shall be Foamglass pipe covering with the following minimum properties:

Absorption of moisture:	<1% per ASTM C209
Water vapor permeability:	0.005 per ASTM E96
Compressive strength:	25 psi per ASTM C165
Density:	2.0 lbs/cf per ASTM D1622
Dimensional stability:	0.8% change
Flexural strength:	64 psi per ASTM C203
Thermal conductivity:	0.29 btu-in/hr-sf-°F @ 75°F per ASTM C177

- B. Polyisocyanurate insulation meeting the above minimum properties will be accepted.
- C. Rigid pipe insulation sealer shall be Foster 60-25 or equal.
- D. Mastic shall be rubber cement, non-flammable equal to Epolux Cadoprene 725. Performance of mastic shall not be affected by room temperature.

### PART 3 - EXECUTION

#### 3.1 PIPE INSULATION

- A. New hot water pipes from boiler shall be insulated with 1-1/2" thick rigid pipe insulation. All seams shall be sealed with pipe insulation sealer. A light coat of sealer shall be applied over the entire surface of the insulation and embedded with Fab-Cloth in the sealer. This application shall be applied twice over the insulation. Surface to be smooth when complete. Provisions shall be provided for expansion, as recommended by the insulation manufacturer. Insulation shall be covered with a U.L. labeled, 8 ounce cotton canvas and two coats of Childers CP-52 lagging adhesive. Adhesive shall completely seal cloth ready for painting.
- B. Hot water pipes exposed to weather shall be covered with 2" thick rigid pipe insulation. All seams and joints shall be sealed with rigid pipe insulation sealer. A light coat of sealer shall be applied

over the entire surface of the insulation and embedded with Fab-Cloth in the sealer. This application shall be applied twice over the insulation. Surface to be smooth when complete. Insulation shall be wired on with 16 gauge Copper-Clad wire, spaced no more than 12" on center. Hot water pipes exposed to weather shall be protected with an aluminum jacket. It shall be applied with a 2" circumferential and 1-1/2" longitudinal lap and be secured with aluminum bands 3/8" wide, 8" on center. All elbows shall also be covered with a PVC jacket.

END OF SECTION 15100

## SECTION 15300 - PUMP

### PART 1 - GENERAL

- 1.1 Section 15000 Mechanical, General applies to the work specified in this section of specifications.
- 1.2 Furnish and install and inline type pumps with capacities as shown on drawings.
- 1.3 Submit pump curves to shown specification compliance for each pump.
- 1.4 All starters shall meet NEMA specifications.
- 1.5 All pumps shall be installed in strict accordance with the recommendations of the manufacturer.
- 1.6 Each unit shall be checked by the contractor and regulated for proper differential pressure, voltage and amperage draw. This data shall be noted on a permanent tag or label and fastened to the pump for owner's reference.

### PART 2 - PRODUCTS

- 2.1 Pumps shall be designed for in-line type installation in vertical or horizontal piping. Pump shall be capable of being serviced without disturbing piping connections.
- 2.2 Pump body shall be of Class 30 cast iron, rated 175 psi working pressure, with gauge ports at nozzles, and with vent and drain ports.
- 2.3 Impeller shall be non-ferrous material, enclosed type, dynamically balanced, keyed to the shaft and secured by a locking capscrew or nut.
- 2.4 The liquid cavity shall be sealed from the pump bearing by an internally-flushed mechanical seal with ceramic seal seat of at least 98% alumina oxide content, and carbon seal ring, suitable for continuous operation at 225°F.
- 2.5 A non-ferrous shaft sleeve shall completely cover the wetted area under the seal.
- 2.6 Pump bearing bracket shall have oil lubricated bronze journal and thrust bearings. Bracket shaft shall be alloy steel having ground and hardened thrust bearing faces. A flexible coupling to dampen starting torque and torsional vibrations shall be employed.
- 2.7 Each pump shall be factory tested. It shall then be thoroughly cleaned and painted with at least one coat of high-grade machinery enamel prior to shipment.
- 2.8 Pump shall be Series "60", as manufactured by Bell and Gossett or equal by Taco, Patterson or approved equal.

### PART 3 - EXECUTION

- 3.1 All pumps shall be installed in strict accordance with the recommendations of the manufacturer.

- 3.2 All in-line pumps shall be supported from hot water pipes as recommended by manufacturer's written installation instructions. Provide vibration isolation in support rods. Support rods for hot water pipes adjacent to pumps shall be 3/8" diameter, minimum.
- 3.3 The piping shall be arranged so that no weight of the piping is resting on the pump and so that no strain is placed on the pump. The pumps shall be placed in proper alignment (plus or minus 0.003" for pump face and rim) and secured to pump support before piping is connected. The pump installation, alignment and leveling in of the pump shall be performed according to the recommendations of a qualified representative of the pump manufacturer and the manufacturer's written installation instructions.
- 3.4 After mounting of pump and piping, prior to pump start-up, each pump shall be field aligned and checked by a qualified technician.
- 3.5 Provide seismic support and tie to building structure as required by the 2009 International Building Code.

END OF SECTION 15300

## SECTION 15310 - PIPE AND PIPING ACCESSORIES

### PART 1 - GENERAL

- 1.1 Section 15000 Mechanical, General applies to the work specified in this section of specifications.
- 1.2 Pipe and equipment locations shown are approximate. Exact location of equipment, pipes and chases to be as approved by Engineer and determined in field, to avoid other pipes and maintain structural clearances.
- 1.3 Piping to comply with best trade practice. Provide clearance between pipe and building structure so pipes can expand without damage to building structure.
- 1.4 Welding shall be done only by qualified welders certified by a recognized and approved local testing laboratory. Welding qualifications shall be in accordance with ANSI Standard Code for Pressure Piping. Welders shall have qualified within the past eighteen (18) months.

### PART 2 - PRODUCTS

#### 2.1 PIPING

- A. Hot water pipe 2-1/2" and larger shall be schedule 40 black steel (ASTM A53 Gr. B, ERW) with butt weld joints. Fittings shall be ASTM A234, Gr. WPB, butt weld, ERW. Flanges shall be ASTM A105, Class 150, R.F., W.N. Gaskets shall be ring type, 1/16" thick, compressed non-asbestos, Garlock Style 3000 or approved equal. Stud bolts shall be ASTM A193, Gr. B7 with heavy hex nuts, ASTM A194, Gr. 2H.
- B. Pool water pipe shall be schedule 40 compound, Type 1, Grade 1, with cell classification of 12454 as defined in ASTM D1784, trade name designation H707 PVC. The pipe shall be marked with the manufacturer's name or trademark, nominal pipe size, material designation code, pipe schedule, and pressure rating in psi for water at 73°F, and date of manufacture.
- C. Solvent cement for pool water pipe shall comply with ASTM D2564-04(2009)e1. Solvent cement shall be used in conjunction with purple primer. Solvent cement shall be applied in strict accordance with manufacturer's printed installation instructions.

#### 2.2 VALVES

Butterfly valves shall be Class 125 designed for a minimum of 125 psi working pressure. Valves shall be lug type butterfly with cast iron body. Disc edge and liner shall be designed for low friction and tight seal. Disc shall be constructed of stainless steel ASTM A-743 gr. CF-8M. Liner shall be EPDM coated. Stem shall include a reinforcing EPDM bushing for low friction and stem-load support. Stem shall be triple sealed for low leakage with blowout-proof stem design. Valves shall be Milwaukee Series M or equal by Nibco, Jenkins, Hammond, Crane, or approved equal.

#### 2.3 THERMOMETERS

Pipe thermometers shall be OMEGA type SPT11 Series Solar Powered LCD Thermometers with hi-impact ABS case, 3/8" LCD digit display, 1% accuracy, 10 Lux rating, and glass passivated thermistor

type sensor. Industrial glass shall have full conformance with Fed Spec GG-T-321D. Bimetallic shall be in full conformance with ASME B40.3 - 1990. "S" dimension shall be 6".

## 2.4 PRESSURE GAUGES

- A. Pressure gauges shall be 4-1/2" dial, flangeless cast aluminum nonferrous case with glass window and bronze bourdon tube. All gauges shall be graduated in psi and corresponding feet of water, with an accuracy of 1% at mid-scale and 1-1/2% over the balance.
- B. All water gauges shall be provided with a pressure snubber and 1/4" quarter-turn ball valve.
- C. Gauge ranges shall be selected so the normal working pressure will be at mid-scale. Gauges shall be located where shown on drawings.
- D. Gauges shall be as manufactured by Terice, Weksler or approved equal.

## 2.5 PIPE HANGERS

- A. Pipe hangers to be the product of one of the following manufacturers shown and of model number indicated in the following table:

	<u>1/2" thru 2"</u>	<u>2-1/2" and larger</u>	<u>wallplate hangers</u>
Grinnell	104	260	139
Fee & Mason	199	239	302
Elgen	92	12	---

- B. Provide oversized pipe hangers over insulated piping. Install 18 gauge galvanized, shield between hanger and insulation. Ten inch long shield to extend 180° around the bottom of the insulated pipe.
- C. Hangers in chiller room shall have spring type vibration isolator of proper size to prevent transmission of noise and vibration to building. All hanger rods in chiller room shall be cadmium plated.
- D. Location and method of support subject to Engineer's approval. Threaded rods and supplementary steel to span structural supports to accommodate hangers is included in Division 15.

## 2.6 FLEXIBLE PIPE CONNECTIONS

Flexible EPDM connectors shall be used on all equipment as indicated on the drawings. They shall be manufactured of multiple plies of friction nylon tire cord with an EPDM cover and liner. No steel wire or rings shall be used as internal pressure reinforcement. Straight connectors shall have two spheres with a centered molded-in external ductile iron ring to maintain the two spherical shapes. Two inch and smaller sizes may have threaded ends. Floating flanges shall have a recess to lock the bead wire in the raised EPDM flanges. Twin sphere connectors shall have a minimum rating of 250 psi at 170°F. and 165 psi at 250°F. Certified safety factors shall be a nominal 4 to 1 with minimum acceptable test results of 3.6 to 1. Tests shall cover burst, flange

leakage, extension without control rods and flange retention at 50% of burst pressure without control rods. Flexible pipe connections Superflex MFTFU.

### PART 3 - EXECUTION

- 3.1 Run pipes parallel to walls and ceilings, using a few fittings consistent with required flexibility. Pipe penetrations shall be perpendicular to walls. Wherever pipes change size, use eccentric fittings.
- 3.2 Provide a union or a flange in ferrous pipes at each piece of equipment, control valve, etc. and as required to service and maintain equipment.
- 3.3 Provide dielectric unions where pipe of dissimilar materials are connected.
- 3.4 Support pipes two inch size and under by hangers not over 8 feet apart. Support pipes over two inch size by hangers not more than 12 feet apart.
- 3.5 Support vertical pipes by clamps not over 12 feet apart. Protect copper pipes by lead sleeves between pipes and clamps.

#### 3.6 PIPING TESTS

- A. All piping installed shall be hydraulically tested as specified herein. Provide all equipment required to make the tests specified herein.
- B. Piping may be tested a section at a time in order to facilitate the construction.
- C. Fill the section of pipe to be tested with water and bring the section up to pressure with a test pump. These tests shall be conducted before any insulation is installed and any insulation installed prior to these tests shall be removed. Gauges used in the tests shall have been recently calibrated with a dead weight tester.
- D. All tests shall apply full test pressure to the piping for a minimum of 24 hours.
- E. All tests shall be conducted at the water working pressure of the pipe installed. When schedule 40 or standard weight pipe is used, the test pressure shall be 150 pounds per square inch.
- F. When the test pressure has fallen over 5% during the 24 hour test period, the point of leakage shall be found, repaired and the test repeated. This procedure shall be followed until the piping system has met requirements above.

#### 3.7 CHEMICAL CLEANING OF PIPES

- A. Furnish all labor and chemicals for the cleaning of pipes.
- B. Chemically clean all new piping systems with Mitco BL-5 (or equal), using 1 gallon for each 1000 gallons of system capacity to remove dirt, oil, grease, and other foreign contaminants. Drain off 25% of system water every two hours and recharge with water and Mitco BL-5. Circulate for six (6) hours or until all contaminants are removed.
- C. After cleaning, drain and flush all systems.



### 3.8 CHEMICAL TREATMENT OF WATER PIPING SYSTEMS

The hot water piping systems shall be chemically treated by a manually operated shot feeder. Provide all piping, weld-o-lets, shot feeder, chemicals, sensors, etc. required for proper water chemical treatment as required HVAC equipment supplier. Water treatment shall be subject to Owner/Engineer's approval.

### 3.9 SEISMIC RESTRAINT OF PIPING

- A. Seismically restrain all piping with cable restraints as listed below:
  - 1. Restrain all piping located in boiler rooms and mechanical rooms 1-1/4 inches nominal diameter and larger.
  - 2. Restrain all pipes 2-1/2 inches nominal diameter and larger.
- B. Piping suspended by individual hangers 12 inches or less in length, as measured from the top of the pipe to the bottom of the support where the hanger is attached, need not be restrained.
- C. Transverse restraint shall be at 40 feet maximum except where a lesser spacing is required to limit pipe stress.
- D. Longitudinal restraints shall be at 80 feet maximum. In pipes where thermal expansion is a consideration, an anchor point may be used as the specified longitudinal restraint provided that it has a capacity equal to or greater than a longitudinal restraint. The longitudinal restraints and connections must be capable of resisting the additional force induced by expansion and contraction.
- E. Transverse restraints for one pipe section may also act as longitudinal restraints for a pipe section of the same size connected perpendicular to it if the restraint is installed within 24 inches of the elbow or tee.
- F. Branch lines may not be used to restrain main lines.

END OF SECTION 15310

## SECTION 15400 - BOILER

### PART 1 - GENERAL

- 1.1 Section 15000 Mechanical, General applies to the work specified in this section of specifications.
- 1.2 The Boiler shall operate on Natural Gas.
- 1.3 The efficiency shall be up to 82%.
- 1.4 The Boiler shall be designed, certified and tested by International Approval Services. The Boiler shall meet the requirements of ANSI Standard Z21.13 and the Canadian Gas Association Standard CAN1-3.1. SCAQMD certified (sub 30 ppm Nox).
- 1.5 The Boiler shall operate on negative stack pressure and Category I according to ANSI Standards or Class I according to CGA Standards. The Boiler shall be approved for outdoor installation.

### PART 2 - PRODUCTS

#### 2.1 COMBUSTION CHAMBER:

- A. The combustion chamber shall be sealed and completely enclosed with high temperature ceramic fiberboard insulation. The burners shall be constructed of "4509 Uginox" stainless steel alloy and fire on a horizontal plane. The Boiler shall have two-speed integral combustion air blowers to precisely control the fuel/air mixture for maximum efficiency across the firing range.

#### 2.2 HEAT EXCHANGER:

- A. The heat exchanger shall be inspected and bear the A.S.M.E. Section IV seal of approval. The A.S.M.E. Section IV seal of approval will not be provided as standard for jurisdictions not requiring the A.S.M.E. Section IV seal of approval. The heat exchanger shall be a two pass design with maximum working pressure of 160 psi. The water tube shall be of straight 7/8" I.D., .064" minimum wall thickness; integral finned copper tube, 7 fins per inch, with a fin height of 3/8". The water tubes shall be set horizontally with heavy galvanized steel "V" baffles tightly secured above the tubes throughout the length of the water tubes. Each end of the water tubes shall be strength rolled onto a steel tube sheet. The headers shall be secured to the tube sheet by properly placed stud bolts, flange nuts and with the use of o'rings. Headers will be of cast iron construction. O'rings must be constructed of EPDM and Silicone, capable of withstanding temperature of 540° F. The Boiler shall have a heat exchanger drawer guide rail so that the heat exchanger may slide out for ease of service and maintenance.
- B. A pressure relief valve of 75 lb/sq. in. shall be equipped with the boiler.

#### 2.3 CONTROLS:

- A. Boiler staging will be controlled by an on-off or two-stage set point control. A relay logic board will incorporate all relay functions and purge time delays. Standard control system will be a United Technologies Controls 600A Series spark-to-pilot proven ignition with full flame monitoring capability. Hot surface ignition systems of any type will not be permitted. The control panel shall have a master switch with an indicating light and sequential and diagnostic indicator lights.

Standard controls shall include factory mounted: high limit control with manual reset, aquastat, low air and blocked flue pressure switches to monitor fan operation, inlet and outlet temperature gauges, flow switch, relief valve and 24 VAC control circuit.

**2.4 FIRING MODE: VENTING OPTIONS:**

The firing mode shall be one of the following:

1. 2-stage
2. Outdoor Venting

**2.5 GAS TRAIN:**

The gas train shall include a main ball valve, pilot valve, pilot gas pressure regulator, main gas valve, safety valve, and firing valve.

**2.6 INDUSTRY STANDARD OPTIONS:**

Industry standard options include:

1. Factory Mutual (FM).
2. CSD-1

**2.7 PAINT FINISH:**

The paint finish shall be RBI Gray Hammer Toned Finish.

**PART 3 - EXECUTION**

- 3.1 Install boiler, piping, gas train, gas vent, etc. in strict accordance with manufacturer's written installation instructions.
- 3.2 Provide seismic snubbers for the boiler bolted to existing concrete pad as required to comply with the seismic requirements of the 2009 International Building Code.
- 3.3 Pipe boiler per Boiler Piping Detail on drawings.

END OF SECTION 15400

## SECTION 15550 - AUTOMATIC TEMPERATURE CONTROLS

### PART 1 - GENERAL

- 1.1 Section 15000 Mechanical, General applies to the work specified in this section of specifications.
- 1.2 The temperature control system shall be furnished and installed by factory trained technicians. The controls shall be capable of future connection to the existing USC Lancaster Automated Logic Controls (ALC) energy management system, and as required to perform the specified control function.
- 1.3 Submittals
  - A. Shop Drawings, Product Data, and Samples
    1. The ATC contractor shall submit shop drawings with submittals for the controls of the new swimming pool water heating system.
    2. At a minimum, submit the following:
      - a. Systems schematics, sequences and flow diagrams.
      - b. Points schedule for each point in the pool heating system, including: Point Type, Object Name, Expanded ID, Display Units, Controller type, and Address.
      - c. Detailed Bill of Material list for each system or application, identifying quantities, part numbers, descriptions, and optional features.
      - d. Product data sheets or marked catalog pages including part number, photo and description for all products including software.
- 1.4 Record Documentation
  - A. Operation and Maintenance Manuals
    1. Two (2) copies of the Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact Disc media, and include the following for the BMS provided:
      - a. Table of contents.
      - b. As-built system record drawings.
      - c. Manufacturers product data sheets or catalog pages for all products including software.
      - d. System Operator's manuals.
      - e. Archive copy of all site-specific databases, field equipment controller software, and sequences.
    2. The Operation and Maintenance Manual CD shall be self-contained, and include all necessary software required to access the product data sheets. A logically organized table of contents shall provide dynamic links to view and print all product data sheets. Viewer software shall provide the ability to display, zoom, and search all documents.
- 1.5 Warranty
  - A. Standard Material and Labor Warranty:

1. Provide a one-year labor and material warranty on the control system.
  2. If within twelve (12) months from the date of acceptance of product, it is found to be defective in operation, workmanship or materials, it shall be replaced, repaired or adjusted at the option of the ATC Contractor at the cost of the ATC Contractor.
  3. Maintain an adequate supply of materials within 100 miles of the Project site such that replacement of key parts and labor support, including programming. Warranty work shall be done during BMS Contractor's normal business hours.
- 1.6 All electrical work required under this section of specifications shall comply with the latest National Electrical Code. Control system power supply shall be served by a separate breaker and fused in control center for secondary protection.
- 1.7 The power supply to control components shall be provided under this section of the specifications. Provide appropriate transformers for controllers. Provide all wiring, conduits, breakers, transformers, etc. required to power all control components requiring a power source.
- 1.8 Motor starters shall be furnished under Division 15. Mounting and wiring of starters including wiring to equipment shall be provided under Division 16. Disconnect switches when required shall be provided Division 16.

## PART 2 - PRODUCTS

- 2.1 All control wiring shall be run in Galvanized EMT. Control wiring below grade or exposed outdoors shall be run in rigid conduit. Control wiring shall be color coded #16 TFF or TFFN wire with 600 volt insulation.

### 2.2 General Description

- A. The Automatic Temperature Controls (ATC) System shall consist of the following:
1. Field Equipment Controller(s)
  2. Input/Output Module(s)
  3. Distributed User Interface(s)
  4. Other components required for a complete and working BMS
- B. The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices, while re-using existing controls equipment.
- C. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

### 2.3 DDC System Controllers

- A. Field Equipment Controller (FEC)
1. The Field Equipment Controller (FEC) shall be a fully user-programmable, digital controller with display that communicates via BACnet MS/TP protocol. The FEC shall support

- read/write and parameter adjustment from the web based User Interface through a hand held pad or laptop computer.
2. The FEC shall accommodate the direct wiring of analog and binary I/O field points.
  3. The FEC shall support the following types of inputs and outputs:
    - a. Analog Inputs (AI)
    - b. Binary Inputs (BI)
    - c. Analog Outputs (AO)
    - d. Binary Outputs (BO)
  4. The FEC shall have the ability to add future point capacity via local Input/Output Modules (IOM). Input/Output Modules that rely on the Network Supervisory Controller (NSC) for communication or programming shall not be accepted.
  5. The FEC shall have the ability to reside on a Field Controller Bus (FC Bus).
    - a. The FC Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard protocol SSPC-135, Clause 9.
    - b. The FC Bus shall support communications between the FECs and the NSC.
    - c. The FC Bus shall also support Input/Output Module (IOM) communications with the FEC and with the NSC.
    - d. The FC Bus shall support a minimum of 32 FECs in any combination.
    - e. The FC Bus shall operate at a maximum distance of 5,000 Ft. between the FEC and the furthest connected device.
  6. The FEC shall have the capability to execute complex control sequences involving direct wired I/O points as well as input and output devices communicating over the FC Bus.
  7. The FEC shall support, but not be limited to, the following:
    - a. Hot water, chilled water/central plant applications
    - b. Built-up air handling units for special applications
    - c. Terminal units
    - d. Special programs as required for systems control

## 2.4 Input Devices

- A. Installation, testing, and calibration of all sensors, transmitters, and other input devices shall be provided to meet the system requirements.
- B. Temperature sensors shall be Resistance Temperature Detector (RTD) type of 500 ohm Balco, 100 or 3000 ohm platinum.
  1. Water sensors shall be provided with a separable stainless steel well. Provide water temperature sensors in the pool water supply and return pipes to and from the heat exchanger.
- C. Current Sensing Switches
  1. The current sensing switch shall be self-powered with solid-state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, 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 over-current up to twice its trip point range.
  2. Current sensing switches shall be used for run status for fans, pumps, and other miscellaneous motor loads.

3. 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.

## 2.5 Output Devices

### A. Control Valves

1. All automatic control valves shall be fully proportioning and provide near linear heat transfer control. The valves shall be quiet in operation and fail-safe open, closed, or in their last position. All valves shall operate in sequence with another valve when required by the sequence of operations. All control valves shall be sized by the control manufacturer, and shall be guaranteed to meet the heating and cooling loads, as specified. All control valves shall be suitable for the system flow conditions and close against the differential pressures involved. Body pressure rating and connection type (sweat, screwed, or flanged) shall conform to the pipe schedule elsewhere in this Specification.
2. Water control valves shall be modulating plug, ball, and/or butterfly, as required by the specific application. Modulating water valves shall be sized per manufacturer's recommendations for the given application. In general, valves serving air handling unit coils shall be sized for a pressure drop of 3 PSI P.D. minimum, 5 PSI P.D. maximum.
3. Modulating plug water valves of the single-seat type with equal percentage flow characteristics shall be used for all chilled water applications, except those described hereinafter. The valve discs shall be composition type. Valve stems shall be stainless steel.

### B. Control Pilot 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 120VAC.
5. Relays shall have an integral indicator light and check button.

## 2.6 Miscellaneous Devices

### A. Local Control Panels

1. All control panels shall be factory constructed, incorporating the ATC manufacturer's standard designs and layouts. All control panels shall be UL inspected and listed as an assembly and carry a UL 508 label listing compliance. Control panels shall be fully enclosed, with perforated sub-panel, hinged door, and slotted flush latch.
2. In general, the control panels shall consist of the DDC controller(s), display module as specified and indicated on the plans, and I/O devices such as relays, transducers, and so forth that are not required to be located external to the control panel due to function. Where specified the display module shall be flush mounted in the panel face unless otherwise noted.
3. All I/O connections on the DDC controller shall be provide via removable or fixed screw terminals.
4. Low and line voltage wiring shall be segregated. All provided terminal strips and wiring shall be UL listed, 300-volt service and provide adequate clearance for field wiring.

5. All wiring shall be neatly installed in plastic trays or tie-wrapped.
6. A convenience 120 VAC duplex receptacle shall be provided in each enclosure, fused on/off power switch, and required transformers.

B. Power Supplies

1. DC power supplies shall be sized for the connected device load. Total rated load shall not exceed 75% of the rated capacity of the power supply.
2. Input: 120 VAC +10%, 60Hz.
3. Output: 24 VDC.
4. Line Regulation: +0.05% for 10% line change.
5. Load Regulation: +0.05% for 50% 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.

PART 3 - EXECUTION

- 3.1 Furnish to engineer four (4) copies of brochure containing control specification data sheets on all control components relating to specific project.
- 3.2 Provide all relays, contactors, wiring, conduit, transformers, and all other required control components to operate the new swimming pool heating system as specified herein.
- 3.3 Label all controllers with engraved bakelite plastic plates indicating control function and correct set point or reading. Label shall clearly relate to controller by functional name as indicated on control wiring diagram.
- 3.4 Install and wire automatic pool water temperature controller and sensors for complete operation. Temperature sensor locations are approximate, where conflicts arise with other trades, install as directed by Architect. Install thermostats 4'-6" above finished floor on flush steel boxes.

3.5 SEQUENCE OF OPERATION

A. POOL WATER HEATER

1. Pool water flow through the tubes of the heat exchanger will be manually controlled by the existing pool water flow control valve. Pool water flow rate will be monitored by the FEC.
2. When the pool water temperature (as sensed by the pool water return temperature) is below the setpoint (85°F, adjustable), hot water pump (P-7) shall start and the 3-way bypass control valve shall position to flow hot water through the shell of the heat exchanger. The status of the pump by a current sensor shall be monitored and alarmed by the operators terminal. The alarms shall be locked out for 30 seconds (adjustable) upon system start-up and de-energized during shut-down to avoid nuisance alarm. "Failure to start" and "failure to stop" alarms will be indicated at the operators terminal.
3. After the boiler flow switch makes and flow is proven, the boiler shall fire and maintain supply water temperature setpoint (180°F, adjustable) by the boiler controls.



4. During pool heating, if the pool water supply from the heat exchanger exceeds 110°F, the 3-way control valve shall modulate to maintain the 110°F setpoint to protect the PVC piping from excessive temperatures.
  5. When the pool return water temperature reaches setpoint, the boiler shall shut down and after 5 minutes the hot water pump (P-7) shall stop.
- 3.6 Furnish to engineer two copies of certifications signed by authorized representative that:
1. Control system has been checked-out and operates according to drawings, specifications, and existing operating conditions,
  2. All controls are warranted unconditionally for one year from date of acceptance and will be serviced for this period free of charge.
  3. Maintenance personnel or responsible party has been instructed as to the operation of control system.

END OF SECTION 15550