ADDENDUM #1

August 23, 2011

RE: Harrisburg Area Community College
Blocker Hall Chiller Replacement
Solicitation #RFB11-23

From: Eastern PCM, LLC
Construction Manager – HACC
645 N. 12th Street, Suite 200
Lemoyne, PA 17043

To: All Planholders

This Addendum is hereby made part of the Plans and Project Manual dated August 12, 2011 for the above referenced project. The provisions of this Addendum are intended to supplement the provisions of the Plans and Project Manual and/or supersede them where contradictory thereto.

This Addendum contains changes to the requirements of the Plans and Project Manual. Such changes shall be incorporated into the Plans and Project Manual and shall apply to work with the same meaning and force as if they had been included in the original Plans and Project Manual. Where this Addendum modifies a portion of a paragraph or phrase of the Project Manual, the remaining unmodified portion of the paragraph or phrase shall remain in force.

The conditions and terms of the Plans and Project Manual shall govern work described in this Addendum. Whenever the conditions of work, or the quality or quantity of materials or workmanship are not fully described in this Addendum, the conditions of work etc. included in the Plans and Project Manual for similar items of work shall apply to the work described in this Addendum. If no similar items of work are included in the Plans and Project Manual, the quality of material and workmanship shall be subject to the written acceptance of the Architect.

1.1 PRE-BID MEETING MINUTES

Meeting minutes from the Pre-Bid Meeting held on August 18, 2011 are attached and are a part of this Addendum. In the event of a conflict between the information contained in the Pre-Bid Meeting Notes and the Drawings, Specifications and responses to questions contained in this Addendum, the latter shall take precedence.

1.2 CHANGES TO THE PROJECT MANUAL

A. **REPLACE** the following Specification Sections in their entirety:

00010 TABLE OF CONTENTS
15181 HYDRONIC PIPING
15628 RECIPROCATING/SCROLL WATER CHILLERS

B. **ADD** the following Specification Section:

15189 HVAC WATER TREATMENT

C. Specification Section 00150 – Information for Bidders

ADD the following paragraph to Article 3: "C. Second walkthrough will be held on Thursday, August 25, 2011 from 8:00am – 9:00am."

1.3 CHANGES TO THE DRAWINGS

A. **REPLACE** the following Drawings:

E2.0 BUILDING 1 – BLOCKER HALL – PARTIAL FIRST FLOOR PLAN – NEW WORK - ELECTRICAL
M2.0 BUILDING 1 – BLOCKER HALL – PARTIAL BASEMENT FLOOR PLAN – NEW WORK - MECHANICAL
M2.1 BUILDING 1 – BLOCKER HALL – PARTIAL ROOF FLOOR PLAN – NEW WORK - MECHANICAL
M3.0 SCHEDULES – MECHANICAL
M5.0 CONTROL DIAGRAM AND SEQUENCE OF OPERATION

END OF ADDENDUM

Attachments:

Pre-Bid Meeting Minutes dated August 18, 2011
00010 TABLE OF CONTENTS
15181 HYDRONIC PIPING
15189 HVAC WATER TREATMENT
15628 RECIPROCATING/SCROLL WATER CHILLERS
E2.0 BUILDING 1 – BLOCKER HALL – PARTIAL FIRST FLOOR PLAN – NEW WORK - ELECTRICAL
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M5.0 CONTROL DIAGRAM AND SEQUENCE OF OPERATION

Please sign and return this page, via fax, to Eastern PCM, LLC at (717) 233-1666 indicating receipt of this Addendum.

HACC Blocker Chiller Replacement
SOLICITATION #RFB11-23

Addendum #_____ has been received.

Company: _____
Print Company Name

Received By: _____
Print Name Signature

Date: _____

Please check one:

_____ We are bidding as a prime contractor
_____ We are not bidding
_____ We are a sub-contractor

EASTERN PCM, LLC

Harrisburg Area Community College
Blocker Hall Chiller Replacement, RFB11-23
Harrisburg Campus

Pre-Bid Meeting

August 18, 2011
10:00 am

Meeting Minutes

Attendees

Larry Livingston – HACC
Mike Jacobs – Brinjac
Brandon Kilgore – MBR
Robert Squillace – G.R. Sponaugle
Brian Stright – Whisler Electric
Scott Searer – McClure Company
Bill Siwiec – Frey Lutz
Ken Lintelman – SSM Industries
Scott Schmittel – Johnson Controls
Greg Lamay – Eastern PCM (EPCM) (Author)

1.0 Introduction of Team

a) Owner — Harrisburg Area Community College
Joseph Wojtysiak - Campus Senior Director, Facilities (not present)
Larry Livingston – Campus HVAC Coordinator

b) Engineer — Brinjac Engineering
Michael Jacobs – Project Manager

c) Construction Manager — Eastern PCM, LLC
Greg Lamay – Senior Project Manager

1.1 EPCM reviewed the bid form and bid documents found in specification section 00410. Bidders were instructed that the following forms must be submitted with the bid: completed bid form, non-collusion affidavit, MBE/WBE utilization form and a bid bond, as the project value is greater than $10,000.

1.2 Bidders were instructed by EPCM that the project and associated bid amount must include all applicable sales taxes.

1.3 The bid date is September 1, 2011 at 2:00pm. Bids will be opened and read aloud in the HACC Purchasing Department's new location: Three Penn Center, 349 Wiconisco Street, Room 224, Harrisburg, PA 17110.

1.4 Project Schedule and Milestones:

Bids Due – September 1, 2011 at 2:00pm
Contract Award – October 4, 2011 subject to HACC Board of Trustees Approval
Notice to Proceed – October 11, 2011
Substantial Completion – January 8, 2012

1.5 Addendum #1 will be issued on or about August 22, 2011. A second addendum will be issued on or about August 30, 2011 if required. The last day for questions is August 26, 2011. All questions must be submitted in writing through EPCM's office. Only those planholders who purchased plans and specifications directly from Eastern PCM will receive addenda directly from EPCM.

1.6 This project is subject to Pennsylvania Department of Labor & Industry Prevailing Wage Rates. Project specific wage rates are listed in Specification Section 00820.

1.7 The Owner will provide the General Building Permit. The successful bidder is responsible for all trade specific permits, associated costs and inspections (i.e. electrical, plumbing) required for projects taking place in the City of Harrisburg.

1.8 All work will be performed as a single prime contract.

1.9 The project consists of replacement of the existing chillers and cooling towers that serve Blocker Hall and the Select Medical Health Education Pavilion. New chilled water pumps will be installed and existing piping will be modified to accommodate the new equipment. Maintaining, modifying and integrating the existing controls is included in the scope of this project.

Work will be performed under a Single Prime Contract including:

- General Trades
- Plumbing
- HVAC and Controls
- Electrical

1.10 Staging areas will be provided by HACC.

1.11 A designated area for Contractor parking will be established prior to the commencement of construction.

1.12 Coordination with HACC Facilities Department will be required for crane access.

Respectfully Submitted,
Greg Lamay, Eastern PCM, LLC

The above summations are the interpretation of the author as to the items discussed and the decisions reached. Corrections or additions to these minutes are to be made in writing and sent to the attention of the author no later than 5 days after receipt; otherwise, these minutes will stand as written.

cc: All Attendees

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SECTION 15181 - HYDRONIC PIPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. General provisions of the Contract Documents including General and Supplementary Conditions and Division 1 Specification Sections apply to all work in this section.

1.2 SUMMARY

A. This Section includes piping, special-duty valves, and hydronic specialties for hot-water heating, chilled-water cooling, and condenser water systems; makeup water for these systems; blowdown drain lines; and condensate drain piping.

1.3 DEFINITIONS

A. CPVC: Chlorinated polyvinyl chloride.

B. PVC: Polyvinyl chloride.

1.4 SUBMITTALS

A. Product Data: For each type of special-duty valve indicated. Include flow and pressure drop curves based on manufacturer's testing for diverting fittings, calibrated balancing valves, and automatic flow-control valves.

B. Shop Drawings: Detail fabrication of pipe anchors, hangers, special pipe support assemblies, alignment guides, expansion joints and loops, and their attachment to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

C. Welding Certificates: Copies of certificates for welding procedures and personnel.

D. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Failed test results and corrective action taken to achieve requirements.

E. Maintenance Data: For hydronic specialties and special-duty valves to include in maintenance manuals specified in Division 1.

F. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.5 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to the ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

1.6 COORDINATION

A. Coordinate layout and installation of hydronic piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Coordinate pipe sleeve installations for foundation wall penetrations.

C. Coordinate piping installation with roof curbs, equipment supports, and roof penetrations. Roof specialties are specified in Division 7 Sections.

D. Coordinate pipe fitting pressure classes with products specified in related Sections.

E. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3 Sections.

F. Coordinate installation of pipe sleeves for penetrations through exterior walls and floor assemblies. Coordinate with requirements for firestopping specified in Division 7 Section "Through-Penetration Firestop Systems" for fire and smoke wall and floor assemblies.

PART 2 PRODUCTS

2.1 MANUFACTURERS

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

1. Grooved Mechanical-Joint Fittings and Couplings:
    a. Central Sprinkler Company; Central Grooved Piping Products.
    b. Grinnell Corporation.
    c. Victaulic Company of America.
2. Calibrated Balancing Valves:
    a. Armstrong Pumps, Inc.
    b. Flow Design, Inc.
    c. Gerand Engineering Company.
    d. Griswold Controls.
    e. ITT Bell & Gossett; ITT Fluid Technology Corp.
    f. Taco, Inc.
3. Automatic Flow-Control Valves:
    a. Flow Design, Inc.
    b. Griswold Controls.

2.2 PIPING MATERIALS

A. General: Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.

2.3 STEEL PIPE AND FITTINGS

A. Steel Pipe, NPS 2-1/2 through NPS 12: ASTM A 53, Type E (electric-resistance welded), Grade B, Schedule 40, black steel, plain ends.

1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53, Schedule 40, black steel; seamless for NPS 2 and smaller and electric-resistance welded for NPS 2-1/2 and larger.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced.

F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.

2. End Connections: Butt welding.

3. Facings: Raised face.]

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

I. Spherical, Rubber, Flexible Connectors: Fiber-reinforced rubber body with steel flanges drilled to align with Classes 150 and 300 steel flanges; operating temperatures up to 250 deg F and pressures up to 150 psig.

J. Welding Materials: Comply with Section II, Part C, of the ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

K. Gasket Material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures.

L. **Grooved Mechanical-Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47, Grade 32510 malleable iron; ASTM A 53, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders designed to accept grooved end couplings.**

M. **Grooved Mechanical-Joint Couplings: Ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.**

2.4 VALVES

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

B. Refer to Part 3 "Valve Applications" Article for applications of each valve.

C. Calibrated Balancing Valves, NPS 2-1/2 and Larger: Cast-iron or steel body, ball type, 125-psig working pressure, 250 deg F maximum operating temperature, and having flanged or grooved connections. Valves shall have calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, and be equipped with a memory stop to retain set position.

D. Automatic Flow-Control Valves: Gray-iron body, factory set to maintain constant flow with plus or minus 5 percent over system pressure fluctuations, and equipped with a readout kit including flow meter, probes, hoses, flow charts, and carrying case. Each valve shall have an identification tag attached by chain, and be factory marked with the zone identification, valve number, and flow rate. Valve shall be line size and one of the following designs:

1. Gray-iron or brass body, designed for 175 psig at 200 deg F with stainless-steel piston and spring.
2. Brass or ferrous-metal body, designed for 300 psig at 250 deg F with corrosion-resistant, tamperproof, self-cleaning, piston-spring assembly easily removable for inspection or replacement.
3. Combination assemblies, including bronze ball valve and brass alloy control valve, with stainless-steel piston and spring, fitted with pressure and temperature test valves, and designed for 300 psig at 250 deg F.

2.5 HYDRONIC SPECIALTIES

A. Manual Air Vent: Bronze body and nonferrous internal parts; 150-psig working pressure; 225 deg F operating temperature; manually operated with screwdriver or thumbscrew; with NPS 1/8 discharge connection and NPS 1/2 inlet connection.

B. Automatic Air Vent: Designed to vent automatically with float principle; bronze body and nonferrous internal parts; 150-psig working pressure; 240 deg F operating temperature; with NPS 1/4 discharge connection and NPS 1/2 inlet connection.

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

D. Spherical, Rubber, Flexible Connectors: Fiber-reinforced rubber body with steel flanges drilled to align with Classes 150 and 300 steel flanges; operating temperatures up to 250 deg F and pressures up to 150 psig.

E. Packed, Slip, Expansion Joints: 150-psig minimum working pressure, steel pipe fitting consisting of telescoping body and slip-pipe sections, packing ring, packing, limit rods, flanged ends, and chrome-plated finish on slip-pipe telescoping section.

F. Y-Pattern Strainers: 125-psig working pressure; cast-iron body (ASTM A 126, Class B), flanged ends for NPS 2-1/2 and larger, threaded connections for NPS 2 and smaller, bolted cover, perforated stainless-steel basket, and bottom drain connection.

G. Basket Strainers: 125-psig working pressure; high-tensile cast-iron body (ASTM A 126, Class B), flanged-end connections, bolted cover, perforated stainless-steel basket, and bottom drain connection.

PART 3 EXECUTION

3.1 PIPING APPLICATIONS

A. Chilled Water, NPS 2-1/2 and Larger: Schedule 40 steel pipe **grooved mechanical-joint couplings**.

B. Condenser Water: Schedule 40 steel pipe with **grooved mechanical-joint couplings**.

3.2 VALVE APPLICATIONS

A. General-Duty Valve Applications: Unless otherwise indicated, use the following valve types:

1. Shutoff Duty: Ball and butterfly valves.
2. Throttling Duty: Globe, ball, and butterfly valves.

B. Install 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. Install throttling duty valves at each branch connection to return mains, at return connections to each piece of equipment, and elsewhere as indicated.

C. Install calibrated balancing valves in the return water line of each heating or cooling element and elsewhere as required to facilitate system balancing.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

3.3 PIPING INSTALLATIONS

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation requirements.

B. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

C. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

D. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

E. Install branch connection takeoffs to chilled water and heating water piping mains using 90-degree fittings in the main piping system from the top of main.

F. Anchor piping for proper direction of expansion and contraction.

3.4 HANGERS AND SUPPORTS

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

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 4: Maximum span, 14 feet; minimum rod size, 1/2 inch.
2. NPS 6: Maximum span, 17 feet; minimum rod size, 1/2 inch.
3. NPS 8: Maximum span, 19 feet; minimum rod size, 5/8 inch.

4. NPS 10: Maximum span, 20 feet; minimum rod size, 3/4 inch.

D. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for joint construction requirements for soldered and brazed joints in copper tubing; threaded, welded, and flanged joints in steel piping; and solvent-welded joints for PVC and CPVC piping.

3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install 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.

3.7 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. Install blinds in flanged joints to isolate equipment.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release trapped air. Use drains installed at low points for complete draining of liquid.
3. Check expansion tanks to determine that they are not air bound and that system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

3.8 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.

3.9 CLEANING

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

END OF SECTION 15181

SECTION 15189 - HVAC WATER TREATMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. General provisions of the Contract Documents including General and Supplementary Conditions and Division 1 Specification Sections apply to all work in this section.

1.2 SUMMARY

A. This Section includes water-treatment systems for the following:

1. Condenser water piping (open system).

1.3 CHEMICAL FEED SYSTEM DESCRIPTION

A. Open-Loop Systems Cooling Towers: Drip feeders to feed chemical.

1. Conductivity controller samples sump water when activated by pump and operates solenoid bleed-off valve in line to drain.

1.4 PERFORMANCE REQUIREMENTS

A. Maintain water quality for HVAC systems that controls corrosion and build-up of scale and biological growth for maximum efficiency of installed equipment without posing a hazard to operating personnel or the environment.

B. Base chemical treatment performance requirements on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.

1. Small, Open Systems for Humidifiers, Air Washers, Evaporative Condensers, and Cooling Towers: Maintain system essentially free of scale, total suspended solids, and fouling to sustain the following water characteristics:

a. pH: Maintain a value within 8.0 to 9.1.

b. "P" Alkalinity: Maintain a value of 100 ppm.

c. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.

d. Soluble Copper: Maintain a maximum value of 0.20 ppm.

e. TDS: Maintain a maximum value of 10 ppm.

f. Ammonia: Maintain a maximum value of 20 ppm.

g. Free “OH” Alkalinity: Maintain a maximum value of 0 ppm.

h. Microbiological Limits:

1) Total Aerobic Plate Count: Maintain a maximum value of 10,000 organisms/ml.

2) Total Anaerobic Plate Count: Maintain a maximum value of 1,000 organisms/ml.

3) Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.

4) Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.

5) Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

i. Polymer Testable: Maintain a minimum value within 10 to 40.

C. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.

PART 2 PRODUCTS

2.1 CHEMICALS

A. Furnish chemicals recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment.

B. Furnish quantity of chemicals to meet initial start-up requirements and operation for one year after system acceptance.

C. System Cleaner: Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products.

D. Biocide: Chlorine release agents or microbiocides.

E. Open-Loop Piping Chemicals Serving Cooling Towers: Sequestering agent to inhibit scaling, corrosion inhibitor, and biocide nonoxidizing.

PART 3 EXECUTION

3.1 WATER ANALYSIS

A. Perform an analysis of supply water to determine the type and quantities of chemical treatment needed to maintain the water quality as specified in "Performance Requirements" Article.

3.2 STRAT UP

A. Provide initial flush of chilled water and condensing water loops

B. Add cleaning chemicals as recommended by manufacturer.

C. Add water treatment chemicals to loop and adjust and calibrate chemical feeders to operate nominally.

END OF SECTION 15189

SECTION 15628 - RECIPROCATING/SCROLL WATER CHILLERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes modular packaged, water-cooled, electric-motor-driven, scroll water chillers.

1.3 DEFINITIONS

A. EER: Energy-efficiency ratio.

B. IPLV: Integrated part-load value.

1.4 SUBMITTALS

A. Product Data: Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Complete set of manufacturer's certified prints of water chiller assemblies, control panels, sections and elevations, and unit isolation. Include the following:

1. Assembled unit dimensions.
2. Weight and load distribution.
3. Required clearances for maintenance and operation.
4. Size and location of piping and wiring connections.
5. Vibration Isolation Calculations and Details: Signed and sealed by a qualified professional engineer.
    a. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
    b. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails and equipment mounting frames.
6. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Floor plans drawn to scale and coordinated with the following:

1. Structural supports.
2. Piping roughing-in requirements.
3. Wiring roughing-in requirements, including spaces reserved for electrical equipment.
4. Access requirements, including working clearances for mechanical controls and electrical equipment, and tube pull and service clearances.

D. Certificates: For certification required in "Quality Assurance" Article.

E. Source quality-control test reports.

F. Startup service reports.

G. Operation and Maintenance Data: For each water chiller to include in emergency, operation, and maintenance manuals.

H. Warranties: Special warranties specified in this Section.

1.5 **QUALITY ASSURANCE**

A. ASHRAE Certification: Signed by manufacturer certifying compliance with ASHRAE 15 for safety code for mechanical refrigeration. Comply with ASHRAE Guideline 3 for refrigerant leaks, recovery, and handling and storage requirements.

B. Comply with NFPA 70.

C. Comply with UL 1995.

D. Comply with UL 465.

1.6 **DELIVERY, STORAGE, AND HANDLING**

A. Ship water chillers from the factory fully charged with refrigerant or nitrogen.

1.7 **COORDINATION**

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

1.8 **WARRANTY**

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water chillers that fail in materials or workmanship.

PART 2 PRODUCTS

2.1 **MANUFACTURERS**

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

1. Scroll Water Chillers:

a. Multistack, Inc. (Basis of Design)

b. Tandem Chillers, Inc.

2.2 **MODULAR PACKAGED WATER CHILLERS**

A. Description: Chiller shall incorporate Scroll-type compressors and consist of multiple 50 and 70 ton refrigerant circuits. Each circuit shall consist of an individual compressor, condenser, evaporator, thermal expansion valve and control system. Each circuit shall be constructed to be independent of other circuits from a refrigeration and electrical stand-point. The modular chiller system shall be able to produce chilled water even in the event of a failure of one or more refrigerant circuits.

1. Casing: Factory-painted finish.

2.3 **SCROLL COMPRESSORS**

A. Description: Positive displacement, direct drive with suction and discharge service valves, crankcase oil heater, and suction strainer. The compressor shall be capable of operating at part-load conditions without increased vibration over normal vibration at full-load operation and shall be capable of continuous operation at its lowest step of unloading.

B. Refrigerant and Oil: HFC-410a.

C. Refrigerant Compatibility: Seals, O-rings, motor windings**,** and internal water chiller parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.

D. Refrigerant Circuit: Each module shall have two separate independent circuits. Each circuit shall include an thermal expansion valve, refrigerant charging connections, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core filter drier, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.

2.4 HEAT EXCHANGERS

A. Evaporator:

1. Description: Brazed plate.
2. Brazed Plate Material: 316 stainless steel.

B. Condenser:

1. Description: Brazed plate.
2. Brazed Plate Material: 316 stainless steel.

C. Isolation valves shall be installed between the heat exchangers and the water supply mains for the heat exchanger isolation and removal without the requirement to shut down the entire chiller allowing for total access to all serviceable components.

D. Each inlet water header connection shall incorporate a built in 30-mesh (minimum) in-line strainer system to prevent heat exchanger fouling and accommodate 100% flow filtration with a minimum surface area of 475 sq inches per module. Condenser-side strainer system shall incorporate an automatic debris blow down system for self-cleaning of the strainer system that is controlled and powered by the chiller.

2.5 INSULATION

A. Cold Surfaces: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type II, for sheet materials.

1. Thickness: 3/4 inches.
2. Adhesive: As recommended by insulation manufacturer.
3. Factory apply insulation over entire surfaces of water chiller components.
   a. Apply adhesive to 100 percent of insulation contact surface.
   b. Seal seams and joints.
   c. After adhesive has fully cured, apply two coats of protective coating to insulation.

2.6 ACCESSORIES

A. Low-ambient head pressure.

B. Chilled and condenser-water flow switch.

2.7 CONTROLS

A. Control Panel: Stand-alone, microprocessor based**.**

B. Enclosure: Unit-mounted, NEMA 250, Type 1 enclosure, hinged or lockable; factory wired with a single-point power connection and a separate control circuit.

C. **BACnet interface card points**: **The following points, at a minimum, shall be read points through the building automation system:**

1. **Entering and leaving chilled water temperature.**
2. **Entering and leaving condenser water temperature.**
3. **Module circuit 1 leaving chilled water temperature.**
4. **Module circuit 2 leaving chilled water temperature.**
5. **Chiller on/off status**
6. **Chilled water flow status.**
7. **Condenser water flow status.**
8. **Phase input monitoring.**
9. **Global alarm status.**
10. **Module compressor 1 on/off status.**
11. **Module compressor 2 on/off status.**
12. **Percentage of compressors on compared to total number of compressors that can run.**
13. **Percentage of current load needed compared to maximum design load.**
14. **Time difference counter.**
15. **System on/off counter.**
16. **Load limit.**
17. **Lead compressor.**
18. **Number of compressors in chiller bank.**
19. **Hour, minute, month, day, year.**
20. **Total operating hours.**
21. **Total number of running hours for module compressor 1.**
22. **Total number of running hours for module compressor 1.**

D. **BACnet interface card points**: **The following points, at a minimum, shall be read/write points through the building automation system:**

1. **Upper entering chilled water set point.**
2. **Lower entering chilled water set point.**
3. **Chiller on/off control.**
4. **Compressor delay function.**
5. **Amount of compressors that are available at any time.**

E. **BACnet interface card points**: **The following points, at a minimum, shall be fault points through the building automation system:**

1. **Low chilled water flow.**
2. **Low condenser water flow.**

3. **Global fault.**

F. Control Functions:

1. Manual or automatic startup and shutdown time schedule.
2. Entering and leaving chilled-water temperature, control set points, and motor load limit. Chilled-water temperature shall be reset based on return-water temperature.
3. Current limit and demand limit.
4. Condenser-water temperature (for water-cooled water chillers only).
5. External water chiller emergency stop.
6. Antirecycling timer.
7. Automatic lead-lag switching.

G. Manually Reset Safety Controls: The following conditions shall shut down water chiller and require manual reset:

1. Low evaporator pressure or high condenser pressure.
2. Low chilled-water temperature.
3. Refrigerant high pressure.
4. High or low oil pressure.
5. High oil temperature.
6. Loss of chilled-water flow.
7. Loss of condenser-water flow (for water-cooled water chillers only)
8. Control device failure.
9. Compressor motor current-overload.
10. Starter fault.

H. Building Management System Interface: Factory-installed hardware and software to enable building management system to monitor and control chilled-water set point and chiller-control displays, **points** and alarms. Shall connect to Johnson Control Metasys System **via BACnet interface card.**

2.8 SINGLE POINT POWER

1. Chiller shall be equipped with a pre-engineered genuine buss bar electrical system for single point power. Where the equipment size exceeds the amp rating of the buss bar, multiple power connections may be applied. Pre-engineered system shall also incorporate individual module isolation circuit breakers for full redundancy and ability of a module to be take off-line for repair while the rest of the modules continue to operate. Individual power feeds to each module shall be unacceptable.

2.9 SOURCE QUALITY CONTROL

A. Factory test and rate water chillers, before shipping, according to ARI 550/590, "Water Chilling Packages Using the Water Compression Cycle." Stamp with ARI label.

B. Rate sound power level according to ARI 575 procedure.

C. Rate sound power level according to ARI 370 procedure.

PART 3 EXECUTION

3.1 EXAMINATION

A. Before water chiller installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, piping, and electrical to verify actual locations, sizes, and other conditions affecting water chiller performance, maintenance, and operations.

1. Final water chiller locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 WATER CHILLER INSTALLATION

A. Install water chillers on concrete base. Concrete base is specified in Division 15 Section "Basic Mechanical Materials and Methods," and concrete materials and installation requirements are specified in Division 3.

B. Concrete Bases: Anchor chiller mounting frame to concrete base.

1. 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 concrete base.

2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install anchor bolts to elevations required for proper attachment to supported equipment.

5. Cast-in-place concrete materials and placement requirements are specified in Division 3.

C. Vibration Isolation: Rubber pads with a minimum deflection of [**0.25 inch**] <**Insert deflection**>. Vibration isolation devices and installation requirements are specified in Division 15 Section "Mechanical Vibration and Seismic Controls."

D. Maintain manufacturer's recommended clearances for service and maintenance.

E. Charge water chiller with refrigerant if not factory charged.

F. Install separate devices furnished by manufacturer.

3.3 CONNECTIONS

A. Chilled and condenser-water piping installation requirements are specified in Division 15 Section "Hydronic Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to chiller to allow service and maintenance.

C. Evaporator Connections: Connect inlet to evaporator with controller-bulb well, shutoff valve, thermometer, strainer, pressure gage, and union or flange. Connect outlet to evaporator with shutoff valve, flow switch, balancing valve, thermometer, pressure gage, and union or flange.

D. Condenser Connections: Connect inlet to condenser with shutoff valve, thermometer, plugged tee, and pressure gage. Connect outlet to condenser with shutoff valve, thermometer, drain line and shutoff valve, strainer, and plugged tee.

E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 STARTUP SERVICE

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

B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.

C. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

1. Verify that refrigerant charge is sufficient and water chiller has been leak tested.
2. Verify that pumps are installed and functional.
3. Verify that thermometers and gages are installed.
4. Operate water chiller for run-in period according to manufacturer's written instructions.
5. Check bearing lubrication and oil levels.
6. Verify that refrigerant pressure relief is vented outside (for water-cooled water chillers).
7. Verify proper motor rotation.
8. Verify static deflection of vibration isolators, including deflection during water chiller startup and shutdown.
9. Verify and record performance of chilled- and condenser-water flow and low-temperature interlocks.
10. Verify and record performance of water chiller protection devices.
11. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

D. Prepare a written startup report that records results of tests and inspections.

E. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water chillers. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION 15628