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Addendum

PROJECT:

Sioux Falls VA Health Care System
Primary Care
Sioux Falls, South Dakota

ADDENDUM NO. 02

DATE ISSUED: June 11, 2014

BIDS DUE: June 17, 2014

VA PROJECT NUMBER: VA263-p-1038
TSP PROJECT NUMBER: 04121121

PROPOSAL NOTICE:

The following changes or modifications are to be incorporated into and become a part of the Contract Documents. The Bidder shall note receipt and make acknowledgement of this Addendum on the Bid Proposal, incorporating these provisions in the bid.

GENERAL: N/A

PRODUCT APPROVALS: N/A

The following manufacturers and products have been approved for bidding. Final acceptance is contingent upon receipt and approval of final shop drawings/submittals. Manufacturers shall conform to all warranties, performances, sizes, materials, etc. as the item specified. The burden of proof of the merit of the proposed substitution is upon the proposer.

PROJECT MANUAL:

ITEM NO. 1: Reference Specification Section 23 23 00, Refrigerant Piping:

Add new specification section to the set.

ITEM NO. 2: Reference Specification Section 23 64 00, Packaged Water Chillers:

Add new specification section to the set.

DRAWINGS: N/A

The following drawings require changes in construction, which are not reflected on same. The Bidder agrees to comply with these changes and mark each drawing as noted:

ATTACHMENTS:

- Specification Section 23 23 00
- Specification Section 23 64 00

END OF ADDENDUM

SECTION 23 23 00
REFRIGERANT PIPING

PART 1 - GENERAL

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

1.2 DESCRIPTION
A. Field refrigerant piping for direct expansion HVAC systems.
B. Refrigerant piping shall be sized, selected, and designed either by the equipment manufacturer or in strict accordance with the manufacturer's published instructions. The schematic piping diagram shall show all accessories such as, stop valves, level indicators, liquid receivers, oil separator, gauges, thermostatic expansion valves, solenoid valves, moisture separators and driers to make a complete installation.
C. Definitions:
1. Refrigerating system: Combination of interconnected refrigerant containing parts constituting one closed refrigeration circuit in which a refrigerant is circulated for the purpose of extracting heat.
a. Low side means the parts of a refrigerating system subjected to evaporator pressure.
b. High side means the parts of a refrigerating system subjected to condenser pressure.
2. Brazed joint: A gas tight joint obtained by the joining of metal parts with alloys which melt at temperatures higher than 449 degrees C (840 degrees F) but less than the melting temperatures of the joined parts.

1.3 RELATED WORK
A. Section 23 05 11 - Common Work Results for HVAC and Steam Generation: General mechanical requirements and items, which are common to more than one section of Division 23.
B. Section 23 07 11 - HVAC, Plumbing, and Boiler Plant Insulation: Requirements for piping insulation.
C. Section 23 21 13 - Hydronic Piping: Requirements for water and drain piping and valves.
D. Section 23 64 00 - Packaged Water Chillers: Piping requirements for air cooled chillers and condensing units.

1.4 QUALITY ASSURANCE
A. Refer to specification Section 23 05 11 - Common Work Results for HVAC and Steam Generation.
B. Comply with ASHRAE Standard 15, Safety Code for Mechanical Refrigeration. The application of this Code is intended to assure the safe design, construction, installation, operation, and inspection of every refrigerating system employing a fluid which normally is vaporized and liquefied in its refrigerating cycle.

C. Comply with ASME B31.5: Refrigerant Piping and Heat Transfer Components.
D. Products shall comply with UL 207 "Refrigerant–Containing Components and Accessories, "Nonelectrical"; or UL 429 "Electrical Operated Valves."

1.5 SUBMITTALS
A. Submit in accordance with specification Section 01 33 23 - Shop Drawings, Product Data, and Samples.
B. Shop Drawings:
1. Complete information for components noted, including valves and refrigerant piping accessories, clearly presented, shall be included to determine compliance with drawings and specifications for components noted below:
a. Tubing and fittings
b. Valves
c. Strainers
d. Moisture liquid indicators
e. Filter driers
f. Flexible metal hose
g. Liquid suction interchanges
h. Oil separators (when specified)
i. Gages
j. Pipe and equipment supports
k. Refrigerant and oil
l. Pipe/conduit roof penetration cover
m. Soldering and brazing materials
2. Layout of refrigerant piping and accessories, including flow capacities, valves locations, and oil traps slopes of horizontal runs, floor/wall penetrations, and equipment connection details.
C. Certification: Copies of certificates for welding procedure, performance qualification record and list of welders' names and symbols.
D. Design Manual: Furnish two copies of design manual of refrigerant valves and accessories.

1.6 APPLICABLE PUBLICATIONS
A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
B. Air Conditioning, Heating, and Refrigeration Institute (ARI/AHRI):
1. 495-1999 (R2002)Standard for Refrigerant Liquid Receivers
2. 730-2005 Flow Capacity Rating of Suction-Line Filters and Suction-Line Filter-Driers
3. 750-2007 Thermostatic Refrigerant Expansion Valves
4. 760 2007 Performance Rating of Solenoid Valves for Use with Volatile Refrigerants
C. American Society of Heating Refrigerating and Air Conditioning Engineers (ASHRAE):
1. ANSI/ASHRAE 15 2007 Safety Standard for Refrigeration Systems (ANSI)
2. ANSI/ASHRAE 17 2008 Method of Testing Capacity of Thermostatic Refrigerant Expansion Valves (ANSI)

3. 63.1-95 (RA 01) Method of Testing Liquid Line Refrigerant Driers (ANSI)

D. American National Standards Institute (ANSI):
1. ASME (ANSI)A13.1-2007 Scheme for Identification of Piping Systems
2. Z535.1-2006 Safety Color Code

E. American Society of Mechanical Engineers (ASME):
1. ANSI/ASME B16.22 2001 (R2005)
2. Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings (ANSI)
3. ANSI/ASME B16.24 2006 Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500 (ANSI)
4. ANSI/ASME B31.5-2006 Refrigeration Piping and Heat Transfer Components (ANSI)
5. ANSI/ASME B40.100-2005 Pressure Gauges and Gauge Attachments
6. ANSI/ASME B40.200-2008 Thermometers, Direct Reading and Remote Reading

F. American Society for Testing and Materials (ASTM)
1. A126-04 Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe FittingsB32 08 Standard Specification for Solder Metal
2. B88 03 Standard Specification for Seamless Copper Water Tube
3. B88M-05 Standard Specification for Seamless Copper Water Tube (Metric)
4. B280 08 Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service

G. American Welding Society, Inc. (AWS):
1. Brazing Handbook
2. A5.8/A5.8M 04 Standard Specification for Filler Metals for Brazing and Braze Welding

H. Federal Specifications (Fed. Spec.)
1. Fed. Spec. GG

I. Underwriters Laboratories (U.L.):
1. U.L.207-2009 Standard for Refrigerant-Containing Components and Accessories, Nonelectrical
2. U.L.429-99 (Rev.2006) Standard for Electrically Operated Valves

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

A. Refrigerant Piping: For piping up to 100 mm (4 inch) use Copper refrigerant tube, ASTM B280, cleaned, dehydrated and sealed, marked ACR on hard temper straight lengths. Coils shall be tagged ASTM B280 by the manufacturer. For piping over 100 mm (4 inch) use A53 Black SML steel.

B. Water and Drain Piping: Copper water tube, ASTM B88M, Type B or C (ASTM B88, Type M or L). Optional drain piping material: Schedule 80 flame retardant Polypropylene plastic.

C. Fittings, Valves and Accessories:
1. Copper fittings: Wrought copper fittings, ASME B16.22.
a. Brazed Joints, refrigerant tubing: Cadmium free, AWS A5.8/A5.8M, 45 percent silver brazing alloy, Class BAg-5.

b. Solder Joints, water and drain: 95 5 tin antimony, ASTM B32 (95TA).

2. Steel fittings: ASTM wrought steel fittings.
   a. Refrigerant piping – Welded Joints.
3. Flanges and flanged fittings: ASME B16.24.
4. Refrigeration Valves:
   a. Stop Valves: Brass or bronze alloy, packless, or packed type with gas tight cap, frost proof, back seating.
   b. Pressure Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; UL listed. Forged brass with nonferrous, corrosion resistant internal working parts of high strength, cast iron bodies conforming to ASTM A126, Grade B. Set valves in accordance with ASHRAE Standard 15.
   c. Solenoid Valves: Comply with ARI 760 and UL 429, UL-listed, two-position, direct acting or pilot-operated, moisture and vapor proof type of corrosion resisting materials, designed for intended service, and solder-end connections. Fitted with suitable NEMA 250 enclosure of type required by location and normally // open // closed // holding coil.
   d. Thermostatic Expansion Valves: Comply with ARI 750. Brass body with stainless-steel or non-corrosive nonferrous internal parts, diaphragm and spring-loaded (direct-operated) type with sensing bulb and distributor having side connection for hot-gas bypass and external equalizer. Size and operating characteristics as recommended by manufacturer of evaporator and factory set for superheat requirements. Solder-end connections. Testing and rating in accordance with ASHRAE Standard 17.
   e. Check Valves: Brass or bronze alloy with swing or lift type, with tight closing resilient seals for silent operation; designed for low pressure drop, and with solder-end connections. Direction of flow shall be legibly and permanently indicated on the valve body.
5. Strainers: Designed to permit removing screen without removing strainer from piping system, and provided with screens 80 to 100 mesh in liquid lines DN 25 (NPS 1) and smaller, 60 mesh in liquid lines larger than DN 25 (NPS 1), and 40 mesh in suction lines. Provide strainers in liquid line serving each thermostatic expansion valve, and in suction line serving each refrigerant compressor not equipped with integral strainer.
6. Refrigerant Moisture/Liquid Indicators: Double ported type having heavy sight glasses sealed into forged bronze body and incorporating means of indicating refrigerant charge and moisture indication. Provide screwed brass seal caps.
7. Refrigerant Filter Dryers: UL listed, angle or in line type, as shown on drawings. Conform to ARI Standard 730 and ASHRAE Standard 63.1. Heavy gage steel shell protected with corrosion-resistant paint; perforated baffle plates to prevent desiccant bypass. Size as recommended by manufacturer for service and capacity of system with connection not less than the line size in which installed. Filter driers with replaceable filters shall be furnished with one spare element of each type and size.

8. Flexible Metal Hose: Seamless bronze corrugated hose, covered with bronze wire braid, with standard copper tube ends. Provide in suction and discharge piping of each compressor.
9. Water Piping Valves and Accessories: Refer to specification Section 23 21 13 - Hydronic Piping.
10. Oil Separators: Provide for condensing units, as shown. All welded steel construction with capacity to eliminate a minimum of 95 percent of the oil from the hot gas flowing through it. Provide manufacturer's published ratings for minimum and maximum refrigeration tonnage corresponding to this oil separating efficiency. Separator shall be equipped with a float valve to prevent return of the hot gas to crankcase, and shall have isolating stop valves so it can be opened and services without pumping out any other part of the system. ASME construction or UL listed.

2.2 GAGES

A. Temperature Gages: Comply with ASME B40.200. Industrial duty type and in required temperature range for service in which installed. Gages shall have Celsius scale in 1-degree (Fahrenheit scale in 2-degree) graduations and with black number on a white face. The pointer shall be adjustable. Rigid stem type temperature gages shall be provided in thermal wells located within 1525 mm (5 feet) of the finished floor. Universal adjustable angle type or remote element type temperature gages shall be provided in thermal wells located 1525 to 2135 mm (5 to 7 feet) above the finished floor. Remote element type temperature gages shall be provided in thermal wells located 2135 mm (7 feet) above the finished floor.

B. Vacuum and Pressure Gages: Comply with ASME B40.100 and provide with throttling type needle valve or a pulsation dampener and shut-off valve. Gage shall be a minimum of 90 mm (3-1/2 inches) in diameter with a range from 0 kPa (0 psig) to approximately 1.5 times the maximum system working pressure. Each gage range shall be selected so that at normal operating pressure, the needle is within the middle-third of the range.
   1. Suction: 101 kPa (30 inches Hg) vacuum to 1723 kPa (gage) (250 psig).
   2. Discharge: 0 to 3445 kPa (gage) (0 to 500 psig).

2.3 THERMOMETERS AND WELLS

A. Refer to specification Section 23 21 13 - Hydronic Piping.

2.4 PIPE SUPPORTS

A. Refer to specification Section 23 05 11 - Common Work Results for HVAC and Steam Generation.

2.5 ELECTRICAL HEAT TRACING SYSTEM

A. Refer to specification Section 23 21 13 - Hydronic Piping. Provide for freezer unit cooler drain piping.

2.6 REFRIGERANTS AND OIL

A. Provide EPA approved refrigerant and oil for proper system operation.

2.7 PIPE/CONDUIT ROOF PENETRATION COVER

A. Prefabricated Roof Curb: Galvanized steel or extruded aluminum 300 mm (12 inches) overall height, continuous welded corner seams, treated wood nailer, 38 mm (1 1/2 inch) thick, 48 kg/cu.m (3 lb/cu.ft.) density rigid mineral fiberboard insulation with metal liner, built in cant strip (except for gypsum or tectum decks). For surface insulated roof deck, provide raised cant strip (recessed mounting flange) to start at the upper surface of the insulation. Curbs shall be constructed for pitched roof or ridge mounting as required to keep top of curb level.

B. Penetration Cover: Galvanized sheet metal with flanged removable top. Provide 38 mm (1 1/2 inch) thick mineral fiber board insulation.

C. Flashing Sleeves: Provide sheet metal sleeves for conduit and pipe penetrations of the penetration cover. Seal watertight penetrations.

2.8 PIPE INSULATION FOR DX HVAC SYSTEMS

A. Insulate suction and hot-gas piping with 1.5″ thick flexible elastomeric insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install refrigerant piping and refrigerant containing parts in accordance with ASHRAE Standard 15 and ASME B31.5

1. Install piping as short as possible, with a minimum number of joints, elbow and fittings.
2. Install piping with adequate clearance between pipe and adjacent walls and hangers to allow for service and inspection. Space piping, including insulation, to provide 25 mm (1 inch) minimum clearance between adjacent piping or other surface. Use pipe sleeves through walls, floors, and ceilings, sized to permit installation of pipes with full thickness insulation.
3. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown on the drawing.
4. Use copper tubing in protective conduit when installed below ground.
5. Install hangers and supports per ASME B31.5 and the refrigerant piping manufacturer's recommendations.

B. Joint Construction:

1. Brazed Joints: Comply with AWS "Brazing Handbook" and with filler materials complying with AWS A5.8/A5.8M.
   a. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper tubing.
   b. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.
   c. Swab fittings and valves with manufacturer's recommended cleaning fluid to remove oil and other compounds prior to installation.

d. Pass nitrogen gas through the pipe or tubing to prevent oxidation as each joint is brazed. Cap the system with a reusable plug after each brazing operation to retain the nitrogen and prevent entrance of air and moisture.

C. Protect refrigerant system during construction against entrance of foreign matter, dirt and moisture; have open ends of piping and connections to compressors, condensers, evaporators and other equipment tightly capped until assembly.

D. Pipe relief valve discharge to outdoors for systems containing more than 45 kg (100 lbs) of refrigerant.

E. Firestopping: Fill openings around uninsulated piping penetrating floors or fire walls, with firestop material. For firestopping insulated piping refer to Section 23 07 11 - HVAC, Plumbing, and Boiler Plant Insulation.

F. Seismic Bracing: Refer to specification Section 13 05 41 - Seismic Restraints Requirements for Non-Structural Components, for bracing of piping in seismic areas.

3.2 PIPE AND TUBING INSULATION

A. Refer to specification Section 23 05 11 - Common Work Results for HVAC and Steam Generation.

B. Apply two coats of weather resistant finish as recommended by the manufacturer to insulation exposed to outdoor weather.

3.3 SIGNS AND IDENTIFICATION

A. Each refrigerating system erected on the premises shall be provided with an easily legible permanent sign securely attached and easily accessible, indicating thereon the name and address of the installer, the kind and total number of pounds of refrigerant required in the system for normal operations, and the field test pressure applied.

B. Systems containing more than 50 kg (110 lb) of refrigerant shall be provided with durable signs, in accordance with ANSI A13.1 and ANSI Z535.1, having letters not less than 13 mm (1/2 inch) in height designating:

1. Valves and switches for controlling refrigerant flow, the ventilation and the refrigerant compressor(s).
2. Signs on all exposed high pressure and low pressure piping installed outside the machinery room, with name of the refrigerant and the letters "HP" or "LP."

3.4 FIELD QUALITY CONTROL

A. Prior to initial operation examine and inspect piping system for conformance to plans and specifications and ASME B31.5. Correct equipment, material, or work rejected because of defects or nonconformance with plans and specifications, and ANSI codes for pressure piping.

B. After completion of piping installation and prior to initial operation, conduct test on piping system according to ASME B31.5. Furnish materials and equipment required for tests. Perform tests in the presence of Resident Engineer. If the test fails, correct defects and perform the test again until it is satisfactorily done and all joints are proved tight.

1. Every refrigerant-containing parts of the system that is erected on the premises, except compressors, condensers, evaporators, safety devices, pressure gages, control mechanisms and systems that are factory tested, shall be tested and proved tight after complete installation, and before operation.
2. The high and low side of each system shall be tested and proved tight at not less than the lower of the design pressure or the setting of the pressure relief device protecting the high or low side of the system, respectively, except systems erected on the premises using non-toxic and non-flammable Group A1 refrigerants with copper tubing not exceeding DN 18 (NPS 5/8). This may be tested by means of the refrigerant charged into the system at the saturated vapor pressure of the refrigerant at 20 degrees C (68 degrees F) minimum.

C. Test Medium: A suitable dry gas such as nitrogen or shall be used for pressure testing. The means used to build up test pressure shall have either a pressure limiting device or pressure-reducing device with a pressure-relief device and a gage on the outlet side. The pressure relief device shall be set above the test pressure but low enough to prevent permanent deformation of the system components.

D. Refrigerator/Freezer Start up and Performance Tests: Specification //Section 11 41 21 – Walk-In Coolers and Freezers//Section 11 53 23 - Laboratory Refrigerators//Section 11 78 13 - Mortuary Refrigerators//.

3.5 SYSTEM TEST AND CHARGING

A. System Test and Charging: As recommended by the equipment manufacturer or as follows:
1. Connect a drum of refrigerant to charging connection and introduce enough refrigerant into system to raise the pressure to 70 kPa (10 psi) gage. Close valves and disconnect refrigerant drum. Test system for leaks with halide test torch or other approved method suitable for the test gas used. Repair all leaking joints and retest.
2. Connect a drum of dry nitrogen to charging valve and bring test pressure to design pressure for low side and for high side. Test entire system again for leaks.
3. Evacuate the entire refrigerant system by the triplicate evacuation method with a vacuum pump equipped with an electronic gage reading in mPa (microns). Pull the system down to 665 mPa (500 microns) 665 mPa (2245.6 inches of mercury at 60 degrees F) and hold for four hours then break the vacuum with dry nitrogen (or refrigerant). Repeat the evacuation two more times breaking the third vacuum with the refrigeration to be charged and charge with the proper volume of refrigerant.

END OF SECTION 23 23 00

SECTION 23 64 00
PACKAGED WATER CHILLERS

PART 1 - GENERAL

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

1.2 DESCRIPTION
A. Air-cooled scroll chillers complete with accessories.

1.3 DEFINITION
A. Engineering Control Center (ECC): The centralized control point for the intelligent control network. The ECC comprises of personal computer and connected devices to form a single workstation.
B. BACNET: Building Automation Control Network Protocol, ASHRAE Standard 135.
C. Ethernet: A trademark for a system for exchanging messages between computers on a local area network using coaxial, fiber optic, or twisted-pair cables.
D. FTT-10: Echelon Transmitter-Free Topology Transceiver.

1.4 QUALITY ASSURANCE
A. Refer to Paragraph, QUALITY ASSURANCE, in Section 23 05 11 - Common Work Results for HVAC and Steam Generation, and comply with the following.
B. Refer to PART 3 herein after and Section 01 00 00 - General Requirements for test performance.
C. Comply with AHRI requirements for testing and certification of the chillers.
D.
E. Refer to paragraph, WARRANTY, Section 00 72 00 - General Conditions, except as noted below:
   1. Provide a 5-year motor and compressor warranty to include materials, parts and labor.
F. Refer to OSHA 29 CFR 1910.95(a) and (b) for Occupational Noise Exposure Standard
G. //Refer to 42 CFR—Public Health, Part 84, "Approval of Respiratory Protective Devices," Subpart H—"Self-Contained Breathing Apparatus," 1998.//
H. Refer to ASHRAE Standard 15, Safety Standard for Refrigeration System, for refrigerant vapor detectors and monitor.

1.5 APPLICABLE PUBLICATIONS
A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
B. Air Conditioning, Heating and Refrigeration Institute (AHRI):
   1. 370-01 Sound Rating of Large Outdoor Refrigerating and Air-Conditioning Equipment
   2. 495-1999 (R2002) Refrigerant Liquid Receivers
   3. 550/590-03 Standard for Water Chilling Packages Using the Vapor Compression Cycle
   4. 560-00 Absorption Water Chilling and Water Heating Packages
   5. 575-94 Methods for Measuring Machinery Sound within Equipment Space
C. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):
   1. ANSI/ASHRASE-15-2007 Safety Standard for Mechanical Refrigeration Systems

2. GDL 3-1996 Guidelines for Reducing Emission of Halogenated Refrigerants in Refrigeration and Air-Conditioning Equipment and Systems

D. American Society of Mechanical Engineers (ASME):
1. 2007 ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels - Division 1"

E. American Society of Testing Materials (ASTM):
1. C 534/ C 534M-2008 Preformed, Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
2. C 612-04 Mineral-fiber Block and Board Thermal Insulation

F. National Electrical Manufacturing Association (NEMA):
1. 250-2008 Enclosures for Electrical Equipment (1000 Volts Maximum)

G. National Fire Protection Association (NFPA):
1. 70-2008 National Electrical Code

H. Underwriters Laboratories, Inc. (UL):
1. 1995-2005 Heating and Cooling Equipment

1.6 SUBMITTALS

A. Submit in accordance with Specification Section 01 33 23 - Shop Drawings, Product Data, and Samples.

B.

C. Manufacturer's Literature and Data.
1. Water chillers, including motor starters, control panels, and vibration isolators, and remote condenser data shall include the following:
a. Rated capacity.
b. Pressure drop.
c. Efficiency at full load and part load WITHOUT applying any tolerance indicated in the AHRI 550/590/Standard.
d. Refrigerant
e. Fan performance (Air-Cooled Chillers only.)
f. Accessories.
g. Installation instructions.
h. Startup procedures.
i. Wiring diagrams, including factory-installed and field-installed wiring.
j. Sound/Noise data report. Manufacturer shall provide sound ratings. Noise warning labels shall be posted on equipment.
k. //Self-contained breathing apparatus (SCBA).//
l. Refrigerant vapor detectors and monitors.

D. Maintenance and operating manuals for each piece of equipment in accordance with Section 01 00 00 - General Requirements.

E. Run test report for all chillers.

F. Product Certificate: Signed by chiller manufacturer certifying that chillers furnished comply with AHRI requirements. The test report shall include calibrated curves, calibration records, and data sheets for the instrumentation used in factory tests.

PART 2 - PRODUCTS

2.1 ROTARY-SCREW AND SCROLL AIR-COOLED WATER CHILLERS

A. General: Factory-assembled and-tested scroll water chillers, complete with evaporator, compressors, motor, starters, remote condenser, and controls mounted on a welded steel base. Chiller shall be capable of operating one of the following refrigerants: HCFC-134a or HCFC-410a.

B. Performance: Provide the capacity as shown on the drawings. Part load and full load efficiency ratings of the chiller shall not exceed those shown on the drawings. Capacity of a single air-cooled chiller shall not exceed 250 Tons (Standard AHRI Conditions). Each refrigerant circuit shall include all refrigerant specialties factory mounted to provide reliable operation down to 45F Ambient.

C. Applicable Standard: Chillers shall be rated and certified according to AHRI 550/590, and shall be stamped in compliance with AHRI certification.

D. Compressor (Scroll Type): Compressor: Each module shall contain two hermetic

E. compressors independently circuited and with internal spring isolation mounted to the module with rubber-in-shear isolators. Each system also includes high discharge pressure and low suction pressure manual reset safety cut-outs.

F.

G. Refrigerants Circuit: Each circuit shall contain include an expansion valve, refrigerant charging connections, hot-gas muffler, compressor suction and discharge shutoff valves, replaceable-core filter drier, sight glass with moisture indicator, liquid-line solenoid valve and insulated suction line.

H. Refrigerant and Oil: Sufficient volume of dehydrated refrigerant and lubricating oil shall be provided to permit maximum unit capacity operation before and during tests. Replace refrigerant charge lost during the warranty period, due to equipment failure, without cost to the Government.

I. Condenser:

1. Air-cooled remote // condenser as shown on the drawings and specified hereinafter.
2. Remote Condenser: Refer to paragraph 2.5

J.

K. Evaporators: Each evaporator shall be a brazed plate

L. heat exchanger constructed of 316 stainless steel; designed, tested, and stamped in accordance with UL 1995 code for 650 psig refrigerant side working pressure and 362 psig water side working pressure. The evaporator heat exchanger shall be mounted below the compressor, to eliminate the effect of migration of refrigerant to the cold evaporator with consequent liquid slugging on start-up.Insulation: Evaporator, suction piping, compressor, and all other parts subject to condensation shall be insulated with 20 mm (0.75 inch) minimum thickness of flexible-elastomeric thermal insulation, complying with ASTM C534.

M.

N. Each inlet header shall incorporate a built in 30-mesh (max) in-line

O. strainer system to prevent heat exchanger fouling.

P.

Q. Controls: Chiller shall be furnished with unit mounted, stand-alone, microprocessor-based controls enclosure, hinged and lockable, factory wired with a single point power connection and separate control circuit. The control panel provide chiller operation, including monitoring of sensors and actuators, and shall be furnished with light emitting diodes or liquid-crystal display keypad.

R.

1. following shall display as a minimum on the panel:
   a. Date and time.
   b. Outdoor air temperature.
   c. Operating and alarm status.
   d. Entering and leaving water temperature-chilled water.
   e. Operating set points-temperature and pressure.
   f. Refrigerant temperature and pressure.
   g. Operating hours.
   h. Number of starts.
   i. Current limit set point.
   j. Maximum motor amperage (percent).

2. Control Functions:
   a. Manual or automatic startup and shutdown time schedule.
   b. Condenser water temperature.
   c. Entering and leaving chilled water temperature and control set points.
   d. Automatic lead-lag switch.
3. Safety Functions: Following conditions shall shut down the chiller and require manual reset to start:
   a. Loss of chilled water flow.
   b. Loss of condenser water flow (for water-cooled chillers only).
   c. Low chilled water temperature.
   d. Compressor motor current-overload protection.
   e. Freeze protection (for air-cooled chillers).
   f. Starter fault.
   g. High or low oil pressure.
   h. Recycling pumpdown.

S. The chiller control panel shall provide leaving chilled water temperature reset based on return water temperature signal from Energy Control Center (ECC).

T. Provide contacts for remote start/stop, alarm for abnormal operation or shutdown, and for Engineering Control Center (ECC).

U. Chiller control panel shall either reside on the "LonTalk FTT-10a network", and provide data using LonMark standard network variable types and configuration properties, or BACnet interworking using ARCNET or MS/TP physical data link layer protocol for communication with building automation control system.

V. Motor Starter: Provide a starter in NEMA I enclosure, designed for floor or unit mounted chiller using multiple compressors, with the lead compressor starting at its minimum capacity may be provided with across the line starter.

2.2 CONDENSERS

A. Air-Cooled Condensers: Suitable for remote installation in a weather protected casing. For multiple compressors chiller units, provide a separate air-cooled condenser to match the compressor:
   1. Condenser coils shall be extended surface fin and tube type, seamless copper tubes with aluminum fins. Fans shall be either housed-centrifugal or plenum or propeller type as best suited for application, directly connected to motor shaft or indirectly connected to motor by means of a V-belt drive. Fans shall be statically and dynamically balanced.
   2. Discharge air from each air-cooled condenser in vertical direction either directly from fan casing or by means of supplementary wind deflectors.

B. Refrigerant Piping: Refrigerant piping shall be as specified in specification Section 23 23 00 - Refrigerant Piping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, piping and electrical to verify actual locations and sizes before chiller installation and other conditions that might affect chiller performance, maintenance, and operation. Equipment locations shown on drawings are approximate. Determine exact locations before proceeding with installation.

3.2 EQUIPMENT INSTALLATION

A. Install chiller on concrete base with isolation pads or vibration isolators.
   1. Concrete base is specified in Section 03 30 00 - Cast-In-Place Concrete

2. Vibration isolator types and installation requirements are specified in Section 23 05 41 - Noise and Vibration Control for HVAC Piping and Equipment
3. Anchor chiller to concrete base according to manufacturer's written instructions // and for seismic restraint on vibration isolators.//
4. Charge the chiller with refrigerant, if not factory charged.
5. Install accessories and any other equipment furnished loose by the manufacturer, including remote starter, remote control panel, and remote flow switches, according to the manufacturer written instructions and electrical requirements.
6. Chillers shall be installed in a manner as to provide easy access for tube pull and removal of compressor and motors etc.

B. Install refrigerant monitoring and safety equipment in accordance with ASHRAE Standard 15.
C. Install refrigerant piping as specified in Section 23 23 00 - Refrigerant Piping and ASHRAE Standard 15.
D. Install thermometers and gages as recommended by the manufacturer and/or as shown on drawings.
E. Piping Connections:
1. Make piping connections to the chiller for chilled water, condenser water, and // automatic tube brush cleaning system // and other connections as necessary for proper operation and maintenance of the equipment.
2. Make equipment connections with flanges and couplings for easy removal and replacement of equipment from the equipment room.
3. Extend vent piping from the // relief valve // rupture disk // and purge system to the outside.

3.3 STARTUP AND TESTING

A. Engage manufacturer's factory-trained representative to perform startup and testing service.
B. Inspect, equipment installation, including field-assembled components, and piping and electrical connections.
C. After complete installation startup checks, according to the manufacturers written instructions, do the following to demonstrate to the VA that the equipment operate and perform as intended.
1. Check refrigerant charge is sufficient and chiller has been tested for refrigerant leak.
2. Check bearing lubrication and oil levels.
3. Verify proper motor rotation.
4. Verify pumps associated with chillers are installed and operational.
5. Verify thermometers and gages are installed.
6. Verify purge system, if installed, is functional and relief piping is routed outdoor.
7. Operate chiller for run-in-period in accordance with the manufacturer's instruction and observe its performance.
8. Check and record refrigerant pressure, water flow, water temperature, and power consumption of the chiller.
9. Test and adjust all controls and safeties. Replace or correct all malfunctioning controls, safeties and equipment as soon as possible to avoid any delay in the use of the equipment.
10. Prepare a written report outlining the results of tests and inspections, and submit it to the VA.

D. Engage manufacturer's certified factory trained representative to provide training for // 16 hours // 8 hours // for the VA maintenance and operational personnel to adjust, operate and maintain equipment, including self-contained breathing apparatus.

END OF SECTION 23 64 00

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