

**SECTION 23 64 23.13**  
**Air-Cooled Scroll Water Chillers**  
**Sugar Ridge Elementary School – SSD2**

**PART 1 - GENERAL**

1.01 SUMMARY

- A. Section includes design, performance criteria, refrigerants, controls, and installation requirements for air-cooled rotary scroll packaged chillers.

1.02 REFERENCES

- A. AHRI 550/590 - Standard for Water Chilling Packages using the Vapor Compression Cycle
- B. AHRI 370 - Sound Rating of Large Outdoor Refrigerating and Air-Conditioning Equipment
- C. ASHRAE 15 - Safety Code for Mechanical Refrigeration
- D. ASHRAE 90.1 - Energy Efficient Design of New Buildings
- E. UL 1995 - Central Cooling Air Conditioners
- F. ASTM B117 - Standard Method of Salt Spray (Fog) Testing
- G. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- H. ASTM A525 - Zinc (Hot-Dip Galvanized) Coatings on Sheet Steel Products
- I. ASTM D1654 - Evaluation of Painted or Coated Specimens, Subjected to Corrosive Environments
- J. ANSI/AFBMA 9-1978 - Load Ratings and Fatigue Life for Ball Bearings.
- K. ISO 9001
- L. California Administrative Code - Title 24

1.03 SUBMITTALS

- A. Submit dimensional plan and elevation view drawings, weights and loadings, required clearances, location and size of all field connections, electrical requirements and wiring diagrams.
- B. Submit product data indicating rated capacities, accessories and any special data.
- C. Submit manufacturer's installation instructions.

1.04 REGULATORY REQUIREMENTS

- A. Comply with codes and standards specified.
- B. Chiller must be built in an ISO 9001 classified facility.

#### 1.05 VERIFICATION OF CAPACITY AND EFFICIENCY

- A. All proposals for chiller performance must include an AHRI approved selection method. Verification of date and version of computer program selection or catalog is available through AHRI.

#### 1.06 DELIVERY, HANDLING AND STORAGE

- A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting chillers.
- B. Chiller shall be capable of withstanding -40°F (-40°C) to 158°F (70°C) storage temperatures for an indefinite period of time.

#### 1.07 WARRANTY

- A. 5 Year parts, labor, and refrigerant warranty whole unit by manufacturer

### **PART 2 - PRODUCTS**

#### 2.01 ACCEPTABLE MANUFACTURERS

- A. Trane model ACS

#### 2.02 CHILLER DESCRIPTION

- A. The contractor shall furnish and install air-cooled water chiller with scroll compressors as shown as scheduled on the contract documents. The chillers shall be installed in accordance with this specification and perform at the specified conditions as scheduled.

#### 2.03 PERFORMANCE

- A. Unit must meet or exceed capacity and efficiency at the below conditions:
  - 1. Evaporator: 45deg. leaving water and 433GPM.
  - 2. Condenser: 95deg. Ambient
- B. Capacity: 181 Tons
- C. EER:10.31(Btu/W-h)
- D. IPLV: 17.40 (Btu/W-h)

#### 2.04 CHILLER OPERATION

- A. High ambient operation; Chiller shall be able to start and operate in ambient conditions from 32°F (0°C) to 130°F (54°C). High ambient operation is accomplished with factory installed and tested protection. If field installed high ambient solution is used, this shall be purchased and installed at contractor expense.

- B. Chiller shall be capable of starting up with 95°F (35°C) entering fluid temperature to the evaporator. Maximum water temperature that can be circulated with the Chiller not operating is 125°F (52°C)
- C. Chiller shall provide evaporator freeze protection and low limit control to avoid low evaporator refrigerant temperature trip-outs during critical periods of chiller operation. Whenever this control is in effect, the controller shall indicate that the chiller is in adaptive limit. If the condition exists for more than 30 seconds, a limit warning alarm relay shall energize.
- D. Rapid Restart™ after power restoration. The Chiller shall be capable of starting in 45 seconds.

#### 2.05 COMPRESSORS

- A. Construct chiller using fully hermetic scroll type compressors with R410A optimized and dedicated scroll profile.
- B. Provide direct drive motor cooled by suction gas with only three major moving parts and a completely enclosed compression chamber which leads to increased efficiency.
- C. Each compressor shall have Intermediate Discharge Valves (IDV) or variable volume ratio technology
- D. Each compressor shall have overload protection internal to the compressor
- E. Each compressor shall include: centrifugal oil pump, oil level sight glass and oil charging valve
- F. Each compressor will have crankcase heaters installed and properly sized to minimize the amount of liquid refrigerant present in the oil sump during off cycles.

#### 2.06 EVAPORATOR

- A. The evaporator shall be a high efficiency, brazed plate-to-plate type heat exchanger consisting of parallel plates. Braze plates shall be stainless steel with copper braze material.
- B. The water side working pressure shall be rated at 150 psig (10.3 bar) and tested at 1.5 times maximum allowable water side working pressure.
- C. The refrigerant side working pressure shall be rated at 460 psig (29.6 bars) and tested at 1.1 maximum allowable refrigerant side working pressure.

- D. Insulate the evaporator with a minimum of 0.75 inch (K=0.28) UV rated insulation from factory.
- E. Evaporator heaters shall be factory installed and shall protect chiller down to -20°F (-29°C). Contractor shall wire separate power to energize heat tape and protect evaporator while chiller is disconnected from the main power.
- F. Provide water drain connection, vent and fittings. Factory installed leaving water temperature control and low temperature cutout sensors.
- G. Water connections shall be grooved pipe.
- H. Proof of flow shall be provided by the equipment manufacturer, mechanically installed and electrically wired, at the factory of origin.

#### 2.07 FANS

- A. Low sound fans shall be balanced and direct driven.
- B. All condenser fan TEAO motors have permanently lubricated ball bearings and external overload protection.
- C. All condenser fans shall have integrated drives to provide variable speed for optimized efficiency and lower part load sound.

#### 2.08 CONDENSER

- A. Construct condenser coils of microchannel all aluminum brazed fin construction. The condenser coils shall have an integral sub-cooling circuit and shall be designed for at least 650 psig working pressure. Leak tested at 650 psig . Coils can be cleaned with high pressure water.
- B. Condenser coils shall be transverse design. If coils are not transverse design, provide coil protection for shipping.

#### 2.09 ENCLOSURES/CHILLER CONSTRUCTION

- A. Unit panels, structural elements and control boxes are constructed of galvanized steel and mounted on a bolted galvanized steel base. Unit panels, control boxes and the structural base are finished with a baked on powder paint.
- B. Control panel doors shall have door stays.
- C. Mount starters and Terminal Blocks in a UL 1995 rated weatherproof panel provided with full opening access doors. If a circuit breaker is chosen, it should be a lockable, through-

the-door type with an operating handle and clearly visible from outside of chiller indicating if power is on or off.

- D. The coating or paint system shall withstand 500 hours in a salt-spray fog test in accordance with ASTM B117.

#### 2.10 CHILLER MOUNTED STARTER

- A. The starter shall be across-the-line configuration, factory-mounted and fully pre-wired to the compressor motor(s) and control panel.
- B. Unit shall have a single point power connection.
- C. A molded case standard interrupting capacity circuit breaker shall be factory pre-wired with terminal block power connections and equipped with a lockable external operator handle, making it available to disconnect the chiller from main power.
- D. A control power transformer shall be factory-installed and factory-wired to provide unit control power.
- E. Unit wiring shall run in liquid-tight conduit.
- F. High short circuit current rating (SCCR) of 10kA.

#### 2.11 REFRIGERANT CIRCUIT

- A. All chillers shall have 2 refrigeration circuits, each with three (manifolded) compressor on each circuit.
- B. Provide for refrigerant circuit:
  - 1. Liquid line shutoff valve
  - 2. Discharge service valve
  - 3. Filter
  - 4. Liquid line sight glass.
  - 5. Electronic expansion valve sized for maximum operating pressure
  - 6. Charging valve
- C. Full operating charge of R410A and oil.

#### 2.12 CONTROLS

- A. A color, touch sensitive liquid crystal display (LCD) shall be unit mounted and a minimum of 7" diagonal.
- B. Digital Communications to BAS system shall consist of a BACnet MS/TP interface via a single twisted pair wiring. BACnet for integration into SSD2 controls, by others.

- C. Display shall consist of a menu driven interface with easy touch screen navigation to organized sub-system reports for compressor and evaporator information as well as associated diagnostics.
- D. The chiller control panel shall provide password protection of all setpoints
- E. The controller shall have the ability to display all primary sub-system operational parameters on dedicated trending graphs. The operator must be able to create up to 6 additional custom trend graphs, choosing up to 10 unique parameters for each graph to trend log data parameters simultaneously over an adjustable period and frequency polling.
- F. Chilled water temperature control shall be microprocessor-based, proportional and integral controller to show water and refrigerant temperature, refrigerant pressure, and diagnostics. This microprocessor-based controller is to be supplied with each chiller by the chiller manufacturer.
- G. The front of the chiller control panel shall display the following in clear language, without the use of codes, look-up tables, or gauges:
  - 1. Run time.
  - 2. Number of starts.
  - 3. Current chiller operating mode.
  - 4. Chilled water set point and set point source.
  - 5. Demand current limit set point and set point source.
  - 6. Entering and leaving evaporator water temperatures.
  - 7. Saturated evaporator and condenser refrigerant temperatures.
  - 8. Evaporator and condenser refrigerant pressure.
  - 9. Phase reversal/unbalance/single phasing and over/under voltage protection.
  - 10. Low chilled water temperature protection.
  - 11. High and low refrigerant pressure protection.
  - 12. Load limit thermostat to limit compressor loading on high return water temperature.
  - 13. Condenser fan sequencing to automatically cycle fans in response to load, expansion valve pressure, condenser pressure, and differential pressure to optimize chiller efficiency.
  - 14. Display diagnostics.

15. Compressors: Status (on/off), anti-short cycle timer, and automatic compressor lead-lag.
- H. Weatherproof control panel shall be mounted on chiller, containing starters, power and control wiring, factory wired with terminal block power connection. Provide primary and secondary fused control power transformer.
- I. The chiller controller shall utilize a microprocessor that will automatically take action to prevent chiller shutdown due to abnormal operating conditions associated with:  
evaporator refrigerant temperature, high condensing pressure and motor current overload.
- J. Provide the following safety controls with indicating lights or diagnostic readouts:
1. Low chilled water temperature protection.
  2. High refrigerant pressure.
  3. Loss of chilled water flow.
  4. Contact for remote emergency shutdown.
  5. Motor current overload.
  6. Phase reversal/unbalance/single phasing.
  7. Over/under voltage.
  8. Failure of water temperature sensor used by controller.
  9. Compressor status (on or off).
- K. Provide the following operating controls:
1. A variable compressor staffing method to control capacity in order to maintain leaving chilled water temperature based on PI algorithms. Five minute solid state anti-recycle timer to prevent compressor from short cycling. Compressor minimum stop-to-start time limit shall be 2 minutes. If a greater than 5 minute start-to-start, or greater than 2 minute stop-to-start timer is included.
  2. Chilled water pump output relay that closes when the chiller is given a signal to start.
  3. Load limit thermostat to limit compressor loading on high return water temperature to prevent nuisance trips.
  4. High ambient unloader pressure controller that unloads compressors to keep head pressure under control and help prevent high pressure nuisance trip outs on days when outside ambient is above design.

5. Low ambient lockout control with adjustable setpoint.
  6. Condenser fan sequencing which adjusts the speed of all fans automatically in response to ambient, condensing pressure and expansion valve pressure differential thereby optimizing chiller efficiency.
- L. Provide user interface on the front of the panel. If display is on the inside of the panel, then a control display access door shall be provided to allow access to the display without removal of panels. Provide user interface with a minimum of the following features:
1. Leaving chilled water setpoint adjustment from the front panel touchscreen display.
  2. Entering and leaving chilled water temperature output
  3. Pressure output of condenser
  4. Pressure output of evaporator
  5. Ambient temperature output
  6. Demand limit setpoint adjustment from the front panel touchscreen display.
- M. The chiller control panel shall provide leaving chilled water temperature reset based upon return water temperature.

### 2.13 SOUND

- A. Acoustics: Manufacturer must provide both sound power and sound pressure data in decibels. Sound pressure data per AHRI 370 must be provided at full load.
- B. Comprehensive sound package with low noise fans and sound wraps on compressors.

### 2.14 OPTIONS AND ACCESSORIES

- A. Chiller shall have full architectural louvers panels for complete protection.
- B. Chiller shall ship with elastomeric isolators to reduce vibration transmission.

## **PART 3 - EXECUTION**

### 3.01 INSTALLATION

- A. Install in accordance with manufacturer's requirements.
  1. Level the chiller using the base rail as a reference. The chiller must be level within 1/2 in over the entire length and width. Use shims as necessary to level the chiller.

### 3.02 SERVICE AND START-UP

- A. Startup - Provide all labor and materials to perform startup. Startup shall be performed by a factory-trained technician from the original equipment manufacturer Trane (OEM). Technician shall confirm that equipment has been correctly installed and passes



specification checklist prior to equipment becoming operational and covered under OEM warranty. This shall be done in strict accordance with manufacturer's specifications and requirements. Third-party service agencies are not permitted.

- B. A start-up log shall be furnished by the factory approved start-up technician to document the chiller's start-up date and shall be signed by the owner or his authorized representative prior to commissioning the chillers.
- C. Chiller manufacturers shall maintain service capabilities no more than 40 miles from the jobsite.
- D. Provide local service agent with direct access to factory support on equipment.

**END OF SECTION**