

## Meri Lou Murry Recreation Center

### Air Cooled Chiller Specification

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Chiller package.
- B. Charge of refrigerant and oil.
- C. Controls and control connections.
- D. Chilled water connections.
- E. Starters.
- F. Electrical power connections.

##### 1.02 REFERENCES

- A. ANSI/AHRI 550/590-2003 - Standard for Water Chilling Packages using the Vapor Compression Cycle.
- B. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.
- C. ANSI/ASHRAE 90.1 - Energy Efficient Design of New Buildings.
- D. ANSI/ASME SEC 8 - Boiler and Pressure Vessel Code
- E. ANSI/NEMA MG 1 - Motors and Generators.
- F. ANSI/UL 1995 - Central Cooling Air Conditioners.
- G. ANSI/UL 984 - Safety Standard for Hermetic Motor Compressors.
- H. ANSI/AFBMA 9-1978 - Load Ratings and Fatigue Life for Ball Bearings.
- I. ASTM B117 - Standard Method of Salt Spray (Fog) Testing
- J. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and

Steel Products

- K. ASTM A525 - Zinc (Hot-Dip Galvanized) Coatings on Sheet Steel Products
- L. ASTM D1654 - Evaluation of Painted or Coated Specimens, Subjected to Corrosive Environments

1.03 SUBMITTALS

- A. Submit drawings indicating components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Indicate accessories where required for complete system.
- B. Submit product data indicating rated capacities, specialties and accessories, electrical requirements and wiring diagrams.
- C. Submit manufacturer's installation instructions.

1.04 OPERATION AND MAINTENANCE DATA

- A. Submit operation data.
- B. Include start-up instructions, maintenance data, controls, and accessories.
- C. Submit maintenance data.

1.05 REGULATORY REQUIREMENTS

- A. Conform to ANSI/AHRI 550/590-2003 Standard for testing and certified rating of Water Chilling Packages using the Vapor Compression Cycle.
- B. Conform to ANSI/UL 1995 code for construction of water chillers. In the event the unit is not UL approved, the manufacturer shall, at manufacturer expense, provide for a field inspection by an UL representative to verify conformance to UL standards. If necessary, contractor shall perform modifications to the unit to comply with UL, as directed by the UL representative.
- C. Conform to ANSI/ASME SEC 8 Boiler and Pressure Vessel Code for construction and testing of water chillers.

- D. Conform to ANSI/ASHRAE 15 code for construction and operation of water chillers.
- E. Chiller must be built in an ISO 9001 classified facility.

#### 1.06 STORAGE AND HANDLING

- A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
- B. Protect units from physical damage. Factory coil shipping covers shall be kept in place until installation.
- C. Unit controls shall be capable of withstanding 203 Deg F (95 Deg C) storage temperatures in the control compartment for an indefinite period of time.

#### 1.07 WARRANTY

- A. Provide a full parts AND labor AND refrigerant warranty for one year from start-up or 18 months from shipment, whichever occurs first.
- B. Provide an extended compressor warranty for 2<sup>nd</sup> through 5<sup>th</sup> year, material only.

### PART 2 PRODUCTS

#### 2.01 SUMMARY

- A. The contractor shall furnish and install complete, air-cooled water chiller as shown as scheduled on the contract documents. The chiller shall be installed in accordance with this specification and perform at the specified conditions as scheduled. Contractor shall provide a complete "turn key" installation including; demolition, removal and proper disposal, piping, site work, electrical, all required materials, removal of fencing and replacement, coordination of controls with Owner's controls' contractor, start-up and commissioning of machine including verification of proper water flow, and charging of system with ethylene glycol.
- B. The contractor shall furnish and install Trane Model RTAC, McQuay Model AGS, York Model YCAV or Carrier Model 30XA air-cooled rotary liquid chiller of size and capacity scheduled. Unit shall be installed in strict accordance

with this specification. Unit shall be furnished complete with helical rotary screw compressors, shell and tube evaporator, air-cooled condenser, electronic expansion valves and microprocessor control panel. Total unit shall be UL certified and include the UL label. The unit shall be designed for outdoor application. The unit shall be rated in accordance with AHRI Standard 550/590-2003.

## 2.02 COMPRESSORS

- A. Construct chiller using semi-hermetic helical rotary screw compressors with independent circuits. Scroll compressor chillers are not approved.
- B. Statically and dynamically balance rotating parts.
- C. Provide oil lubrication system with oil charging valve and oil filter to ensure adequate lubrication during starting, stopping, and normal operation.
- D. Provide compressor with automatic capacity reduction equipment consisting of capacity control slide valve, step un-loaders or variable speed modulation. Compressor must start unloaded for soft start on motors.
- E. Provide 3600 rpm compressor motor, suction gas cooled with robust construction and system design protection, designed for soft start (wye-delta or variable speed) starting. Furnish with starter.
- F. Provide compressor heater to evaporate refrigerant returning to compressor during shut down. Energize heater when compressor is not operating.
- G. Provide sound absorbing panels to attenuate compressor noise.
- H. Suction lines shall be factory insulated to prevent sweating.

## 2.03 EVAPORATOR

- A. The evaporator shall be designed, tested, and stamped in accordance with ASME code for a refrigerant side working pressure of 200 psig. Waterside working pressure shall be 150 psig.

- B. Insulate the evaporator and water boxes with a minimum of 3/4 inch (K=0.26) insulation. If field installed the additional money to cover this in the field should be included in the bid.
- C. Evaporator heat tape shall be factory installed and shall protect unit down to -20 F. Contractor shall wire separate 20 amp, 115v power to energize heat tape and protect cooler while chiller is disconnected from the main power.
- D. Provide shell and tube type evaporator, seamless or welded steel construction with cast iron or fabricated steel heads, seamless internally and externally finned copper tubes, roller expanded into tube sheets.
- E. Provide ability to remove evaporator tubes from either end of the heat exchanger.
- F. Provide water drain connection, vent and fittings for factory installed leaving water temperature control and low temperature cutout sensors.
- G. Water connections shall be grooved pipe. Evaporator shall have only one entering and one leaving connection. If manufacturer provides 2 separate evaporators, contractor shall provide manifold and pressure gauges to ensure equal flow is provided to each evaporator.

#### 2.04 CONDENSER AND FANS

- A. Provide vertical discharge direct driven propeller type condenser fans with fan guard on discharge. Entire fan assembly shall be statically and dynamically balanced and fan assembly shall be either painted or zinc coated steel. Fan guard shall be either PVC, chrome, or zinc coated.
- B. Provide TEAO (Totally Enclosed Air Over) fan motors with permanently lubricated ball bearings.
- C. Chiller shall be able to operate in ambient conditions down to 25 degrees F
- D. Construct condenser coils of aluminum fins mechanically bonded to seamless copper tubing. Provide sub-cooling circuits. Air test under water to 506 psig.
- E. Provide coil protection for shipping. Entire condenser

coil shall be covered with heavy plastic to prevent inadvertent damage to coil during shipment or rigging.

## 2.05 ENCLOSURES / STARTERS

- A. House components in a galvanized steel frame and mounted on welded structural steel base. Hot-dip galvanized steel frame coating shall be Underwriters Laboratories Inc. (UL) recognized as G90-U, UL guide number DTHW2.
- B. Unit panels and control panels shall be finished with a baked on powder paint. Control panel doors shall have door stays. Paint system shall meet the requirements for outdoor equipment of Federal Government Agencies.
- C. Mount starters and Terminal Blocks in weatherproof panel provided with full opening access doors.
- D. Casings fabricated from steel that do not have a Zinc coating conforming to ASTM A 123 or ASTM A525 shall be treated for the prevention of corrosion with a factory coating or paint system. The coating or paint system shall withstand 500 hours in a salt-spray fog test in accordance with ASTM B 117. Each specimen shall have a standard scribe mark as defined in ASTM D 1654. Upon completion of exposure, the coating or paint system shall be evaluated and rated in accordance with procedures A and B of ASTM D 1654. The rating of failure at the scribe mark shall be not less than six (average creepage not greater than 1/8 inch). The rating of the un-scribed area shall not be less than ten (no failure). Thickness of coating or paint system on the actual equipment shall be identical to that on the test specimens with respect to materials, conditions of application, and dry-film thickness.
- E. For each compressor provide a wye-delta starter or variable speed drive. Across-the-line starters are not acceptable.
- F. Compressors utilizing variable speed drive design shall be IEEE 519-1992 compliant. They shall include as standard integrated active rectification control system to limit total demand distortion (TDD) in current at the VSD to less than or equal to 5-percent as measured at the VSD input. If optional active filters are used to meet the less than or equal to 5% TDD, then the losses associated with the filter shall be included in the chiller

performance on the selection.

## 2.06 REFRIGERANT CIRCUIT

- A. All units shall have 2 refrigeration circuits to provide redundancy, each with a maximum of one or two (manifolded) compressors on each circuit. Single refrigerant circuit chillers are not acceptable.
- B. Provide for each refrigerant circuit:
  - 1. Liquid line shutoff valve.
  - 2. Suction Service Valve
  - 3. Filter - replaceable core type.
  - 4. Liquid line sight glass.
  - 5. Electronic or thermal expansion valve sized for maximum operating pressure.
  - 6. Charging valve.
  - 7. Discharge and oil line check valves.
  - 8. High side pressure relief valve.
  - 9. Full operating charge of HFC-134a and oil.
- C. Capacity Modulation: Provide capacity modulation by either slide valve, un-loader valves, or variable speed control. Unit shall be capable of operation down to 20%.

## 2.07 CONTROLS

- A. 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. Controls shall include the following readouts and diagnostics:
  - 1. Phase reversal/unbalance/single phasing and over/under voltage protection.

2. Low chilled water temperature protection.
  3. High and low refrigerant pressure protection.
  4. Load limit thermostat to limit compressor loading on high return water temperature.
  5. Condenser fan sequencing to automatically cycle fans in response to load, expansion valve pressure, condenser pressure, and differential pressure to optimize unit efficiency.
  6. Display diagnostics.
  7. Oil pressure control based off of maintaining system differential pressure.
  8. Compressors: Status (on/off), %RLA, anti-short cycle timer, and automatic compressor lead-lag.
- B. On chiller, mount weatherproof control panel, containing starters, power and control wiring, factory wired with terminal block power connection. Provide primary and secondary fused control power transformer and a single 115 volt 60 Hz single phase connection for evaporator freeze protection heaters.
1. The unit controller shall utilize a microprocessor that will automatically take action to prevent unit shutdown due to abnormal operating conditions associated with: evaporator refrigerant temperature, high condensing pressure and motor current overload.
- C. In the above case, the chiller will continue to run in an unloaded state, and will continue to produce some chilled water in an attempt to meet the cooling load. However, if the chiller reaches the trip-out limits, the chiller controls will take the chiller off line for protection, and a manual reset will be required. Once the "near-trip" condition is corrected, the chiller will return to normal operation and can then produce full load cooling.
- D. Provide the following safety controls with indicating lights or diagnostic readouts.
1. Low chilled water temperature protection.

2. High refrigerant pressure.
3. Low oil flow protection.
4. Loss of chilled water flow.
5. Contact for remote emergency shutdown.
6. Motor current overload.
7. Phase reversal/unbalance/single phasing.
8. Over/under voltage.
9. Failure of water temperature sensor used by controller.
10. Compressor status (on or off).

E. Provide the following operating controls:

1. Eight (8) or more step leaving chilled water temperature controller which cycles compressors and activates cylinder un-loaders or slide valve or varies compressor speed based on PI algorithms. If manufacturer is unable to provide at least 8 steps of unloading, providing hot gas bypass shall be required.
2. 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, hot gas bypass shall be provided to insure accurate chilled water temperature control in light load applications.
3. Chilled water pump output relay that closes when the chiller is given a signal to start.
4. Load limit thermostat to limit compressor loading on high return water temperature to prevent nuisance trip outs.
5. High ambient un-loader 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.

6. Compressor current sensing un-loader unit that unloads compressors to help prevent current overload nuisance trip outs.
7. Auto lead-lag functions that constantly even out run hours and compressor starts automatically. If contractor cannot provide this function then cycle counter and hour meter shall be provided for each compressor so owner can be instructed by the contractor on how to manually change lead-lag on compressors and even out compressor starts and running hours.
8. Low ambient lockout control with adjustable setpoint.
9. Condenser fan sequencing which automatically cycles fans in response to ambient, condensing pressure and expansion valve pressure differential thereby optimizing unit efficiency.

F. Provide user interface that displays chilled water temperature setpoint and actual leaving chilled water temperature. Display should be on the front of 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.

**2.08 MANUFACTURER OPTIONS (SELECT AS REQUIRED)**

- A. BacNet interface
- B. Unit Disconnect switch.
- C. Condenser coil hail guards. Coil only protection from hail.
- D. Compressor acoustic enhancement. Weatherproof compressor enclosure to reduce compressor sound levels.
- E. Low noise condenser fans. Acoustically designed condenser fans designed for reduced airflow turbulence and noise generation.
- F. Convenience outlet. Factory powered 15 amp, 115 volt convenience outlet on the unit.

- G. Thermal dispersion flow switch (proof of evaporator flow). Shall be provided by the equipment manufacturer, mechanically installed and electrically wired, at the factory of origin. Paddle-type flow switches are not approved.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Align chiller package on existing concrete foundations, or modify if required.
- C. Connect to electrical service.
- D. Connect to chilled water piping.
- E. Arrange piping for easy dismantling to permit tube cleaning.

#### 3.02 MANUFACTURER'S FIELD SERVICES

- A. OEM Startup is performed by factory trained and authorized servicing technicians confirming equipment has been correctly installed and passes specification checklist prior to equipment becoming operational and covered under OEM warranty.
- B. Owner training. Provide up to 4 hours of owner personnel training on the operation and maintenance of chiller. Training to be provided by OEM service technician.