

**SECTION 23 81 25**  
**REFRIGERANT BASED PRECISION COOLING SYSTEM**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. These specifications describe requirements for a refrigerant based Precision Cooling system. The system shall be designed to control temperature and humidity conditions in rooms containing electronic equipment, with good insulation and vapor barrier. The manufacturer shall design and furnish all equipment to be fully compatible with heat dissipation requirements of the room.
  - 1. Systems shall include indoor unit (CRAC), air cooled condensers, pumping unit, integral controllers and control devices, and piping riser assembly.
- B. The system shall be furnished by a single manufacturer and be a fully integrated system complete with indoor cooling units, piping, condensers, piping assemblies, pumping unit, controls and start-up services.
- C. Basis of Design is the Liebert DSE series. Certain nomenclature herein reference Liebert products.

**1.2 DESIGN REQUIREMENTS**

- A. The Precision Cooling system shall be a Liebert self-contained, factory-assembled unit with downflow air delivery. The system shall have a net total cooling capacity of 181.5 kW with a net sensible cooling capacity of 181.5 kW based on an entering air temperature of 95 °F dry bulb, 20.5% RH.
- B. The unit is to be supplied with 460 volt 3 ph 60 Hz 3 wire, no neutral electrical service. Net capacities shall include losses due to fan motor heat. The system cooling capacity shall be factory certified per ASHRAE 127-2007, and the system sensible coefficient of performance (SCOP) shall exceed ASHRAE 90.1-2010.

**1.3 RELATED SECTIONS**

- A. Section 23 00 10 – General Mechanical Requirements, is an integral part of this section. Requirements and work indicated in 23 00 10 are not repeated in this Section.
- B. Section 23 05 29 – Supports and Anchors
- C. Section 23 07 00 - Insulation
- D. Section 23 08 00 – Mechanical Systems Identification
- E. Section 23 08 13 – Testing, Adjusting and Balancing
- F. Section 23 09 00 – Building Management System
- G. Section 23 23 00 – Refrigerant Piping

**1.4 COORDINATION**

- A. Coordinate work under provisions indicated in Section 23 00 10.

## **1.5 QUALIFICATIONS / QUALITY ASSURANCE**

- A. Conform to requirements indicated in Section 23 00 10.
- B. ASHRAE Compliance:
  - 1. Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment," and Section 7 - "Construction and Startup."
  - 2. The system cooling capacity shall be factory certified per ASHRAE 127-2007, and the system sensible coefficient of performance (SCOP) shall exceed ASHRAE 90.1-2010.
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.

## **1.6 REGULATORY REQUIREMENTS**

- A. Conform to requirements indicated in Section 23 00 10.

## **1.7 SUBMITTALS**

- A. Submit as required herein and under Section 23 00 10 and 01 33 00.
- B. Product Data: For each type of product indicated, include rated capacities, operating characteristics, operating conditions, electrical characteristics, and furnished specialties and accessories.
- C. Shop Drawings: For the precision cooling system, submit all equipment and components, including plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Wiring Diagrams: For power, signal, and control wiring.

## **1.8 EXTRA MATERIALS**

- A. Furnish under provisions indicated in Section 23 00 10.
- B. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Filters: One set(s) of filters for each indoor cooling unit.

## **1.9 PROJECT RECORD DOCUMENTS**

- A. Submit under provisions indicated in Section 23 00 10.

## **1.10 OPERATION AND MAINTENANCE DATA**

- A. Submit under provisions indicated in Section 23 00 10.

## **1.11 WARRANTY**

- A. Provide under provisions indicated in Section 23 00 10.

## **PART 2 - PRODUCT**

### **2.1 FRAME AND CASING**

- A. The frame shall be welded, formed sheet metal. It shall be protected against corrosion using the autophoretic coating process. The frame shall be capable of being separated into three parts in the field to accommodate rigging through small spaces.
- B. The supply air shall exit from the bottom of the unit.
- C. The return air shall enter the unit from the top
- D. The exterior panels shall be insulated with a minimum 1 in., 1.5 lb. density fiber insulation. The main front panel shall have captive quarter-turn fasteners. The indoor unit color shall be ZP-0420, Charcoal Gray.
- E. Filter access through filter access plenum.

### **2.2 FILTERS**

- A. The filter plenum shall be exterior to the main CRAC unit, and shall be field assembled and installed. The filters shall be removable from the front of the filter plenum. The filter plenum shall match the panel colors and finish of the indoor cooling unit (CRAC).
- B. Filters shall be deep pleated 4" filters with an ASHRAE 52.2, MERV 8 efficiency rating.
- C. One extra set of filters shall be provided per each indoor cooling unit.

### **2.3 FAN SECTION**

- A. The fans shall be plug/plenum Electronically Commutated (EC) type, with motorized impellers, single inlet and dynamically balanced. The drive package shall be direct drive, electronically commutated and variable speed. The fans shall be located to draw air over the A-frame coil to ensure even air distribution and maximum coil performance. EC fans shall be capable of being lowered into a raised floor (during field installation) with minimum height of 24". EC fans shall also be capable of operating within the cooling cabinet, instead of under the floor.

### **2.4 DUAL REFRIGERATION SYSTEM**

- A. Each unit shall include two independent refrigeration circuits and shall include liquid line filter driers, refrigerant sight glass with moisture indicator and electronic expansion valves. Compressors shall be located outside the airstream and shall be removable and serviceable from the front of the unit. Each compressor circuit shall be connected to the full-face area of the evaporator coil.
- B. The compressors shall be tandem, scroll-type with a variable capacity operation capability of one compressor of the pair. Compressor solenoid valve shall unload the compressor and allow for variable capacity operation. The compressor shall have vibration isolators, thermal overloads, automatic reset high-pressure switch with lockout after three failures, rotalock service valves, suction line strainer and a maximum operating speed of 3500 RPM. The compressor motor shall be suction gas cooled.
- C. The compressors shall include crankcase heaters, powered from the indoor unit electric panel.
- D. The evaporator coil shall be A-frame design and have 56.2 sq. ft. face area, six rows deep, with each circuit feeding three rows. It shall be constructed of rifled copper tubes and aluminum fins with a maximum face velocity of 374 ft. per minute at 21,000 CFM. A stainless steel condensate drain pan shall be provided.

- E. The indoor evaporator unit shall include refrigerant piping and shall have a factory holding charge of nitrogen. The hot-gas and liquid lines shall be spun shut and each shall include a factory-installed Schrader valve. Field-relief of the Schrader valve shall indicate a leak-free system from the factory
- F. The system shall be designed for use with R-410A refrigerant, which meets the U.S. Clean Air Act for phase-out of HCFC refrigerants. Refrigerant shall be field supplied and field charged by the installing contractor.

## **2.5 ECONOPHASE PUMPING UNIT**

- A. Furnish factory packaged Econophase Pumping Units for each Precision Cooling System in the Computer Room (Not included on UPS Room units). During cold outdoor temperatures, refrigerant pumps in the Pumping Unit shall circulate refrigerant through the cooling system, in lieu of operating the compressors. The compressors shall ramp down during EconoPhase operation, and if able to completely offset the load, the control system shall shut the compressors off. Dual refrigerant pumps shall be housed in an enclosure, with each pump dedicated to its own refrigerant circuit. The EconoPhase system shall include a variable speed drive on each refrigerant pump to enable to pumps' speed to adjust in response to the load.
- B. Furnish accessory SFA #: DC-35515-1, with Single Point Power in an outdoor enclosure for the condensers and EconoPhase Pump. Connection shall serve two condensers and single EconoPhase Pumping Unit.

## **2.6 FACTORY FABRICATED CONDENSER SKID**

- A. Coil
  - 1. Microchannel coils are all-aluminum construction with full-depth louvered aluminum fins.
  - 2. Tubes, fins and aluminum headers are oven-brazed to form a complete refrigerant-to-air heat exchange coil. Baffles are used in the headers to separate one coil slab into multiple passes as needed.
  - 3. The coil shall be factory leak tested at a minimum of 300 PSIG and dehydrated.
  - 4. Copper stub pipes are electric resistance welded to aluminum coils and joints are protected with polyolefin to seal joint from environmental corrosive elements.
  - 5. Hot gas and liquid lines are brazed to stub pipes with spun closed ends for customer piping connections.
  - 6. Coil pipe assemblies to be filled and sealed with a nitrogen holding charge for shipment.
- B. Fan/Motor Assembly
  - 1. The fan/motor assembly is complete with external rotor motor, fan blades and fan/finger guard.
  - 2. Fan blades are constructed to stamped aluminum or steel extrusion coated with PP plastic.
  - 3. Fan guards are heavy gauge, close meshed, steel wire, coated with a black corrosion resistant finish.
  - 4. Fan terminal blocks located on the top of the fan guard with IP54 protection class.
  - 5. Fans are factory balanced and tested before shipment.
  - 6. Fan motors are variable speed. The EC fans provide internal overload protection through the built-in electronics.
  - 7. Each EC fan motor has built-in controller and communication module, linked via RS485 communication wire to each fan and the Premium Control Board.
- C. Premium Efficiency Fan Control
  - 1. The premium efficiency condenser control system is complete with control board, EC fan motor(s), refrigerant-pressure transducer(s), refrigerant-temperature thermistor(s),

- ambient-temperature thermistor, and motor overload protection in the factory wired control panel.
2. The control board maintains EC fans on the same circuit to the same speed in order to maintain refrigerant head pressure. The control board receives a run signal from the compressor of the indoor unit via field-supplied low voltage interlock wires or with optional, field-supplied CANBUS communication wires from the indoor unit iCOM. The system head pressure can be maintained to a minimum ambient temperature of 0°F (-18°C).
- D. Housing
1. The condenser housing is constructed of bright aluminum sheet and divided into individual fan sections by full width baffles.
  2. Internal structural support members, including coil support frame, are galvanized steel for strength and corrosion resistance.
  3. Panel doors are provided on two sides of each coil/fan section to provide for coil cleaning.
  4. Aluminum legs are provided with rigging holes for hoisting the unit into position.
- E. Electrical
1. Locking unit disconnect switches are factory installed and wired in attached condenser control section.
- F. Skid Mounting
1. Condensers shall be skid mounted at the manufacturer's factory, and be pre-piped and pre-wired. Refer to the drawings for arrangement and details.

## **2.7 MISCELLANEOUS OPTIONS**

- A. Dual Locking Disconnect Switches
1. SFA #: E-33253-6, Dual Locking disconnect switches and reversing starter.
  2. 460V 60Hz unit with two Reversing starters to provide primary power and secondary power. First reversing starter to provide power to main fan motor, compressors, controls and condensate pump. Second reversing starter to provide power to PRE unit, which provides single point power to Liebert MC (condensers).
  3. Unit to be marked for 65 KAIC SCCR.
  4. Furnish two pneumatic timers for delay on switchover for either power supply, selector switch in low volt section, status contacts to customer connection terminals, and Indicator lights on accent panel.
- B. Smoke Sensor
1. The smoke sensor in the indoor cooling unit shall immediately shut down the Precision Cooling system and activate the alarm system when activated. The smoke sensor shall be mounted in the electrical panel with the sensing element in the return air compartment. The smoke sensor is not intended to function as or replace any room smoke detection system that may be required by local or national codes. The smoke sensor shall include a supervision contact closure.
- C. Condensate Pump, Dual Float
1. The condensate pump shall have a minimum capacity of 145 GPH at 20 ft. head. It shall be complete with integral dual-float switches, pump-and-motor assembly and reservoir. The secondary float shall send a signal to the local alarm and shut down the unit upon high water condition.
- D. Main Fan Overload
1. A pair of N/O contacts shall be factory-installed and wired to indicate Main Fan Overload.
- E. Compressor Overload

1. A pair of N/O contacts shall be factory-installed and wired to each compressor to indicate Compressor Overload.

**F. Electrical**

1. Indoor unit configured for 460V, 3Φ, 3-wire service.
  2. Unit rated at 65 KAIC.
  3. Unit configured for 120V.1Φ UPS power to indoor CRAC unit iCOM controller.
- G. Furnish iCOM control over ride (Quick Start). Fan(s) to re-start immediately on power up. iCOM controls take over after time delay.**

## **2.8 LIQUID SENSORS**

- A. One leak detection cable.**

## **2.9 FLOOR STAND**

- A. The floor stand shall be constructed of a welded steel frame. The floor stand shall have adjustable legs with vibration isolation pads. The floor stand shall be 36 inches to match access flooring.**
- B. Isolation pads furnished by Section 23 05 29.**

## **2.10 FILTER ACCESS**

- A. Furnish and install separate 18" filter access section located at the top of the indoor cooling unit (CRAC) to enable front filter access.**

## **2.11 CONTROL AND SEQUENCES**

- A. The Liebert iCOM unit control is factory-set for Intelligent Control. Proportional and Tunable PID are user selectable options. Internal unit component control shall include the following: System Auto Restart, Sequential Load Activation, and Predictive Humidity Control. The control system and electronic circuitry shall be provided with self-diagnostics. The microcontroller board shall be diagnosed and reported as pass/not pass. Control inputs shall be indicated as on or off at the front monitor panel. Control outputs shall be able to be turned On or Off from the front monitor panel without using jumpers or a service terminal.**
- B. Refer to Owner furnished document in Appendix A: DLR Data Center – Liebert DSE Systems – Data Center & Electrical Room – Sequence of Operations – Release dated 10/09/14, Version 1.8, attached to this specification for specific controls sequences.**

## **2.12 ICOM MICROPROCESSOR CONTROL WITH LARGE GRAPHIC DISPLAY**

- A. The Liebert iCOM Large Graphic Display shall include a 320x240 dot matrix graphic display and a 120V power supply.**
- B. The system displays user menus for active alarms, event log, graphic data, unit view/status overview (including the monitoring of room conditions, operational status in % of each function, date and time), total run hours, various sensors, display setup and service contacts. A password is required to make system changes within the service or advanced menus.**
- C. The Liebert iCOM control shall activate an audible and visual alarm in event of any of the following conditions:**
- D. High/Low Temperature, High/Low Humidity, Main Fan Overload (if option selected), Change Filters, Loss of Air Flow or Power, and four separate Custom Alarms.**

### **2.13 ADDITIONAL SENSORS**

- A. A factory furnished and commissioned supply air temperature sensor with 40'-0" of horizontal wiring ships with the unit for sensor location in the field. The sensor is terminated on the Liebert iCOM unit controller terminal strip and the associated cable wiring is coiled within the unit for shipment.
- B. A factory furnished and commissioned differential pressure sensor ships with the unit for sensor location in the field. The sensor is terminated on the Liebert iCOM unit controller terminal strip.
- C. A factory furnished combination return air temperature/humidity sensor is factory installed and wired within the return plenum of the unit. The sensor is terminated on the Liebert iCOM unit controller terminal strip.

### **2.14 LOW VOLTAGE TERMINAL PACKAGE**

- A. Two additional remote shutdown terminals.
- B. Two additional common alarm normally open contacts for remote indication of unit alarms.
- C. Main fan auxiliary switch, with one set of normally open contacts

### **2.15 NETWORK INTERFACE CARD (NIC)**

- A. The Liebert IntelliSlot 485 Card provides Liebert SiteScan® Web or Building Management Systems monitoring and control of your Liebert equipment. The card delivers Modbus or Liebert's proprietary protocol via the RS-485 port.

### **2.16 SMOKE SENSOR**

- A. Furnish smoke sensor in the return air and shuts down the unit if smoke is detected.
- B. Furnish a visual and audible alarm.
- C. Furnish dry contacts are available for a remote alarm.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Verify that flooring system is ready to receive work and opening dimensions are as indicated on shop drawings.
- B. Verify that proper power supply is available.
- C. Contractor shall field verify Piping and Electrical Riser Connection Assembly dimensions.
- D. Field fabricated return air plenum to be furnished and installed by mechanical installer.

### **3.2 INSTALLATION & START UP**

- A. Install units in accordance with manufacturer's instructions. Coordinate installation of indoor cooling units with computer room raised floor installer. Place floor stands during construction

of raised floor. Provide adequate drainage connections for condensate system. Secure floorstands to floor slab with anchor bolts.

- B. Connect field furnished refrigerant piping to equipment and Riser Assembly. Refer to section 23 23 00 for requirements.
- C. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to electrical installer.
  - 1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.
- D. Arrange and pay for the services of a qualified representative of the manufacturer to start up and commission all new CRAH units, and to provide a written start up report for each unit.
- E. Install condensers and EconoPhase Pumping Units on the roof structural supports, as indicated on the drawings.
- F. Refrigerant shall be field supplied and field charged by the installing contractor.

### **3.3 INTEGRATED SYSTEMS TESTING**

- A. Provide support for Integrated Systems Testing (Commissioning Level 5) in addition to and after successful completion of Acceptance Testing (Level 4). Provide for one 4-hour day for each Precision Cooling System.

**END OF SECTION**