# Vertiv™ Liebert® Mini-Mate2 8 - Ton
# GUIDE SPECIFICATIONS

## 1.0 GENERAL

### 1.1 Summary

These specifications describe requirements for a ceiling-mounted Thermal Management system. The system shall be designed to control temperature conditions in rooms containing electronic equipment, with good insulation and vapor barrier. The system is also available with an optional humidity control system.

The manufacturer shall design and furnish all equipment in the quantities and configurations shown on the project drawings.

### 1.2 Design Requirements

The Thermal Management system shall be a Liebert® Mini-Mate2 factory assembled unit. On direct expansion models, the refrigeration system shall be split, with the compressor located in a remote or close-coupled condensing unit.

The evaporator section shall be designed for above dropped-ceiling installation. Condensing units shall be designed for either outdoor or above-dropped-ceiling installation. Refer to Section 2.3 for condensing unit guide specifications.

The system shall have a net total cooling capacity of _____ BTU/hr (kW) and a net sensible cooling capacity of _____ BTU/hr (kW), based on entering air conditions of _____°F (°C) dry bulb and _____°F (°C) wet bulb. Net capacities shall include losses due to fan motor heat. The system cooling capacity shall be factory certified per ASHRAE 127-2007 testing.

The unit is to be supplied for operation on a _____ volt, _____ phase, _____ Hz power supply.

System shall be supplied with CSA Certification to the harmonized U.S. and Canadian product safety standard CSA C22.2 No 236/UL 1995 for "Heating and Cooling Equipment" and marked with the CSA c-us logo (60 Hz only).

The system model numbers shall be:

Evaporator _____

Condensing Unit _____

### 1.3 Submittals

Submittals shall be provided after the agreement of the proposal and shall include: Single-Line Diagrams; Dimensional, Electrical and Capacity data; Piping and Electrical Connection Drawings.

### 1.4 Quality Assurance

The specified system shall be factory-tested before shipment. Testing shall include, but shall not be limited to: Quality Control Checks, “HiPot” Test (two times rated voltage plus 1000 volts, per NRTL agency requirements) and Metering Calibration Tests. The system shall be designed and manufactured according to world class quality standards. The manufacturer shall be ISO 9001 certified.

## 1.5 Acceptable Alternatives

Acceptable alternatives shall be permitted with engineer's prior approval only. Contractor to submit a detailed summary form listing all variations to include size deviations, electrical load differences, functional and component changes, and savings to end user.

# 2.0 PRODUCT

## 2.1 Standard Features/All Systems

### 2.1.1 Evaporator Cabinet Construction

The cabinet and chassis shall be constructed of heavy gauge galvanized steel and shall be serviceable from one side only. Mounting brackets shall be integral to the cabinet design. Internal cabinet insulation shall meet ASHRAE 62.1 requirements for Mold Growth, Humidity and Erosion, tested per UL 181 and ASTM 1338 standards.

### 2.1.2 Air Distribution

The fan shall be the belt-drive, centrifugal type, double width, double inlet. The shaft shall be heavy-duty steel with self-aligning ball bearings with minimum life of 100,000 hours. The fan motor shall be 1750 rpm (1450 rpm @ 50hz) and mounted on an adjustable base. The drive package shall be equipped with an adjustable motor pulley. The fan/motor assembly shall be mounted on vibration isolators.

The evaporator system shall be capable of delivering ____CFM (CMH) at ___ inches (mm) of external static pressure.

The fan motor shall be ____ HP (W).

System shall be suitable for ducted supply and return air distribution. Refer to 2.5.2 Air Filter Box/Duct Flange.

### 2.1.3 Microprocessor Control

The control system shall be microprocessor-based, factory-wired into the system cabinet and tested prior to shipment. The wall-mounted controller shall include a 2-line by 16-character liquid crystal display (LCD) providing continuous display of operating status and alarm condition which is wired into the control board using 4-conductor field-supplied wire. A 7-key membrane keypad for setpoint/program control and unit On/Off shall be located below the display. The control shall be capable of displaying values in °F or °C. Wall-mounted controller shall be password protected to prevent unauthorized set point adjustments.

The controller shall provide three stages of cooling for direct expansion units by cycling the 3-ton compressor, 5-ton compressor and then both compressors. The controller shall determine the average cooling requirements, updated every hour, to determine the lead compressor to minimize compressor cycling or the lead compressor shall be user selectable from the wall controller.

For chilled water units, the controller shall adjust the modulating chilled water valve.

Temperature and humidity sensors shall be located in the wall controller, which shall be capable of being located up to 300 ft (91.4m) from the evaporator unit when using a remote temperature/humidity sensor in the conditioned space.

#### Monitoring

The LCD shall provide an On/Off indication, operating mode indication (cooling, heating, humidifying, dehumidifying) and current day, time, temperature, and humidity (if applicable) indication. The monitoring system shall be capable of relaying unit operating parameters and alarms to the Vertiv™ Liebert® IS-UNITY-DP monitoring systems.

### Control Setpoint Parameters

- Temp. Setpoint 65-85°F (18-29°C)
- Temp. Sensitivity 1-9.9 °F (1-5°C)
- Humidity Setpoint 20-80% RH
- Humidity Sensitivity 1-30% RH

### Unit Controls

#### 1. Compressor Short-Cycle Control

The control system shall prevent compressor short-cycling by a 3-minute timer from compressor stop to the next start.

#### 2. Common Alarm and Remote On/Off

A common alarm relay shall provide a contact closure to a remote alarm device. Two (2) terminals shall also be provided for remote On/Off control. Individual alarms shall be “enabled” or “disabled” from reporting to the common alarm.

#### 3. Setback Control

The control shall be user-configurable to use a manual setpoint control or a programmable, time-based setback control. The setback control will be based on a 5 day/2 day programmed weekly schedule with capability of accepting two events per program day.

#### 4. Temperature Calibration

The control shall include the capabilities to calibrate the temperature and humidity sensors and adjust the sensor response delay time from 10 to 90 seconds. The control shall be capable of displaying temperature values in °F or °C.

#### 5. System Auto Restart

For startup after power failure, the system shall provide automatic restart with a programmable (up to 9.9 minutes in 6-second increments) time delay. Programming can be performed either at the wall-mounted controller or from the central, site-monitoring system.

## 2.1.4 Electrical Switches and Sensors

#### 1. Disconnect Switch, Non-Locking

The non-automatic, non-locking, molded case circuit interrupter shall be factory mounted in the high-voltage section of the electrical panel. The switch handle shall be accessible from the unit front and mounted on:

_____ the evaporator/chilled water unit

_____ the indoor air-cooled centrifugal condensing unit

_____ the water/glycol-cooled condensing unit.

#### 2. High-Temperature Sensor

The high-temperature sensor shall immediately shut down the system when high temperatures (125°F, 51.7°C) are detected. The high-temperature sensor shall be mounted with the sensing element in the return air.

#### 3. Filter Clog Switch

The filter clog switch senses pressure drop across the filters and shall annunciate the wall controller upon exceeding the adjustable setpoint.

### 2.1.5 Alarms

#### 1. Unit Alarm

The control system shall monitor unit operation and activate an audible and visual alarm in the event of the following factory preset alarm conditions:

- High Temperature
- Low Temperature
- High Humidity
- Low Humidity
- High Water Alarm - Lockout Unit Operation
- High Head Pressure #1 and #2
- Loss of Power
- Compressor Short Cycle #1 and #2
- Humidifier Problem
- Filter Clog

**Custom Alarms (3x)**

- Smoke Detected
- Standby Unit On
- Water Flow Loss
- Standby GC Pump
- Custom 1
- Custom 2
- Custom 3

User-customized text can be entered for the three (3) custom alarms.

#### 2. Alarm Controls

Each alarm (unit and custom) shall be individually enabled or disabled (except for high head pressure and high water in condensate pan) and can be programmed for a time delay of 0 to 255 seconds of continuous alarm condition to be recognized as an alarm. Each alarm can also be enabled or disabled to activate the common alarm (except high head pressure and high water in condensate pan).

#### 3. Audible Alarm

The audible alarm shall annunciate at the LCD wall box any alarm that is enabled by the operator.

#### 4. Common Alarm

A programmable common alarm shall be provided to interface user selected alarms with a remote alarm device. Alarms shall be enabled or disabled from reporting to the common alarm.

#### 5. Remote Monitoring

All alarms shall be communicated to the Liebert remote monitoring system with the following information: date and time of occurrence, unit number and present temperature and humidity.

## 2.2 Direct Expansion System Evaporator Components

### 2.2.1 Direct Expansion Coil

The direct expansion units shall have two (2) independent refrigeration circuits; a nominal 3-ton circuit and a nominal 5-ton circuit to provide three levels of cooling.

The evaporator coil shall have two circuits, minimum 7.6 sq. ft. (0.71 sq. m) face area, four rows deep, constructed of copper tubes and aluminum fins, and have a maximum face velocity of ___ ft. per minute (m/s) at ___ CFM (CMH). Externally equalized thermostatic expansion valves shall control refrigerant flow. A filter drier shall be provided for each circuit. The refrigerant piping shall be spun-closed and filled with a nitrogen holding charge. Field relief of the Schrader valves shall indicate a leak-free system. Evaporator and condensing unit shall be field piped using copper lines, brazed, evacuated and field charged with R-407C refrigerant.

The coil assembly shall be mounted in a condensate drain pan, with an internally trapped drain line. The evaporator drain pan shall include a factory-installed float switch to shut down the evaporator upon high water condition.

## 2.3 Chilled Water System Components

### 2.3.1 Chilled Water Control Valve

A (2-way) (3-way) modulating, non-spring return valve shall be controlled by the microprocessor to position the valve in response to room conditions. Water-side design pressure shall be 400 psig (2757 kPa) static pressure, with a maximum close-off pressure of ____ psi (kPa).

### 2.3.2 Chilled Water Coil

The cooling coil shall have a minimum 7.6 sq. ft. (0.71 sq. m) face area, four rows deep, constructed of copper tubes and aluminum fins, and have a maximum face velocity of ____ ft. per minute (m/s) at ____ CFM (CMH). The coil shall be supplied with 45°F (7.2°C) entering water temperature. The coil shall be supplied with _____ GPM (l/s) of chilled water and the pressure drop shall not exceed _____ PSI (kPa). The coil assembly shall be mounted in a condensate drain pan with internally trapped drain line. The evaporator drain pan shall include a factory-installed float switch to shutdown the unit upon high water condition.

## 2.4 Indoor Air-Cooled Centrifugal Fan Condensing Unit

Condensing unit components shall include a two (2) circuit condenser coil, a 3-ton scroll compressor, a 5-ton scroll compressor, and each shall contain a high-pressure switch, Vertiv™ Liebert® Lee-Temp refrigerant receiver, head pressure control valve, hot gas bypass system and liquid line solenoid valve. A non-automatic, non-locking, molded case disconnect switch shall be factory mounted in the high voltage section of the electrical panel. The switch handle shall be accessible from the unit front. The cabinet and chassis shall be constructed of heavy gauge galvanized steel and shall be serviceable from one side. Mounting brackets shall be integral to the cabinet design and be designed for ceiling mounting.

The hot gas bypass circuit shall be provided to reduce compressor cycling and improve operation under low load conditions. The two hot gas bypass systems shall be completely contained in the condensing unit. Field installed third refrigerant lines shall not be acceptable. Hot gas bypass shall be automatically deactivated upon a call for dehumidification.

High pressure switches shall protect the unit from abnormal refrigerant pressure conditions and shall deactivate the compressor affected and annunciate an alarm at the wall controller. The blower shall continue to circulate air. The wall controller shall be used to manually restart the compressor function after the automatic pressure switch resets. Three high head pressure alarms in a rolling 12-hour period shall lock out the manual restart feature until power is cycled to the evaporator unit.

A pressure balancing valve shall be factory installed on each circuit to reduce the chance of high pressure cut-out due to excessive refrigerant migration to the receiver due to changing outdoor temperatures during off-cycles.

The refrigerant piping shall be spun-closed and filled with a nitrogen holding charge. Field relief of the Schrader valves shall indicate a leak-free system. Evaporator and condensing unit shall be field piped using copper lines, brazed, evacuated and field charged with R-407C refrigerant. Condensing unit shall be designed for 95°F (35°C) ambient and be capable of operation to -30°F (-34.4°C) inlet air temperature. The condensing unit can be coupled directly to the evaporator or can be mounted remote to the evaporator.

The condensing unit coil shall have a minimum 9.2 sq. ft. (0.85 sq. m) face area, four rows deep, constructed of copper tubes and aluminum fins. The condenser fan shall be centrifugal type, double inlet, heavy-duty steel shaft, with self-aligning bearings. The fan motor shall operate at 1750 rpm (1450 rpm @ 50 Hz), shall be equipped with adjustable motor pulley, and shall be mounted on an adjustable base. The fan and motor assembly shall be mounted on vibration isolators. The fan motor assembly shall be belt-drive.

The condenser fan shall be designed for ____CFM (CMH) at ____" (mm) external static pressure.

## 2.5 Outdoor Air-Cooled Prop Fan Condensing Unit

The condensing unit shall be designed for outdoor use with either roof or ground level mounting. The condensing unit is constructed of galvanized and galvanneal painted steel for corrosion resistance. Removable exterior panels shall allow access to the electric panel or refrigeration components for service or maintenance. Both inlet and outlet air grilles shall be heavy duty steel with a durable polyester coating.

Condensing unit components shall include two (2) independent refrigeration circuits, with one based on a 3-ton compressor and the other based on a 5-ton compressor. Each circuit shall contain a scroll compressor, condenser coil, high-pressure switch, Vertiv™ Liebert® Lee-Temp insulated refrigerant receiver with internal heater, head pressure control valve, hot gas bypass system and liquid line solenoid valve.

The hot gas bypass circuit shall be provided to reduce compressor cycling and improve operation under low load conditions. The two (2) hot gas bypass systems shall be completely contained in the condensing unit. Field installed third refrigerant lines shall not be acceptable. Hot gas bypass shall be automatically deactivated upon a call for dehumidification.

High pressure switches shall protect the unit from abnormal refrigerant pressure conditions and shall deactivate the compressor affected and annunciate an alarm at the wall controller. The blower shall continue to circulate air. The wall controller shall be used to manually restart the compressor function after the automatic pressure switch resets. Three high head pressure alarms in a rolling 12-hour period shall lock out the manual restart feature until power is cycled to the evaporator unit.

A pressure balancing valve shall be factory installed on each circuit to reduce the chance of high pressure cut-out due to excessive refrigerant migration to the receiver due to changing outdoor temperatures during off-cycles.

The condenser coils shall be constructed of copper tubes and aluminum fins. A common direct-drive propeller fan shall provide the heat rejection airflow. The condensing unit refrigerant piping shall be spun-closed and filled with a nitrogen holding charge. Field relief of the Schrader valves shall indicate a leak-free system. Evaporator and condensing unit shall be field piped using copper lines, brazed, evacuated and field charged with R-407C refrigerant.

Condensing unit shall be designed for 95°F (35°C) ambient and be capable of operation to -30°F (-34.4°C).

(Option) The coils shall be epoxy-coated for extended coil life in corrosive environments, such as coastal areas. Factory-applied E-coat using immersion and baking process shall provide a flexible epoxy-coating to all coil surfaces. Coil color shall be black and shall be protected from solar UV ray degradation with a factory-applied UV topcoat.

## 2.6 Indoor Water/Glycol-Cooled Condensing Unit

The water/glycol condensing unit shall include two (2) independent refrigeration circuits, with one based on a 3-ton compressor and the other based on a 5-ton compressor. Each circuit shall contain a scroll compressor, coaxial condenser, water-regulating valve, high head pressure switch, hot gas bypass system and liquid line solenoid valve. A non-automatic, non-locking, molded case disconnect switch shall be factory mounted in the high voltage section of the electrical panel. The switch handle shall be accessible from the unit front. The cabinet and chassis shall be constructed of heavy gauge galvanized steel and shall be serviceable from one side. Mounting brackets shall be integral to the cabinet design and be designed for ceiling mounting.

The hot gas bypass circuit shall be provided to reduce compressor cycling and improve operation under low load conditions. The two (2) hot gas bypass systems shall be completely contained in the condensing unit. Field installed third refrigerant lines shall not be acceptable. Hot gas bypass shall be automatically deactivated upon a call for dehumidification.

High pressure switches shall protect the unit from abnormal refrigerant pressure conditions and shall deactivate the compressor affected and annunciate an alarm at the wall controller. The blower shall continue to circulate air. The wall controller shall be used to manually restart the compressor function after the automatic pressure switch resets. Three high head pressure alarms in a rolling 12-hour period shall lock out the manual restart feature until power is cycled to the evaporator unit.

The condensing unit refrigerant piping shall be spun-closed and filled with a nitrogen holding charge. Field relief of the Schrader valves shall indicate a leak-free system. Evaporator and condensing unit shall be field piped using copper lines, brazed, evacuated and field charged with R-407C refrigerant.

The water/glycol condensing unit shall be equipped with two coaxial condenser coils piped to common supply and return headers and shall have a total system pressure drop of _____ ft. of water (kPa) and a flow rate of _____ GPM (l/s) with _____ °F (°C) entering water/glycol temperature.

Each condenser coil shall be pre-piped with a [(2-way) (3-way)] regulating valve which is head-pressure actuated.

The condenser water/glycol circuit shall be designed for a static operating pressure of [(150 PSI (1034kPa)) (350 PSI (2413 kPa))].

## 2.7 Factory-Installed Options

### 2.7.1 Steam Generating Humidifier

The Thermal Management system shall be equipped with a steam generating humidifier that is controlled by the microprocessor control system. It shall be complete with disposable canister, all supply and drain valves, 1" (25.4 mm) air gap on fill line, inlet strainer, steam distributor and electronic controls. The need to change canister shall be annunciated on the microprocessor wall box control panel. The humidifier shall have a capacity of 4.5 lb/hr (10 kg/h). An LED light on the humidifier assembly shall indicate cylinder full, overcurrent detection, fill system fault and end of cylinder life conditions. The canister flush water shall not drain into the coil drain pan, due to risk of aggressive corrosion of the evaporator coil. The humidifier wand shall be mounted over the coil drain pan.

### 2.7.2 Electric Reheat

The electric reheat shall be low-watt density, 304/304 stainless steel, finned-tubular and shall be capable of maintaining room dry bulb conditions when the system is calling for dehumidification. The reheat section shall include an agency-approved safety switch to protect the system from overheating. A ground current detector shall be factory installed to shut-down the entire unit if a ground fault in the reheat system is detected.

The capacity of the reheat coils shall be _____ BTU/HR (kW), with unit input voltage of _____ V, controlled in two stages.

### 2.7.3 Hot Water Reheat

The hot water reheat coil shall have copper tubes and aluminum fins with a capacity of _____ BTU/HR (kW) when supplied with _____°F (°C) entering water temperature at _____ GPM (l/s) flow rate. Maximum pressure drop shall be _____ PSI (kPa). The control system shall be factory-prepiped with a 2-way solenoid valve and cleanable Y-strainer. The hot water reheat coil shall only be available on chilled water units.

### 2.7.4 SCR Electric Reheat

The electric reheat shall be low-watt density, 304/304 stainless steel, finned-tubular and shall be capable of maintaining room dry bulb conditions when the system is calling for dehumidification. The reheat section shall include an agency-approved safety switch to protect the system from overheating. A ground current detector shall be factory installed to shut-down the entire unit if a ground fault in the reheat system is detected.

The SCR (Silicon Controlled Rectifier) controller shall proportionally control the reheat elements to maintain the selected room temperature. The rapid cycling made possible by the SCR controller provides precise temperature control, and the more constant element temperature improves heater life. The unit microprocessor control shall operate the SCR controller, while cooling is locked on. The capacity of the reheat coils shall be _____ BTU/HR (kW), unit input voltage of _____ V. Not available on chilled water or free-cooling units.

### 2.7.5 Smoke Sensor

The smoke sensor shall immediately shut down the Thermal Management system and activate the alarm system when activated. The sensing element shall be located in the return air compartment. This smoke sensor shall not function or replace any room smoke detection system that may be required by local or national codes.

### 2.7.6 Remote Monitoring and Control – IS-UNITY-DP And BMS

The Vertiv™ Liebert® IS-UNITY-DP BMS Monitoring Solution shall provide SNMP v1/v2c/v3, BACnet IP, BACnet MSTP, Modbus TCP/IP, and Modbus RTU monitoring capability to the Vertiv™ Liebert® Mini-Mate2 system. Card shall employ Ethernet and RS-485 networks to monitor and manage a wide range of operating parameters pertaining to the cooling system. The Unity card shall provide access to the Liebert® Mini-Mate2 remotely via a web interface and shall support Vertiv™ Liebert® Nform connectivity. The IS-UNITY-DP card shall be factory mounted inside an enclosure on the outside of the Liebert® Mini-Mate2 unit and shall be factory wired for power and unit communications. Ethernet cable providing network access to the world-wide web or to a BMS shall be field wired.

### 2.7.7 Vertiv™ Liebert® Glycool (Free-Cooling)/Dual Cooling Coil

A secondary free-cooling coil shall be integral to the evaporator cabinet and shall be constructed of copper tubes and aluminum fins. The coil shall be rated at _____ BTU/HR (kW) sensible cooling capacity with a 45°F (22°C), ___% glycol solution. The coil shall require _____ GPM (l/s) and the total unit pressure drop shall not exceed _____ feet of water (kPa) when in the free cooling mode. Free cooling shall be activated when the inlet coolant temperature is low enough to provide cooling and shall include factory piped three-way valves.

Coil shall be designed for closed-loop applications using properly treated and circulated fluid. An optional CuNi coil or a field-supplied heat exchanger system shall be required to prevent premature corrosion if applied to open water tower loop. Not available with SCR reheat.

## 2.8 Ship - Loose Accessories

### 2.8.1 Remote Sensors

The unit shall be supplied with remote temperature and humidity sensors. The sensors shall be connected to the unit by a _____ ft. _____ (m) shielded cable.

### 2.8.2 Air Filter Box/Duct Flange

The evaporator section shall be supplied with an air filter box for use with ducted installations. Two (2) filters shall be included 4" x 20" x 25" (102 mm x 508mm x 635mm) each, deep-pleated type, with a MERV 8 rating, based on ASHRAE 52.2-2007. A duct flange shall be supplied for use on the supply air opening of the unit.

### 2.8.3 Condensate Pump

The condensate pump shall have the capacity of _____ GPH (___ l/h) at ___ ft. head (___ kPa). It shall be complete with integral float switch, discharge check valve, pump, motor assembly and reservoir. A secondary float switch on the condensate pump shall tie into the unit to provide an alarm on the wall-mounted controller and shut down the unit upon high water in the basin of the pump. Condensate pump shall be powered from the Liebert® Mini-Mate2. A separate electrical feed is not acceptable.

### 2.8.4 Condensate Pump Bracket

A condensate pump bracket shall be provided to mount condensate pump to the end of the unit and allow easy alignment and installation of the condensate pump.

### 2.8.5 Single Point Power Kit

A Single Point Power Kit shall be provided for a close-coupled system to allow a single electrical feed to supply power to both the evaporator and indoor close-coupled (attached) condensing unit.

**Remote Monitoring and Control – IS-Unity-DP and BMS – Field-installed Unit-mount Kit**

The Vertiv™ Liebert® IS-UNITY-DP BMS Monitoring Solution shall provide SNMP v1/v2c/v3, BACnet IP, BACnet MSTP, Modbus TCP/IP, and Modbus RTU monitoring capability to the Vertiv™ Liebert® Mini-Mate2 system. Card shall employ Ethernet and RS-485 networks to monitor and manage a wide range of operating parameters pertaining to the cooling system. The Unity card shall provide access to the Liebert® Mini-Mate2 remotely via a web interface and shall support Vertiv™ Liebert® Nform connectivity. The unit-mount external enclosure kit for field-installation shall include the IS-UNITY-DP card, power/communication interface card, galvanized steel enclosure, power and communication wire harnesses and full instructions. Field-supplied wiring for communication from the Liebert® Mini-Mate2 to other systems shall be required to access features.

### 2.8.6 Remote Monitoring and Control – IS-Unity-DP and BMS – Field-installed Wall-mount Kit

The Liebert® IS-UNITY-DP BMS Monitoring Solution shall provide SNMP v1/v2c/v3, BACnet IP, BACnet MSTP, Modbus TCP/IP, and Modbus RTU monitoring capability to the Liebert® Mini-Mate2 system. Card shall employ Ethernet and RS-485 networks to monitor and manage a wide range of operating parameters pertaining to the cooling system. The Unity card shall provide access to the Liebert® Mini-Mate2 remotely via a web interface and shall support Liebert® Nform connectivity. The wall-mount kit for field-installation shall include the IS-UNITY-DP card, power/communication interface card, painted enclosure, 120V wall outlet transformer with 6ft (2m) low voltage power wire, and full instructions. Power shall be supplied from unit using field-supplied wiring or from single phase power (120 V) source using included transformer. Field-supplied wiring for communication to the Liebert® Mini-Mate2 and to other systems shall be required to access features.

### 2.8.7 Drycooler

The Liebert drycooler shall be a low-profile, direct-drive propeller fan-type air-cooled unit. The drycooler shall be constructed with an aluminum cabinet and a copper-tube aluminum fin coil, and multiple direct drive fans. All electrical connections and controls shall be enclosed in an integral electric control panel. Weatherproof section of the drycooler the unit is quiet and corrosion resistant.

The drycooler shall be designed for _____°F (°C) ambient.

### 2.8.8 Glycol Pump Package

The system shall include a centrifugal pump mounted in a weatherproof and vented enclosure. The pump shall be rated for ____ gpm (l/s) at ____ ft. (kPa) of head, and operate on _____ volt, ____ phase, _____ Hz.

# 3.0 EXECUTION

## 3.1 Installation of Air Conditioning Unit

### 3.1.1 General

Install air conditioning unit in accordance with manufacturer's installation instructions. Install unit plumb and level, firmly anchored in location indicated, and maintain manufacturer’s recommended clearances.

### 3.1.2 Electrical Wiring

Install and connect electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer’s electrical connection diagram submittal to electrical contractor. Install and wire per local and national codes.

### 3.1.3 Piping Connections

Install and connect devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer’s piping connection diagram submittal to piping contractor.

### 3.1.4 Supply and Drain Water Piping

Connect water supply and drains to air conditioning unit. Unit drain shall be trapped internally and shall not be trapped externally.

### 3.1.5 Field-Supplied Pan

A field-supplied pan with drain shall be installed beneath cooling units and water/glycol condensing units.

## 3.2 Field Quality Control

Startup air conditioning unit in accordance with manufacturer’s startup instructions. Test controls and demonstrate compliance with requirements.