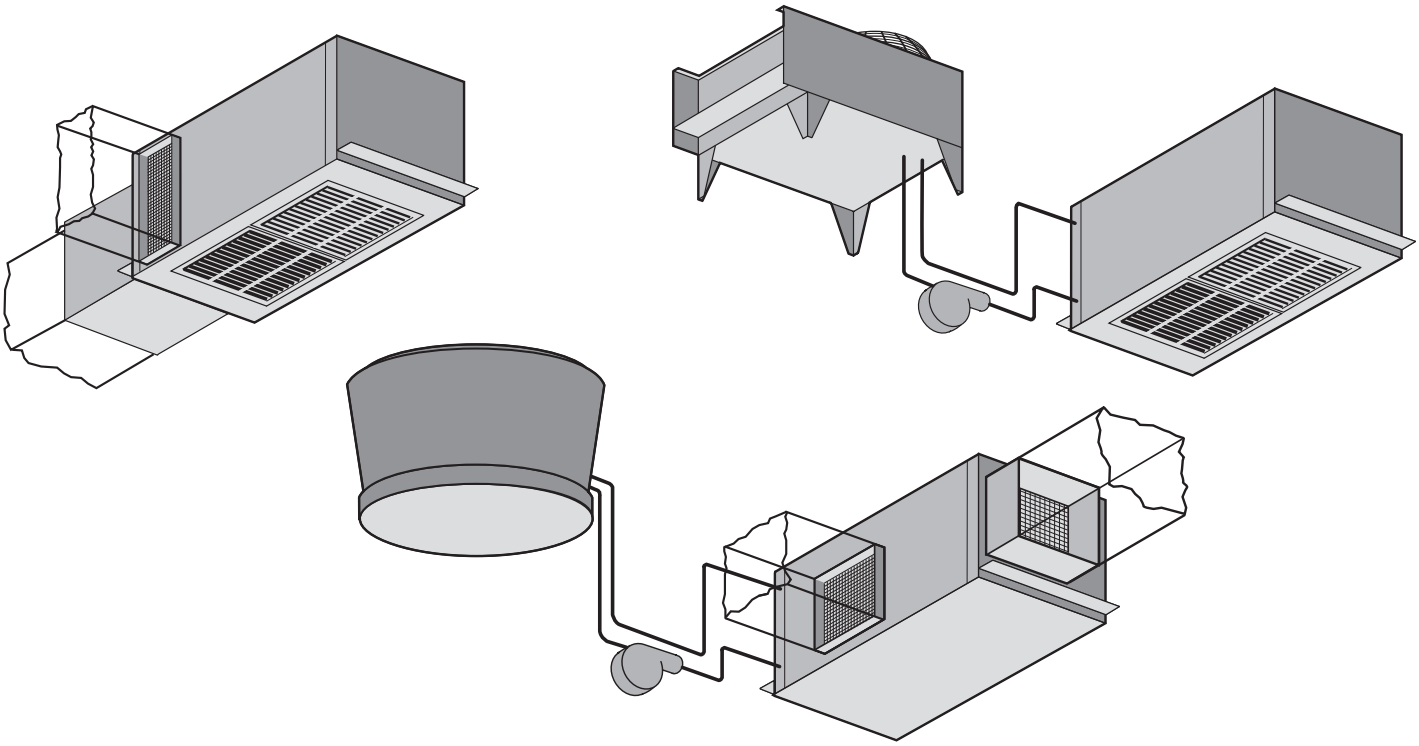
Precision Cooling
For *Business-Critical Continuity™*

Liebert® Mini-Mate2™

User Manual - 1 & 1.5 Tons, 50 & 60Hz



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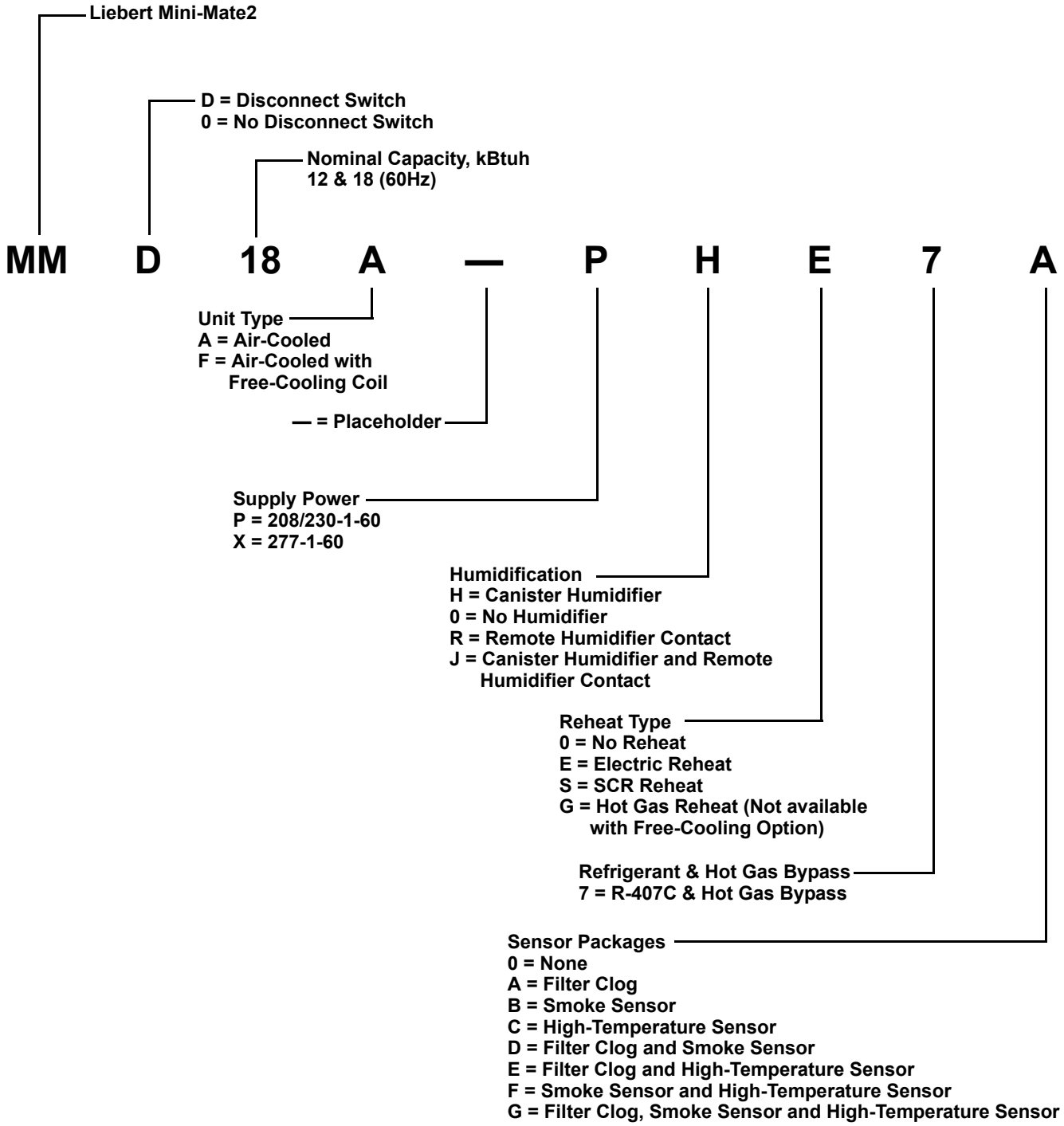

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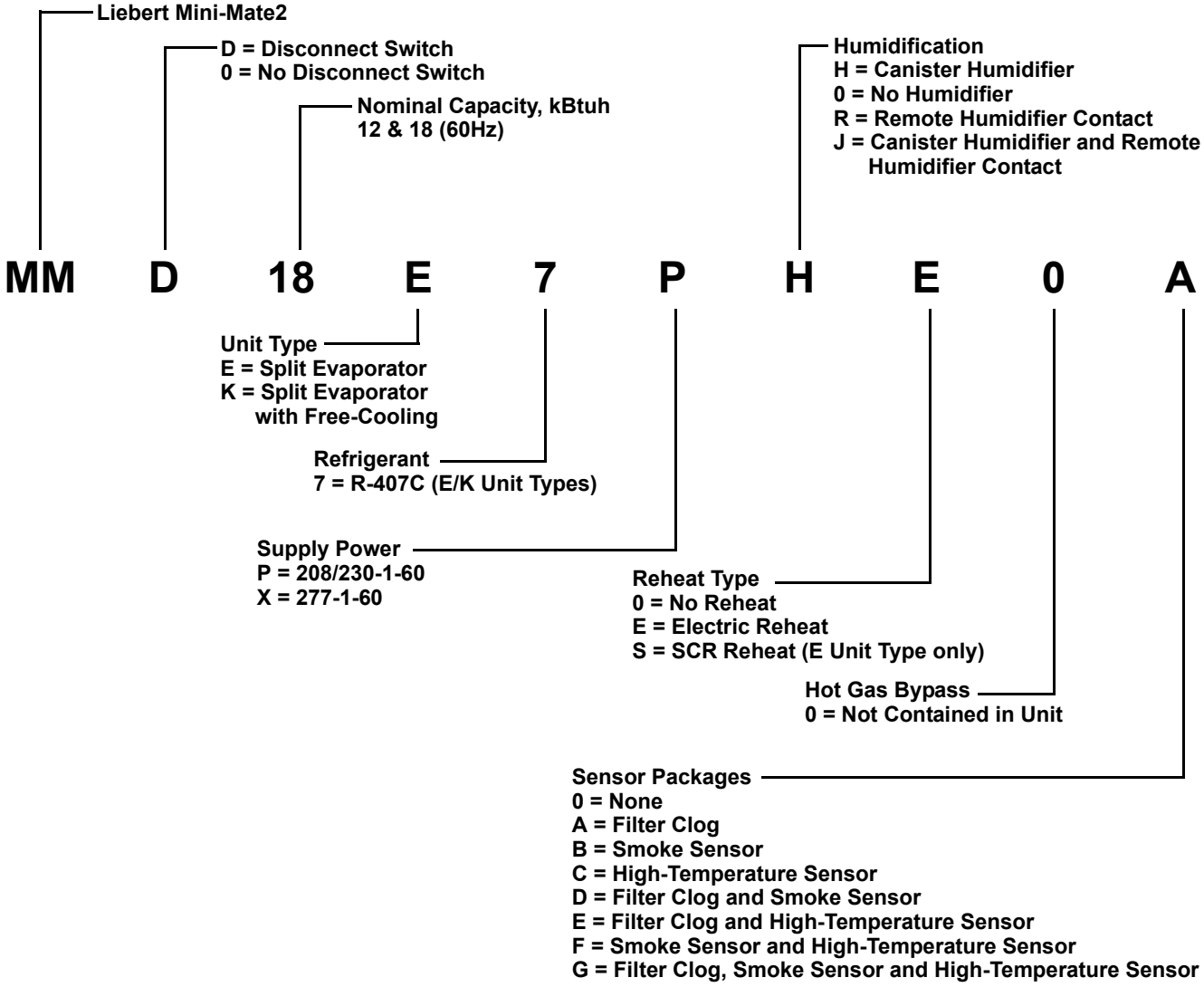

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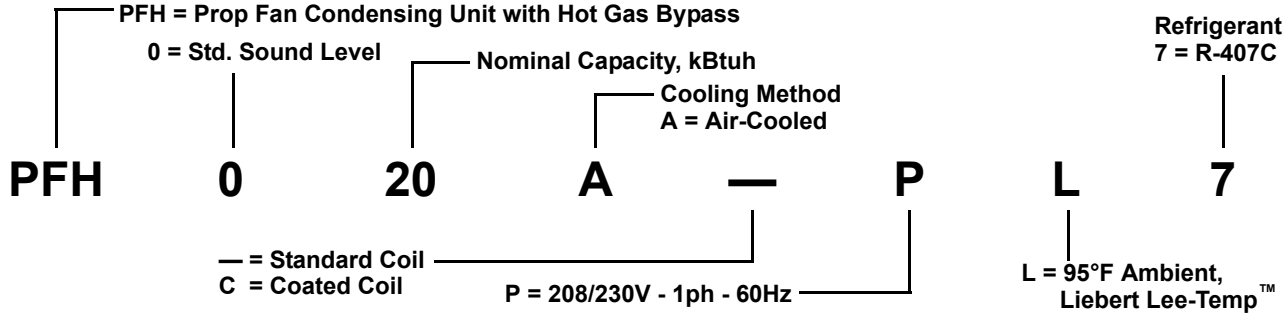

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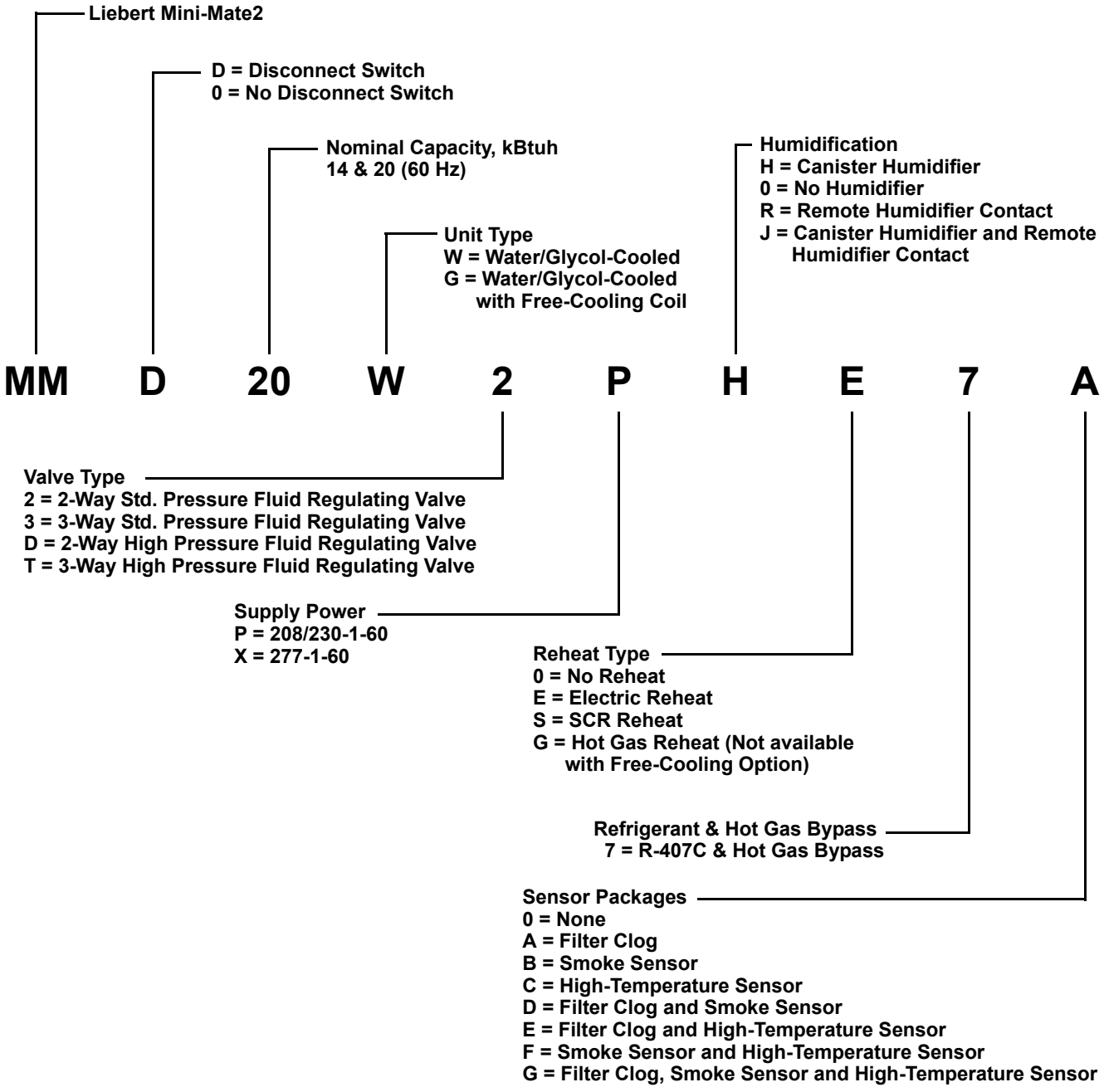

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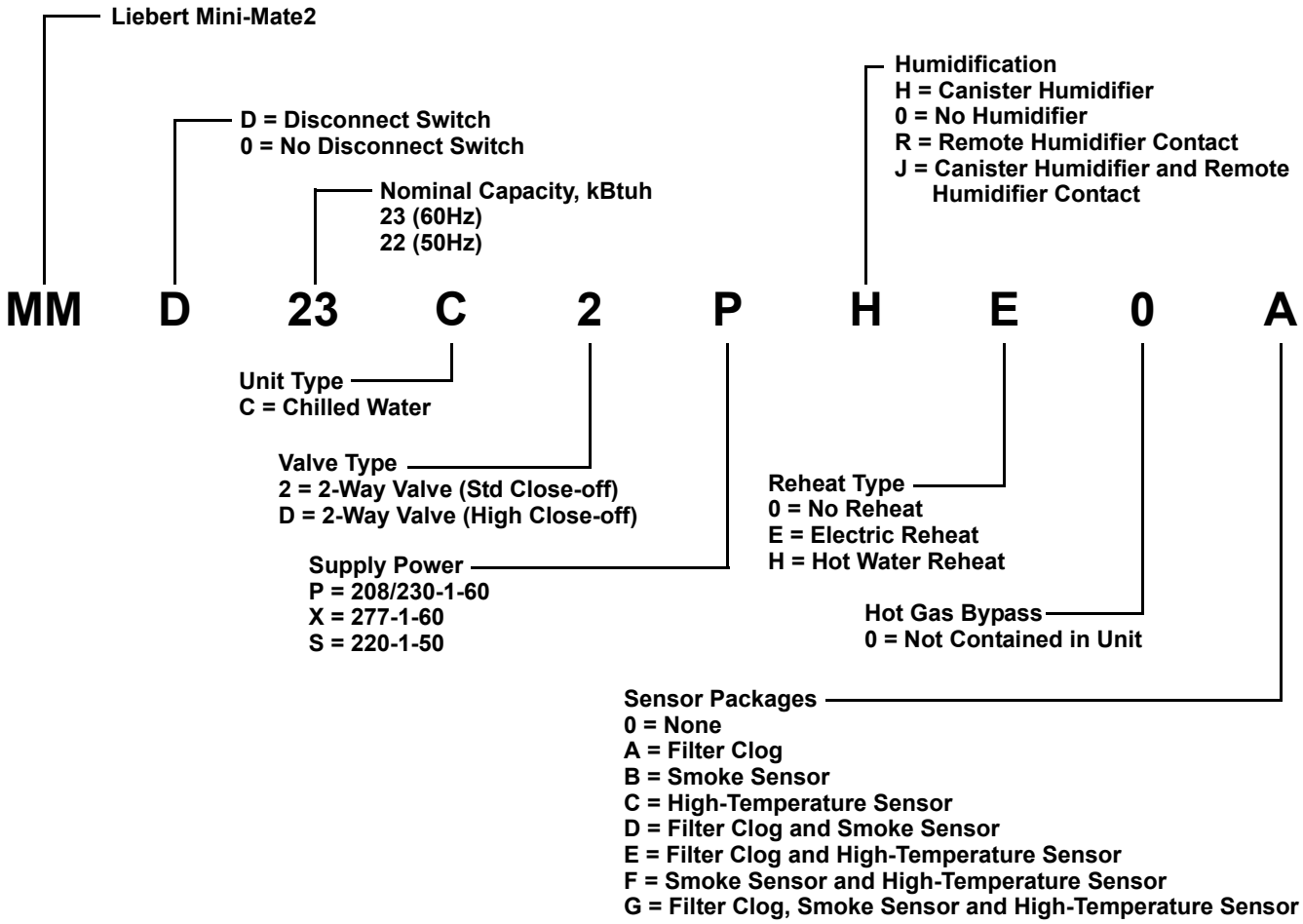


IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important safety instructions that should be followed during the installation and maintenance of the Liebert Mini-Mate2. Read this manual thoroughly before attempting to install or operate this unit. Only qualified personnel should move, install or service this equipment.

Adhere to all warnings, cautions and installation, operating and safety instructions on the unit and in this manual. Follow all installation, operation and maintenance instructions and all applicable national and local building, electrical and plumbing codes.

WARNING

Arc flash and electric shock hazard. Disconnect all electric power supplies and wear protective equipment per NFPA 70E before working within electric control enclosure. Failure to comply can cause serious injury or death.

Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable.

Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power.

The Liebert microprocessor control does not isolate power from the unit, even in the Unit Off mode. Some internal components require and receive power even during the Unit Off mode.

The line side of the disconnect switch on the front of the unit contains live hazardous voltage potential.

The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch and check the internal power supply wires with a voltmeter. Refer to unit electrical schematic. Follow all applicable national and local electric codes.

WARNING

Risk of explosive discharge from high-pressure refrigerant. Can cause injury or death.

This unit contains fluids and gases under high pressure. Relieve pressure before working with piping.

WARNING

Risk of refrigerant system rupture or explosion from overpressurization. Can cause equipment damage, injury or death.

If a pressure relief device is not provided with the condenser unit, the system installer must provide and install a discharge pressure relief valve per national and local codes in the high side refrigerant circuit. Do not install a shutoff valve between the compressor and the field installed relief valve. Do not isolate any refrigerant circuits from overpressurization protection.

WARNING

Risk of high-speed moving parts. Can cause injury or death.

Open all local and remote electrical power disconnect switches before working within the unit and component electrical enclosures.

CAUTION

Risk of contact with hot surfaces. Can cause injury.

The compressors, refrigerant discharge lines, humidifiers and reheats are extremely hot during unit operation. Allow sufficient time for them to cool before working within the unit cabinet. Use extreme caution and wear protective gloves and arm protection when working on or near hot compressors, discharge lines, humidifiers and reheats.

CAUTION

Risk of sharp edges, splinters and exposed fasteners. Can cause injury.

Only properly trained and qualified personnel wearing appropriate safety headgear, gloves, shoes and glasses should attempt to move the unit, lift it, remove packaging from or prepare the unit for installation.

NOTICE

Risk of leaking water. Can cause equipment and building damage.

Improper installation, application and service practices can result in water leakage from the unit. Do not mount this unit over equipment and furniture that can be damaged by leaking water. Install a water tight drain pan with a drain connection under the cooling unit and the ceiling mounted water/glycol condenser unit. Route the drain pan to a frequently used maintenance sink so that running water can be observed and reported in a timely manner. Post a sign to alert people to report water flowing from the secondary drain pan. Emerson recommends installing monitored leak detection equipment for unit and supply lines and in the secondary drain pan. Check drain lines periodically for leaks, sediment buildup, obstructions, kinks and/or damage and verify that they are free running.

NOTICE

Risk of a leaking coil due to freezing and/or corrosion. Can cause equipment and building damage.

Cooling coils and piping systems that are connected to open cooling towers or other open water/glycol systems are at high risk of freezing and premature corrosion. Fluids in these systems must contain the proper antifreeze and inhibitors to prevent freezing and premature coil corrosion. The water or water/glycol solution must be analyzed by a competent water treatment specialist before startup to establish the inhibitor requirement. The water or water/glycol solution must be analyzed every six months to determine the pattern of inhibitor depletion. The complexity of water-caused problems and their correction makes it important to obtain the advice of a water treatment specialist and follow a regularly scheduled maintenance program.

NOTICE

Risk of damage from forklift. Can cause unit damage.

Keep tines of the forklift level and at a height suitable to fit below the skid and/or unit to prevent damage.

NOTICE

Risk of improper storage. Can cause unit damage.

Keep the Liebert Mini-Mate2 upright, indoors and protected from dampness, freezing temperatures and contact damage.

1.0 INTRODUCTION

1.1 Designed to Match Computer and Electronic Equipment Needs—From Installation to Operation

Installed above the ceiling, the Liebert Mini-Mate2 system controls the cooling, humidity and air distribution required by sensitive electronic equipment. A range of sizes and configurations are available to meet site needs.

The Liebert Mini-Mate2 is also easy to use. Advanced microprocessor technology allows easy, precise control, and menu-driven monitoring keeps you informed of system operation through the LCD readout. These features, combined with Liebert quality construction and reliable components, guarantee satisfaction from installation through operation.

Liebert Precision Cooling

Liebert Precision Cooling systems are designed to control the temperature and humidity required for computers and other sensitive electronic equipment. Liebert Mini-Mate2 provides complete control on an around-the-clock basis, as well as the high sensible heat ratio required by sensitive electronic equipment.

Easy Installation

Self-contained systems have all refrigerant piping factory installed. Split-system evaporator and outdoor condensing unit are pre-charged with refrigerant and are available with pre-charged refrigerant lines or sweat adapters for field refrigerant piping. Thermostat-type wiring to control wall box and condensing units, if applicable, further simplifies the installation.

Easy to Service

Low-maintenance components are easily accessed through removable panels. Spare parts are always in Liebert's inventory and available on short notice.

Advanced Control Technology

A menu-driven microprocessor control system provides precise temperature and humidity control and accurate alarm setpoints. Using touch sensitive buttons, the wall-mounted monitor/control panel allows you to display temperature and other monitored parameters.

High Efficiency

High system efficiency is a result of high sensible heat ratio, two selectable fan speeds and precise microprocessor control.

Space Saving Design

All indoor components are installed above the ceiling, so no floor space is required.

Reliable

The Liebert Mini-Mate2 family installed base is a testimony to the system's reliability. Components include a rugged compressor, high-efficiency copper tube, aluminum fin evaporator coil and a double inlet, direct-drive fan.

Agency Listed

Standard 60Hz units are CSA Certified to the harmonized U.S. and Canadian product safety standard CSA C22.2 No 236/UL 1995 for "Heating and Cooling Equipment" and are marked with the CSA c-us logo.

Location

When determining installation locations, consider that these units contain water and that water leaks can cause damage to sensitive equipment and furniture below.

NOTICE

Risk of leaking water. Can cause equipment and building damage.

Do not mount units over equipment or furniture that can be damaged by leaking water. Install a watertight drain pan with a drain connection beneath ducted cooling units and ceiling mounted water/glycol condenser units. Route the drain line to a frequently used maintenance sink so that running water can be observed and reported in a timely manner. Post a sign to report running water from the secondary drain.

Do not install units in areas where normal unit operating sound might disturb the working environment.

2.0 STANDARD FEATURES—1 & 1.5 TON SYSTEMS

2.1 Self-Contained Systems

The self-contained system is designed for ceiling installation. The cabinet and chassis are constructed of heavy gauge galvanized steel. The unit can be serviced using only one side, increasing its versatility in mounting locations. Mounting brackets are factory-attached to the cabinet. Internal cabinet insulation meets ASHRAE 62.1 requirements for Mold Growth, Humidity & Erosion, tested per UL 181 and ASTM 1338 standards. Unit can be configured with canister humidifier and/or reheat and various sensor options.

2.1.1 Air-Cooled Unit

The air-cooled unit includes the evaporator coil, condenser coil, compressor, all refrigerant piping, R-407C unit charge, hot gas bypass, filter drier, high head pressure switch, two-speed direct-drive blower assembly, microprocessor control with wall-mounted control box and factory-mounted disconnect switch. MM2CF is a centrifugal blower box with a fan speed controlled motor that ships separately and field-mounts on the cabinet to provide condenser head pressure control down to -20°F (-29°C) ambient.

2.1.2 Water/Glycol-Cooled Unit

The water/glycol-cooled unit includes the evaporator coil, coaxial condenser, compressor, all internal refrigerant and water/glycol piping, R-407C unit charge, hot gas bypass, filter drier, high head pressure switch, two-speed direct-drive blower assembly, microprocessor control with wall-mounted control box and factory-mounted disconnect switch.

2.1.3 Chilled Water Unit

The chilled water unit includes the chilled water coil, two-speed, direct-drive centrifugal blower, two-way, slow-close solenoid, spring-return valve and factory-mounted disconnect switch. Design pressure is 300psi (2068 kPa) with a 25psi (172 kPa) close-off differential.

2.2 Evaporator Section—Split Systems

The split-system evaporator is designed for ceiling installation. The cabinet and chassis are constructed of heavy gauge galvanized steel. The unit can be serviced using only one side increasing its versatility in mounting locations. Mounting brackets are factory-attached to the cabinet. Internal cabinet insulation meets ASHRAE 62.1 requirements for Mold Growth, Humidity & Erosion, tested per UL 181 and ASTM 1338 standards. The evaporator section includes the evaporator coil, R-407C unit charge, filter drier, two-speed direct-drive blower assembly, microprocessor control with wall-mounted control box and factory-mounted disconnect switch. Unit can be configured with canister humidifier and/or reheat and various sensor options.

2.3 Condensing Unit Section—Split System

The outdoor prop fan condensing unit includes compressor, condenser coil, R-407C unit charge, prop fan, liquid-line solenoid valve, high-pressure switch, Liebert Lee-Temp™ head pressure control and hot gas bypass. Condensing unit is designed for outdoor locations with operating ambients ranging from -30°F to 95°F (-34°C to 35°C).

2.4 System Controls

System controls include a microprocessor control board mounted in the cooling unit and a wall-mounted interface with a two-line, 16-character liquid crystal display. An eight-key, membrane keypad for setpoint/program control, unit On/Off, fan speed and alarm silence is below the LCD screen. It provides temperature setpoint and sensitivity adjustment, humidity setpoint and sensitivity adjustment, digital display of temperature, humidity, setpoints, sensitivities, fan speed and alarm conditions.

The wall-box is field-wired to the microprocessor control using standard four-conductor thermostat wire (field-supplied). The temperature and humidity sensors are in the wall box, which can be installed up to 300 feet (91.4m) from the evaporator unit. The unit-mounted control board also includes common alarm terminals and shutdown terminals. The unit automatically restarts after a power failure.

Figure 6 Wall-mounted display box

2.4.1 Other Standard Control Features

- Adjustable auto restart
- 5 day/2 day setback
- Password protection
- Alarm enable/disable
- Self-diagnostics
- Calibrate sensors
- Predictive humidity control
- Common alarm output
- Remote shutdown terminals

3.0 OPTIONAL FACTORY-INSTALLED FEATURES—SELF-CONTAINED AND EVAPORATOR UNITS

3.1 Reheat

Electric Reheat includes 304/304 stainless steel finned tubular reheat elements for added durability and corrosion resistance with a high limit safety switch.

SCR Reheat provides tight temperature control by rapidly pulsing the 304/304 stainless steel reheat elements in small increments. A solid state relay is factory-installed and wired to the microprocessor control. The compressor is locked On, with the reheat modulated to track the load. Not available on chilled water, free-cooling or other reheat options.

Hot Water Reheat includes a hot water coil, two-way solenoid valve and Y-strainer. Available only on chilled water units; not available with other reheat options.

Hot Gas Reheat can be ordered on self-contained models. This option includes the coil and necessary piping and the control valve. This option is not available with chilled water, free-cooling or other reheat options.

3.2 Humidifier

The **Canister Humidifier** includes a steam-generating type humidifier with automatic flushing circuit, inlet strainer, drain, 1" (25.4mm) air gap on fill line and solenoid valves. Humidifier problem alarm annunciates at the wall-mounted display panel.

Remote Humidifier Contact allows the unit's humidity controller to control a humidifier outside the unit. Power to operate the remote humidifier does not come from the Liebert Mini-Mate2. Available on units with or without internal humidifier.

3.3 Sensors

Smoke Sensor checks return air, shuts down the unit upon sensing smoke and activates visual and audible alarms at the wall-box display. This smoke sensor is not intended to function as or replace any smoke sensor system that may be required by codes.

High-Temperature Sensor senses the return air temperature and shuts down unit if the temperature reaches 125°F (52°C). This device is not meant to replace any fire detection system that may be required by national or local codes.

3.4 Switches

Filter Clog senses pressure drop across the filters and activates visual and audible alarms at the wall-box display. The wall-box display annunciates the alarm and flashes a notification upon reaching a customer setpoint.

A **Factory-Installed Non-Fused Disconnect Switch** allows the unit to be turned off for maintenance.

A disconnect switch is standard for the evaporators, chilled water units and indoor condensing units, but these units may be specified without the switch.

3.5 Free-Cooling

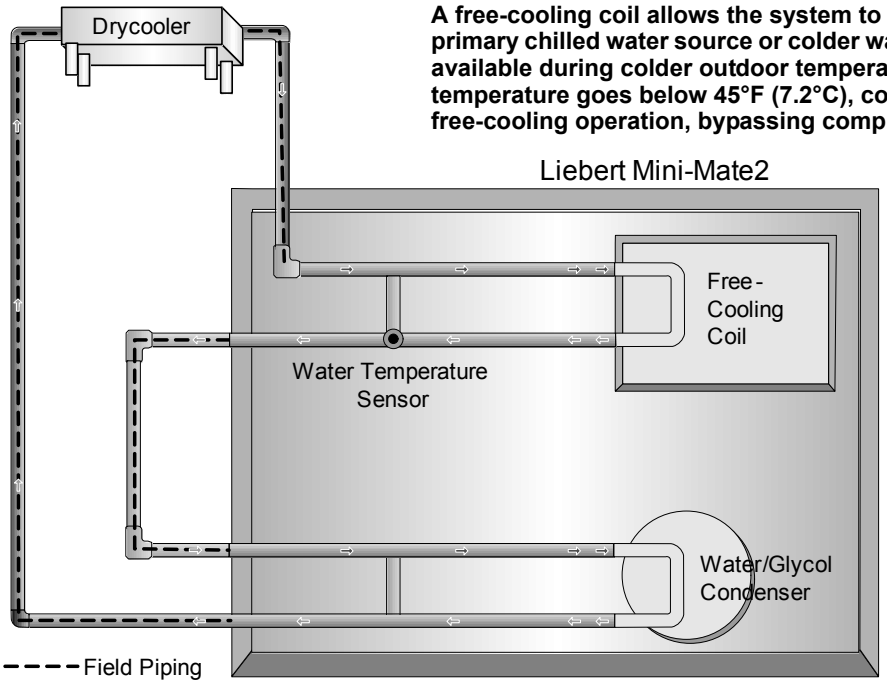
Free-cooling option includes separate cooling coil, three-way, slow-close valve and separate supply and return piping. Free-cooling is activated when the water temperature reaches a field-adjustable temperature, typically 45°F (7°C). The valve is rated for 300psi (2068kPa) working pressure.

Air-cooled units can be specified with free-cooling coils, allowing chilled water to be the primary cooling and the air-cooled section to be the backup. Water/glycol units have two sets of piping, each with three-way water regulating valves, increasing options of free-cooling sources, such as external chilled water or glycol from a drycooler loop (see **Figure 7**). The free-cooling coil is designed for closed-loop applications using properly treated and circulated fluid. Not available with SCR reheat options.

NOTE

If free-cooling is applied to an open water tower, a heat exchanger must separate the tower water from the free-cooling loop.

Figure 7 Free cooling option—example



A free-cooling coil allows the system to take advantage of a primary chilled water source or colder water/glycol temperatures available during colder outdoor temperatures. When the fluid temperature goes below 45°F (7.2°C), cooling switches to free-cooling operation, bypassing compressor operation.

3.6 Optional Configuration—Prop Fan Condensing Units

Outdoor Prop Fan Condensing Units are also available in the following optional configurations:

- Condenser coils can be phenolic-coated for extended coil life in coastal areas.

3.7 Optional Configurations—Water/Glycol-Cooled Units

Water/glycol-cooled units are also available with the following piping options:

- Two-way water regulating valve with 350 psi (2413kPa) design pressure.
- Three-way water regulating valve with 150psi (1034kPa) design pressure.
- Three-way water regulating valve with 350psi (2413kPa) design pressure.

3.8 Optional Configuration—Chilled Water Units

Chilled water units are available with the following valve option:

- Three-way, slow-close, motorized chilled water valve rated for 300psi (2068kPa) working pressure. Valve is non-spring return.

4.0 SHIP-LOOSE ACCESSORIES—FIELD-INSTALLED

Supply and Return Grille Kit includes supply and return grilles, 1" x 20" x 20" (25mm x 508mm x 508mm) MERV 8 rated filter to ASHRAE 52.2-2007, for installation into a 2ft. x 4ft. (610mm x 1220mm) ceiling grid.

Duct Kit includes return air filter box with 1" duct collar, 1" duct collar for supply air, and air block-off plates. Duct kit is supplied with a 4" x 16" x 20" (102mm x 406mm x 508mm) MERV 8 filter (based on ASHRAE 52.2-2007)

Duct Collar Kit (no filter) includes 1" supply duct collar, a 1" return collar, and the necessary block-off plates to make the Liebert Mini-Mate2 a ducted configuration. Filter box and filter are not included.

Condensate Pump is field-mounted on the outside of the cabinet, wired to the unit power block and is equipped with a discharge check valve. A secondary float is field-wired to shut down the unit upon high condensate level. Power can be obtained from the Liebert Mini-Mate2 electrical panel.

Pre-Charged Refrigerant Line Set (R-407C) contains an insulated copper suction line and a copper liquid line for interconnection of the indoor and outdoor sections. Available in 15-foot (4.5m) and 30-foot (9m) sections.

Refrigerant-Line Sweat Adapter Kit contains two suction and two liquid line fittings that allow field-supplied refrigerant piping between the evaporator and condensing unit.

A **Remote Temperature and Humidity Sensor** package includes sensors in an attractive case with 30 ft. (9m) of cable. Can be wall- or duct-mounted. Remote sensors should be used when the wall box is not located in the space to be conditioned.

NOTE
Installing the remote sensors disables the sensors included in the wall box.

Field-Installed Kits available for filter clog, smoke sensor, high-temperature sensor, electric reheat and humidifier. The kits include installation instructions and are designed to be added to the evaporator unit before it is installed in the ceiling. Electric reheat kits cannot be installed in units with free-cooling.

4.1 Remote Monitoring, Autochangeover and Leak Detection Equipment

The **Liebert RCM4™** is a four-point, normally open, dry contact monitoring panel. One Form-C, dry contact common alarm relay output (rated at 24 VAC, 3 Amp) is provided. Four red LEDs illuminate on the respective alarm and the alarm buzzer is silenced by a front panel switch. The RCM4 requires a 24VAC or 24VDC power source. Power supply is not included.

The **Liebert AC4™ Autochangeover Controller** provides autochangeover and autosequence control for up to four Liebert Mini-Mate2 units within a room. The Liebert AC4 will enable redundant units in an alarm condition, balance usage and test standby units at programmed intervals. Two common alarm relay outputs are available. A built-in LCD and RS-232 port for direct PC/terminal connection provides two options for configuration and monitoring of the product. The Liebert AC4 requires 24VAC input power.

The **Liebert AC8™** is ideal for coordinated control of systems with redundant units. The Liebert AC8 enables redundant devices during an alarm condition, balances usage of devices and tests standby devices at programmable intervals. Supports four zones and can use the 4-20mA temperature sensor (TW420) for temperature staging in each zone. Two programmable output control relays are available for auxiliary control such as humidity lockout. Emergency power operation input provided for device control during an emergency. Two common alarm relay outputs are available. A built-in LCD and RS-232 port for direct PC/terminal connection provides two options for configuration and monitoring of the product.

The **Liebert ENV-DO™** interface card provides 16 discrete outputs, corresponding to status and major alarm conditions of Environmental units. The Liebert ENV-DO-ENCL1 packages one Environmental DO interface card in its own steel enclosure and the ENV-DO-ENCL2 packages two Environmental DO interface cards in one enclosure for installation external to the Liebert Mini-Mate2. The self-contained kit includes an external 120VAC-to-24VAC power transformer. Wiring harnesses are not provided. Power and communication wiring is field-provided.

The Liebert Liqui-tect® 410 Point Leak Detection Sensor detects the presence of conductive liquid using a pair of corrosion-resistant, gold-plated probes mounted in a painted, height-adjustable enclosure. Dual Form-C, dry contact common alarm relays (rated at 24VAC, 3A) signal a leak detected as well as loss of power and cable fault. The Liebert Liqui-tect 410 requires an external 24VAC or 24VDC power source.

Liebert LT460 Zone Leak Detection Kits include one LT460 sensor, a specified length of LT500-xxY cable (maximum length is 100 ft [30.5m]) and a corresponding number of hold-down clips. The Liebert LT460 requires an external 24VAC, 0.12A power source, such as EXT-XFMR or XFMR24.

Liebert SiteScan® is a monitoring solution that gives you decision-making power to effectively manage the equipment critical to your business.

Liebert SiteScan enables communication from Liebert environmental and power units, as well as many other pieces of analog or digital equipment, to a front-end software package that provides real-time status and alarms so you can react quickly to changing situations.

Liebert SiteScan is designed with flexibility for both small systems and large, complex systems such as those in computer rooms, telecommunications facilities or industrial process control rooms. Contact your local Emerson® representative for assistance with a Liebert SiteScan system.

The **NIC-ENCL1 and NIC-ENCL2** package one or two Liebert IntelliSlot® Web/485 Cards with Adapters, respectively, in one steel enclosure for installation external to the Liebert Mini-Mate2. The Liebert IntelliSlot Web/485 Card with Adapter provides communication with Liebert Mini-Mate2 via SNMP, HTTP, RTU Modbus 485 and BACnet IP. The self-contained kit includes an external 120VAC-to-24VAC transformer as a power source. Wiring harnesses are not provided. Power and communication wiring are field-provided.

5.0 SITE PREPARATION AND INSTALLATION

NOTE
Before installing unit, determine whether any building alterations are required to run piping, wiring and ductwork. Follow all unit dimensional drawings and refer to the submittal engineering dimensional drawings of individual units for proper clearances.

5.1 Installation Considerations

The evaporator unit is usually mounted above the suspended ceiling in the space to be conditioned. Ducted systems may be located in a different room. Refer to **Figures 8- 10** for possible configurations. The system may be:

- Self-contained air-cooled with centrifugal condenser fan attached to the evaporator box.
- Split system air-cooled with outdoor propeller fan condensing units.
- Self-contained chiller water, requiring connection to building chilled water loop.
- Self-contained water/glycol-cooled, requiring water or glycol loop connection.

Table 1 Application limits - evaporator and chilled water units*

Input Voltage		Range of Return Air Conditions to Unit	
Minimum	**Maximum**	**Dry Bulb Temp**	**Relative Humidity**
-5%	+10%	65 to 85°F (10 to 29°C)	20 to 80%

* Unit will operate at these conditions but will not control to these extremes of conditions.

Table 2 Application limits - outdoor air-cooled condensing unit

Input Voltage		Entering Dry Bulb Air Temperature	
Minimum	**Maximum**	**Minimum**	**Maximum**
-5%	+10%	-30°F (34°C) (units with Lee-Temp receiver)	115°F (46°C)

Table 3 Application limits - water/glycol-cooled condenser

Input Voltage		Entering Fluid Temperature	
Minimum	**Maximum**	**Minimum**	**Maximum**
-5%	+10%	45°F (7°C)*	115°F (46°C)

* Operation below 65°F (18°C) may result in reduced valve life and fluid noise.

5.1.1 Room Preparation

The room should be well insulated and must have a sealed vapor barrier. The vapor barrier in the ceiling and walls can be a polyethylene film. Paint on concrete walls and floors should contain either rubber or plastic.

NOTE
The vapor barrier is the single most important requirement for maintaining environmental control in the conditioned area.

Outside or fresh air should be kept to a minimum when tight temperature and humidity control is required. Outside air adds to the site's cooling, heating, dehumidifying and humidifying loads. Doors should be properly sealed to minimize leaks and should not contain ventilation grilles.

NOTE
Temperature and humidity sensors are located in the wall box. Proper and efficient cooling requires placing the wall box where discharge air does not directly blow on the sensors.

5.1.2 Location Considerations

NOTICE

Risk of leaking water. Can cause equipment and building damage.

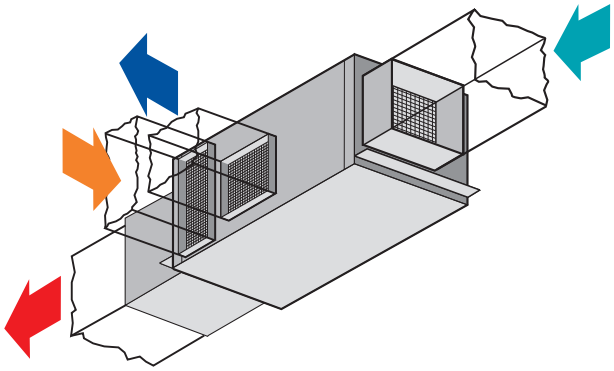
Do not mount units over equipment or furniture that can be damaged by leaking water. Install a watertight drain pan with a drain connection beneath ducted cooling units and ceiling mounted water/glycol condenser units. Route the drain line to a frequently used maintenance sink so that running water can be observed and reported in a timely manner. Post a sign to report running water from the secondary drain.

Locate the evaporator unit over an unobstructed floor space if possible. This will allow easy access for routine maintenance or service. Do not attach additional devices (such as smoke detectors, etc.) to the housing because they could interfere with maintenance or service.

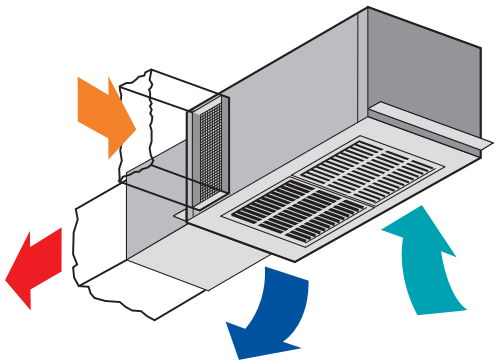
Do not install units in areas where normal unit operating sound might disturb the working environment.

Avoid locating the evaporator unit with the optional air grille kit in confined areas that affect the airflow pattern. Such locations could cause short cycles, downdrafts and air noise. Avoid installing the unit in an alcove or at the extreme end of a long, narrow room. Avoid installing multiple units close to each other. This could result in crossing air patterns, uneven loads and competing operating modes.

Figure 8 Air-cooled systems, 1 and 1.5 tons



Self-Contained, Air-Cooled, Ducted



Self-Contained, Air-Cooled, Grille

Figure 9 Water/glycol-cooled systems, 1 and 1.5 tons

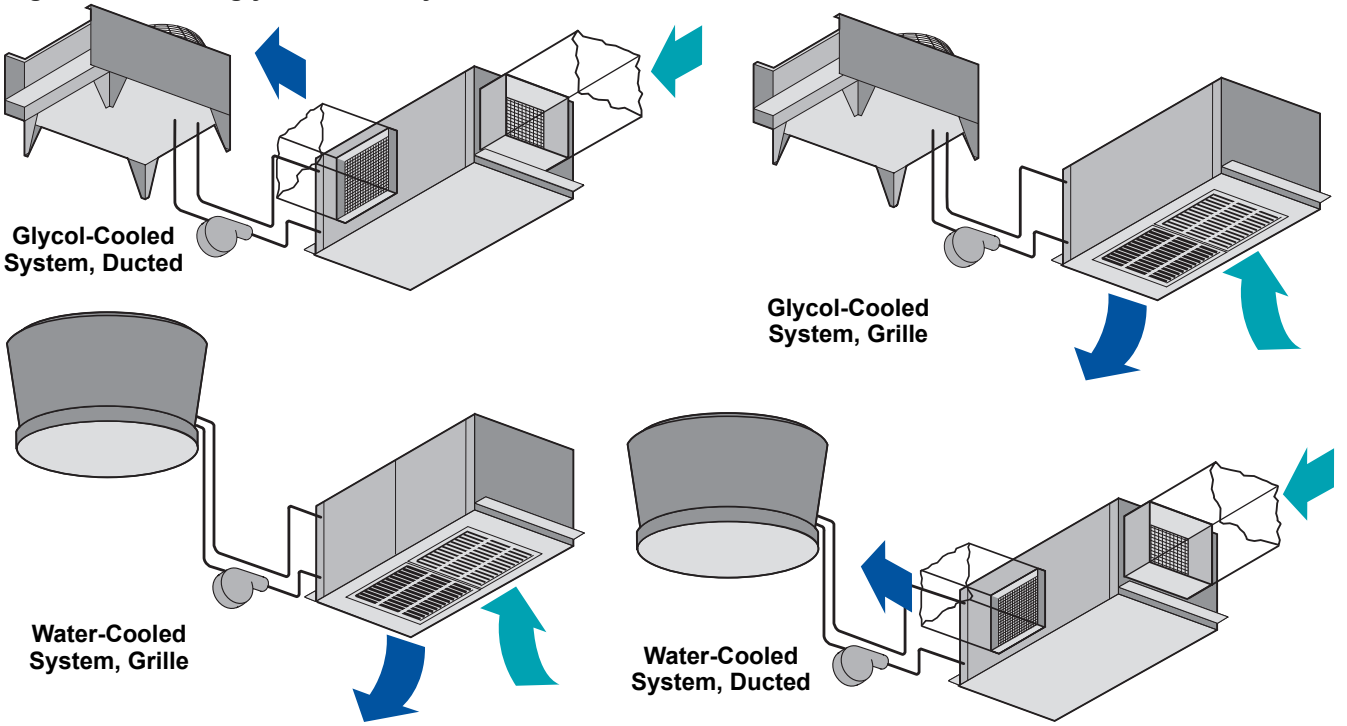
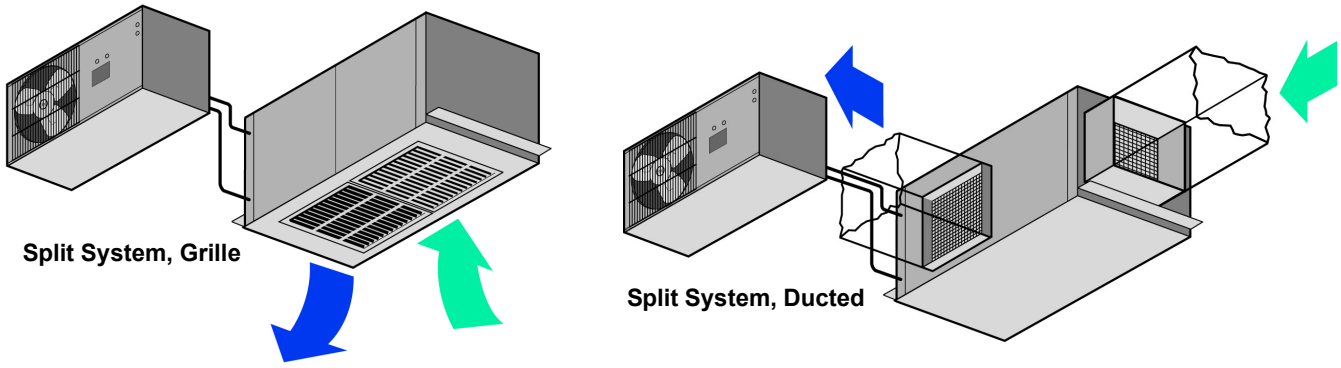


Figure 10 Split system, air-cooled systems



5.2 System Weights

Table 4 Unit weights

Model #	Weights, lb (kg)
MMD12A	265 (120)
MMD12E	220 (100)
MMD14W	260 (118)
MMD18A	295 (134)
MMD18E	225 (102)
MMD20W	300 (136)
MMD22C	220 (100)
MMD23C	220 (100)
MM2CF	63 (29)

*Add 40 lb. (20 kg.) to units with free-cooling or hot water reheat coils.
Weights assume reheat and humidifier package is included.

5.3 Equipment Inspection (Upon Receipt)

Do not uncrate the equipment until it is close to its final location. All required assemblies are banded and shipped in corrugated containers. If any damage is discovered when the unit is uncrated, report it to the shipper immediately. If any concealed damage is later discovered, report it to the shipper and to Emerson®.

5.4 Installing Ceiling Units

The evaporator unit is usually mounted above the ceiling and must be securely mounted to the roof structure. The ceiling and ceiling supports of existing buildings may require reinforcement.

WARNING

Risk of ceiling collapse and heavy unit falling. Can cause building damage, serious injury or death.

Verify that the supporting roof structure is capable of supporting the weight of the unit(s) and the accessories during installation and service (see **5.2 - System Weights**).

NOTICE

Risk of improper installation. Can cause water leaks that result in damage to the building, equipment and furniture below.

The Liebert Mini-Mate2 must be level or condensate will not drain properly and can overflow the drain pan and leak from the cabinet. Verify that the unit is level before startup.

Follow all national and local building codes.

- Use field-supplied threaded suspension rods and 3/8-16 factory hardware kit.
- Recommended clearance between ceiling grids and building structural members is the unit's height plus 3 inches (76mm).
- Install the four field-supplied rods by suspending them from suitable building structural members. Locate the rods so that they will align with the four mounting holes in the flanges that are part of the unit base. Securely anchor the top ends of the suspension rods. Make sure all nuts are tight.
- Using a suitable lifting device that is rated for the weight of the unit (see **5.2 - System Weights**), raise the Liebert Mini-Mate2 and pass the threaded rods through the four mounting holes in the flanges that are part of the unit base.
- Attach the threaded rods to the flanges using the supplied nuts and grommets. (See **Figure 12**). The rubber grommets provide vibration isolation.
- Use the plain nuts to hold unit in place. Adjust these nuts so that the weight of the unit is supported evenly by the four rods, does not rest on the ceiling grid and to ensure the unit is level.
- Use the shake-proof nuts to jam the plain nuts.

5.4.1 Evaporator Air Distribution

Filter Box

The optional filter box available for the unit attaches directly to the return air opening of the evaporator. The filter box is supplied with a filter measuring 16" x 20" x 1" (406 x 508 x 25mm).

Grille Installation

The airflow grilles are directional devices and MUST be installed with the louvers properly aligned for unit to operate properly. An air baffle is included with the grille kit and must be installed to ensure proper air distribution. Locate the return and discharge grilles as shown in the grille kit instructions. Lower the grilles into place with the louvers in the proper direction. Note that a field-supplied T-bar is required between the two grilles. If required, grilles may be screwed directly to the sub-base.

Install the disposable filter (20" x 20" x 1") in the return grille. Do not operate the Liebert Mini-Mate2 without the filter installed in the return air grille. Refer to instructions shipped with kit for more details. The evaporator unit should be lowered until the gasket material is compressed 1/4" (6 mm).

CAUTION

Risk of the grille falling. Can cause equipment damage or injury.

Do not allow the weight of the unit to rest on the grilles.

5.4.2 Piping Connections and Coolant Requirements

The following pipe connections are required:

- A drain line from the evaporator coil drain pan. This line also serves as the drain for the optional humidifier.
- A water supply line to the optional humidifier (if applicable).
- Refrigerant piping connections between the evaporator unit and the outdoor condensing unit (for split systems). If the evaporator unit is a chilled water model, connections to the building chilled water source are required.
- Connections to a water or glycol loop on water/glycol type systems.

Drain Line

NOTICE

Risk of water backing up in the drain line. Leaking and overflowing water can cause equipment and building damage.

The drain line must not be trapped outside the unit.

A 3/4 in. NPT female connection is provided for the evaporator coil condensate drain. This line also drains the humidifier, if applicable. The drain line must be located so it will not be exposed to freezing temperatures. The drain should be the full size of the drain connection.

The evaporator drain pan includes a float switch to prevent operation if the drain becomes blocked.

The optional condensate pump kit is required when the evaporator is installed below the level of the gravity-fed drain line.

NOTE

Remove the shipping band from the float switch in the evaporator pan before operating the unit.

Humidifier Water Supply Line

Units supplied with the optional humidifier package have a 1/4 in. OD copper compression fitting with ferrule at the water supply connection. Supply pressure range is 10 psig to 150 psig (69 to 1034kPag). Required flow rate is 1 gpm (3.8 lpm). A shutoff valve should be installed in this line to isolate the humidifier for maintenance.

Assembly Instructions

1. Cut the tube square and remove any burrs.
2. Slide nut then sleeve on tube; threaded end of nut faces end of tube.
3. Insert the tube into the fitting, seating it against the stop shoulder and tighten the nut hand-tight to the body.
4. Use a wrench to tighten the nut 1-1/4 to 2-1/4 turns.

NOTICE

Risk of improper tightening of the piping fittings. Can damage fittings and cause leaks.

Use caution not to overtighten or undertighten the piping fittings.

Chilled Water Loop

On chilled water units, install manual service shutoff valves at the supply and return lines of each unit. These shutoff valves are used for routine service and for emergency isolation of the unit.

Chilled water supply and return lines must be insulated to prevent condensation of the water supply and return lines.

The minimum recommended water temperature is 42°F (5.5°C). Design pressure is 300 psig (2068kPa). Supply and return connection sizes are 5/8" (15.9mm) OD copper.

Water/Glycol Loop

Emerson recommends installing manual service shutoff valves at the supply and return line to each unit. This permits routine service and emergency isolation of the unit. Install 1/2" (13mm) diameter condensing fluid inlet and 1/2" (13mm) diameter condensing fluid outlet.

When the condensing fluid quality is poor, Emerson recommends placing proper filters in the supply line to extend the service life of the condenser. These filters must be easily replaced or cleaned. The standard maximum fluid pressure is 150 psig (1034 kPa) or optional 350 psig (2413 kPa) systems. For applications above this pressure, consult the factory.

The water/glycol-cooled system will operate in conjunction with a cooling tower, city water or drycooler.

NOTICE

Risk of frozen pipes and corrosion from improper coolant mixture. Can cause equipment damage and building.

When piping or the Liebert Mini-Mate2 may be exposed to freezing temperatures, charge the system with the proper percentage of glycol and water for the coldest design ambient. Automotive antifreeze is unacceptable and must NOT be used in any glycol fluid system. Use only HVAC glycol solution only that has been prepared by industry practices.

Regulating Valve

Water/glycol-cooled units include a coolant flow regulating valve that is factory-adjusted and should not need field adjustment.

Standard-pressure and high-pressure valves are adjusted differently. Contact Liebert Precision Cooling Support before making any adjustments.

Split System, Air-Cooled Model Refrigerant (R-407C) Loop

All split systems require two refrigerant lines—an insulated copper suction line and a copper liquid line—between the evaporator and the outdoor condensing unit.

The refrigerant lines can be piped by installing:

- an optional sweat adapter kit and hard piping between the two units.
- optional pre-charged line sets (maximum combined length of 45' [13.7m]).

WARNING

Risk of explosive discharge from high-pressure refrigerant. Can cause injury or death.

This unit contains fluids and gases under high pressure. Relieve pressure before working with piping.

All refrigeration piping should be installed with high-temperature brazed joints. Prevailing good refrigeration practices should be employed for piping supports, leak testing, evacuation, dehydration and charging of the refrigeration circuits. The refrigeration piping should be isolated from the building with vibration-isolating supports. To prevent tube damage when sealing openings in walls and to reduce vibration transmission, use a soft, flexible material to pack around the tubes.

NOTICE

Risk of twisted or kinked piping. Can cause flow restriction or leaks.

Handle the pre-charged lines with care so they do not get kinked or damaged. Use tube benders and make all bends before making connections to either end. Coil any excess tubing in a horizontal plane with the slope of the tubing toward the condensing unit.

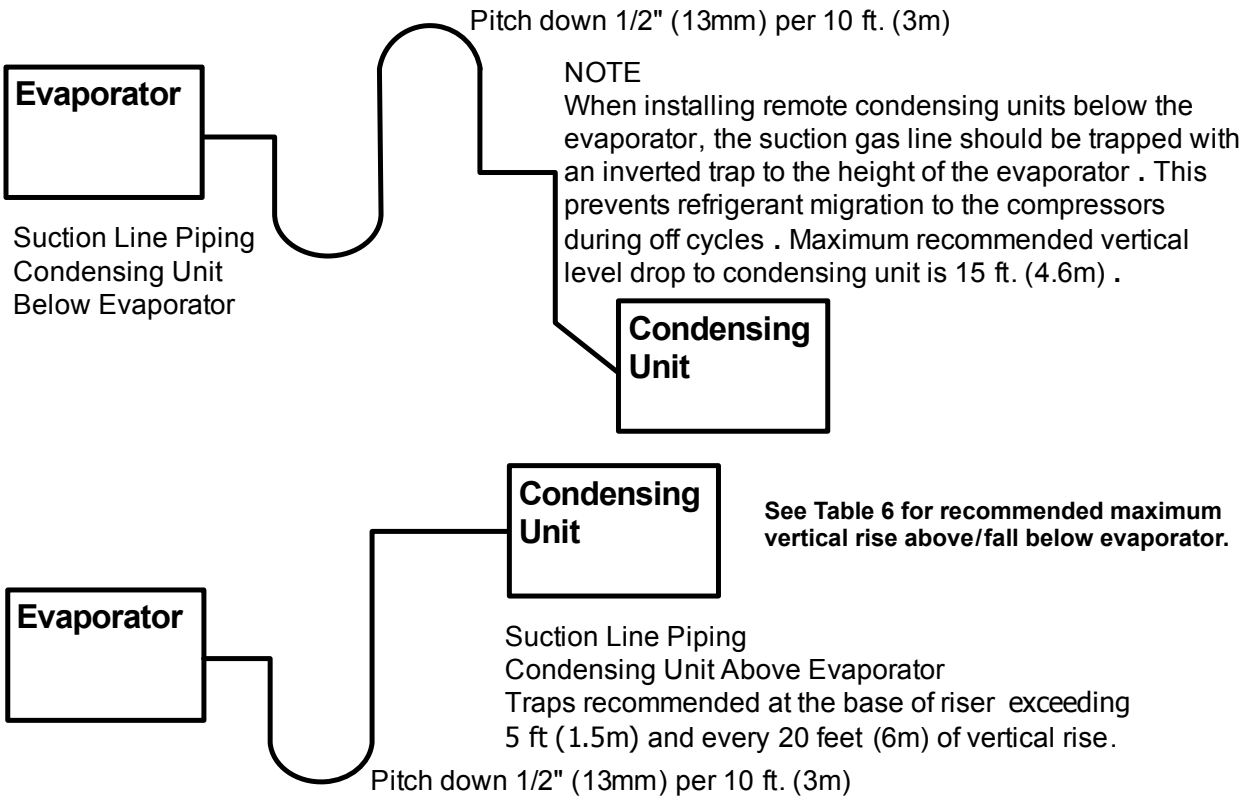
Field-Fabricated Piping

All field-fabricated refrigeration piping should use copper pipe with high-temperature brazed joints. A brazing alloy with a minimum temperature of 1350°F (732°C), such as Sil-Fos. Avoid soft solders such as 50/50 or 95/5.

1. Use sweat adapter kit matched to the Liebert Mini-Mate2 and outdoor condensing unit refrigerant connection sizes.
2. Measure pipe runs and calculate pipe size and equivalent feet of suction and liquid lines per **Tables 5** and **8**.
3. Use a flow of dry nitrogen through the piping during brazing to prevent formation of copper oxide scale inside the piping. Copper oxide forms when copper is heated in the presence of air. POE oil will dissolve these oxides from inside the copper pipes and deposit them throughout the system, clogging filter driers and affecting other system components. A pure dry nitrogen flow of 1-3 ft^3/min (0.5-1.5 l/s) inside the pipe during brazing is sufficient to displace the air. Control the flow using a suitable metering device.
4. Pressurize and leak-test the completed lines at approximately 150 psig (1034kPa) pressure.
5. Evacuate each line twice to 250 microns. Break the vacuum each time with clean, dry nitrogen.
6. Evacuate the lines a third time to 250 microns.
7. See **Quick-Connect Fittings on page 24** for the proper procedure to connect lines to each unit of the split system.
8. Add refrigerant (R-407C) to the completed system as calculated per **Table 7** for both liquid and suction line sizes used.

When installing remote condensing units above the evaporator, the suction gas line should be trapped at the evaporator. This trap will retain refrigerant oil during the Off cycle. When the unit starts, oil in the trap is carried up the vertical riser and returns to the compressor (see **Figure 11**).

Figure 11 Refrigerant piping diagram



NOTE

When installing remote condensing units below the evaporator, the suction gas line should be trapped with an inverted trap the height of the evaporator. This prevents refrigerant migration to the compressor during off cycles.

Table 5 Recommended line sizes, O.D. Cu

Equivalent ft. (m)	PFH_14A		PFH_20A	
	Suction	Liquid	Suction	Liquid
50 (15.2)	5/8"	3/8"	5/8"	3/8"
75 (22.9)	5/8"	3/8"	7/8"	3/8"
100 (30.5)	7/8"	3/8"	7/8"	3/8"
125 (38.1)	7/8"	3/8"	7/8"	1/2"
150 (45.7)	7/8"	3/8"	7/8"	1/2"

* Suction line and liquid line sizing based on < 3 psi pressure drop in each and suction line refrigerant velocities >700FPM (3.6m/s), horizontal and 1000FPM (5.1m/s), vertical.

Table 6 Pipe length and condenser elevation relative to evaporator

Nominal System Size, Tons	Maximum Equiv. Pipe Length, ft. (m)	Maximum PFH Level Above Evaporator, ft. (m)	Maximum PFH Level Below Evaporator, ft. (m)
1 or 1.5	150 (45)	40 (12)	15 (4.6)

Maximum recommended total equivalent pipe length is 150 ft (46m). Suction and liquid lines may require additional specialty items when vertical lines exceed 20 ft. (6m) and/or condensing unit installation is more than 15 ft. (4.6m) below the evaporator. Contact Emerson Application Engineering for assistance.

Table 7 Line charges—refrigerant per 100 ft. (30m) of Type L copper tube

Line Size, O.D., in.	R-407C, lb/100 ft. (kg/30m)	
	Liquid Line	Suction Line
3/8	3.7 (1.7)	—
1/2	6.9 (3.1)	—
5/8	11.0 (5.0	0.4 (0.2)
3/4	15.7 (7.1)	0.6 (0.3)
7/8	23.0 (10.4)	1.0 (0.4)
1-1/8	—	1.7 (0.7)
1-3/8	—	2.7 (1.1)

Table 8 Equivalent lengths for various pipe fittings, ft (m)

Copper Pipe OD, in.	90 Degree Elbow Copper	90 Degree Elbow Cast	45 Degree Elbow	Tee	Gate Valve	Globe Valve	Angle Valve
1/2	0.8 (0.24)	1.3 (0.39)	0.4 (0.12)	2.5 (0.76)	0.26 (0.07)	7.0 (2.13)	4.0 (1.21)
5/8	0.9 (0.27)	1.4 (0.42)	0.5 (0.15)	2.5 (0.76)	0.28 (0.08)	9.5 (2.89)	5.0 (1.52)
3/4	1.0 (0.3)	1.5 (0.45)	0.6 (0.18)	2.5 (0.76)	0.3 (0.09)	12.0 (3.65)	6.5 (1.98)
7/8	1.45 (0.44)	1.8 (0.54)	0.8 (0.24)	3.6 (1.09)	0.36 (0.1)	17.2 (5.24)	9.5 (2.89)
1-1/8	1.85 (0.56)	2.2 (0.67)	1.0 (0.3)	4.6 (1.4)	0.48 (0.14)	22.5 (6.85)	12.0 (3.65)
1-3/8	2.4 (0.73)	2.9 (0.88)	1.3 (0.39)	6.4 (1.95)	0.65 (0.19)	32.0 (9.75)	16.0 (4.87)
1-5/8	2.9 (0.88)	3.5 (1.06)	1.6 (0.48)	7.2 (2.19)	0.72 (0.21)	36.0 (10.97)	19.5 (5.94)

Refrigerant trap = Four times equivalent length of pipe per this table

Table 9 Connection sizes and torque

Size OD Cu	Model Tons	Coupling Size	Torque lb-ft.
3/8	1 and 1.5	#6	10-12
5/8	1 and 1.5	#11	35-45

NOTE

If field-supplied refrigerant piping is installed, R-407C refrigerant must be added to the system.

Refrigerant Charge Requirements

Total R-407C refrigerant charge will be required only if units are evacuated during installation or maintenance. For safe and effective operation, refer to pressures in **5.4.2 - Piping Connections and Coolant Requirements.**

Total Refrigerant = Units and Lines

Table 10 Refrigerant charge

Unit Type	Model # 60Hz	Charge R-407C * oz (kg)
Self Contained-Air	MM*12A/F	42 (1.19)
Self Contained-Water	MM*14W/G	27 (0.77)
Split Evaporator-Air	MM*12E/K	3 (0.085)
Self Contained-Air	MM*18A/F	49 (1.39)
Self Contained-Water	MM*20W/G	28 (0.79)
Split Evaporator-Air	MM*18E/K	4 (0.11)
Split Condensing Unit	PFH014A-_L7	134 (3.80)
Split Condensing Unit	PFH020A-_L7	134 (3.80)

Self-contained DX units, split-system evaporators and split-system condensing units are pre-charged with R-407C refrigerant. Use **Table 11** to determine the charge contained in Liebert pre-charged R-407C line sets. Use **Table 7** to determine the charge to be added for field-fabricated refrigerant lines.

* For units with Hot Gas Reheat coil, add 18oz (0.51kg) refrigerant to listed values.

Table 11 Refrigerant charge in Liebert pre-charged R-407C line sets

Line Size, in.	Length, ft. (m)	Charge R-407C, oz (kg)
3/8 Liquid	15 (4.5)	5 (0.14)
	30 (9)	10 (0.28)
5/8 Suction	15 (4.5)	5 (0.14)
	30 (9)	10 (0.28)

Refrigerant (R-407C) must be added to field refrigerant piping.

Quick-Connect Fittings

NOTE
When hard piping is used, complete all piping and evacuate the lines before connecting quick connects.

Be especially careful when connecting the quick-connect fittings. Read and understand the following steps before making the connections.

1. Remove the protector caps and plugs.
2. Carefully wipe the coupling seats and threaded surfaces with a clean cloth.
3. Lubricate the male diaphragm and synthetic rubber seal with refrigerant oil.
4. Thread the coupling halves together by hand to ensure that the threads mate properly.
5. Tighten the coupling body hex nut and union nut with the proper size wrench until the coupling bodies "bottom out" or until a definite resistance is felt.
6. Using a marker or pen, make a line lengthwise from the coupling union nut to the bulkhead.
7. Tighten the nuts an additional quarter-turn; the misalignment of the lines shows how much the coupling has been tightened. This final quarter-turn is necessary to ensure that the joint will not leak. Refer to **Table 9** for torque requirements.

Figure 12 Dimensions—Air-cooled, self-contained and split systems

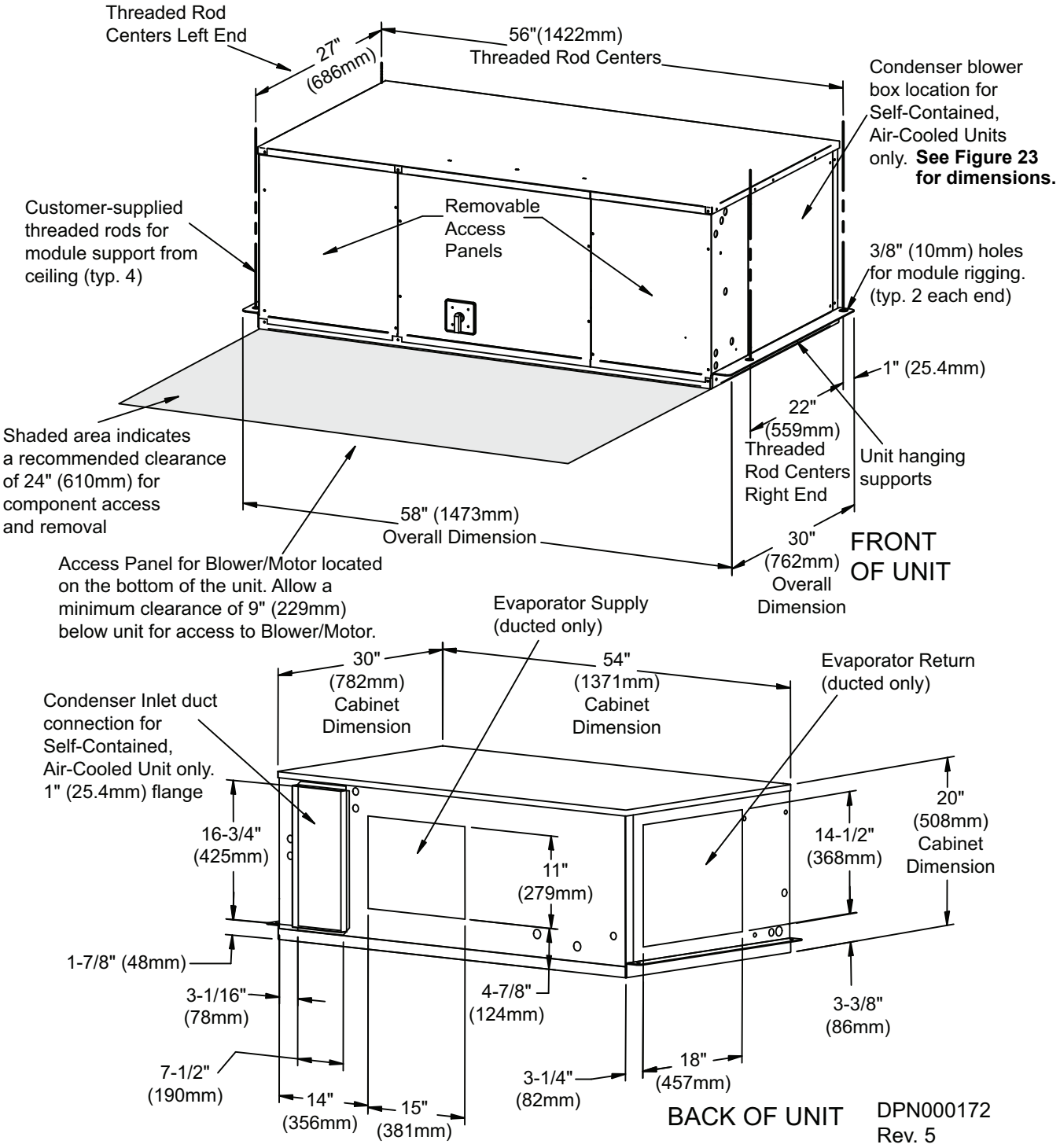


Table 12 Unit net weights—Air-cooled units

Model #		Net Weight lb (kg)
60Hz	50Hz	
MM*12E	NA	220 (100)
MM*12A		265 (120)
MM*18E		225 (102)
MM*18A		300 (136)

Figure 13 Dimensions—Return filter box, all systems

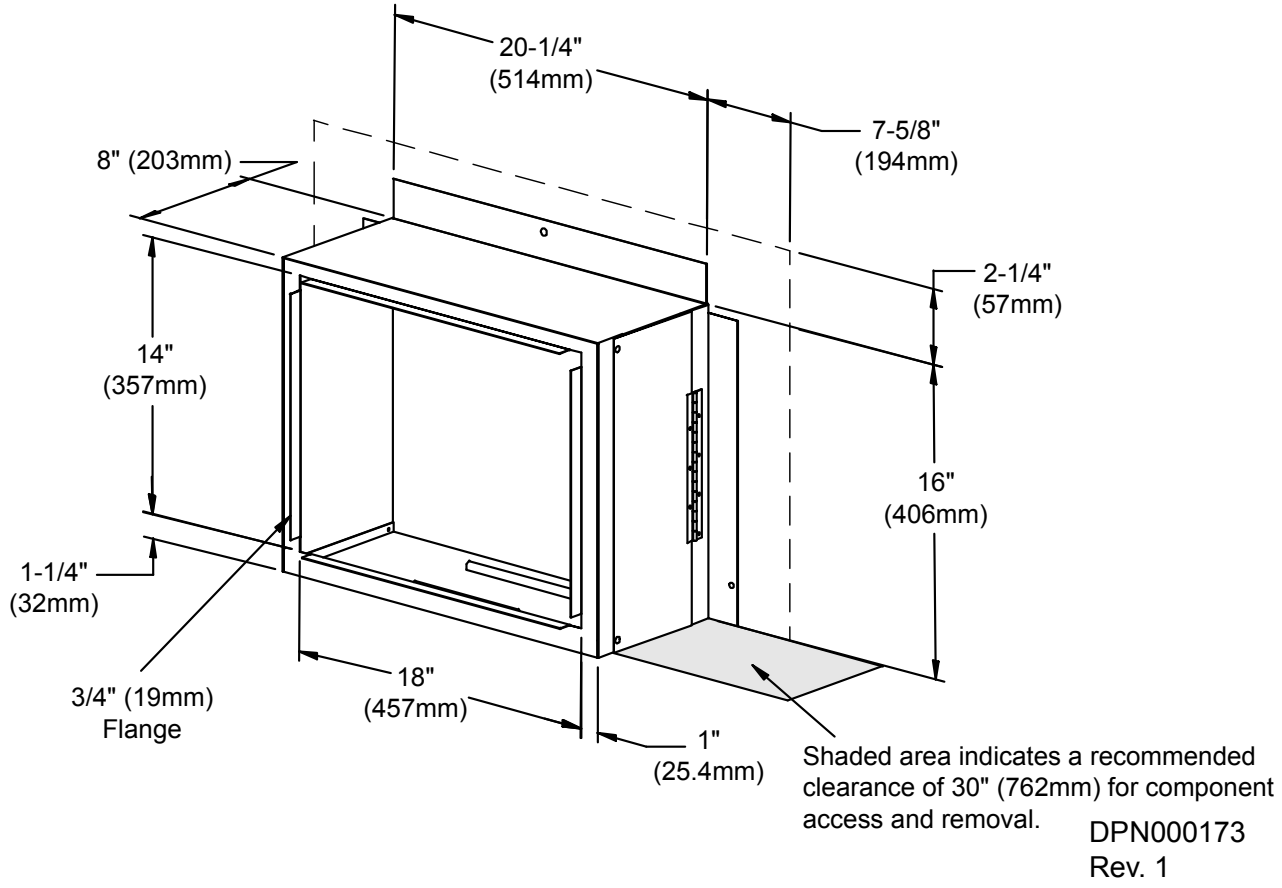


Figure 14 Dimensions—Supply/return grille kit, all systems

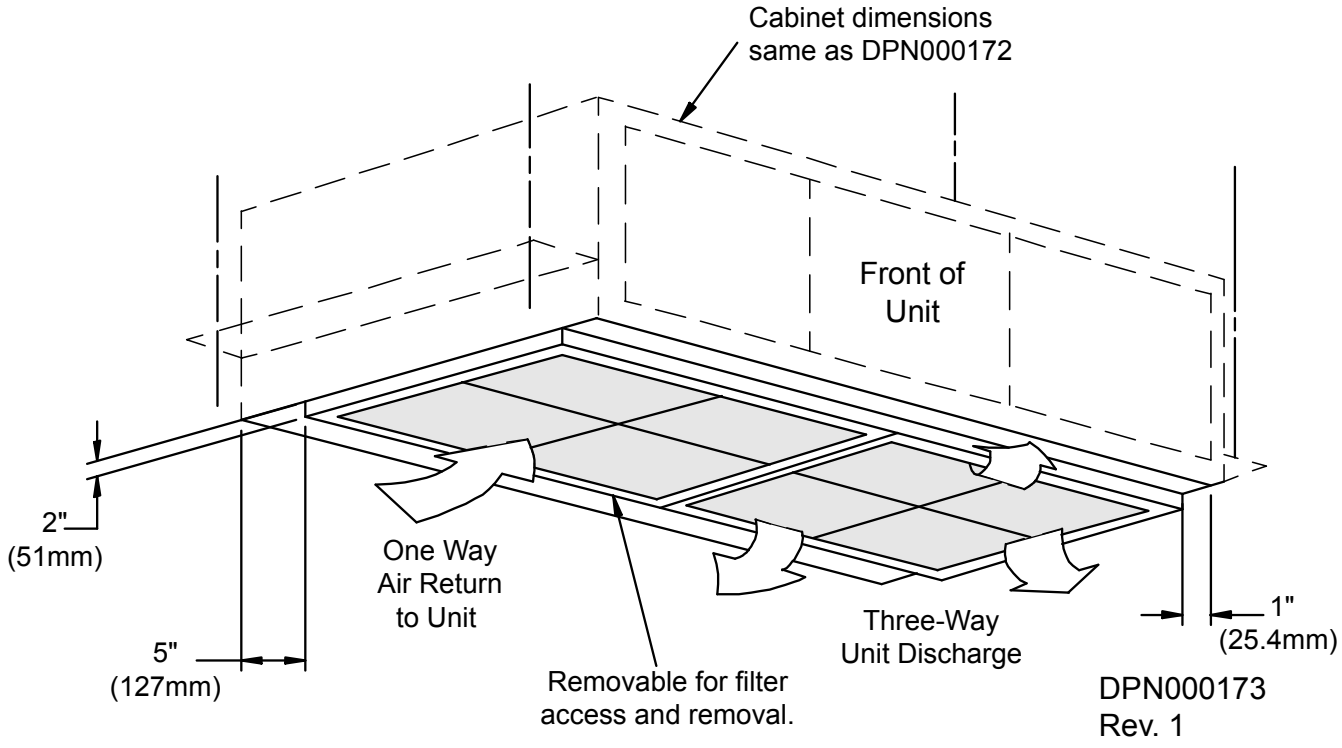
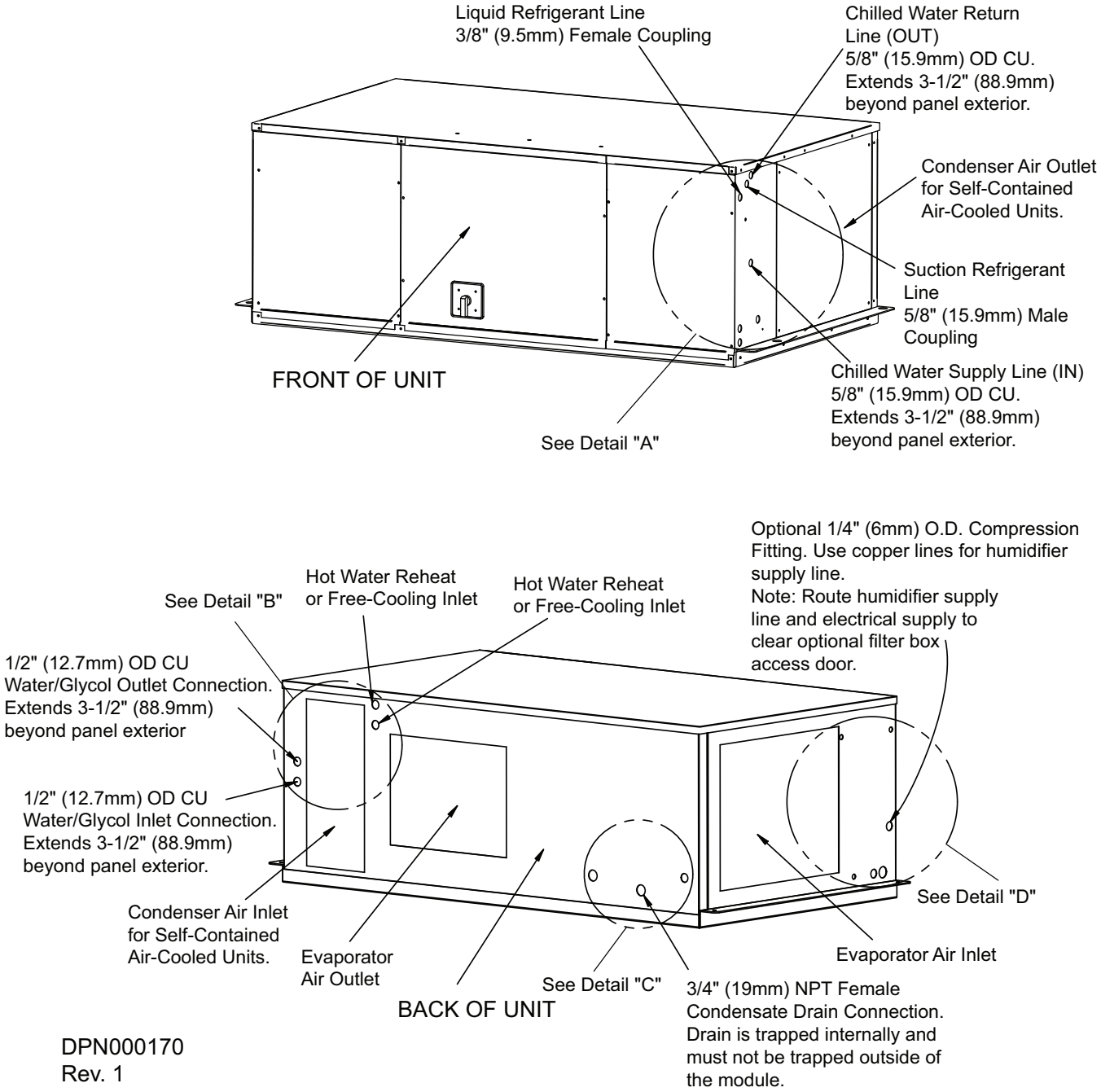


Figure 15 Unit piping data



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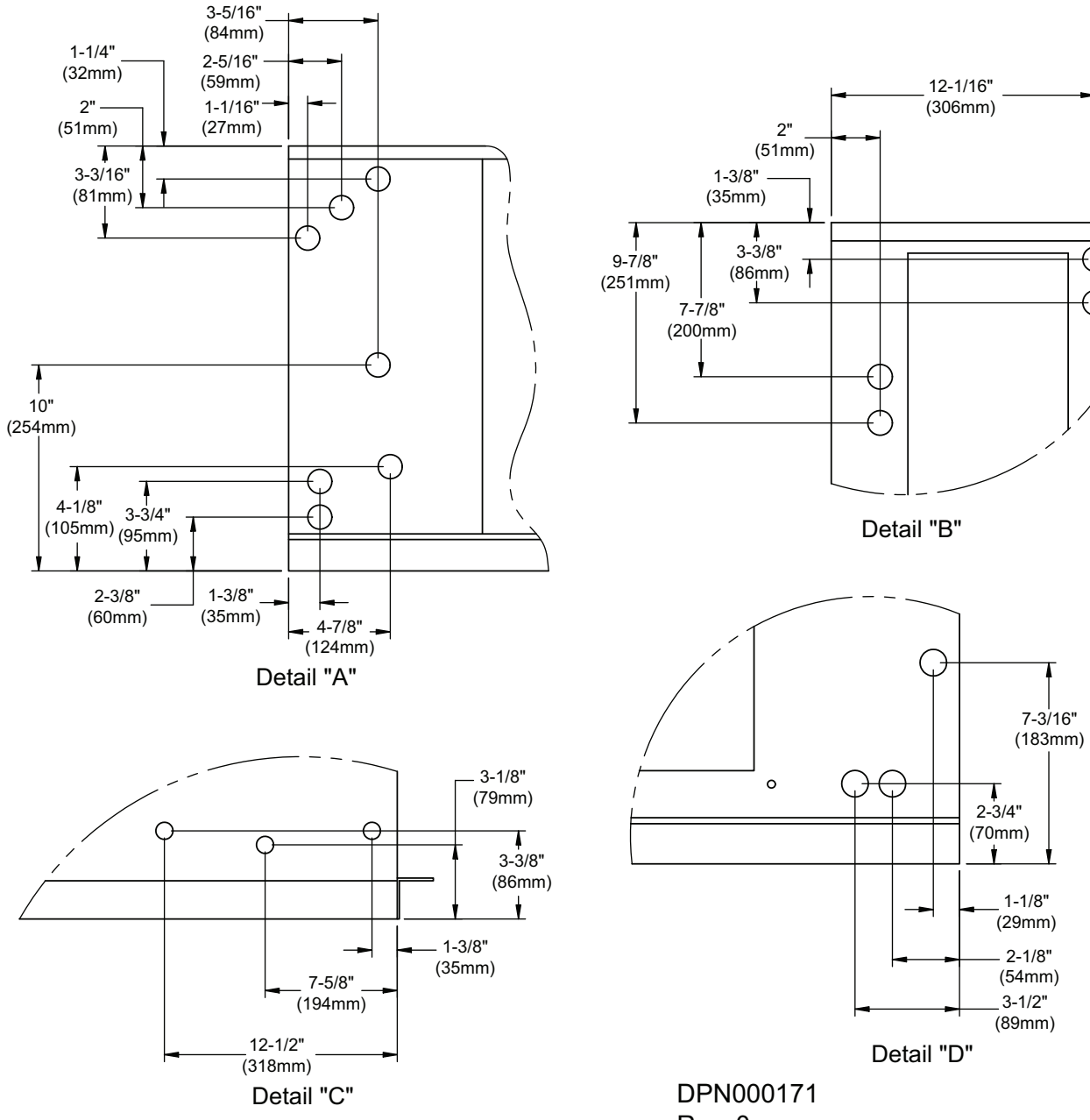
Rev. 1

Figure 16 Unit piping data



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5.4.3 Condensate Pump Kit Installation

WARNING

Risk of electric shock. Can cause injury or death.

Disconnect all local and remote electric power supplies before working within the unit.

Line side of factory disconnect remains energized when disconnect is Off.

All Units

1. Refer to the instructions and drawings supplied with the pump.
2. Disconnect all power to the unit.
3. Remove the access panels.

NOTE

Remove the *shipping band from* the *float switch in* the *evaporator pan*

4. Use mounting brackets if the pump is not attached to ductwork. Pump inlet must be at least 1/2 in. (13mm) below evaporator drain. Mount the pump to the unit exterior as shown in **Figure 17**.
5. Connect 3/4 in. flexible rubber tubing with a hose clamp (both supplied with pump kit) to the 3/4 in. hose barb fitting on the pump.
6. Connect the evaporator drain to 3/4 in. NPT female hose assembly on the pump inlet using 3/4 in. hard pipe. Do not install a trap in the line. Provide at least 1 in. (25mm) clearance between the access panel and the drain line. Support the piping as required.
7. Connect a drain line to the pump discharge 3/8 in. O.D. Cu (compression fitting provided).
8. Connect electric leads L1 and L2 to the line voltage terminal block. Connect the ground lead to the lug near the terminal block.
9. Connect wires from the auxiliary pump contacts to terminals TB1-8 and TB1-9 to shut down the unit upon high water condition in the pump.
10. Reinstall the access panels.
11. Reconnect power to the unit.
12. Run the unit to make sure the pump works properly. Operate the pump and check the drain line and discharge line for leaks. Correct as needed.

Figure 17 Condensate pump

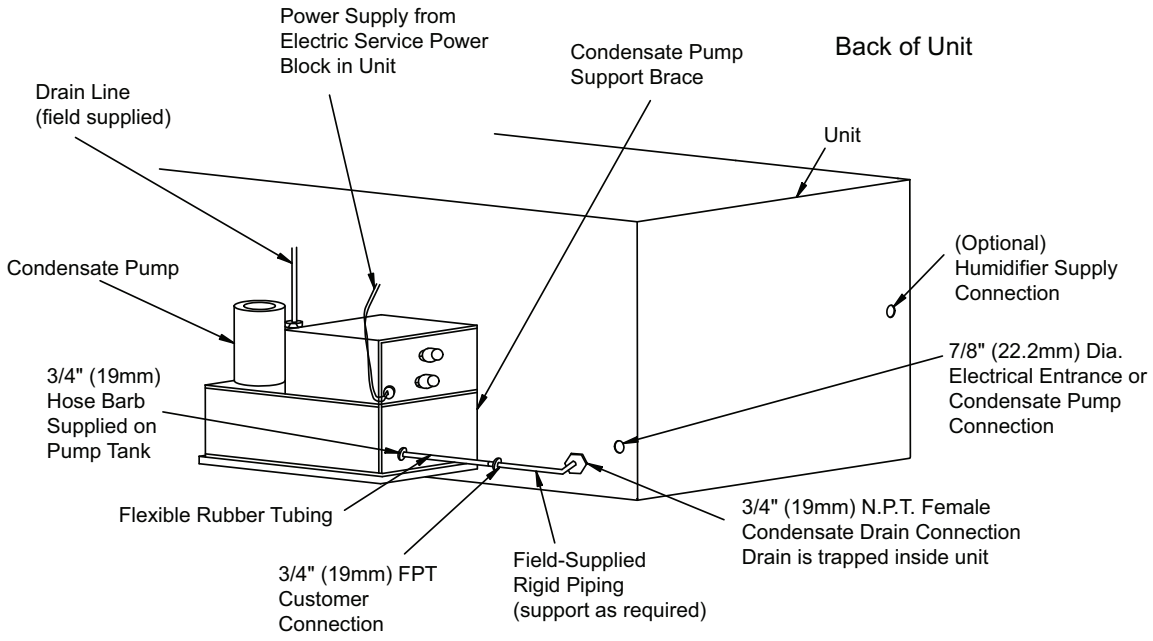


Figure 18 General arrangement diagram - split systems with air-cooled condensing units

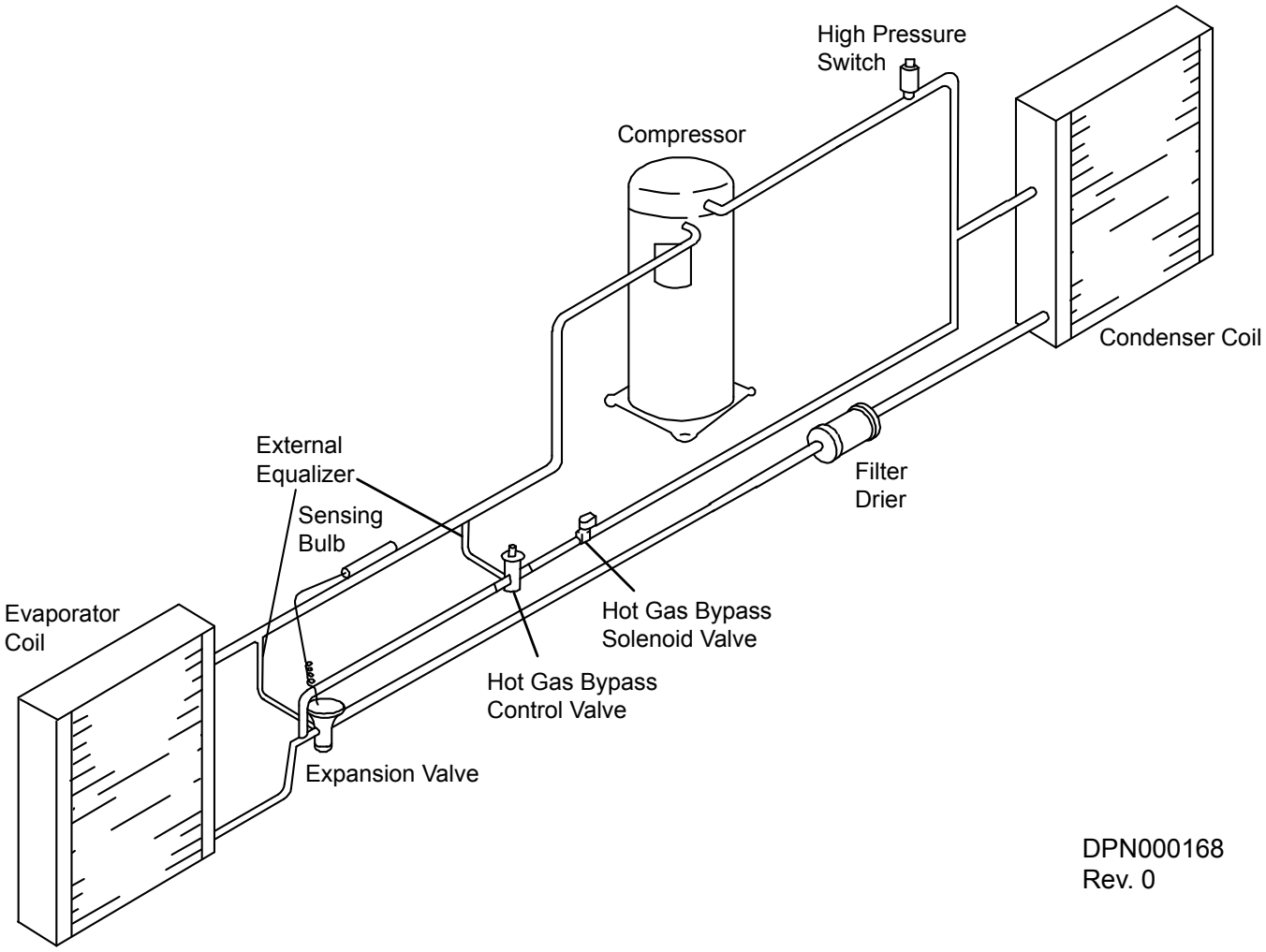


Figure 19 Free-cooling coil arrangement, air-cooled units

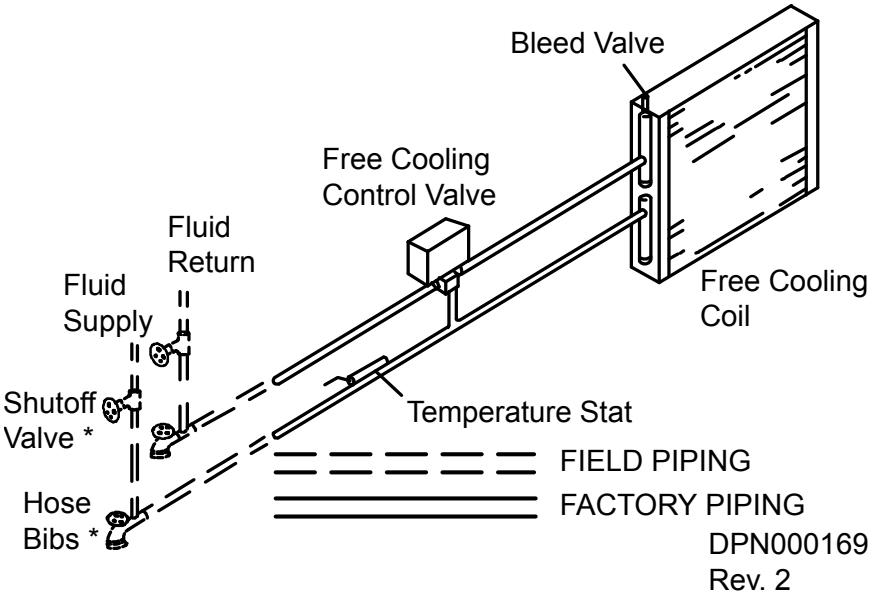


Figure 20 General arrangement—Self-contained air-cooled unit with hot gas reheat

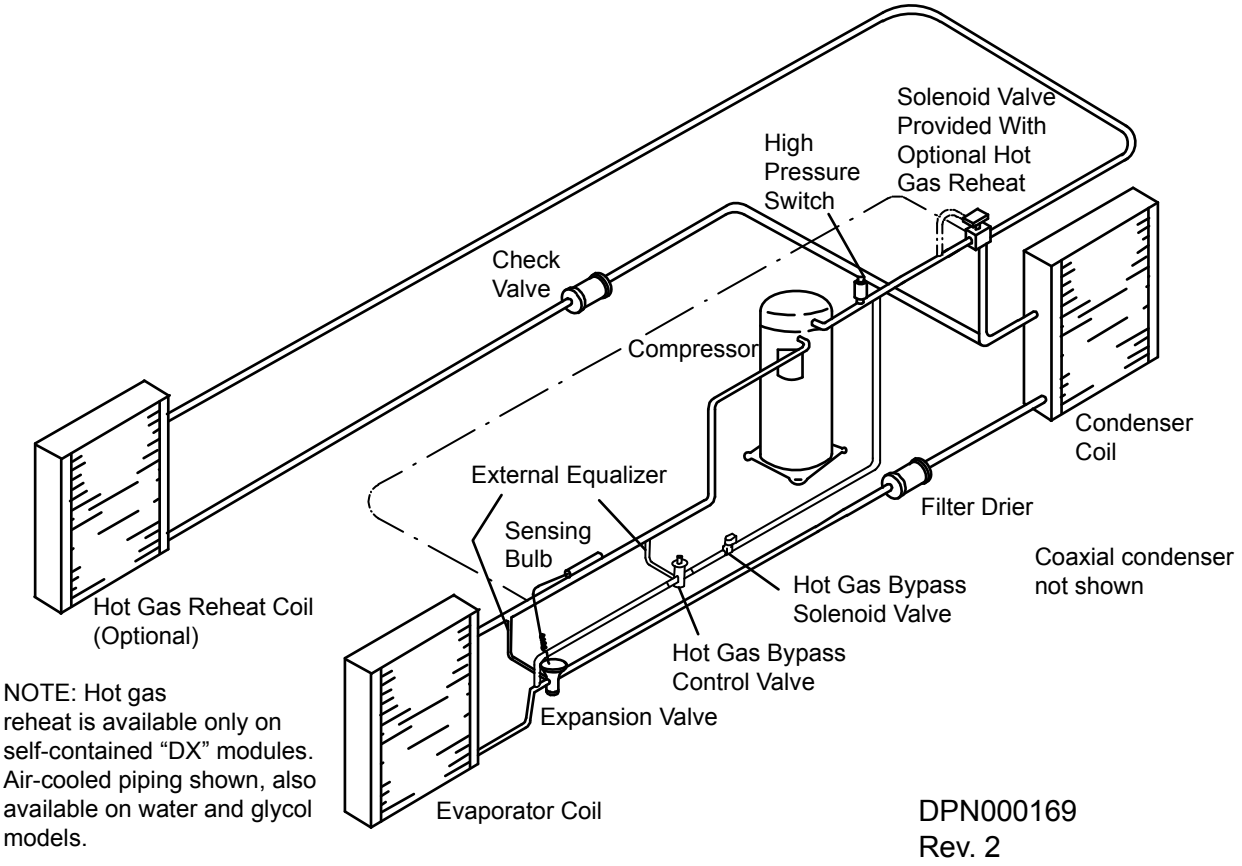
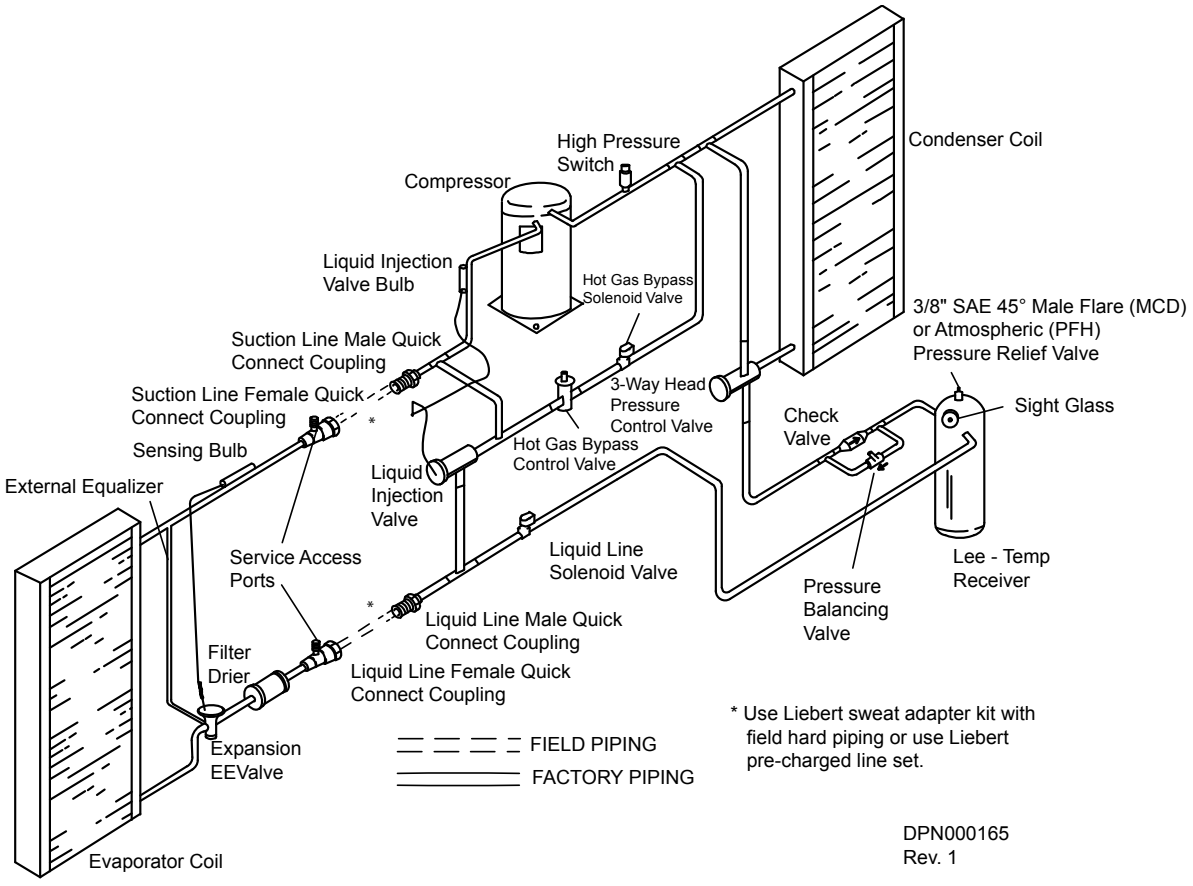


Figure 21 General arrangement—Split systems with air-cooled condensing units



5.4.4 Electrical Connections

WARNING

Arc flash and electric shock hazard. Open all local and remote electric power disconnect switches and wear protective equipment per NFPA 70E before working within the electric control enclosure.

Failure to comply can cause injury or death.

Unit contains hazardous voltage electric power. Line side of factory disconnect remains energized when factory disconnect is Off.

Each unit is shipped from the factory with internal wiring completed. Refer to the electrical schematic when making connections. Electrical connections to be made at the installation site are:

- Power supply to each ceiling unit.
- Control wiring between the evaporator unit and outdoor condensing unit, if applicable.
- Control the wiring between the control panel (wall box) and the evaporator unit control board.

Power Connections

All power and control wiring and ground connections must be in accordance with the National Electrical Code and local codes. Refer to the unit's serial tag data for electrical requirements.

WARNING

Risk of loose electrical connections. Can cause overheating of wire, smoke and fire resulting in building and equipment damage, injury or death.

Use copper wiring only. Verify that all connections are tight.

Voltage supplied must agree with the voltage specified on the unit name plate. If a field-supplied disconnect switch is required, it may be bolted to the ceiling unit, but not to any of the removable panels. This would interfere with access to the unit. Make sure that no refrigerant lines are punctured when mounting the disconnect switch.

Route the electrical service conduit through the hole provided in the cabinet and terminate it at the electric box. Make connections at the factory terminal block or disconnect switch, L1, L2, (L3). Connect earth ground to lug provided. For 208 VAC applications, the low-voltage transformer tap must be changed. Refer to the electrical schematic.

Wall Box Control Connections

A four-conductor (thermostat type) field-supplied wire must be connected between the evaporator control board and the wall box display. See **Figures 22**, **28** and **29** for electrical connections.

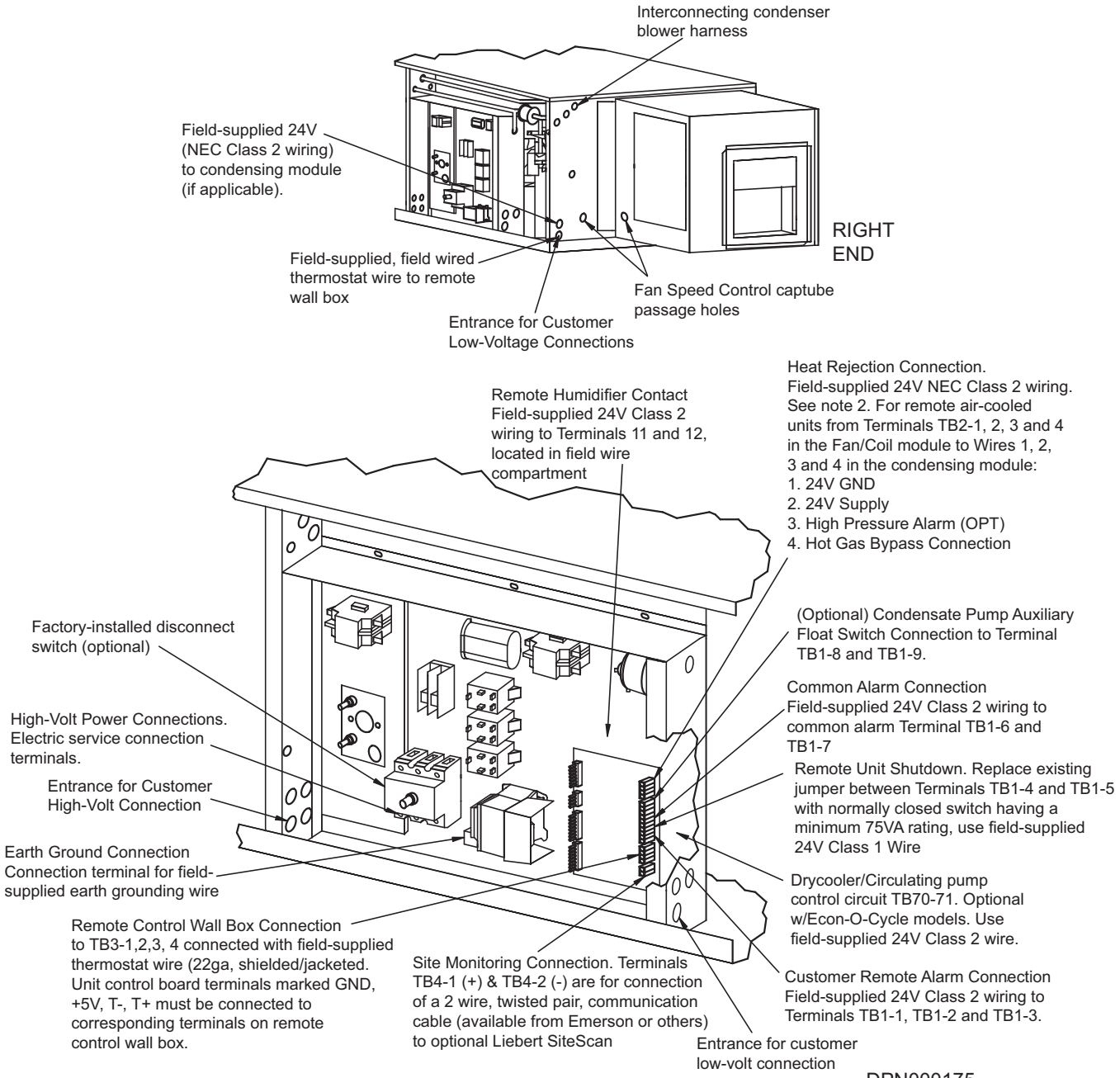
Condensing Unit Control Connections

A field-supplied four-conductor (thermostat type) wire (24VAC) must be connected between the evaporator and the outdoor condensing unit, whenever a split system condensing unit is used. Control wiring must be installed in accordance with NEC and local codes.

Glycol-Cooled Control Connections

Glycol-cooled units require a field-supplied two-conductor (thermostat type) wire connection between the evaporator unit and the drycooler. Control wiring must be installed in accordance with NEC and local codes.

Figure 22 Unit electrical connections



NOTES:
1. Refer to specification sheet for full load amp and wire size amp ratings.
2. Control voltage wiring must be a minimum of 16 GA (1.3mm) for up to 75'(23m) or not to exceed 1 volt drop in control line.

5.5 Centrifugal Condenser Fan Installation

The self-contained, air-cooled model utilizes a centrifugal blower in a housing that attaches directly to the right end of the ceiling unit. Mounting holes are pre-cut at the factory and fasteners are provided. In addition, a wiring harness is included for the power and control connections required from the ceiling unit to the blower. Route capillary tube from fan speed controller through hole in ceiling unit. Screw end of capillary tube on to access valve in discharge line. Providing ductwork for outdoor air to/from the condenser is optional.

5.5.1 Electrical, Control and Power Connections

Field connections are required at the ceiling unit using the provided wiring harness. A four-wire connection is required from the condenser fan to the ceiling unit. Route the conduit through the hole provided in the left side of the cabinet.

If a field-supplied disconnect switch is installed, mount it on the ceiling unit but not on any removable panels.

NOTICE

Risk of punctured refrigerant lines. Can cause sudden loss of refrigerant and cooling.

During mounting of external disconnect switch, take special care that no refrigerant lines are punctured or damaged.

The ceiling unit power connections are made at the terminal block or disconnect switch in the lower left-hand corner of the electric panel (middle). The power terminal connections are labeled L1 and L2. (For 208VAC applications, change the input transformer connection as described in the electrical schematic attached to cabinet). Self-contained, air-cooled models require power connections from the evaporator ceiling unit to the condenser fan (See **Figures 12** and **22** and provided electrical schematic).

NOTICE

Risk of incorrect input power supply. Can cause equipment damage.

The line voltage supplied must correspond with the voltage specified on the unit's nameplate.

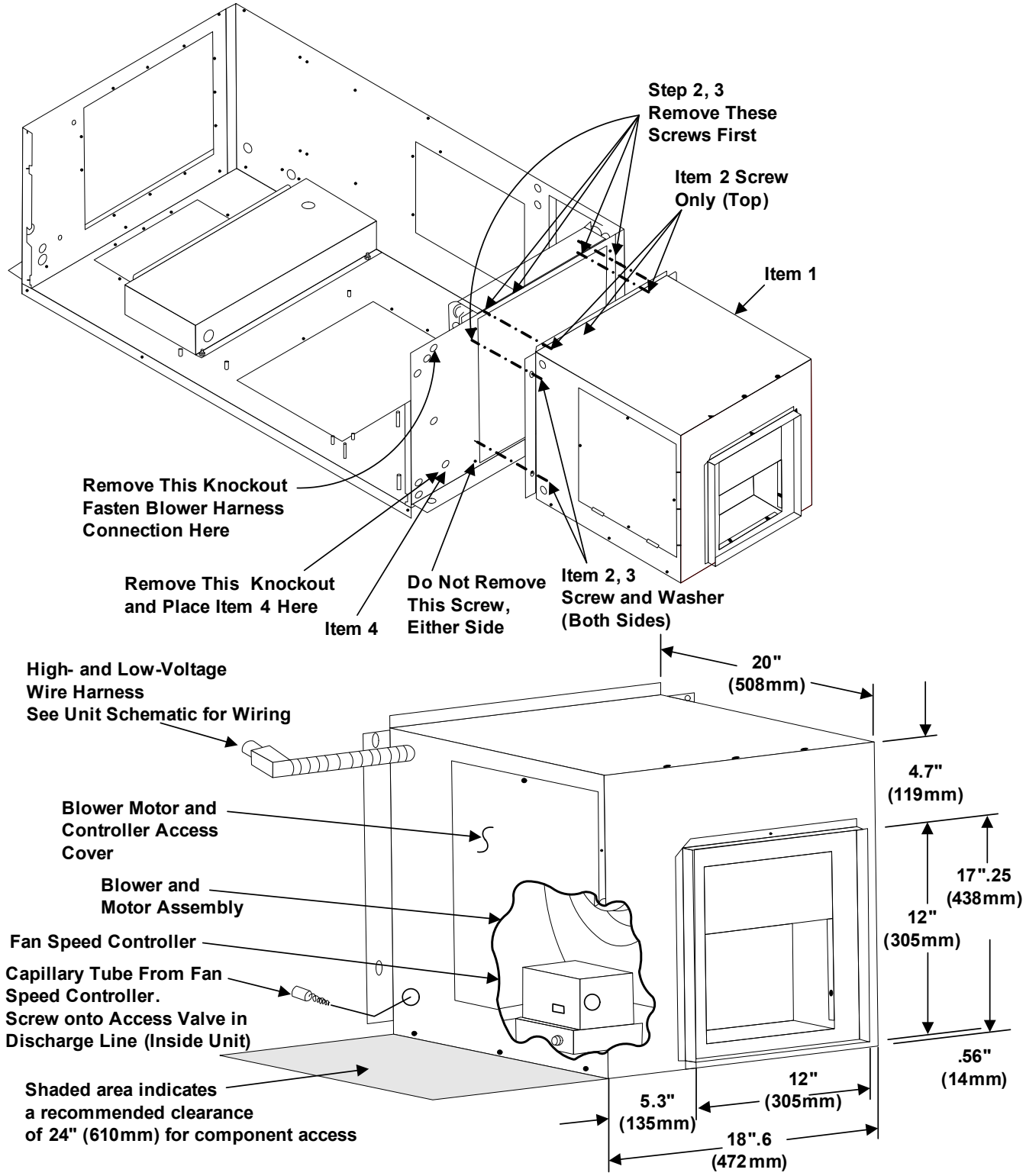
5.5.2 Indoor Condenser Fan Ductwork

The total external static pressure for the inlet and outlet ducts, including grille, must not exceed 0.5 inches of water. Hood intake dimensions should be the same as the condensing unit duct dimensions. The duct connection provided for air flow to the ceiling unit 7-1/2" x 16-3/4" (191mm x 425mm). The duct opening for air flow from the condenser fan is 12" x 12" (305mm x 305mm). Ductwork should be designed for 950 CFM (1614 CMH).

If the unit draws air from the outside of the building, rain hoods must be installed. In addition, install a triple-layer bird screen over rain hood openings to eliminate the possibility of insects, bird, water and debris entering the unit. Use flexible ductwork or nonflammable cloth collars to attach ductwork to the unit and to control vibration transmission to the building. Attach the ductwork to the unit using the flanges provided. Locate the unit and ductwork so that the discharge air does not short circuit to the return inlet. Avoid directing the hot exhaust air toward adjacent doors or windows.

Normal operating sound may be objectionable if the unit is placed directly over quiet work areas. Ductwork that runs through a conditioned space or is exposed to areas where condensation may occur must be insulated. Whenever possible, ductwork should be suspended using flexible hangers. Avoid mounting the duct directly to the building's structure. In applications where the ceiling plenum is used as the heat rejection domain, the discharge air must be directed away from the air inlet and a screen must be added to the end of the discharge duct to protect service personnel. For multiple unit installation, space the units so that hot exhaust air is not directed toward the air inlet of an adjacent unit.

Figure 23 Centrifugal condenser fan dimensions and installations



5.6 Outdoor Air-Cooled Condensing Unit Installation

NOTE
Follow all applicable national and local building, electrical and plumbing codes.

5.6.1 Location Considerations

To insure a satisfactory air supply, locate air-cooled propeller fan condensing units in an environment providing clear air, away from loose dirt and foreign matter that may clog the coil. Condensing units must not be located in the vicinity of steam, hot air or fume exhausts or closer than 18 inches from a wall, obstruction or adjacent unit. Avoid areas where heavy snow will accumulate at air inlet and discharge locations.

The condensing unit should be located for maximum security and maintenance accessibility. Avoid ground-level sites with public access. The recommended maximum refrigerant line length is 45 feet (13.7m).

Install a solid base, capable of supporting the weight of the condensing unit. The base should be at least 2 inches (51mm) higher than the surrounding grade and 2 inches (51mm) larger than the dimensions of the condensing unit base. For snowy areas, a base of sufficient height to clear snow accumulation must be installed.

Table 13 Unit dimensions

Model	Width (A)	Height (B) in. (mm)	Depth (C) in. (mm)
PFH014A-_L	40 (1016)	23.5 (597)	18 (457)
PFH020A-_L	40 (1016)	23.5 (597)	18 (457)

5.6.2 Piping Connections

Details for Refrigerant (R-407C) Loop piping are in **5.4.2 - Piping Connections and Coolant Requirements.**

5.6.3 Electrical Connections

Refer to **5.4.4 - Electrical Connections**, for general wiring requirements and cautions. Refer to electrical schematic when making connections.

Power Connections

The outdoor condensing unit requires its own power source and earth ground, with a disconnect switch (field-supplied) to isolate the unit for maintenance. A transformer is available for 277VAC, single-phase, applications.

Low-Voltage Control Wire Connections

A field-supplied four-wire control connection is required between the outdoor condensing unit and the evaporator. Refer to **Figures 22**, **24** and **25** and to the unit's electrical schematic.

Low-voltage wiring should be sized to allow a 1 volt maximum drop due to line resistance between the evaporator and condensing unit. Use NEC Class 1 or 2 wiring according to wire routing conditions chosen and local codes, sizing wire per maximum wire lengths using **Table 14**.

Table 14 Recommended minimum wire size

Max. Distance * ft. (m)	Min. Wire Gauge AWG (mm^2)
50 (15)	20 (0.75)
100 (30)	18 (1.0)
150 (45)	16 (1.5)

* One-way control wire run between outdoor condensing unit and evaporator.

Figure 24 Piping and electrical connections

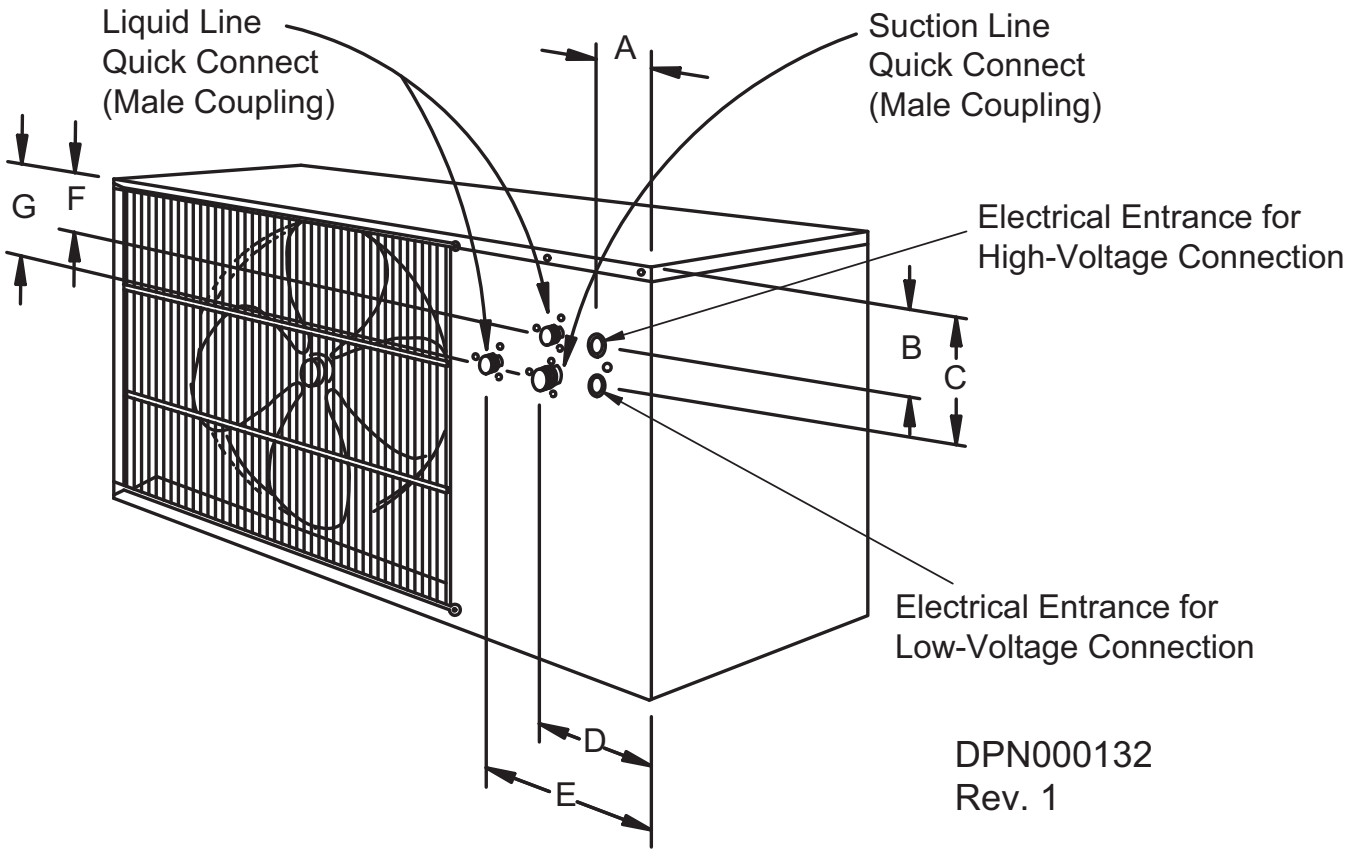
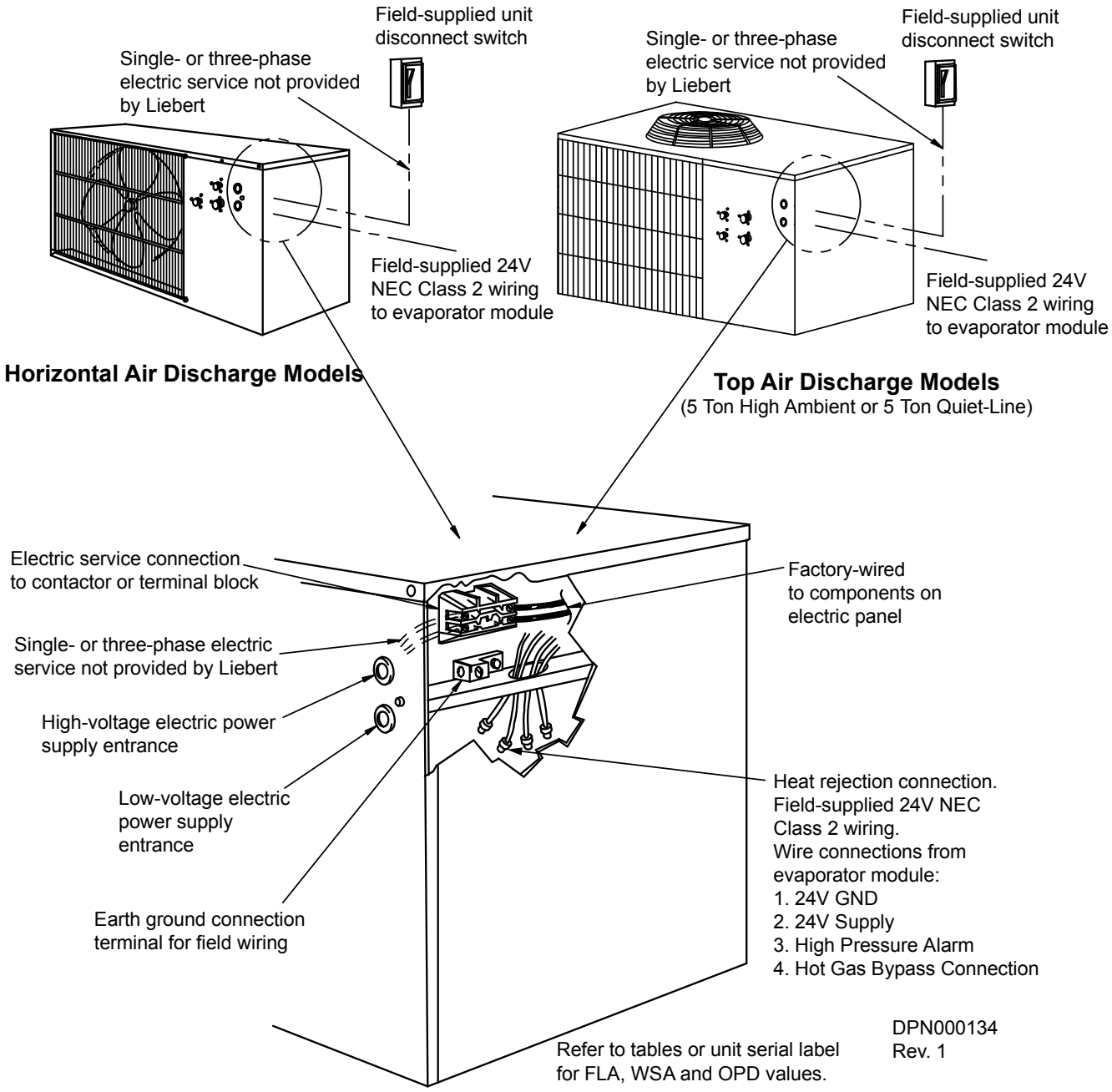


Table 15 Piping and electrical connections

Model Numbers	Electrical Connections, in. (mm)			Piping Connections, in. (mm)			
60 Hz	**A**	**B**	**C**	**D**	**E**	**F**	**G**
PFH014A-L	2-1/4 (57)	5-1/4 (133)	7-3/4 (197)	8-3/4 (222)	—	5 (127)	7-1/4 (184)
PFH020A-L							

Source: DPN000132, Rev. 1

Figure 25 Electrical field connections, 1- to 5-ton units



5.7 Checklist for Completed Installation

___ 1. Proper clearance for service access have been maintained around the equipment.

___ 2. Equipment is level and mounting fasteners are tight.

___ 3. Piping completed to refrigerant or coolant loop (if required). Refrigerant charge added (if required).

___ 4. Condensate pump installed (if required).

___ 5. Drain line(s) connected and checked for leaks.

___ 6. Water supply line connected to humidifier (if required).

___ 7. All piping connections are tight.

___ 8. Field-provided pan with drain installed under ducted cooling units.

___ 9. Filter box installed on ducted units.

___ 10. Ducting completed or optional grille installed.

___ 11. Filter(s) installed in return air duct.

___ 12. Line voltage to power wiring matches equipment nameplate.

___ 13. Power wiring connections completed between disconnect switch, evaporator and condensing unit, including earth ground.

___ 14. Power line circuit breakers or fuses have proper ratings for equipment installed.

___ 15. Control wiring connections completed to evaporator and condensing unit (if required), including wiring to wall-mounted control panel and optional controls.

___ 16. Control panel DIP switches set based on customer requirements.

___ 17. All wiring connections are tight.

___ 18. Foreign materials have been removed from in and around all equipment installed (shipping materials, construction materials, tools, etc.)

___ 19. Fans and blowers rotate freely without unusual noise.

___ 20. Inspect all piping connections for leaks during initial operations. Correct as needed.

___ 21. Drain pan is installed under ducted, ceiling-mounted unit.

___ 22. Rubber band is disconnected from evaporator condensate pan float switch.

6.0 MICROPROCESSOR CONTROL

The Microprocessor Control for the Liebert Mini-Mate2 unit features an easy to use, menu-driven LCD. The menus, control features and circuit board details are described in this section. Detailed information concerning controls (**7.0 - System Performance Microprocessor Controls**) and alarms (**8.0 - Alarms**) are provided.

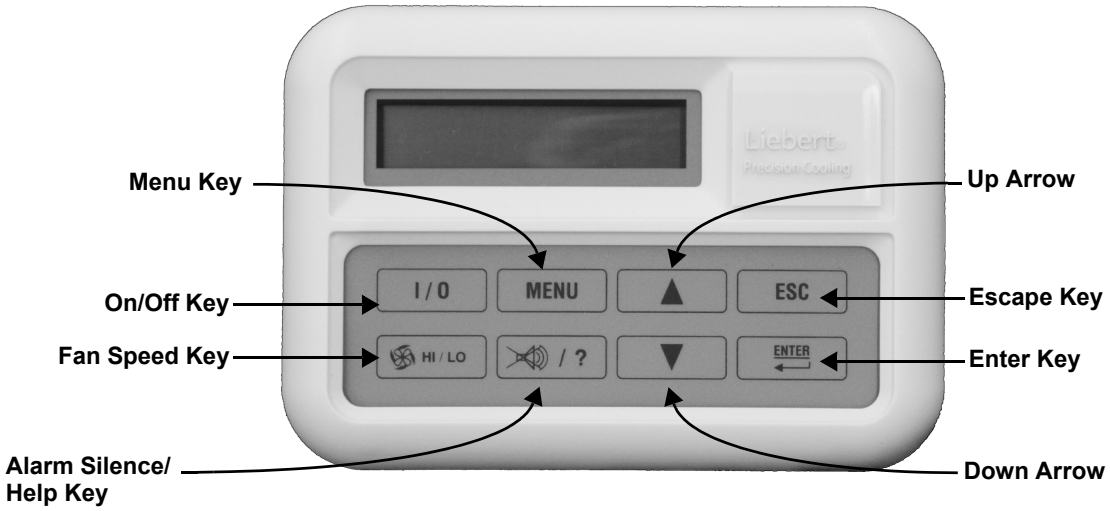
6.1 Feature Overview

To turn the unit ON, press the ON/OFF (I/O) key after power is applied. To turn the unit OFF, press the ON/OFF/(I/O) key before power is disconnected.

The following control keys may be used to move through the menus, as prompted on the LCD display:

- I/O (On/Off)—Turns unit On or Off.
- MENU—Enables user to access the program menu to change control parameters, alarms, setback schedule, etc.
- Up Arrow—Increases the value of a displayed parameter while in a set mode (setpoints, time, etc.).
- ESC (Escape)—Allows user to move back to a previous menu.
- HI/LO (Fan Speed)—Changes the fan speed between high and low.
- Alarm Silence/Help—Silences active, current alarms. If no alarms are present, help text will appear.
- Down Arrow—Decreases the value of displayed parameter while in a set mode.
- ENTER—Stores changes or new settings in the microprocessor.

Figure 26 Microprocessor control layout



Active alarms are displayed on the LCD screen and sound an audible beeper. To silence an alarm, press the Alarm Silence/Help key as prompted on the display.

Setpoints, DIP switch settings and other selections were made during factory testing of your unit and are based upon typical operating experience. (Other default selections were made according to options included with your unit). MAKE ADJUSTMENTS TO THE FACTORY DEFAULT SELECTIONS. ONLY IF THEY DO NOT MEET YOUR SPECIFICATIONS.

Allowable ranges are displayed by pressing the help key. A password will be required (if enabled) to change setpoints, time delays, etc.

The display normally shown includes the present room temperature, humidity, active status functions (cooling, heating, dehumidifying, humidifying), normal fan speed/low fan speed and active alarms. The Status Display may also be selected from the Main Menu.

MAIN MENU <MENU>

Press the MENU key to display the Main Menu. The menu selections, in order, include:

- SETPOINTS
- STATUS
- ACTIVE ALARMS
- TIME
- DATE
- SETBACK
- SETUP OPERATION
- SETPOINT PASSWORD
- SETUP PASSWORD
- CALIBRATE SENSORS
- ALARM ENABLE
- ALARM TIME DELAY
- COMMON ALARM ENABLE
- CUSTOM ALARMS
- CUSTOM TEXT
- DIAGNOSTICS
- END OF MENU

Use the Up/Down Arrows to scroll through the selections, then when ready to select a particular function press “Enter”.

6.1.1 Setpoints

Setpoints and system setup parameters are kept in non-volatile memory. Selecting SETPOINTS from the Main Menu will display the following selections:

- TEMPERATURE SETPOINT
- TEMPERATURE SENSITIVITY
- HUMIDITY SETPOINT
- HUMIDITY SENSITIVITY
- HIGH TEMPERATURE ALARM
- LOW TEMPERATURE ALARM
- HIGH HUMIDITY ALARM
- LOW HUMIDITY ALARM

Scroll through this sub-menu by using the Up/Down Arrows, then press Enter to select a particular function. To change a particular value, press Enter and use the Up/Down Arrows to change the value. When the value has been changed press Enter to store the value. For example to change the temperature setpoint from the main status display.

1. Press Menu key to display main menu.
2. Scroll to “SETPOINTS” using the Up/Down Arrows. Press Enter key.
3. Scroll to “TEMP SETPOINT” using the Up/Down Arrows. Press Enter key.
4. Use the Up/Down Arrows to change the value. Press Enter key.

Table 16 View default setpoints and allowable ranges

Setpoint	Default	Range
Temperature Setpoint	72°F	40-90°F (5-32°C)
Temperature Sensitivity	2.0°F	1-9.9°F (0.6-5.6°C)
Humidity Setpoint	50%	20-80% RH
Humidity Sensitivity	5%	1-30% RH
High Temperature Alarm	80°F	35-95°F (2-35°C)
Low Temperature Alarm	65°F	35-95°F (2-35°C)
High Humidity Alarm	60%	15-85% RH
Low Humidity Alarm	40%	15-84% RH

6.1.2 Status

The operator can monitor the percentage heating, cooling, dehumidifying and humidifying status of the unit by selecting the "STATUS" submenu.

6.1.3 Active Alarms

The operator can monitor the alarms status by selecting "ALARMS" which will display a "No Alarm Present" or "Alarm XX of YY" alert and description. If more than one alarm is activated, use the Up/Down Arrows to scroll through the alarms list. ("XX" reference is the number of the alarm shown, while the "YY" reference is the total number of alarms activated).

6.1.4 Time

The controller time clock must be set to allow for the setback control. The clock uses the 24 hour system (i.e., 12 midnight is entered as *24:00*). To change the time press "Enter" to select the function, then use the Up/Down Arrows to change the first character, press enter to store, press the up/down button to change the section character, press enter to store, etc. THERE IS A BATTERY BACKUP FOR THE DATE AND TIME FEATURES.

6.1.5 Date

The controller date must be set to allow for the setback control. To change the date press "Enter", then use the Up/Down arrows to change the first character, press enter to store, press the up/down button to change the second character, etc.

6.1.6 Setback

The microprocessor can be programmed for night and weekend setback. Two (2) events can be programmed for a five-day work week and two (2) events can be programmed for a two-day weekend. The following table can be used to devise a setback plan.

Table 17 Logging a setback plan

Event	Weekend	Weekday
Time 1		
Temperature 1		
Sensitivity 1		
Humidity 1		
Humidity Sensitivity 1		
Time 2		
Temperature 2		
Sensitivity 2		
Humidity 2		
Humidity Sensitivity 2		

6.1.7 Setup Operation

Selecting Setpoint/Setup from the Main Menu will display the following selections:

- RESTART TIME DELAY
- C/F DEGREES
- HUMIDITY CONTROL METHOD

Use the Up/Down arrows to scroll through the submenu. Press Enter to select a particular function.

Restart Time Delay

This function delays unit restart after main power is restored to the unit. If several systems are operating, the time delays should be set to different values to cause a sequential start. Delay can be set from 0.1 minutes (6 seconds to 9.9 minutes. Setting the value to zero (0) will prevent unit restart when power is restored. In this case, the unit must be restarted manually by pressing the "On/Off" button on the keypad.

C/F Degrees

The control may be selected to show readings and setpoints in either degrees Fahrenheit (F) or Celsius (C). To change the value, use Enter to select this function, then use the Up/Down Arrows to change the value. Press Enter to store the value.

Humidity Control Method

The operator may select either relative (direct) or absolute (predictive) humidity control. If "relative" is selected, the RH control is taken directly from the RH sensor. If "absolute" is selected, the RH control is automatically adjusted whenever return air temperature deviates from the desired temperature setpoint (i.e., predictive humidity control). The LCD display will indicate percentage relative humidity for both methods of control. If the "absolute" feature is selected, the adjusted humidity reading will also be shown. When utilizing the predictive humidity control feature, the humidity level is automatically adjusted ~2% RH for each degree difference between the return air temperature and the temperature setpoint.

In terms of relative humidity control, unnecessary dehumidification can result when overcooling occurs during a dehumidification cycle. This is due to a higher than normal RH reading caused by overcooling the room (about 2% RH for each degree of overcooling). This drop in temperature extends the dehumidification cycle. Later, when the dehumidification ends and the temperature rises to the setpoint, the RH reading falls. The final RH reading will then be lower than actually desired. If the temperature drop was significant enough, the percentage RH could be low enough to activate the humidifier.

If the absolute humidity control is selected, over-dehumidification may be avoided. When overcooling occurs (i.e., causing an increase in the RH reading) the humidity control program estimates what the RH will be when the dehumidification cycle ends and temperature returns to the setpoint. This allows the dehumidification cycle to end at the proper time. The predictive humidity control can greatly reduce energy consumption by minimizing both compressor/reheat operation and elimination unnecessary operation. Use the Up/Down Arrows to select the desired humidity control method.

Table 18 Setup functions, default values and allowable ranges

Function	Default	Range
Restart Time Delay	0.1	0 to 9.9 min (0 = manual restart)
C/F Degrees	°F	°C or °F
Humidity Control	Rel	Relative or Absolute

6.1.8 Change Passwords

The display will prompt the operator to enter a three digit password when attempting to make changes. The system includes two (2) passwords, one for setpoints and one for setup. The system allows the password to be changed by first entering the default password set at the factory set (12-3) for setpoints and (3-2-1) for setup. The password function provides system security, so that only authorized personnel are allowed to make changes to the system. (If unauthorized changes are being made, the passwords may be compromised and new ones should be selected). The password function can be disabled by setting DIP switch 8 in the wall box to OFF.

6.1.9 Calibrate Sensors

The temperature and humidity sensor can be calibrated by selecting the CALIBRATE SENSORS menu item. The temperature sensor can be calibrated +5°F, while the humidity sensor can be calibrated ±10% RH. When calibrating the humidity sensor, the value shown will always be % RH, even though absolute humidity control may be selected. If absolute humidity control is selected, the Normal Status Display will display the adjusted reading. This reading may not agree with the relative humidity reading displayed while in calibration.

If the sensors are subject to frequent wide temperature and humidity swings, it may be necessary to shorten the cycling by increasing the sensor time delay. If the cycling by increasing the sensor time delay. If the sensors are located too close to the air discharge, they will likely experience rapid swings in measurement. Another method in reducing compressor cycling is to increase the temperature and/or humidity sensitivity.

6.1.10 Alarm Enable

Each alarm can be disabled or enabled. Use the Up/Down Arrows to select a particular alarm, press Enter to select either enable or disable. Then press Enter again to store the change. When the alarm is disabled it will NOT report to either the wall box beeper or the common alarm relay. THE HIGH WATER ALARM WILL AUTOMATICALLY SHUT THE UNIT OFF, EVEN IF THE ALARM IS DISABLED. SIMILARLY, OPTIONAL FACTORY-INSTALLED SMOKE DETECTORS ARE WIRED TO SHUT THE EVAPORATOR UNIT OFF, REGARDLESS OF THE ENABLE/DISABLE STATUS.

6.1.11 Alarm Time Delay

Each individual alarm can be programmed with a time delay (see **Table 19**), causing the unit to delay a specified amount of time (0-255 seconds) before recognizing the alarm. The alarm condition must be present for the full amount of the time delay before the alarm will sound. If the alarm condition is diverted prematurely, the alarm will not be recognized and the time delay time will automatically reset. FOR SOFTWARE ALARMS SUCH AS “LOSS OF POWER” AND “SHORT CYCLE”, THE TIME DELAY SHOULD BE LEFT AT THE FACTORY DEFAULT OF 0.

Table 19 Alarm default time delays

Alarm	Default Time Delay (seconds)
Humidifier Problem	2
High Head Pressure	2
Custom Alarm #1	0
Custom Alarm #2	6
High Temperature	30
Low Temperature	30
High Humidity	30
Low Humidity	30
Short Cycle	0
Loss of Power	0

6.1.12 Common Alarm Enable

Each individual alarm can be selected to activate/deactivate the common alarm relay. If the energize common alarm function is set to YES, the relay is energized immediately as the alarm is annunciated and de-energized when the alarm condition is diverted after the alarm has been recognized. If the alarm is completely DISABLED, the alarm has no effect on the common alarm relay. Use the Up/Down Arrows to scroll to a particular alarm, press the Enter button to select it, then press the Enter button again to select Yes or No.

6.1.13 Custom Alarms

The custom alarm messages can be selected from a list of standard alarm messages, allowing the operator to write his/her own message. A MAXIMUM OF TWO (2) ALARM MESSAGES CAN BE CUSTOMIZED. The two custom alarm messages will initially display the previously programmed message but can be changed.

The text for custom alarms can be changed at any time by selecting "CUSTOM ALARMS". To change the text for a custom alarm, select the alarm you would like to change, 1 or 2. Using the Up/Down Arrows, step through the list of five standard alarm messages (listed below) and two custom alarms. Select the alarm message desired and store it by pressing Enter.

- STANDARD CUSTOM ALARM MESSAGES •
- WATER FLOW LOSS
- SMOKE DETECTED
- LOSS OF AIR FLOW
- HUMIDIFIER PROBLEM
- FILTER CLOG

6.1.14 Custom Text

To modify the two custom alarm messages select "CUSTOM TXT". Then select "CUS TXT #1" or "CUS TXT #2". Text can be up to 20 characters in length and can be either a blank space or any of the following alphanumeric characters and symbols:

- A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q,R,S,T,U,V,W,X,Y,Z
- #,%,*,-
- 0,1,2,3,4,5,6,7,8 or 9

Use the Up/Down Arrows to select a character, then press Enter. The cursor will move to the next space where you may once use the Up/Down Arrows to select another character, etc.

LCD Contrast

The level of contrast due to the viewing angle of the Liquid Crystal Display (LCD) can be adjusted using a potentiometer screw, inside the wall box next to the display.

Nonvolatile Memory

All critical information is stored in nonvolatile memory. Setpoints, setup parameters and component run hours are kept inside the microcontroller in EEPROM.

Equipment Options Switches

Equipment options are selected and enabled using DIP switches 1 through 7. These are located on the control board near TB1. These switches are factory-set and should not require any user changes. The setting and function of the switches can be individually read on the LCD.)

NOTE

In order to update the DIP switch settings, power must be cycled Off, then On, from the unit disconnect switch.

Table 20 Equipment switch settings (unit control board)

Switch	OFF Position	ON Position
1	Compressor	Chill Water
2	Staged Reheat	SCR Reheat
3	Not Used-Must remain in OFF position	
4	Not Used-Must remain in OFF position	
5	Enable Reheat	Disable Reheat
6	Enable Humidifier	Disable Humidifier
7	Enable Dehumidifier	Disable Dehumidifier
8	Electric Reheat	Gas Reheat

Table 21 Switch settings (wall box board)

Switch	OFF Position	ON Position
1	Disable Beeper	Enable Beeper
2	Not Used-Must remain in OFF position	
3	Not Used-Must remain in OFF position	
4	Not Used-Must remain in OFF position	
5	Not Used-Must remain in OFF position	
6	Not Used-Must remain in OFF position	
7	Disable Setback	Enable Setback
8	Enable Password	Disable Password

6.1.15 Run Diagnostics (Available On Rev 1.001.0)

By selecting Run Diagnostics, maintenance personnel can check system inputs, outputs and conduct a test of the microcontroller circuit board from the wall box control. A review of the system inputs and the microcontroller test can be done without interrupting normal operation.

Show Inputs

With the unit on and the fan running, the input states may be displayed for the following devices:

- High Water Alarm-Normally off unless High Water Alarm is active.
- High Head Pressure Alarm-Normally off unless High Head Pressure Alarm is active.
- Custom alarm #1-Normally off unless this special customer selectable alarm is active.
- Custom alarm #2-Normally off unless this special customer selectable alarm is active.
- Power-Normally on unless unit is turned off through the wall box or any of the following optional devices: high temperature sensor, smoke detector, High Water Alarm or Remote Shutdown.

Test Outputs

When this feature is selected, the unit is effectively turned off. When stepping from one load to the next, the previous load is automatically turned off if it is on. The loads can also be toggled On and Off by selecting “ENTER”. Once turned On, the output will remain On for five minutes unless toggled Off or the Test Outputs function is exited by selecting “MENU/ESC” (Compressor is limited to 15 seconds On to prevent damage.)

NOTICE

Risk of overheating the compressor during the Test Output mode. Testing the compressor output for more than a few seconds can cause compressor damage.

Extended unit operation in the Test Outputs mode may damage the unit. Do not operate the unit in the Test Outputs mode any longer than is necessary for troubleshooting.

NOTICE

Risk of extended unit operation in the test outputs mode for troubleshooting. Can cause damage to the unit.

Do not operate unit in the test outputs mode any longer than is necessary for troubleshooting.

The outputs are as follows:

- Normal Fan: Normal speed fan contactor
- Low Speed Fan: Low speed fan contactor
- Humidifier: Humidifier contactor
- Cool: Compressor contactor
- HGBP: Hot gas bypass valve
- Reheat: Reheat contactor
- Common Alarm: Common alarm relay

NOTE

Fan turned On with all loads.

Test Control Board

By selecting this function, the microcontroller will perform a self test lasting approximately 10 seconds. When the test is complete, the display will show the ROM checksum, ROM part number and firmware vision number.

Figure 27 Control menu

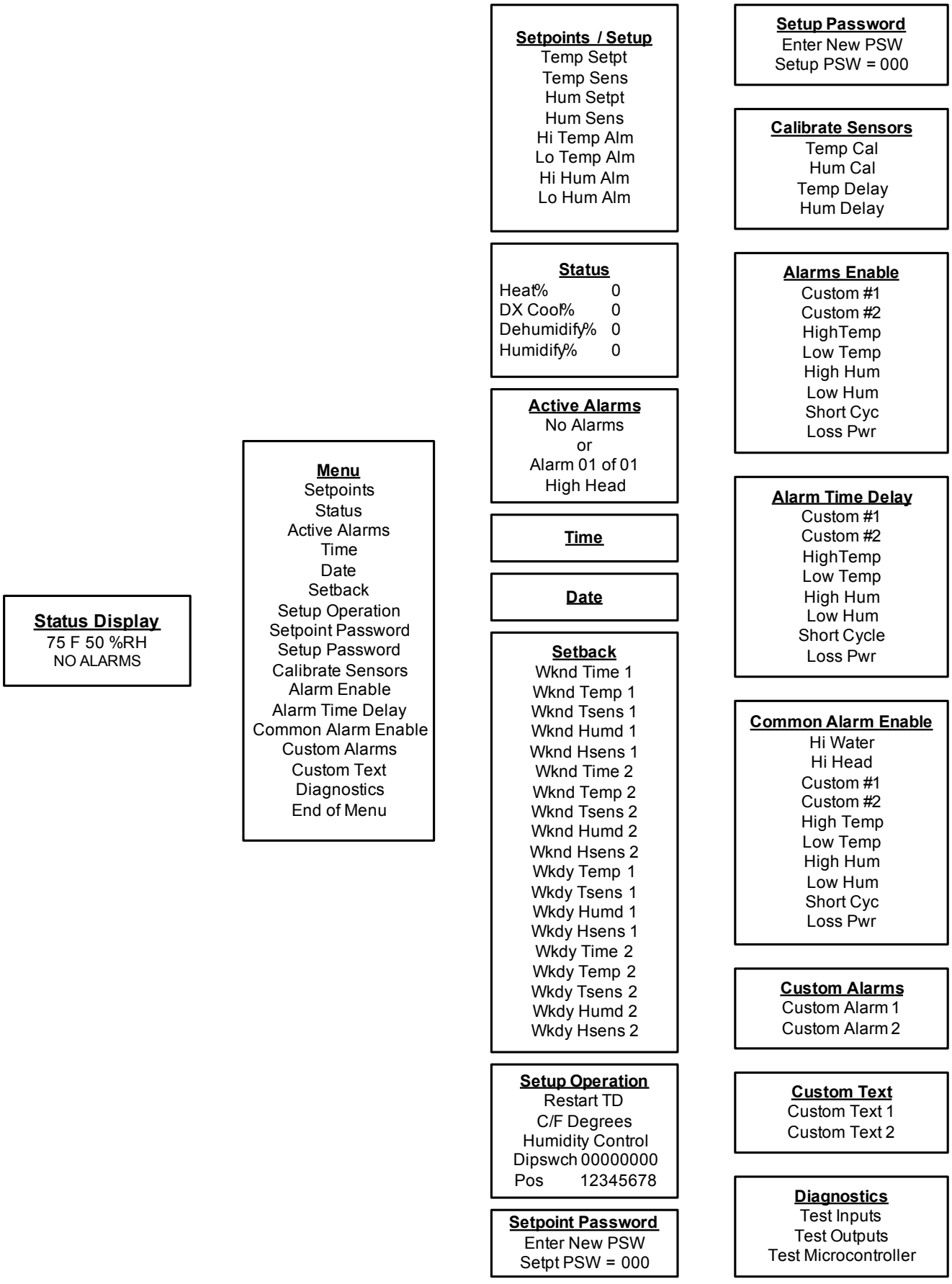


Figure 28 Control board (inside evaporator)

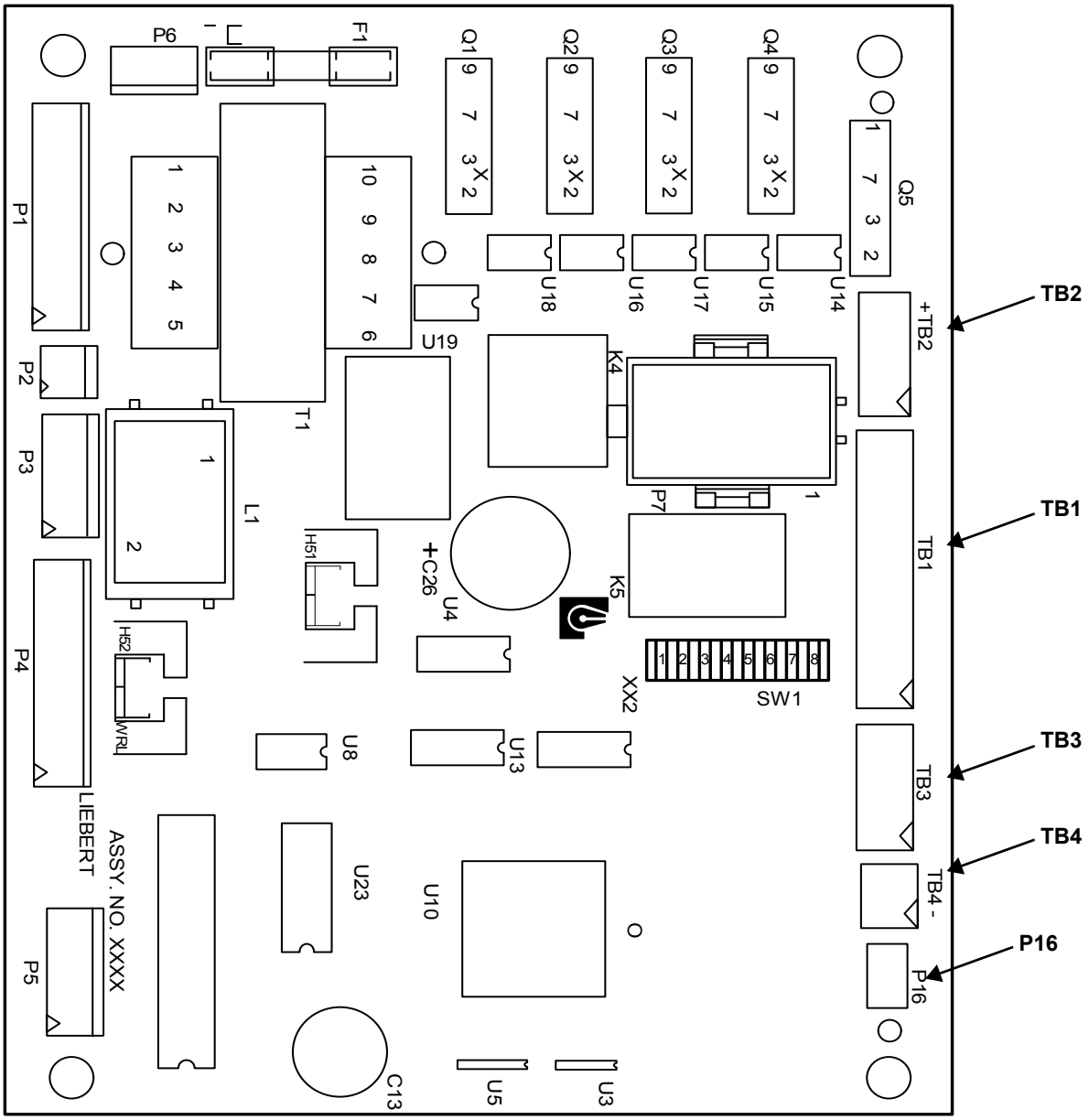
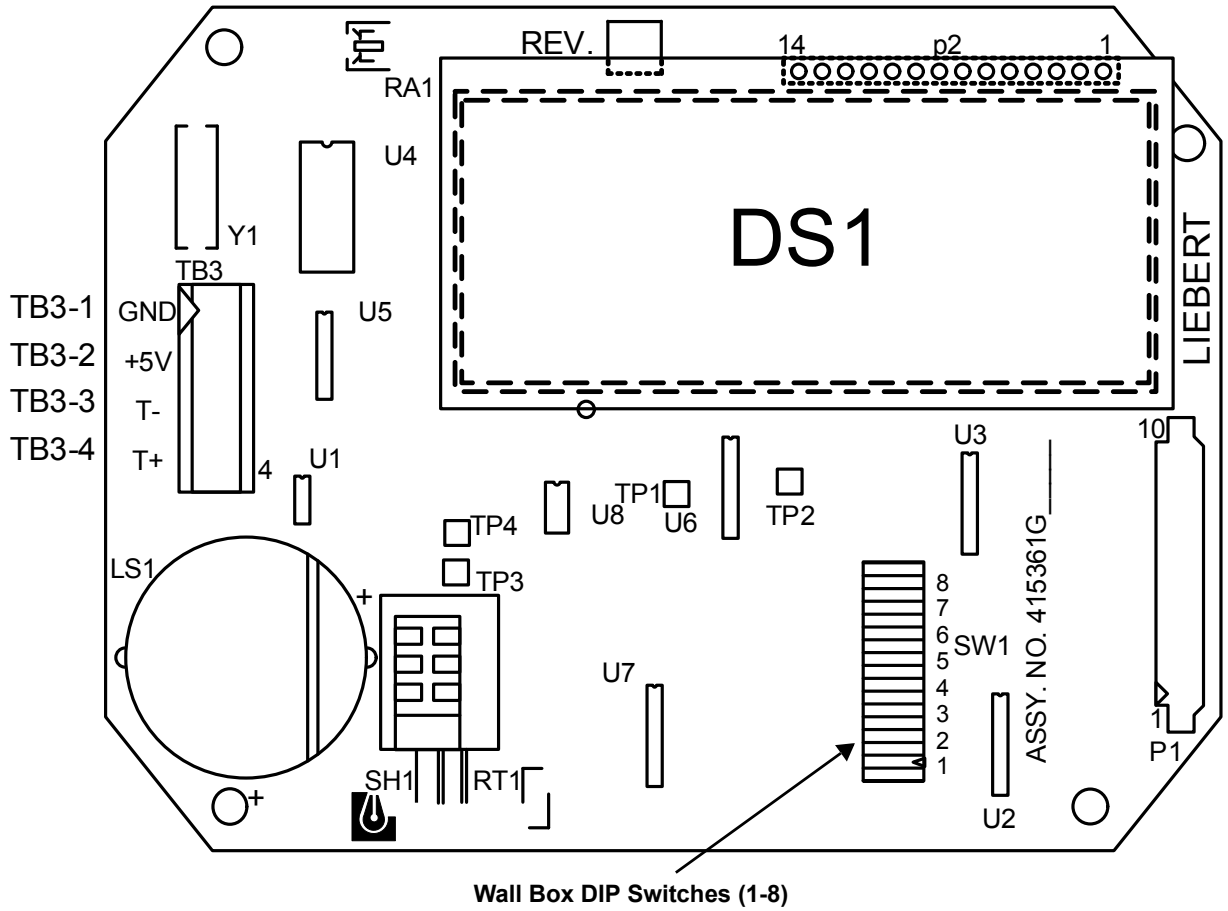


Table 22 Control board connections and functions

Switch	Function
TB2-4	Hot Gas Bypass
TB2-3	High Head Alarm Connection
TB2-2	Heat Rejection (24VAC+)
TB2-1	Heat Rejection (24VAC GND)
TB1-9	Condensate Pump Aux Alarm
TB1-8	Condensate Pump Aux Alarm
TB1-7	Common Alarm Connection
TB1-6	Common Alarm Connection
TB1-5	Remote Shutdown
TB1-4	Remote Shutdown
TB1-3	Customer Alarm Connection #2

Switch	Function
TB1-2	Customer Alarm Connection #1
TB1-1	Customer Alarm Connection (Common)
TB3-4	Connection to Terminal #4 Wall Box
TB3-3	Connection to Terminal #3 Wall Box
TB3-2	Connection to Terminal #2 Wall Box
TB3-1	Connection to Terminal #1 Wall Box
TB4-2	Site Monitoring Connection (-)
TB4-1	Site Monitoring Connection (+)
P16	Remote Sensor Connection

Figure 29 Wall box board



7.0 System Performance Microprocessor Controls

This section provides a detailed description of how the Liebert Mini-Mate2 responds to operator inputs and room conditions.

7.1 Temperature Control

7.1.1 Cooling/Heating Required

The temperature control program for the microprocessor is based on a calculated percentage requirement for cooling/heating.

7.1.2 Cooling Operation (Cooling, Compressorized Direct Expansion and Chilled Water)

Cooling is ACTIVATED when the temperature control calculates a requirement for cooling of 100%. It is DEACTIVATED when the cooling requirement drops below 50%. The optional hot gas bypass is energized when a call for cooling occurs unless there is also a call for dehumidification.

Table 23 Cooling and dehumidification load response of hot gas bypass

Situation	Response
Cooling only	ON
Dehumidification only	OFF
Cooling with Dehumidification	OFF

7.1.3 Heating Operation

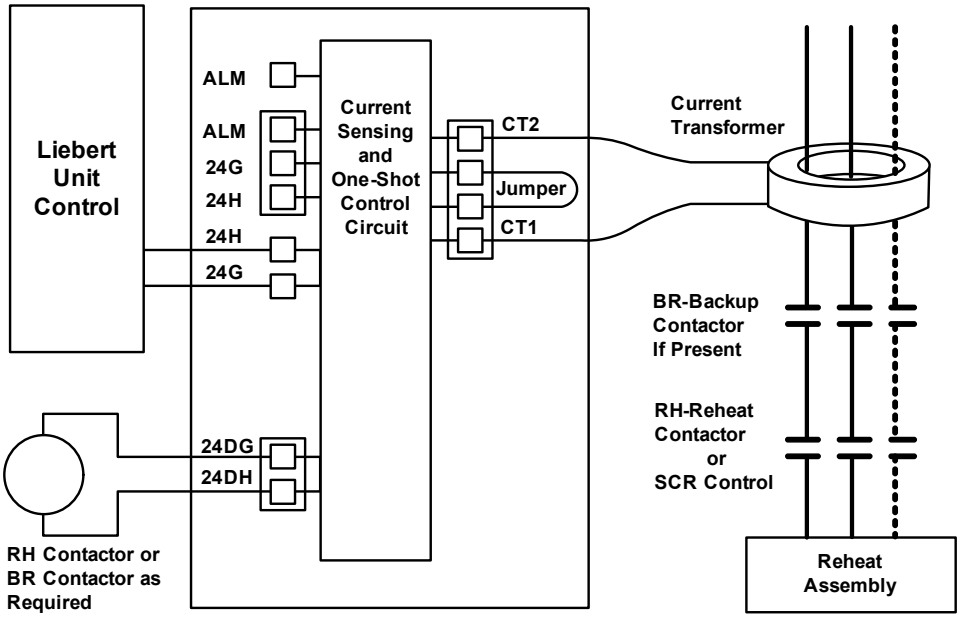
Electric Heat or Hot Water

The reheat stage is ACTIVATED when the temperature control calculates a requirement of 100%. The reheat is DEACTIVATED when the heat requirement is 50% less than the activation point.

Ground Current Detector (GCD)

A Ground Current Detector is factory-installed on all 1-ton through 3-ton Liebert Mini-Mate2 units with reheat. The GCD detects reheat leakage current and shuts down operation of the reheat. A steady green LED indicates that the reheat is operating properly. A red LED indicates that the reheat has failed and both the reheat element and GCD need to be replaced.

Figure 30 Ground current detector



WARNING

Risk of heater element failure, smoke and fire. Can cause building and equipment damage, injury or death

Do not remove or disable the ground current detector.

Silicon Controlled Rectifier Electric Reheat (SCR)

The SCR proportionally controls the stainless steel reheat feature to maintain the selected room temperature. The rapid cycling made possible by the SCR controller provides precise temperature control, while the constant element temperature improves heater life. During operation of the SCR control, THE COMPRESSOR OPERATES CONTINUOUSLY. The heaters are modulated to provide temperature control. The display status will show when the unit is cooling and heating. The control will automatically lock the compressor cooling in the "ON" position, except when the temperature falls below the low temperature alarm setpoint. Cooling will then be disabled until the room temperature reaches this minimum temperature setpoint.

7.2 Humidity Control

7.2.1 Dehumidification/Humidification Required

The humidity control is based on a calculated percentage requirement for dehumidification or humidification (i.e., the difference between the return air humidity and the humidity setpoint). As the return air humidity rises above the humidity setpoint, the percent dehumidification required increases proportionally from 0% to 100% over a humidity band equal to the humidity sensitivity setting. The converse is true for percent humidification requirement.

7.2.2 Dehumidification Operation, Compressorized Direct Expansion (DX) Systems

Dehumidification with the standard configuration is accomplished by operating the compressor without the hot gas bypass active. The fan will operate at low speed unless the cooling requirement reaches 100%. At that point, the low speed fan is disabled (unless manually overridden by the user) until the cooling requirement decreases to 0%. Dehumidification will also be disabled if the heating requirement exceeds 125%. It will be re-enabled when the heating requirement reaches 50%.

7.2.3 Humidification Operation

The canister humidifier is activated when the humidity control calculates a requirement of 100% humidification, and it is deactivated when the humidification requirement falls below 50%.

7.3 Load Control Features

The control system monitors the compressor and prevents it from turning on within a 3-minute period of being off. If this on-off-on cycle occurs too often (e.g., 10 times in a one-hour period), a Short Cycle Alarm will occur.

7.4 Communication

The control system uses a two-wire, RS-422 channel to communicate with Liebert Site Monitoring Products via a proprietary protocol. A converter board (ECA2) is available to allow communications with a "dumb" terminal or a computer using RS-232 channel. More details are provided in the Site Products and ECA2 user manual.

The communications channel provides both monitoring and control options, including:

- TEMPERATURE/HUMIDITY: Current temperature and humidity readings.
- STATUS (%): Cooling/heating and humidify/dehumidify operating status.
- PRESENT ALARMS: Alarms currently activated.
- SETPOINTS:
  - Temperature Setpoint
  - Temperature Sensitivity
  - Humidity Setpoint
  - Humidity Sensitivity
  - High Temperature Alarm
  - Low Temperature Alarm
  - High Humidity Alarm
  - Low Humidity Alarm
- ON/OFF STATUS
- SILENCE ALARM

8.0 ALARMS

The microprocessor control system will audibly and visually signal all ENABLED Alarms (including two (2) custom alarms). These special alarms can be chosen from the optional alarm list and/ or can have their own fully custom text. The custom alarm inputs are contact closures wired from terminal TB1-1 through a normally open contact to either TB1-2 (alarm 1) or TB1-3 (alarm 2). The alarms can be enabled/disabled (refer to **6.0 - Microprocessor Control**) and a time delay of 0-255 seconds can be set. The alarms can also be programmed to either sound the alarm & activate the common alarm relay OR to sound the alarm only

When a new alarm occurs, it is displayed on the screen and the audible alarm is activated. (If communicating with a Liebert Site Monitoring Product, the alarm is also transmitted). The message "PRESS ALARM SILENCE" will prompt the operator to silence the alarm. After the alarm is silenced, the display will return to the Normal Status display. Alarms can be reviewed by selecting the "ACTIVE ALARMS" feature. The alarms can also be silenced through communications with a Liebert Site Monitoring Product unit.

Many alarms will reset automatically when the alarm condition is no longer represented and only after it has been acknowledged by being silenced. The exceptions are:

- software alarms, i.e., Loss of Power and Short Cycle alarms will reset automatically 30 seconds after being silenced or acknowledged; and
- specific alarms monitoring overload or high-pressure switches may require a manual reset depending on the model.

8.1 Alarms: Definitions and Troubleshooting

The following list provides a definition and troubleshooting suggestions for each type of alarm. Refer to **11.0 - Troubleshooting** for additional details. If you need further assistance, contact your Emerson supplier. THE CUSTOMER MUST SPECIFY ALARM(S) AT THE TIME OF ORDER. OTHER DEVICES AND WIRING MAY BE REQUIRED AT THE FACTORY FOR SOME OF THE ALARMS.

8.1.1 Custom Alarms

Custom alarm(s) messages are programmed at the LCD display. The message displayed may be included in a list of provided alarms or it may be customized text (for up to two alarms). IF CUSTOMIZED TEXT IS USED, MAINTENANCE PERSONNEL SHOULD BE INFORMED OF THE ALARM FUNCTION AND THE REQUIRED ACTION.

8.1.2 High Head Pressure

Compressor head pressure is monitored with a pressure-sensor switch. (One SPDT pressure switch is used). If head pressure exceeds 400 psig (2758kPag), the switch turns off the compressor contactor and sends an input signal to the control. The condition is acknowledged by pressing the alarm silence button on the wall box, which will clear if the head pressure is alleviated. If the head pressure alarm has activated three times, the alarm will lock until the unit is serviced. After the head pressure problem is fixed, reset the control by disconnecting power to the evaporator unit.

Air-Cooled Systems

Check for power shut off to the condenser, condenser fans not working, defective head pressure control valves, dirty condenser coils or crimped lines.

Water/Glycol/ Systems

Check water regulating valves. Verify water/glycol flow (i.e., pumps operating and service valves open). Is water tower or drycooler operating? Is the coolant temperature entering the condenser at or below design conditions? Is AUX relay (terminals 70 & 71) operating during cooling to turn on the drycooler?

8.1.3 Humidity Level

The humidity level alarm may be activated under the following conditions:

High: The room return air humidity exceeds the pre-set high-humidity alarm setpoint. Is the unit set up for dehumidification? Check DIP switch.

Low: The room return air humidity decreases to the high-humidity alarm setpoint. Is the unit setup for humidification? Check DIP switch.

High and Low Simultaneously: simultaneous display of two alarms results in loss of the humidity input signal. DASHES WILL BE DISPLAYED IN THE HUMIDITY READING DISPLAY Under these conditions, the control system deactivates both humidification and dehumidification. Check for a disconnected cable or failed sensor.

8.1.4 Temperature

The temperature level alarm may be activated under the following conditions:

High: Room return air temperature increases to the high-temperature alarm setpoint. Check for proper setpoint value. Is the room load more than the unit can handle (i.e., capacity too small)? Make sure cooling components are operating (compressor or valves).

Low: The room return air temperature decreases to the low temperature alarm setpoint. Check for proper setpoint value. Make sure all heating components are operating (e.g., contactors, reheats, etc.). Are reheats drawing the proper current (refer to amp rating on nameplate)?

High and Low Simultaneously: The simultaneous display of these two alarms results in loss of the temperature input signal (or the humidity is out of sensor range-15 to 85% RH). Dashes will be displayed for the temperature reading. The control system will initiate 100% cooling. Check for a disconnected cable or a failed sensor.

NOTE

Check for proper setpoints. Does the room have a vapor barrier to seal it from outdoor humidity? Are doors or windows open to outside air?

8.1.5 Humidifier Problem Alarm

The Humidifier Problem Alarm will sound and display a message if any of the following humidifier conditions occur: Overcurrent detection; fill system fault or end of cylinder life.

8.1.6 High-Water Alarm

A float switch in the evaporator pan will shut down the evaporator on a high water level. Clear the drain and reset power to the unit in order to clear the alarm.

8.1.7 Loss of Power

The Loss of Power Alarm will activate (after power is restored to the unit) if the unit has lost power or the disconnect switch was incorrectly turned off before the unit's On switch was pressed. A Liebert remote monitoring unit (optional) will immediately indicate loss of power.

8.1.8 Short Cycle

A Short Cycle Alarm will occur if the compressor system has exceeded 10 cooling start attempts in a one-hour period. This can happen if the refrigerant level is low or if the cooling load is small compared to the unit's capacity. Check for leaks, crimped lines and defective components. If the cooling load is low, increase sensitivity to reduce cycle.

8.2 Optional/Custom Alarms

8.2.1 Loss of Water Flow

The Loss of Water Flow Alarm will occur if no water flow is detected in the chilled water or condenser water supply line. An external flow switch is required for this alarm. Determine whether service valves are closed, pumps are not working, etc.

8.2.2 Smoke Detected

This alarm is triggered when smoke is detected in the return air by an optional Liebert Smoke Detector. The evaporator unit will automatically shut down upon smoke detection. Locate the source of the smoke and follow appropriate emergency procedures.

9.0 System Testing And Maintenance

This section describes system testing, maintenance and replacement procedures. Use copies of the **Maintenance Inspection Checklist on page 63** to record preventive maintenance inspections.

WARNING

Risk of electric shock. Can cause injury or death.

Open all local and remote electrical power disconnect switches before working within the electrical enclosures.

Line side of the factory disconnect remains energized when factory disconnect is Off.

WARNING

Risk of high-speed moving parts. Can cause injury or death.

Open all local and remote electrical power disconnect switches and verify that fans/blowers have stopped rotating before working inside the unit cabinet

9.1 System Testing

9.1.1 Environmental Control Functions

The performance of all control circuits can be tested by changing the setpoints, which actuates each of the main functions.

9.1.2 Cooling

To test the cooling function, set the setpoint to a temperature of 10°F (5°C) below room temperature. A call for cooling should register and prompt the equipment to begin cooling cycle. (Disregard any temperature alarms). Upon completion of testing, return the setpoint to the desired temperature.

9.1.3 Heating

Reheat may be tested by setting the setpoint for 10°F (5°C) above room temperature. A call for heating should register and prompt the equipment to begin heating cycle. (Disregard any temperature alarms). Upon completion of testing, return the setpoint to the desired temperature.

9.1.4 Humidification

To check humidification, set the humidity setpoint at 10% RH above the room humidity reading. After a short delay, the canister will fill with water and steam will be produced. Upon completion of testing, return the humidity setpoint to the desired humidity.

9.1.5 Dehumidification

The dehumidification performance can be tested by setting the humidity setpoint at 10% RH below room relative humidity. The compressor should turn on and the fan should switch to low speed. Upon completion of testing, return the humidity setpoint to the desired humidity.

9.1.6 High-Temperature Sensor—Optional

The optional high-temperature sensor feature is a bi-metal operated sensing device with a closed switch under normal conditions. Connected between pins 1-8 and 1-9, this device will shut down the entire unit when the inlet air temperature exceeds a preset setpoint.

9.1.7 Smoke Sensor

While the smoke sensor is located in the unit, the power supply for the smoke sensor is located in the electric panel. It constantly samples return air through a tube. No adjustments are required.

9.1.8 Remote Shutdown

A connection point is provided for remote shutdown devices supplied by the customer. This terminal strip is on the printed circuit board. (Terminals TB1-4 and TB1-5 are fitted with a jumper when no remote shutdown device is installed.)

9.2 Maintenance

9.2.1 Electric Panel

The electric panel should be inspected on a semi-annual basis for any loose electrical connections.

9.2.2 Filters

Experience shows that filters are usually the most neglected item in an environmental control system. In order to maintain efficient operation, they should be checked monthly and changed as required.

Filters can be replaced by either opening the hinged door on the return air filter box or by opening the return air grille (grille version only). Replacement filters are commercially available in several efficiencies, refer to the Liebert Mini-Mate2 engineering manual, SL-10525, for appropriate filter sizes.

9.2.3 Direct Drive Blower Package

Monthly inspection of the blower package include: motor mounts, fan bearings and impellers.

Fan Impellers and Motor Bearings

Fan impellers should be thoroughly inspected and any debris removed. Check to see if they are tightly mounted on the fan shaft and do not rub against the fan housing during rotation. Although the unit's motor bearings are permanently sealed and self-lubricating, they should be inspected monthly for signs of wear.

Air Distribution

Since all unit models are designed for constant volume air delivery, any unusual restrictions within the air circuit must be avoided. Note that high-efficiency filters can reduce air performance and evaporator capacity.

Motor Replacement

If the evaporator motor needs to be replaced, first remove the air distribution plate on the bottom of the unit. Removing the mounting screws, allows the entire blower wheel and motor to be lifted out.

9.2.4 Refrigeration System

Each month the components of the refrigeration system should be inspected for proper function and signs of wear. Since in most cases evidence of malfunction is present prior to component failure, periodic inspections can be a major factor in the prevention of most system failures. Refrigerant lines must be properly supported and not allowed to vibrate against ceilings, floors or the unit frame. Inspect all refrigerant lines every six months for signs of wear and proper support. Inspect the capillary and equalizer lines from the expansion valve.

Suction Pressure

Suction pressure will vary with load conditions. Suction pressure normally ranges from 58 psi to 75 psi (405 kPa to 517 kPa).

Discharge Pressure

The discharge pressure will vary greatly with load and ambient conditions (**Table 24**). The high-pressure switch will shut the compressor down at its cut-out setting.

Table 24 Typical discharge pressure

System Design	Discharge Pressure, psig (kPa)
Air-Cooled	200-300 (1380-2070)
Water-Cooled 65 to 85°F water (18 to 29.4°C)	200-250 (1380-1725)
Glycol-Cooled	250-350 (1725-2415)
High-Pressure Cut-Out	400 (2760)

Thermostatic Expansion Valve

The thermostatic expansion valve keeps the evaporator supplied with enough refrigerant to satisfy load conditions. Proper valve operation can be determined by measuring superheat level. If too little refrigerant is being fed to the evaporator, then the superheat will be high. Conversely, if too much refrigerant is being supplied, then the superheat will be low. The correct superheat setting is between 10 and 15°F (5.6 and 8.3°C).

Air-Cooled Condenser

Restricted airflow through the condenser coil will reduce the operating efficiency of the unit. Additionally, it can result in high compressor head pressure and loss of cooling. Using compressed air or commercial coil cleaner, clean the condenser coil of all debris that will inhibit airflow. In winter, do not permit snow to accumulate around the side or underneath the condenser. At the same time check for bent or damaged coil fins and repair as necessary. Check all refrigerant lines and capillaries for vibration and support as necessary. Carefully inspect all refrigerant lines for signs of oil leaks.

Coaxial Condensers (Water/Glycol-Cooled Condensers Only)

Each water or glycol-cooled module has a coaxial condenser consisting of an exterior steel tube and an interior copper tube. If the water supply is clean, coaxial condensers do not normally require maintenance or replacement. Should your system begin to operate at high head pressure with reduced capacity and all other causes have been eliminated, the condenser may be obstructed or fouled and should be cleaned or replaced.

Regulating Valves

The water regulating valve automatically regulate the amount of fluid necessary to remove the heat from the refrigeration system, permitting more fluid to flow when load conditions are high and less fluid to flow when load conditions are low. The valve consists of a brass body, balance spring, valve seat, valve disc holders, capillary tube to discharge pressure and adjusting screw.

The water regulating valve is designed to begin opening at 180 psi (1240 kPa) and be fully opened at 240 psi (1655 kPa). The valve is factory set and should not need adjustment. There is significant difference in the way standard pressure and high-pressure valves are adjusted. Consult Liebert Precision Cooling Support.

Glycol Solution Maintenance

It is difficult to establish a specific schedule of inhibitor maintenance since the rate of inhibitor depletion depends upon local water conditions. Analysis of water samples at time of installation and every six (6) months should help to establish a pattern of depletion. A visual inspection of the solution and filter residue is often helpful in judging whether or not active corrosion is occurring. The complexity of problems caused by water requires expert advice from a water treatment specialist plus a regular maintenance program schedule. It is important to note that improper use of water treatment chemicals can cause more severe problems than simply using none.

Proper inhibitor maintenance must be performed in order to prevent corrosion of the glycol system.

Consult your glycol manufacturer for proper testing and maintenance procedures. Do not mix products from different manufacturers.

Hot Gas Bypass

Operation

When applying hot gas bypass with split system condensing units, bypassing discharge gas to the compressor suction line offers more flexibility than conventional hot gas bypass to the evaporator unit.

The hot gas bypass valve is installed between the compressor discharge piping and suction piping, bypassing the condenser and evaporator coils. The discharge gas mixes with the suction gas, raising the suction temperature and pressure and decreasing the mass flow through the evaporator. The higher suction temperatures could cause compressor overheating, therefore a separate liquid quenching valve is provided to mix refrigerant from the system liquid line with the discharge gas before mixing with the suction gas entering the compressor.

During normal operation, when the evaporator is under full load the hot gas bypass equalizer pressure will remain high enough to keep the valve port closed. If the evaporator load decreases, the evaporator temperature and pressure will drop. When the suction pressure reduces below the hot gas bypass valve setting the hot gas bypass valve opens diverting some of the refrigerant flow back to the

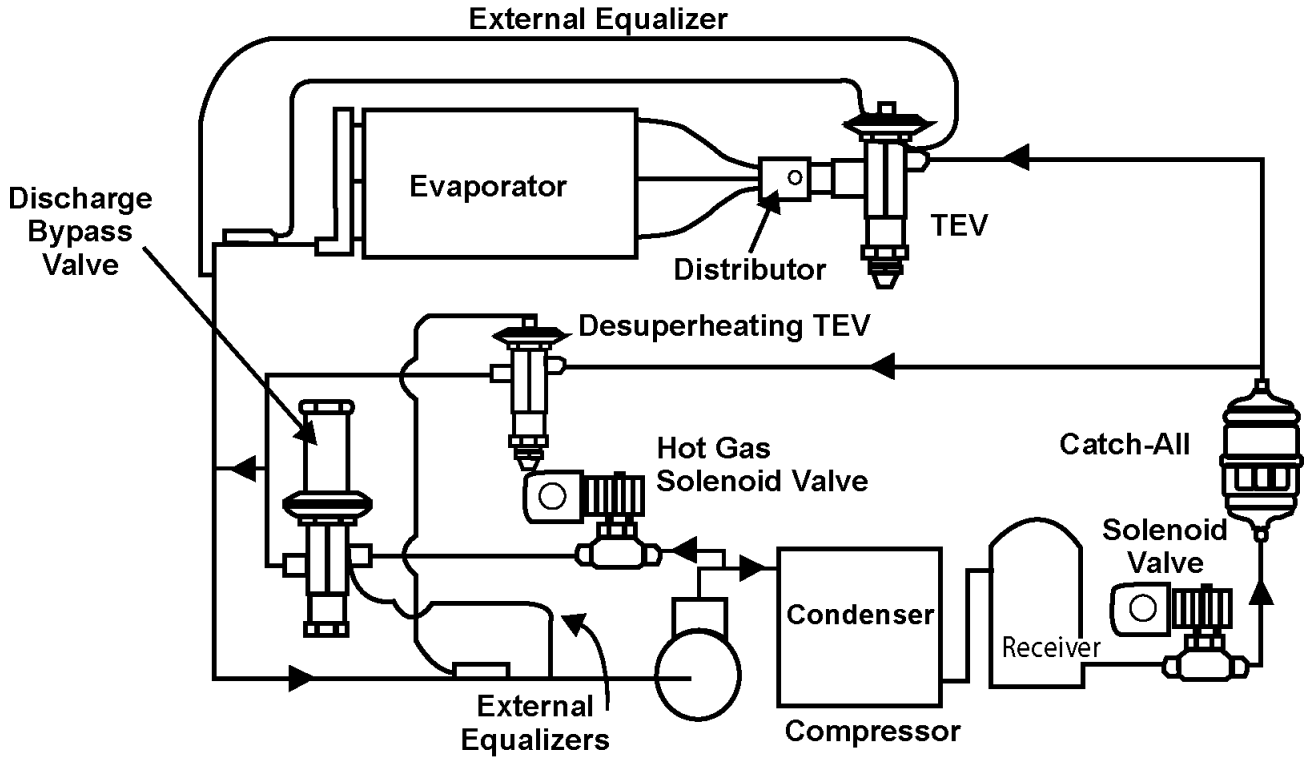
compressor suction. The liquid quenching valve bulb senses this increased superheat and opens, allowing liquid refrigerant to mix with the discharge gas, desuperheating it.

Proper mixing of the three refrigerant paths ensures stable operation and system performance. The liquid quenching valve bulb must be located down steam of all these connections to control superheat at the compressor inlet. Superheat settings for the liquid quenching valve are chosen to maintain consistency with the system expansion valve. During hot gas bypass operation higher superheats, 50-60°F (10 to 15°C), may be observed at the compressor. The liquid-quenching valve is internally equalized and superheat is not adjustable.

Adjustment:

1. Install the suction and discharge pressure gauge.
2. Adjust temperature setpoint to call for cooling so that the refrigeration compressor will run continuously.
3. Remove the TOP adjusting nut from the valve.
4. Insert an Allen wrench in the brass hole at top of valve in adjusting port, and turn CLOCKWISE if a higher evaporator temperature is required. Adjust no more than 1/4 turn at a time. Let the system stabilize for 15 minutes before determining if additional adjustment are necessary.
5. After obtaining the suction pressure required, reinstall cap tightly making sure there are no leaks.
6. Let the evaporator operate for approximately 10 to 15 minutes to make sure the suction pressure is within the range desired.
7. There may be a fluctuation of approximately 3 to 6 psig (21 to 41 kPa) on the evaporator due to the differential on the hot gas bypass.
8. Return temperature setpoint to the desired setting.

Figure 31 Hot gas bypass



9.3 Replacement Procedures

9.3.1 Compressor Replacement

Infrequently a fault in the motor insulation may result in a motor burnout (if system is properly installed, motor burnout rarely occurs). Primarily this type of failure is due to mechanical or lubrication problems, where the burnout is a secondary consequence.

Early detection can prevent a large percentage of the problems that can cause compressor failures. Periodic maintenance inspections by alert service personnel (i.e., identification of abnormal operation) can be a major factor in reducing maintenance costs. It is easier and more cost-effective to implement the necessary preventative steps that ensure proper system operation; rather than ignore a problem until it results in compressor failure and costly replacement. When troubleshooting a compressor problem, check all electrical components for proper operation:

WARNING

Risk of explosive discharge from high-pressure refrigerant. Can cause injury or death.

This unit contains fluids and gases under high pressure. Relieve pressure before working with piping.

CAUTION

Risk of contacting caustic substances. Can cause injury.

Avoid touching or contacting the gas and oils with exposed skin. Severe burns will result. Wear protective clothing, safety goggles and long rubber gloves when handling contaminated parts.

- Check all fuses and circuit breakers.
- Check pressure switch operation.
- If a compressor failure has occurred, determine whether its cause is an electrical or mechanical problem.

Mechanical Failure

If you have determined that a mechanical failure has occurred, the compressor must be replaced. If a burnout occurs, correct the problem and clean the system. It is important to note that successive burnouts OF THE SAME SYSTEM are usually caused by improper cleaning. If a severe burnout has occurred, the oil will be black and acidic.

9.3.2 Electrical Failure

In the event of an electrical failure and subsequent burnout of the refrigeration compressor motor, proper procedures must be followed to thoroughly remove any acids that would cause a future failure. There are two kits that can be used with a complete compressor burnout - Sporlan System Cleaner and Alco Dri-Kleener. Follow the manufacturer's procedure. DAMAGE TO A REPLACEMENT COMPRESSOR DUE TO IMPROPER SYSTEM CLEANING CONSTITUTES ABUSE UNDER THE TERMS OF THE WARRANTY, THEREBY VOIDING THE WARRANTY

Replacement compressors are available from your Emerson supplier and will be shipped to the job site in a reusable crate (as required by the service contractor). If the compressor is under warranty, it must be returned to Emerson, in order to receive proper warranty credit. It should be returned in the same container it was shipped in. The possible cause(s) or condition(s) of the damage should be recorded on the provided return tag.

Replace a Failed Compressor

Proper procedures to remove and replace the failed compressor are:

1. Disconnect power
2. Attach suction and discharge gauges to access fittings.
3. Recover refrigerant using standard recovery procedures and equipment. Use a filter-drier when charging the system with recovered refrigerant.

NOTE

Release of refrigerant to the atmosphere is harmful to the environment and unlawful. Refrigerant must be recycled or discarded in accordance with federal, state and local regulations.

4. Remove failed compressor.
5. Install replacement compressor and make all connections. Use a flow of dry nitrogen through the piping during brazing to prevent formation of copper oxide scale inside the piping. Copper oxide forms when copper is heated in the presence of air. POE oil will dissolve these oxides from inside the copper pipes and deposit them throughout the system, clogging filter driers and affecting other system components.

   A pure dry nitrogen flow of 1-3 ft^3/min (0.5-1.5 l/s) inside the pipe during brazing is sufficient to displace the air. Control the flow using a suitable metering device.Pressurize and leak test the system at approximately 150 psig (1034kPa) pressure.
6. Follow manufacturer's instructions for clean out kits.
7. Evacuate the system twice to 250 microns. Break the vacuum each time with clean, dry nitrogen.
8. Evacuate the system a third time to 250 microns.
9. Charge the system with refrigerant (R-407C) based on requirements of the evaporator, condensing unit and lines. Refer to the unit nameplate.
10. Apply power and operate the system. Check for proper operation. Refer to **Table 24.**

9.3.3 Steam Generating Humidifier—Operation Procedures

Steam generating humidifiers operate efficiently over a wide range of water quality conditions and automatically adjust to changes in the conductivity of water. The system will automatically drain and refill to maintain an amperage setpoint and alert the operator when the humidifier canister needs to be replaced.

The humidifier RUN/DRAIN switch is located in the humidifier assembly. This switch should be in the RUN position when the humidifier is in normal operation, and in the DRAIN position when a manual drain sequence is required. The electronic control board for the humidifier is also located in the humidifier assembly. When the unit is energized, power is available to humidifier. Operations involves the following steps:

1. During startup, when the humidity control calls for humidification, the fill valve will open, allowing water to enter the canister. When the water level reaches the electrodes, current flows and the water will begin to warm. The canister fills until the amperage reaches the setpoint and the fill valve closes. As the water warms, its conductivity increases and the current flow, in turn, rises. If the amperage reaches 115% of the normal operating amperage, the drain valve opens and flushes some of the water out of the canister. This reduces electrode contact with the water and lowers the current flow to the amperage setpoint. Boiling soon commences and the canister operates normally.
2. If the conductivity of the water is low, the canister fills and the water level reaches the canister full electrode before the amperage setpoint is reached. The humidifier stops filling to prevent overflow. Boiling should commence in time. As water is boiled off, the mineral concentration in the canister increases and current flow also increases. The canister eventually reaches full output and goes to normal operation. No drain is permitted until then.
3. When full output is reached the circuit board starts a time cycle which is factory set at 60 seconds. During this repeating time cycle, the fill valve will open periodically to replenish the water being boiled off and maintain a “steady state” output at the setpoint. The amperage variance will depend on the conductivity of the water.

4. After a period of time, the mineral concentration in the canister becomes too high. When this occurs, the water boils too quickly. As the water quickly boils off and less of the electrode is exposed, the current flow decreases. When the current crosses the low threshold point (factory set at 85%) before the end of the time cycle, the drain valve opens, draining the mineral laden water out and replacing it with fresh water. This lowers the mineral concentration and returns the canister to "steady state" operation and prolongs canister life. The frequency of drains depends on water conductivity.
5. Over a period of time, the electrode surface will become coated with a layer of insulating material, which causes a drop in current flow. As this happens, the water level in the canister will slowly rise exposing new electrode surface to the water to maintain normal output. Eventually, the steady state water level will reach the canister full electrode and indicate so by activating the canister full alarm. At this point, all of electrode surface has been used up and the canister should be replaced.
6. After the entire electrode surface has been coated, the output will slowly decrease. This allows for maintenance scheduling. During these last hours of electrode life, the mineral concentration can increase and arcing can occur. If the electrodes start to arc, turn off the humidifier immediately and replace the canister with the identical part.

Replacing the Humidifier Canister

The proper procedure to replace the humidifier canister is:

1. Turn off the humidifier by lowering the humidity setpoint below the ambient humidity level. Record the original setpoint.
2. Place the RUN/DRAIN switch in the DRAIN position to drain the water from the canister.
3. Return the RUN/DRAIN switch to the RUN position after the canister has drained.
4. Turn OFF the power at the main unit.
5. Remove the cover from the humidifier cabinet.
6. Locate the power wires to the steam canister. They are connected to the canister with 1/4" quick connects. Make note of the wiring configuration before removing any wires. Refer to schematic on unit. Slide the rubber boot back to expose the connections. Remove the two (2) power wires and the canister-full wire. Do not loosen the screws that secure the electrodes.

CAUTION

Risk of contact with extremely hot surfaces. Can cause injury.

Canister and steam hose may be hot. Do not attempt to replace parts until the humidifier has cooled down to a temperature that is safe for human contact.

7. Loosen the steam outlet hose clamps and slide the steam hose away from the canister fitting. Release the canister clamp along the base of the canister.
8. Remove the canister.
9. Reverse previous steps to re-assemble humidifier, paying special attention to the following:

- When replacing the wiring, connect the red wire from terminal #1 on the interface to the red tip terminal on the canister. Reconnect the power wires as before (#2 on the left and #1 on the right)
- When replacing the canister, always check the fill and drain solenoids for proper operation.

9.3.4 Humidifier Circuit Board Adjustments

WARNING

Risk of electric shock. Can cause injury or death.

Open all local and remote electrical power disconnect switches before working on the humidifiers printed circuit board. Circuit board contains hazardous voltage. Adjustment should be performed by properly trained and qualified personnel only.

The humidifier control board governs humidifier operation. There are three potentiometers mounted on the board and can be used to adjust for extreme water conductivity conditions.

POT2 controls the amperage at which the drain will energize and is clearly marked in percentages. This adjustment is factory set at 85%, which indicates that the unit will drain when the amperage falls off to 85% of the capacity setpoint. Raising the value increases the frequency of drain cycles. Lowering the value decreases the frequency of drain cycles.

The frequency should be increased for highly conductive water and decreased for less conductive water. If adjustment is necessary and a change of three to four percent in either direction does not permit normal operation of the unit, consult your Emerson supplier.

The POT1 controls the duration of the drain cycle. This adjustment is factory set at 60 seconds and should not be readjusted without consulting your Emerson supplier.

The POT3 control is factory set at 100%. The maximum capacity of the system is factory set, subsequently no field adjustment is possible.

The DIP switch settings are used to set the capacity of the humidifier. If the humidifier is replaced in the field the DIP switches should be set to the required settings described below **(see Table 25)**.

Table 25 DIP switch settings for humidifier control board

Voltage	SW1	SW2	SW3	SW4	Amps
208/230	On	Off	On	Off	4.0
220/240	Off	Off	On	Off	3.7
277	Off	On	Off	Off	3.1

10.0 MAINTENANCE INSPECTION CHECKLIST

Make photocopies of this form for your records

Date: _____ Prepared By: _____

Model #: _____ Serial Number: _____

NOTE

Reheat element sheaths and fins are manufactured with stainless steel. Regular inspections are necessary to assure proper cleanliness of the reheating element. Should inspection reveal corrosion particles on the reheating element or adjoining surfaces (including ducts and plenums), appropriate cleaning should be performed. Periodic reheating element replacement may be required to meet specific application requirements.

MONTHLY

Filters

___ 1. Check for restricted airflow.

___ 2. Check for filter.

___ 3. Wipe section clean.

Fan Section

___ 1. Impellers free of debris

___ 2. Bearings in good condition

Humidifier

___ 1. Check canister for mineral deposits.

___ 2. Check condition of electrodes.

___ 3. All hoses and fittings tight.

___ 4. Check water make-up valve for leaks.

Drain Lines

___ 1. Check for obstructions and sediment buildup.

___ 2. Check for external damage and/or corrosion.

___ 3. Check for leaks.

SEMIANNUALLY

Compressor Section

___ 1. Signs of oil leaks

___ 2. Vibration isolation

Air-Cooled Condensing Unit (if applicable)

___ 1. Condenser coil clean

___ 2. Motor mount tight

___ 3. Bearings in good condition

___ 4. Refrigerant lines properly supported

Water or Glycol-Cooled Condensing

___ 1. Water valve adjustment

___ 2. Water flow

___ 3. Water leaks

Electric Panel

___ 1. Check electrical connections

___ 2. Operational sequence

Refrigeration Cycle

___ 1. Suction pressure

___ 2. Head pressure

___ 3. Superheat

___ 4. Evaporator coil clean

___ 5. Insulation intact

Flood Back Head Pressure Control (if applicable)

___ 1. Check refrigerant level

Glycol Pump (if applicable)

___ 1. Glycol leaks

___ 2. Pump operation

___ 3. Glycol solution

___ 4. pH level

Notes:

Signature

11.0 TROUBLESHOOTING

WARNING

Risk of electric shock. Can cause injury or death.

Open all local and remote electrical power disconnect switches before working within electrical enclosures.

Hazardous voltage will be present at evaporator, condenser, reheat and humidifier even with the unit turned Off at the control panel. With power and controls energized, unit could begin operating automatically without warning.

Table 26 Troubleshooting

Symptom	Possible Causes	Check or Remedy
Unit will not start	No power to unit	Check voltage at input terminal block.
	Control voltage circuit breaker (at transformer) open	Locate short and reset circuit breaker.
	Float switch relay has closed due to high water in the condensate pan.	Has rubber band been removed from float switch? Check drain and line. Access from bottom through discharge air grille. Power must be cycled at the disconnect to reset.
	Jumper not in place	Check terminal TB1-4 and TB1-5 for jumper or N/C contact. Check Pins 1-8 and 1-9 for jumper or N/C optional high-temperature sensor contact. Check Pins 5-4 and 5-5 for jumper or N/C smoke detector contact.
No cooling	"Cooling" is not displayed at the control panel.	Adjust TEMP control setpoint and sensitivity to require cooling.
	Short cycle prevention control.	Control software delays compressor 3 minutes cooling, from stop to start
	Compressor contactor not pulling in.	Check for 24VAC ± 2 VAC at terminals P4-8 and P4-4. If voltage is detected, check contactor. If there is no voltage at P4-8 and P4-4, check at terminals P2-3 and P2-8. If voltage, check freezestat.
	Compressor high head pressure.	See below for cause.
	Plugged filter/dryer.	Replace filter/dryer.
	Low refrigerant charge.	Check pressure gauges. See **Tables 5** and **9** for recommended pressures. At low ambient temperatures, proper refrigerant charge is very important on units with Lee-Temp receivers.
Compressor high head pressure	Insufficient air flow across condenser coil	Remove debris from coil and air inlets.
	Water/Glycol-Cooled only: No fluid flowing through condenser.	Check fluid supply to regulating valve. Adjust valve if necessary.
	Self-Contained, Air-Cooled only: Condenser fan not operating	Check fan operation.
Reheat will not operate	DIP switch not set to enable reheat option	See DIP switch settings **Table 20.**
	"HEAT" not displayed at the control panel	Increase temperature setpoint to require heating.
	Reheat safety open, defective reheat contact or defective board	Check voltage at P2-1 and P1-9 on interface board for 24 VAC ± 2 VAC. If voltage, check reheat contactor and reheat safety. If no voltage, check wiring and/or replace board.
	Element is burned out	Turn off power. Check element continuity with Ohm meter.
	GCD has tripped	Replace GCD and heating element.
Display freezes and control pads do not respond	Static discharge	During period of low humidity, static electricity can cause the control program to freeze or display incorrect information. Although this is unlikely, the control can be reset by cycling power from the disconnect switch.

Table 26 Troubleshooting (continued)

Symptom	Possible Causes	Check or Remedy
Humidifier does not operate	DIP switch not set to enable humidifier option	See DIP switch settings **Table 20**.
	"HUMIDIFY" not displayed at control panel	Increase humidity control setpoint and sensitivity to require humidification.
	Defective board	Check voltage at P3-1 and P1-9 on interface board for 24 VAC ± 2 VAC. If no voltage, check wiring and/or replace board. Check wiring from control panel to board.
	Failed humidity sensor	Humidity display will indicate dashes. Check wiring from temperature/ humidity board to the control board and from the wall box to the control board. Replace wall box or temperature/humidity circuit board (if remote).
	No water flow	Make sure switch is in Run position. Check humidifier water supply (including filter screen) and check nylon overflow line if canister is full.
	Canister fill rate is not keeping up with the steam output	Check fill valve screen opening and capillary tube for obstructions. Check water supply pressure (minimum 10 psig [69kPa]).
Fan will not operate at low speed when selected from control panel.	Open wiring or failed board	Verify "LOW FAN" is displayed at the control panel. Check for 24 VAC ± 2 VAC at terminals P3-4 and P1-9. If no voltage, check wiring and/or replace interface board. Check fan relays.
Fan will not operate at low speed during dehumidification	Temperature requirement is too high.	Verify with display. Cooling requirement overrides dehumidification.
Cooling cycle too short	Sensor response delay too short	Increase sensor response delay. See **6.1.9 - Calibrate Sensors**.
Condensate pump does not operate	Open or short circuit in wiring	Find open or short circuit and repair power to pump.
Continuous Cooling	Failed temperature sensor	Temperature display will indicate dashes. Check wiring from temperature/humidity board (remote sensors) to the control board or from control board to wall box. Replace temperature/humidity circuit board (remote sensors) or wall box.
Continuous Cooling Dehumidification Humidification	Shorted wiring or failed control board	Check wiring and/or replace control board.

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