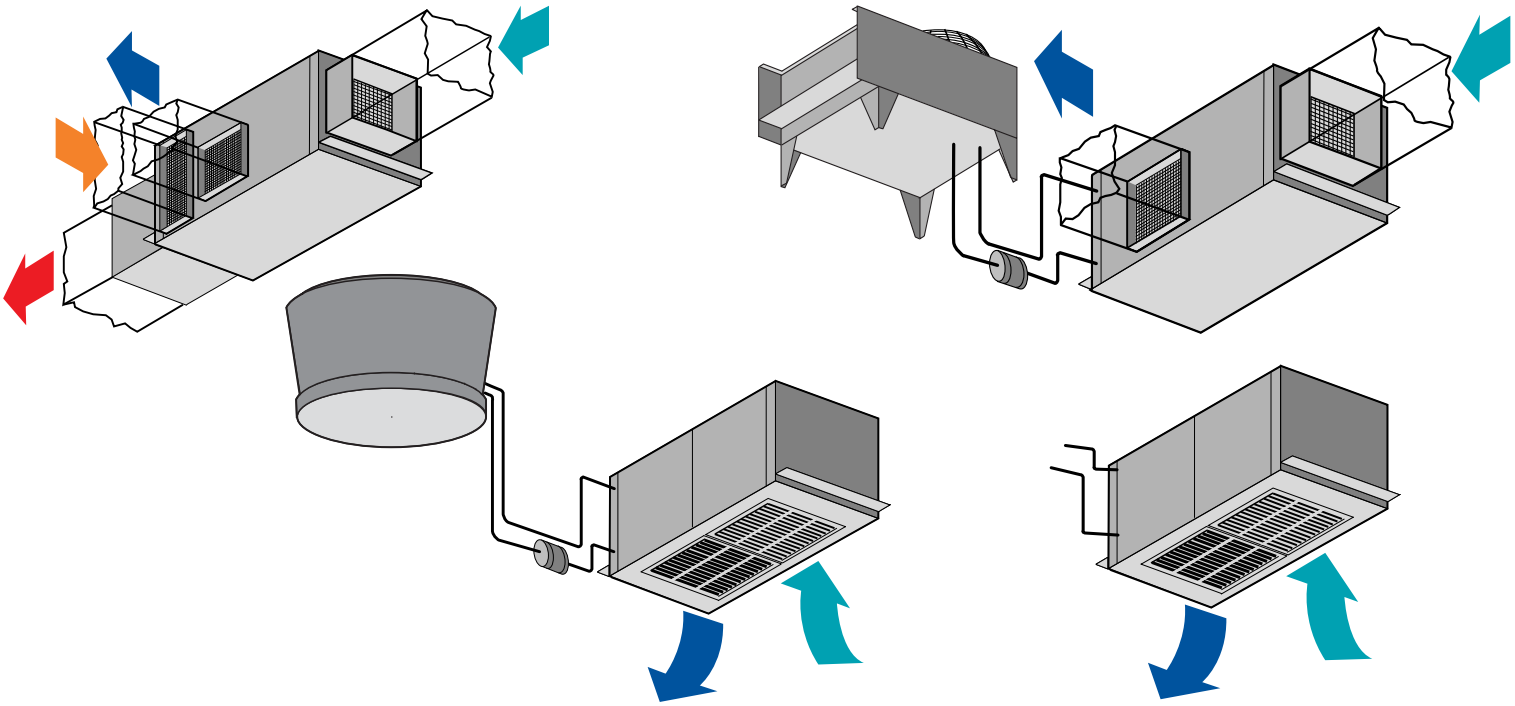
Precision Cooling
For *Business-Critical Continuity™*

Liebert Mini-Mate2™—1 & 1.5 Ton (3.5 & 5kW) Capacity

Technical Data Manual—Air, Water, Glycol, Chilled Water; 50 & 60 Hz



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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 below. Do not mount these units above sensitive equipment. A field-supplied pan with drain must be installed beneath ducted cooling units.

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 1 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. Hot gas reheat operates only during dehumidification and cannot be used for space heating.

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 local or national 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 local or national 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

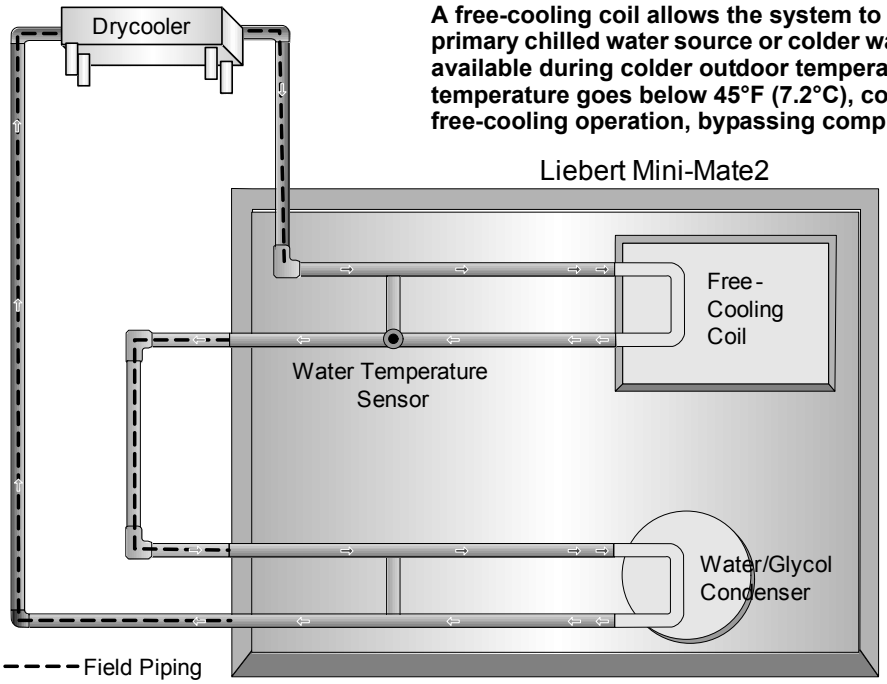
Free-cooling option includes separate cooling coil, three-way, slow-close valve and separate supply and return piping. Free-cooling is activated when the water temperature reaches a field-adjustable temperature, typically 45°F (7°C). The valve is rated for 300psi (2068kPa) working pressure.

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 2**). 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 2 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.

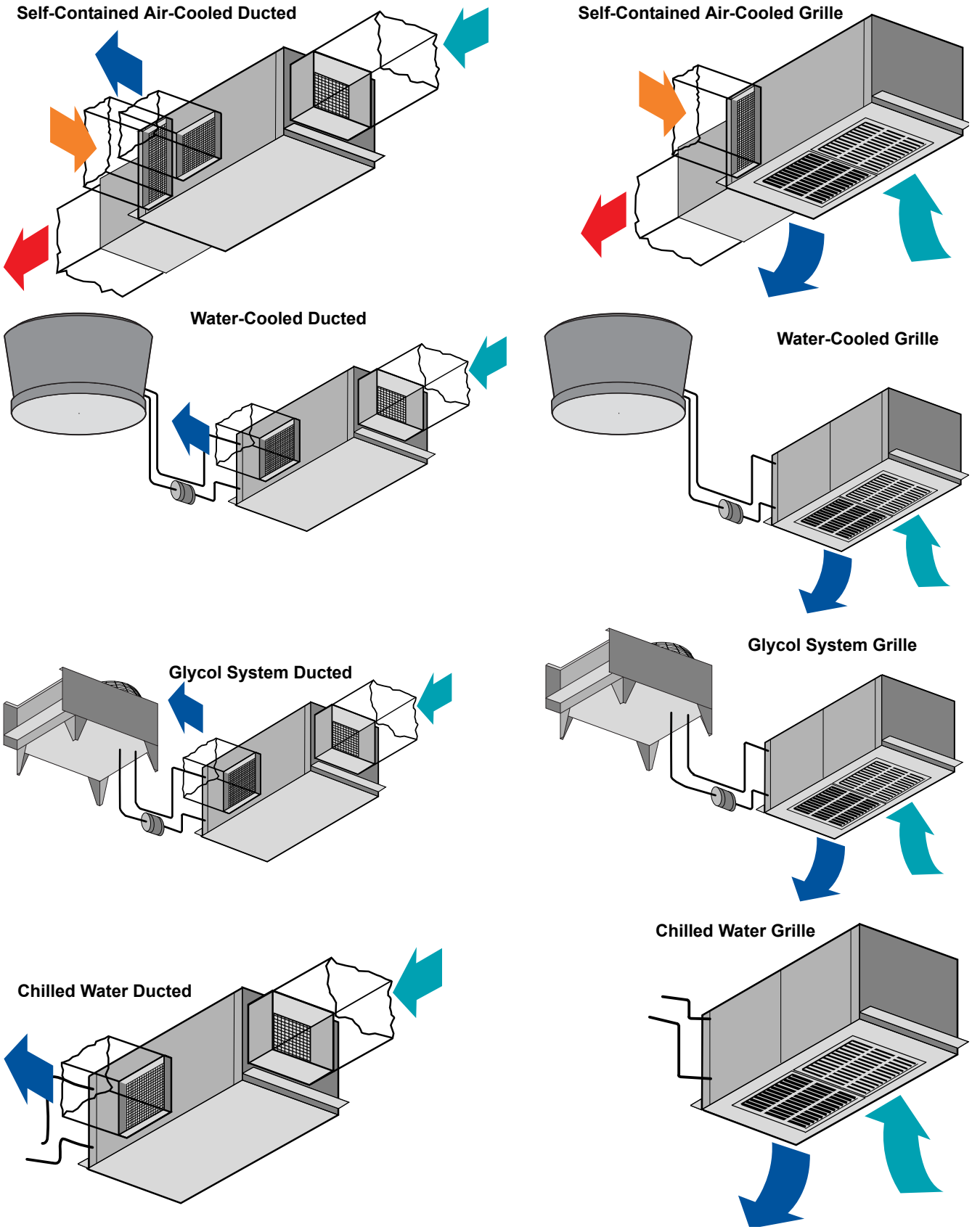
Liebert SiteScan enables communication from Liebert environmental and power units, as well as many other pieces of analog or digital equipment, to a front-end software package that provides real-time status and alarms so you can react quickly to changing situations.

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 FLEXIBLE CONFIGURATIONS

Figure 3 Flexible configurations



6.0 AIR-COOLED SYSTEMS—CAPACITIES AND DIMENSIONS

Table 1 Air-cooled data, 60Hz

Evaporator Model		MMD12A	MMD12E	MMD18A	MMD18E
Cabinet Type		**Self-Contained**	**Split System**	**Self-Contained**	**Split System**
DX Evaporator- Net Capacity Data - kW (Btu/hr) @ High Speed CFM					
80°F DB, 62.8°F WB (26.7°C DB, 17.1°C WB) 38% RH	Total	3.70 (12,600)	4.25 (14,400)	5.55 (18,900)	5.65 (19,300)
	Sensible	3.60 (12,300)	3.95 (13,500)	5.30 (18,100)	5.35 (18,300)
75°F DB, 61°F WB (23.9°C DB, 16.1°C WB) 45% RH	Total	3.50 (12,000)	4.00 (13,700)	5.30 (18,100)	5.40 (18,500)
	Sensible	3.25 (11,100)	3.55 (12,100)	4.75 (16,300)	4.85 (16,500)
72°F DB, 60°F WB (22.2°C DB, 15.5°C WB) 50% RH	Total	3.45 (11,700)	3.90 (13,300)	5.15 (17,600)	5.25 (18,000)
	Sensible	3.00 (10,200)	3.25 (11,100)	4.40 (15,000)	4.45 (15,200)
Fan Data - Evaporator					
CFM (CMH) - High Speed		600 (1019)		750 (1274)	
CFM (CMH) - Low Speed		480 (816)		600 (1019)	
Fan Motor hp (W)		0.2 (149)		0.2 (149)	
External Static Pressure, in. (mm) water gauge		0.3 (8)		0.3 (8)	
Evaporator Coil - Copper Tube/Aluminum Fin					
Face Area ft.^{2} (m^2)		2.44 (0.23)		2.44 (0.23)	
Coil Rows		2		3	
Max Face Velocity-fpm (m/s)		232 (1.2)		291 (1.5)	
Unit Refrigerant Charge, oz. (kg)		42 (1.19)	3 (0.09)	49 (1.39)	4 (0.11)
Unit Operating Weight		265 (120)	220 (100)	300 (136)	225 (102)
Electric & SCR Reheat Capacities (Includes Fan Motor)-kW (Btu/hr)					
Input Voltage 208-1-60		3.6 (12160)		3.6 (12160)	
Input Voltage 230-1-60		4.4 (14875)		4.4 (14875)	
Input Voltage 277-1-60		4.8 (16285)		4.8 (16285)	
Hot Gas Reheat Capacities - kW (Btu/hr) *					
Based on 103°F (39.4°C) return gas temperature		4.7 (16050)	N/A	4.7 (16050)	N/A
Humidifier Data - Steam Generator Type					
Steam capacity - lb./hr (kg/hr)		2.5 (1.14)		2.5 (1.14)	
Electrical Input Power - kW		0.88		0.88	
Evaporator Connection Sizes					
Liquid line Diameter - Aeroquip Coupling Size		N/A	3/8" - #6 Female	N/A	3/8" - #6 Female
Suction Line Diameter - Aeroquip Coupling Size			5/8" - #11 Female		5/8" - #11 Female
Humidifier Supply		1/4" OD Cu Compression Fitting		1/4" OD Cu Compression Fitting	
Evaporator/Condensate Drain		3/4" NPT-Female		3/4" NPT-Female	
MERV 8 Filter, Supply/Return Grille, qty. (1), Nom. Size-in. (mm)		1x20x20 (25x508x508)		1x20x20 (25x508x508)	
MERV 8 Filter, Return Air Filter Box, qty. (1), Nom. Size-in. (mm)		1x16x20 (25x406x508)		1x16x20 (25x406x508)	
Condensing Unit Model Number		**N/A**	**PFH014A-_L7**	**N/A**	**PFH020A-_L7**
Condenser Fan Model Number		**MM2CF**	**N/A**	**MM2CF**	**N/A**
Condenser Coil Face Area ft.^{2} (m^2)		2.25 (0.21)	4.1 (0.38)	2.25 (0.21)	4.1 (0.38)
Rows of Coil		3	2	3	2
CFM (CMH)		950 (1614)	2200 (3738)	950 (1614)	2200 (3738)
Motor hp (W)		0.25 (186)	0.20 (149)	0.25 (186)	0.20 (149)
External Static Pressure, in wg. (mm)		0.5 (13)	N/A	0.5 (13)	N/A
Condensing Unit Refrigerant Charge, oz. (kg)		N/A	134 (3.8)	N/A	134 (3.8)
Unit Operating Weight, lb. (kg)		63 (29)	200 (91)	63 (29)	200 (91)
Free-Cooling Coil Option Net Capacity Data - kW (Btu/hr) using 45°F EWT					
80°F DB, 62.8°F WB (26.7°C DB, 17.1°C WB) 38% RH	Total	3.70 (12,600)		4.25 (14,500)	
	Sensible	3.70 (12,600)		4.25 (14,500)	
75°F DB, 61°F WB (23.9°C DB, 16.1°C WB) 45% RH	Total	3.15 (10,800)		3.60 (12,300)	
	Sensible	3.10 (10,600)		3.60 (12,300)	
72°F DB, 60°F WB (22.2°C DB, 15.5°C WB) 50% RH	Total	2.85 (9,700)		3.25 (11,100)	
	Sensible	2.75 (9,300)		3.15 (10,800)	
Flow Rate - GPM (l/m)		2.3 (8.7)		2.6 (9.9)	
Pressure Drop - ft. water (kPa)		5.2 (15.5)		6.6 (19.7)	
Free-Cooling Coil - Copper Tube/Aluminum Fin					
Face Area ft.^{2} (m^2)		2.44 (0.23)		2.44 (0.23)	
Coil Rows		2		2	
Max Face Velocity-fpm (m/s)		232 (1.2)		291 (1.5)	
Internal Fluid Volume - gal (l)		1.7 (6.4)		1.7 (6.4)	
Water supply and return connections, in. (mm) OD		5/8 (15.9)		5/8 (15.9)	

The net capacity data has fan motor heat factored in for all ratings and the entering air conditions of 75°F (23.9°C), 45% RH, is the standard rating condition for ASHRAE 127-2007. All capacities are nominal values; actual performance will be ±5%.

* Hot Gas Reheat operates only during dehumidification. Capacity shown is offset by cooling capacity; cannot be used for space heating and is for reference only.

Figure 4 General arrangement—self contained air-cooled system

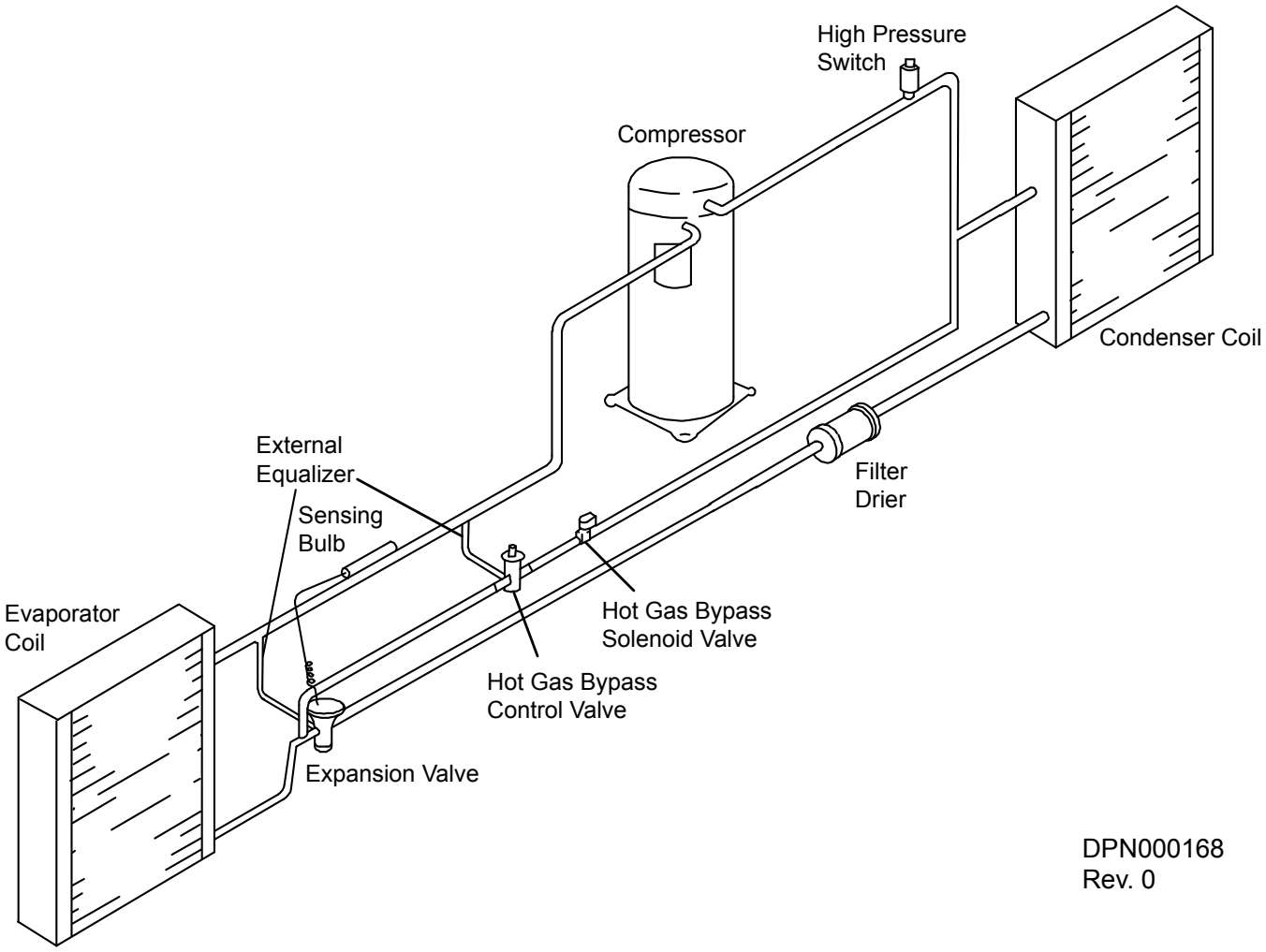


Figure 5 Free-cooling coil arrangement, air-cooled units

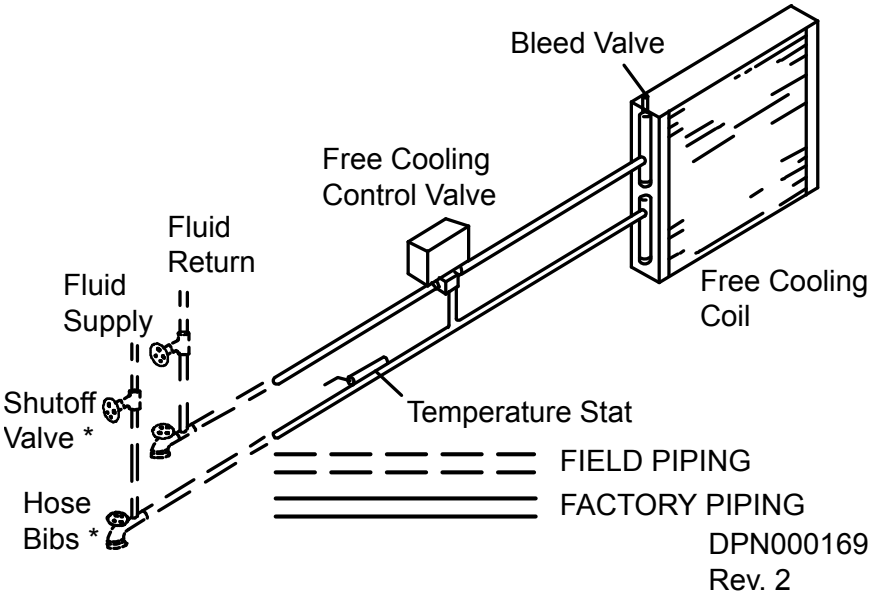


Figure 6 General arrangement—Self-contained air-cooled unit with hot gas reheat

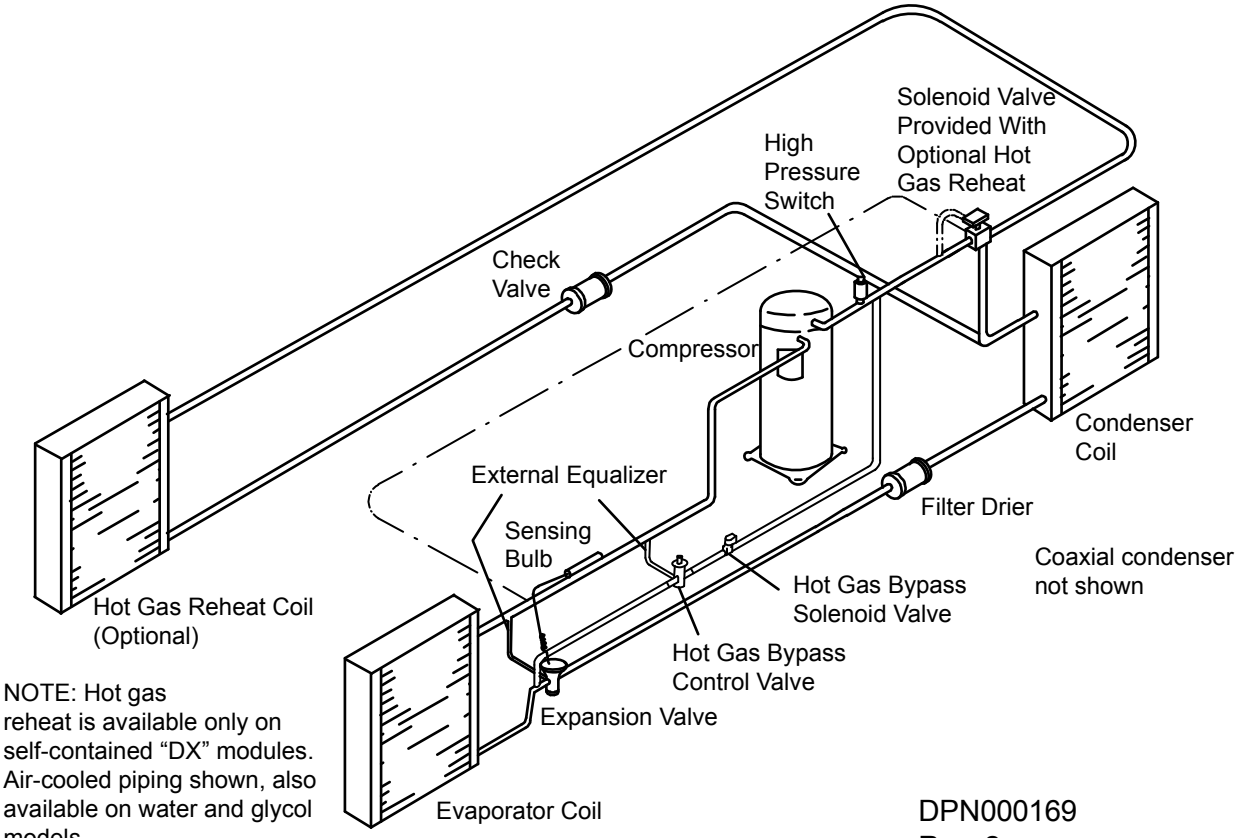


Figure 7 General arrangement—Split systems with air-cooled condensing units

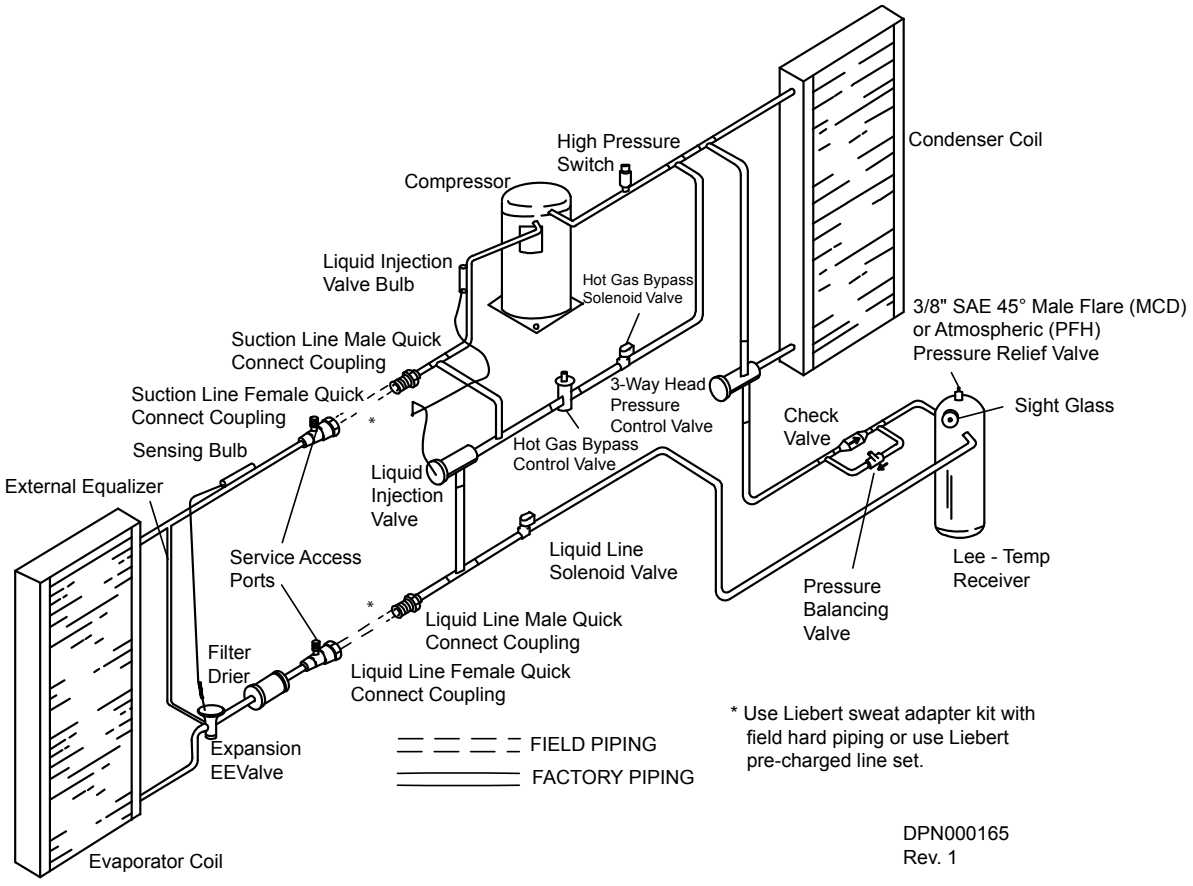


Figure 8 Dimensions—Air-cooled, self-contained and split systems

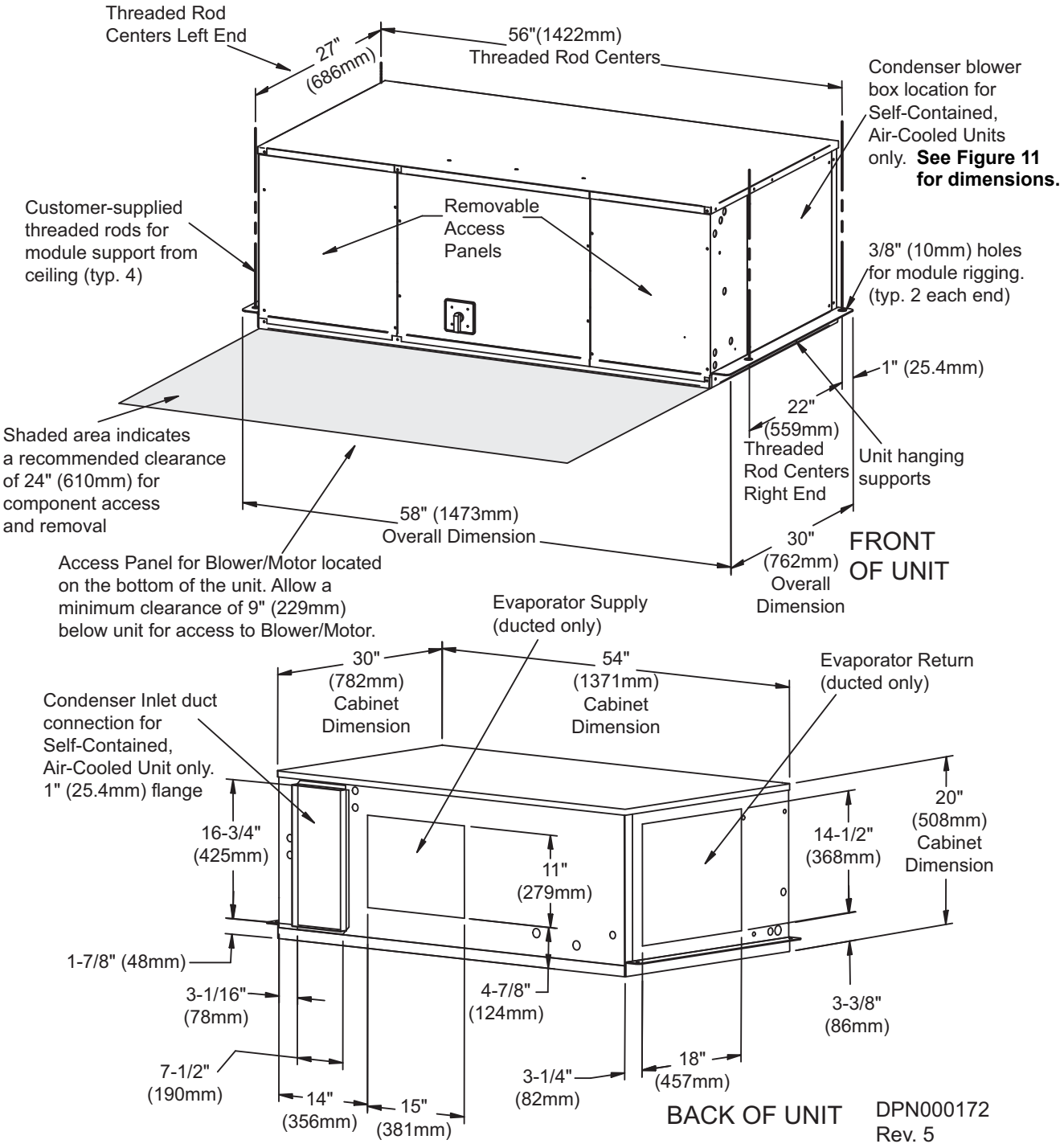


Table 2 Unit net weights—Air-cooled units

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

Source: DPN000172, Rev. 5

Figure 9 Dimensions—Return filter box, all systems

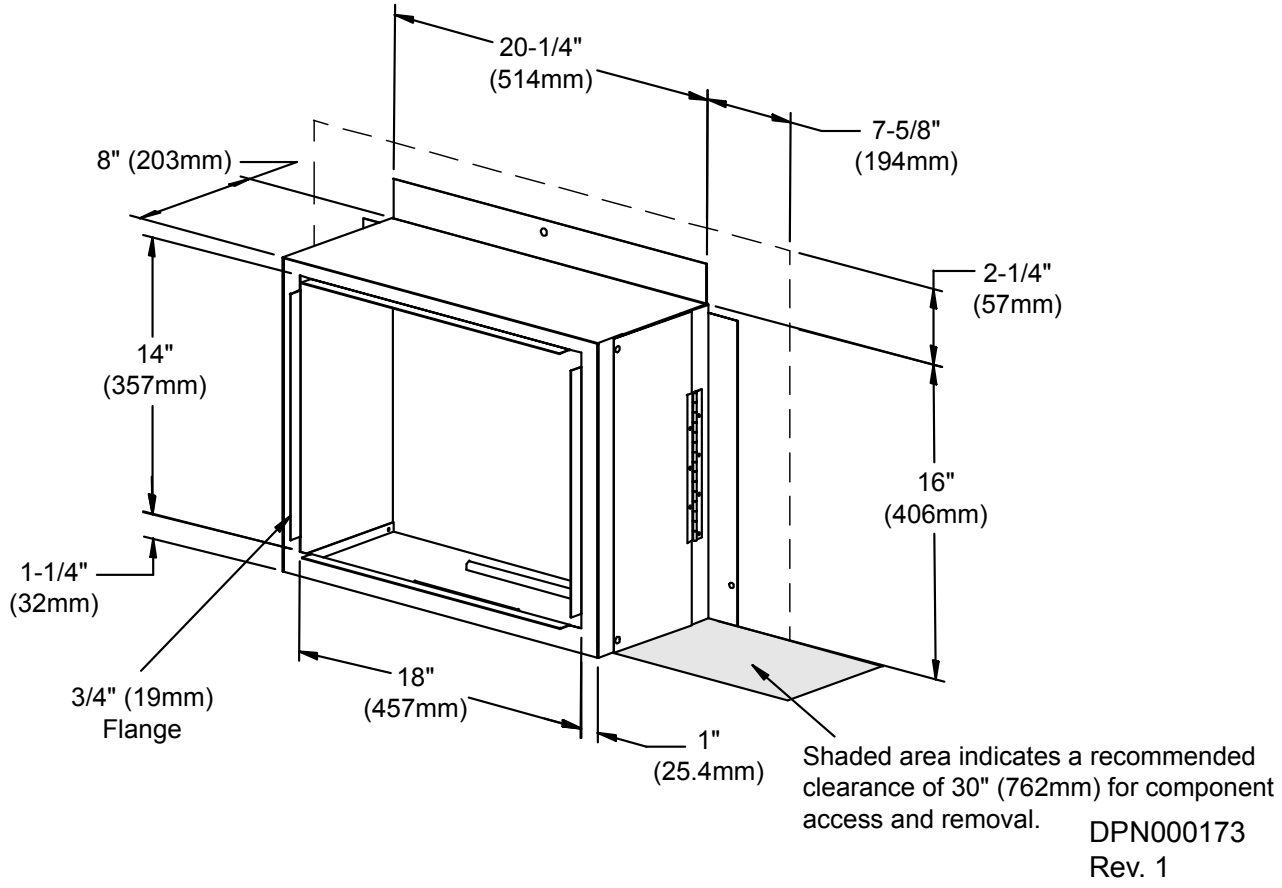


Figure 10 Dimensions—Supply/return grille kit, all systems

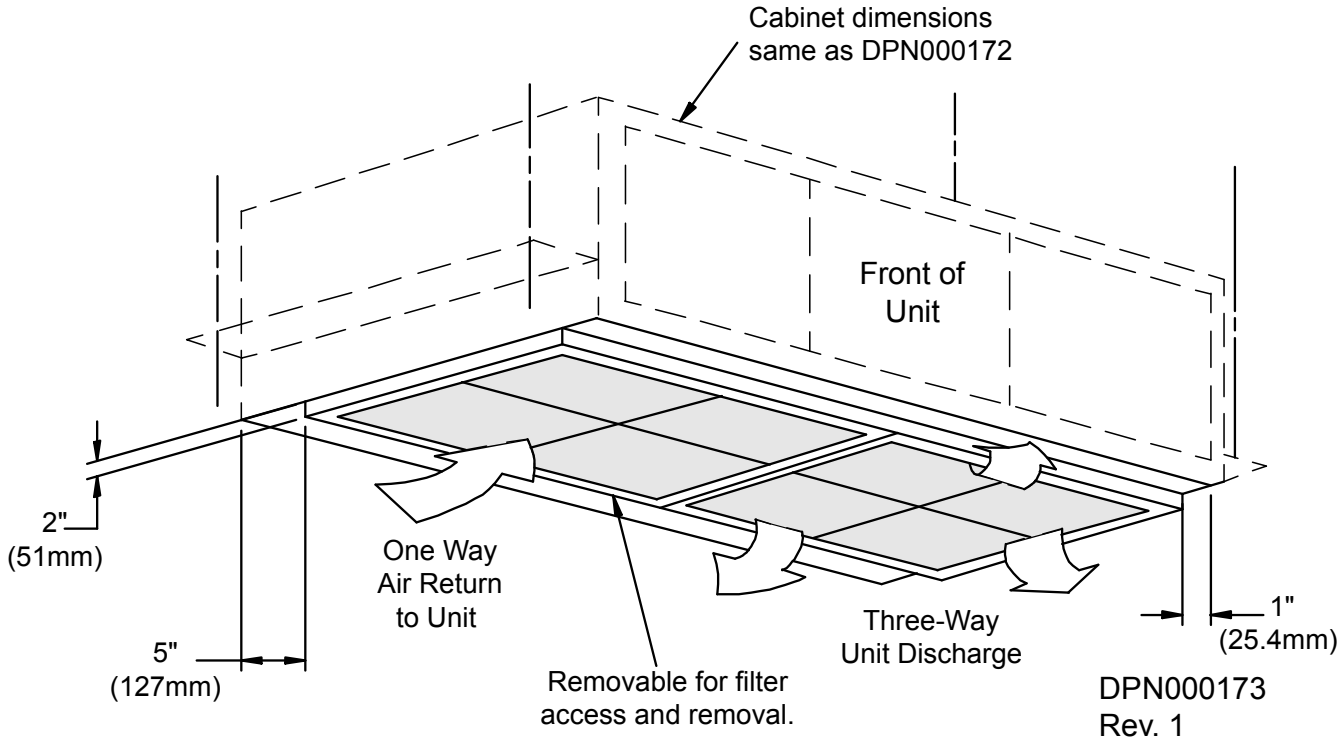
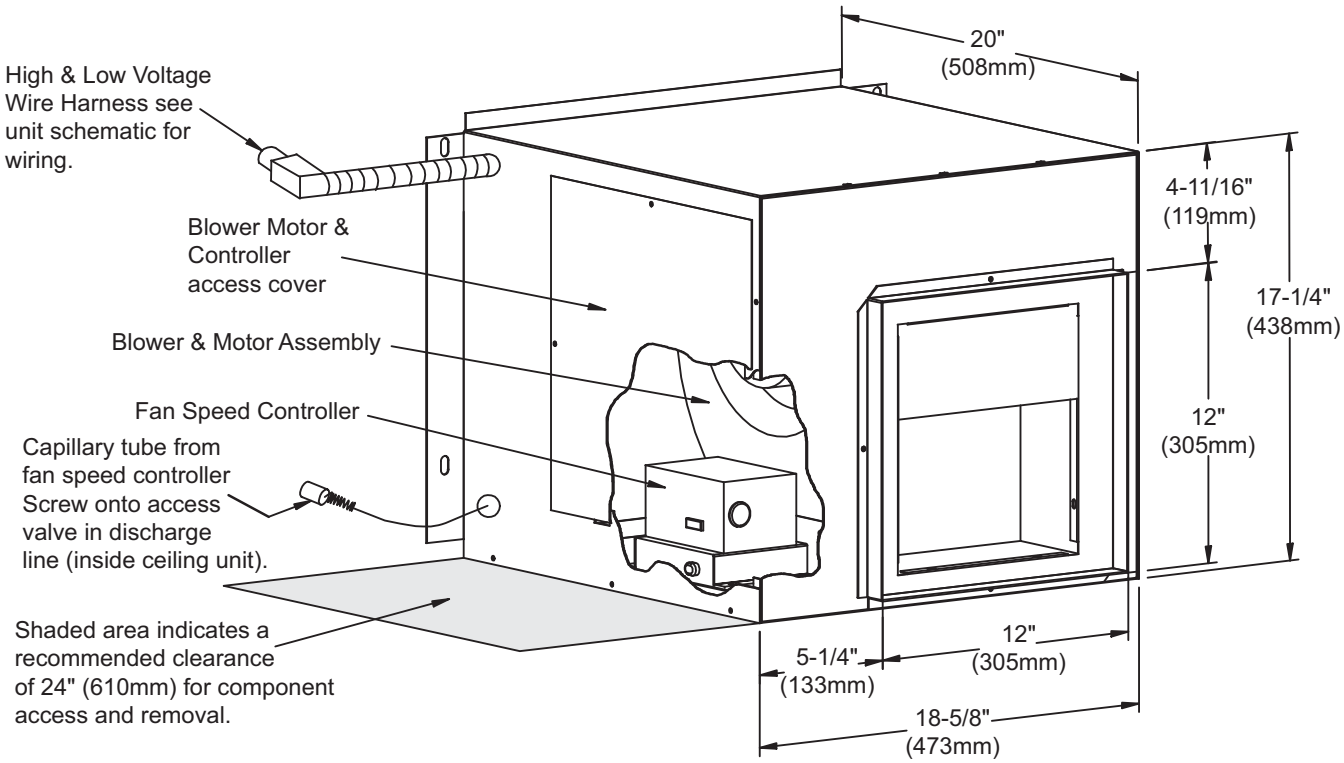
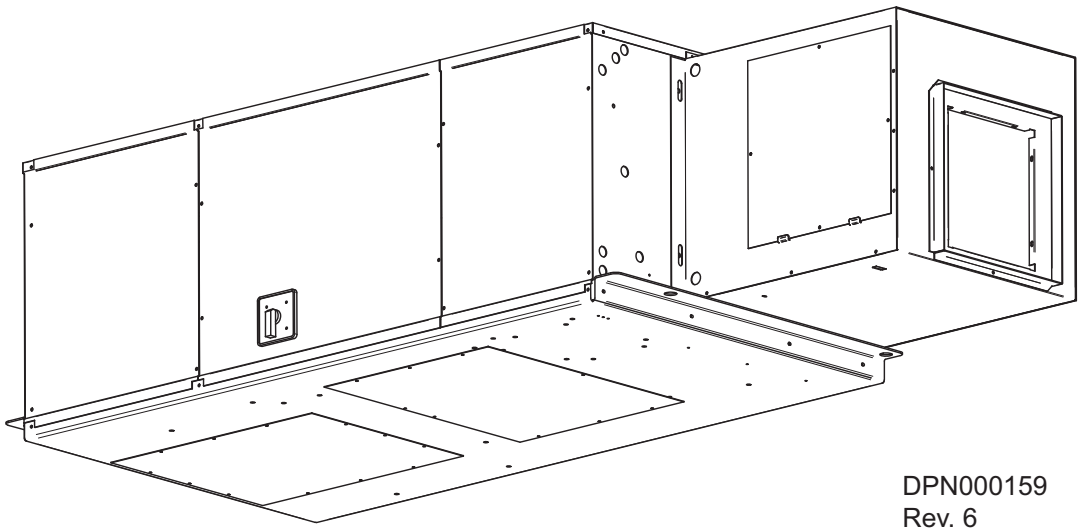


Figure 11 Dimensions—Condenser fan module





DPN000159
Rev. 6

Table 3 Net weight, condenser fan module

Model #	Net Weight, lb (kg)
MM2CF	63 (29)

Source: DPN000159, Rev. 6

Figure 12 Dimensions—Air-cooled systems, outdoor condensing unit

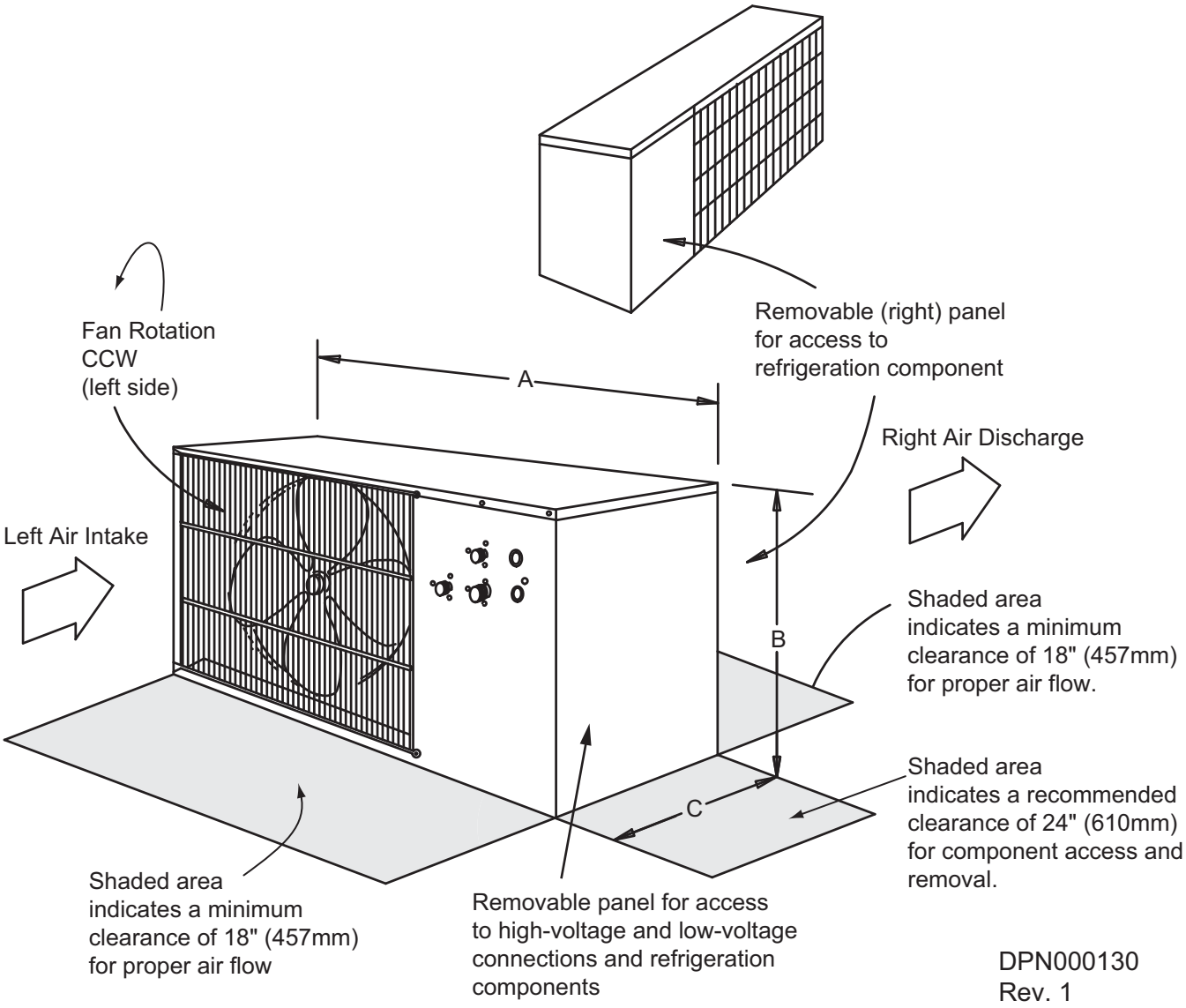


Table 4 Dimensions and weight—Air-cooled systems, outdoor condensing unit

Model Numbers		Dimensions, in. (mm)			Module Net Weight, lb. (kg)
60Hz	50Hz	A	B	C	
PFH014A-L	NA	40 (1016)	23-1/2 (597)	18 (457)	200 (91)
PFH020A-L					

Source: DPN000130, Rev. 1

7.0 WATER/GLYCOL SYSTEMS—CAPACITIES AND DIMENSIONS

Table 5 Water/Glycol data, 60Hz

Evaporator Model (Self-Contained)		MMD14W		MMD20W	
Condensing Unit Fluid		**Water-Cooled**	**Glycol-Cooled**	**Water-Cooled**	**Glycol-Cooled**
DX Evaporator- Net Capacity Data - kW (Btu/hr) @ High Speed CFM					
80°F DB, 62.8°F WB (26.7°C DB, 17.1°C WB) 38% RH	Total	4.05 (13,800)	3.50 (11,900)	6.40 (21,800)	5.20 (17,800)
	Sensible	3.85 (13,100)	3.45 (11,800)	5.80 (19,800)	5.10 (17,400)
75°F DB, 61°F WB (23.9°C DB, 16.1°C WB) 45% RH	Total	3.85 (13,100)	3.30 (11,300)	6.15 (21,000)	5.00 (17,000)
	Sensible	3.45 (11,800)	3.10 (10,600)	5.20 (17,700)	4.55 (15,600)
72°F DB, 60°F WB (22.2°C DB, 15.5°C WB) 50% RH	Total	3.80 (12,900)	3.20 (11,000)	6.00 (20,500)	4.85 (16,600)
	Sensible	3.15 (10,800)	2.90 (9,800)	4.80 (16,400)	4.10 (14,000)
Fan Data - Evaporator					
CFM (CMH) - High Speed		600 (1019)		750 (1274)	
CFM (CMH) - Low Speed		480 (816)		600 (1019)	
Fan Motor hp (W)		0.2 (149)		0.2 (149)	
External Static Pressure, in. (mm) water gauge		0.3 (8)		0.3 (8)	
Evaporator Coil - Copper Tube/Aluminum Fin					
Face Area ft.^{2} (m^2)		2.44 (0.23)		2.44 (0.23)	
Coil Rows		2		3	
Max Face Velocity-fpm (m/s)		232 (1.2)		291 (1.5)	
Unit Refrigerant Charge, oz. (kg)		27 (0.77)		34 (0.96)	
Unit Operating Weight		260 (118)		295 (134)	
Electric & SCR Reheat Capacities (Includes Fan Motor)-kW (Btu/hr)					
Input Voltage 208-1-60		3.6 (12160)		3.6 (12160)	
Input Voltage 230-1-60		4.4 (14875)		4.4 (14875)	
Input Voltage 277-1-60		4.8 (16285)		4.8 (16285)	
Hot Gas Reheat Capacities - kW (Btu/hr) *					
Based on 103°F (39.4°C) return gas temperature		4.7 (16050)		4.7 (16050)	
Humidifier Data - Steam Generator Type					
Steam capacity - lb./hr (kg/hr)		2.5 (1.14)		2.5 (1.14)	
Electrical Input Power - kW		0.88		0.88	
Unit Connection Sizes					
Water/Glycol Condenser Connection Sizes, in. (mm) OD		1/2 (12.7)		1/2 (12.7)	
Humidifier Supply		1/4" OD Cu Compression Fitting		1/4" OD Cu Compression Fitting	
Evaporator/Condensate Drain		3/4" NPT-Female		3/4" NPT-Female	
MERV 8 Filter, Supply/Return Grille, qty. (1), Nom. Size - in. (mm)		1x20x20 (25x508x508)		1x20x20 (25x508x508)	
MERV 8 Filter, Return Air Filter Box, qty. (1), Nom. Size - in. (mm)		1x16x20 (25x406x508)		1x16x20 (25x406x508)	
Condenser Fluid Requirements		85°F (29.4°C) EWT	110°F (43.3°C) EGT - 40% PG	85°F (29.4°C) EWT	110°F (43.3°C) EGT - 40% PG
THR - kW (Btu/hr) @ 75°F/45% RH		5.15 (17,500)	4.80 (16,400)	7.85 (26,700)	7.35 (25,000)
Flow Rate - GPM (l/m)		1.5 (5.7)	2.6 (9.9)	3.3 (12.5)	4.6 (17.4)
Pressure Drop - ft. of H_20 (kPa)		1.9 (5.7)	5.3 (15.8)	7.0 (20.9)	14.1 (42.2)
Water-Cooled Condensing Temperature		105°F (40.6°C)	NA	105°F (40.6°C)	NA
Water/Glycol Condenser Loop Volume - gal (l)		0.5 (1.9)		0.5 (1.9)	
Free-Cooling Coil Option Net Capacity Data - kW (Btu/hr) using 45°F EWT					
80°F DB, 62.8°F WB (26.7°C DB, 17.1°C WB) 38% RH	Total	3.70 (12,600)	2.80 (9,600)	4.25 (14,500)	3.55 (12,100)
	Sensible	3.70 (12,600)	2.80 (9,600)	4.25 (14,500)	3.55 (12,100)
75°F DB, 61°F WB (23.9°C DB, 16.1°C WB) 45% RH	Total	3.15 (10,800)	2.35 (8,100)	3.60 (12,300)	3.00 (10,200)
	Sensible	3.10 (10,600)	2.35 (8,100)	3.60 (12,300)	3.00 (10,200)
72°F DB, 60°F WB (22.2°C DB, 15.5°C WB) 50% RH	Total	2.85 (9,700)	2.10 (7,200)	3.25 (11,100)	2.65 (9,100)
	Sensible	2.75 (9,300)	2.10 (7,200)	3.15 (10,800)	2.65 (9,100)
Flow Rate - GPM (l/m)		2.3 (8.7)	2.6 (9.9)	2.6 (9.9)	4.6 (17.4)
Pressure Drop - ft. water (kPa)		5.2 (15.5)	9.9 (29.6)	6.6 (19.7)	29.0 (86.7)
Free-Cooling Coil - Copper Tube/Aluminum Fin					
Face Area ft.^{2} (m^2)		2.44 (0.23)		2.44 (0.23)	
Coil Rows		2		2	
Max Face Velocity-fpm (m/s)		232 (1.2)		291 (1.5)	
Internal Fluid Volume - gal (l)		1.7 (6.4)		1.7 (6.4)	
Free-Cooling Coil supply and return connections, in. (mm) OD		5/8 (15.9)		5/8 (15.9)	

The net capacity data has fan motor heat factored in for all ratings and the entering air conditions of 75°F (23.9°C), 45% RH, is the standard rating condition for ASHRAE 127-2007. All capacities are nominal values; actual performance will be ±5%.

* Hot Gas Reheat operates only during dehumidification. Capacity shown is offset by cooling capacity; cannot be used for space heating and is for reference only.

Figure 13 General arrangement—Self-contained water/glycol-cooled system

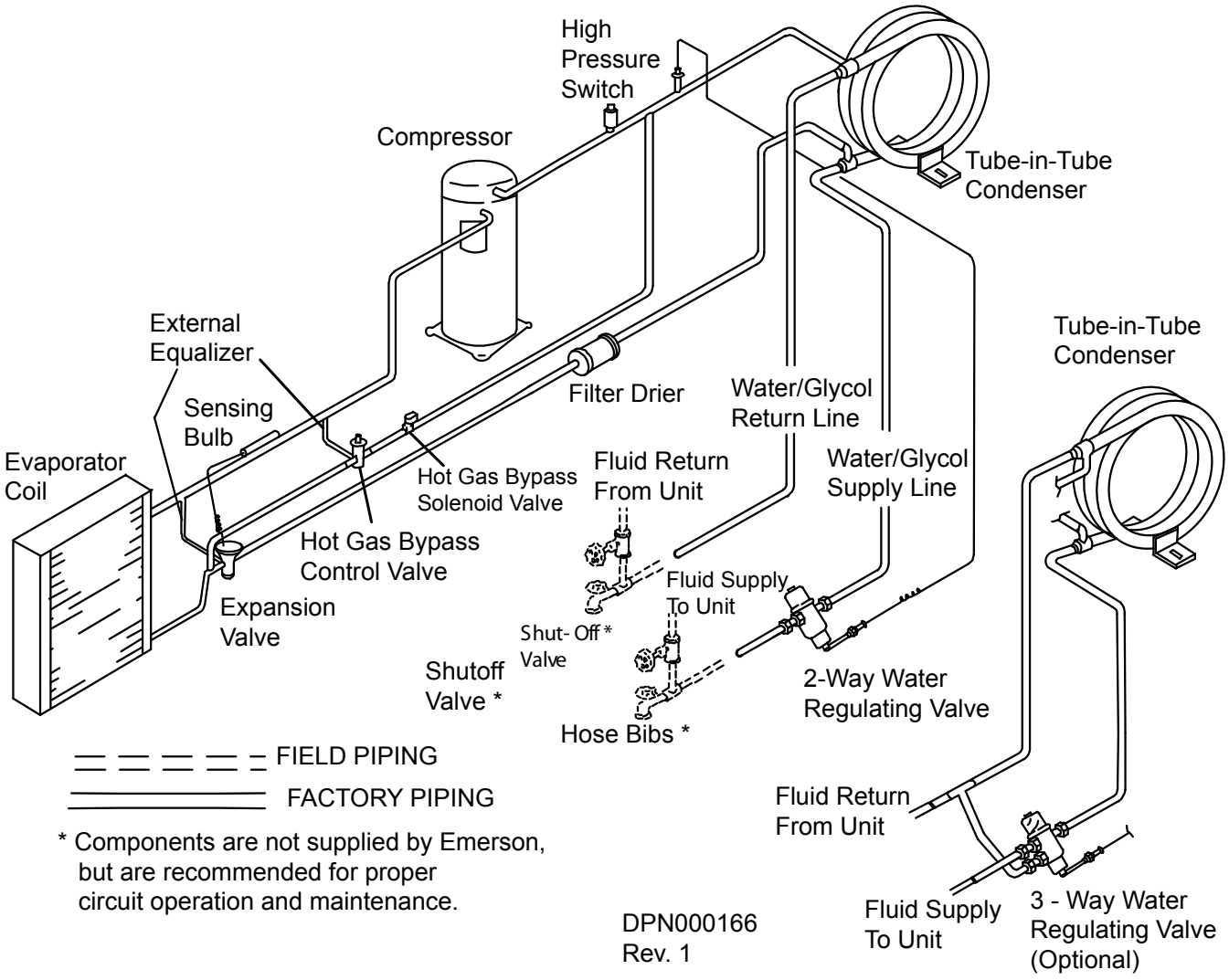


Figure 14 Free-cooling coil arrangement—Water/glycol-cooled units

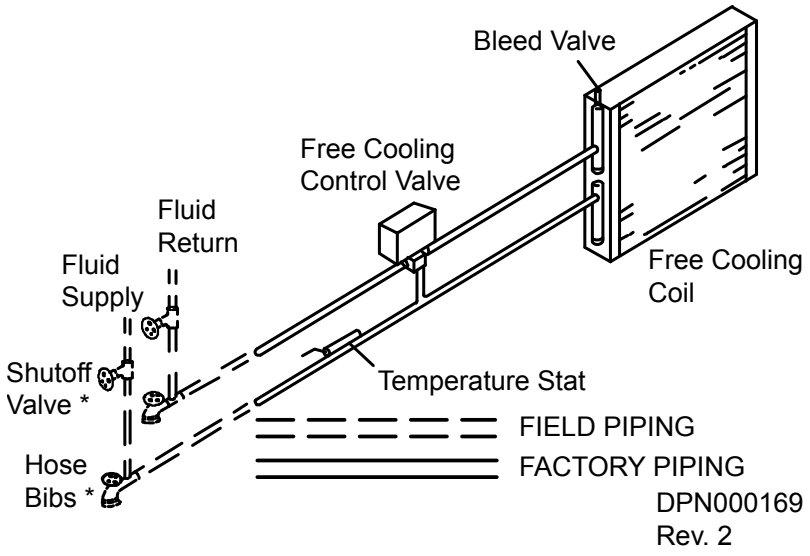
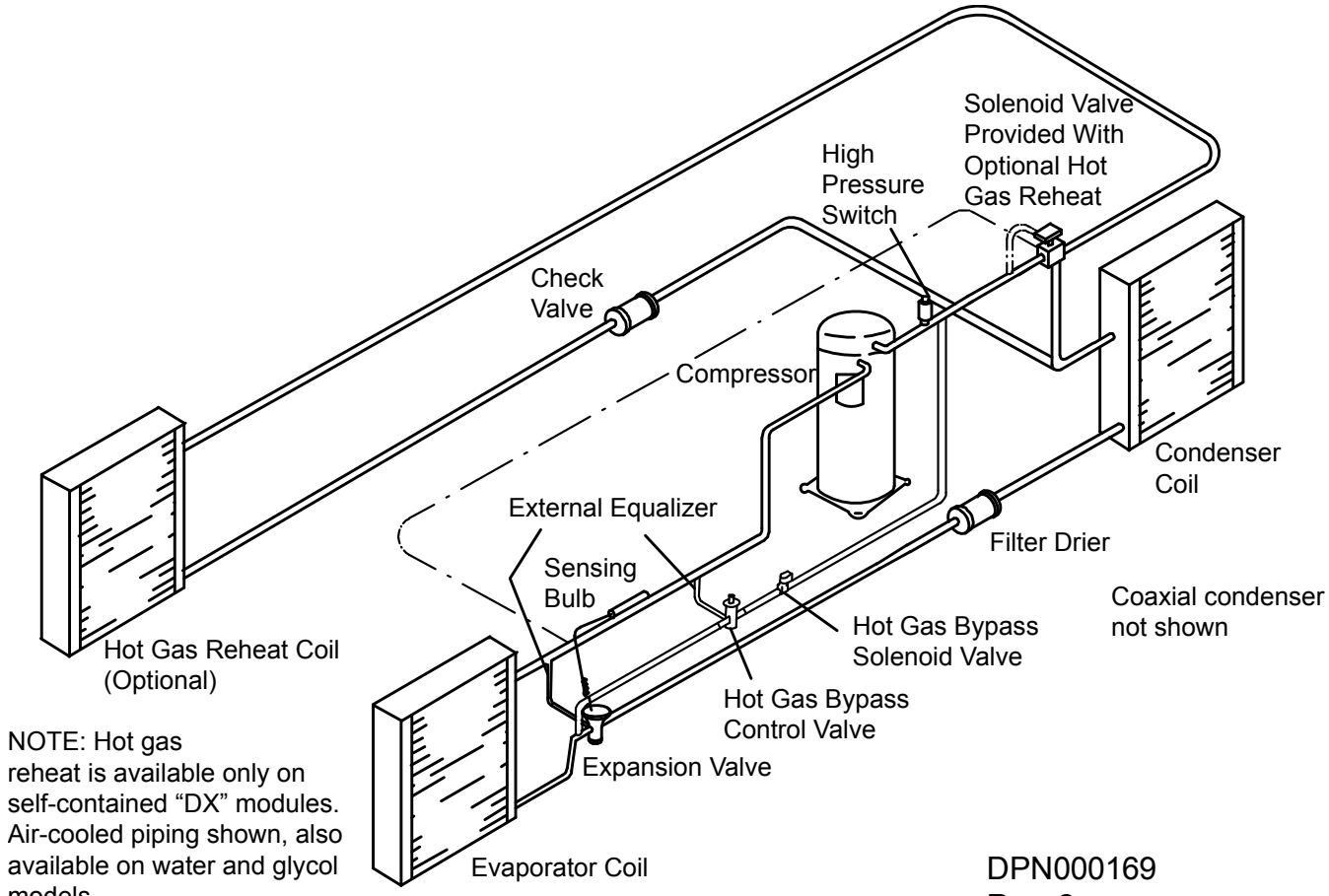


Figure 15 General arrangement, Self-contained water/glycol-cooled unit with hot gas reheat



NOTE: Hot gas reheat is available only on self-contained “DX” modules. Air-cooled piping shown, also available on water and glycol models.

Figure 16 Dimensions - Water/glycol self-contained units

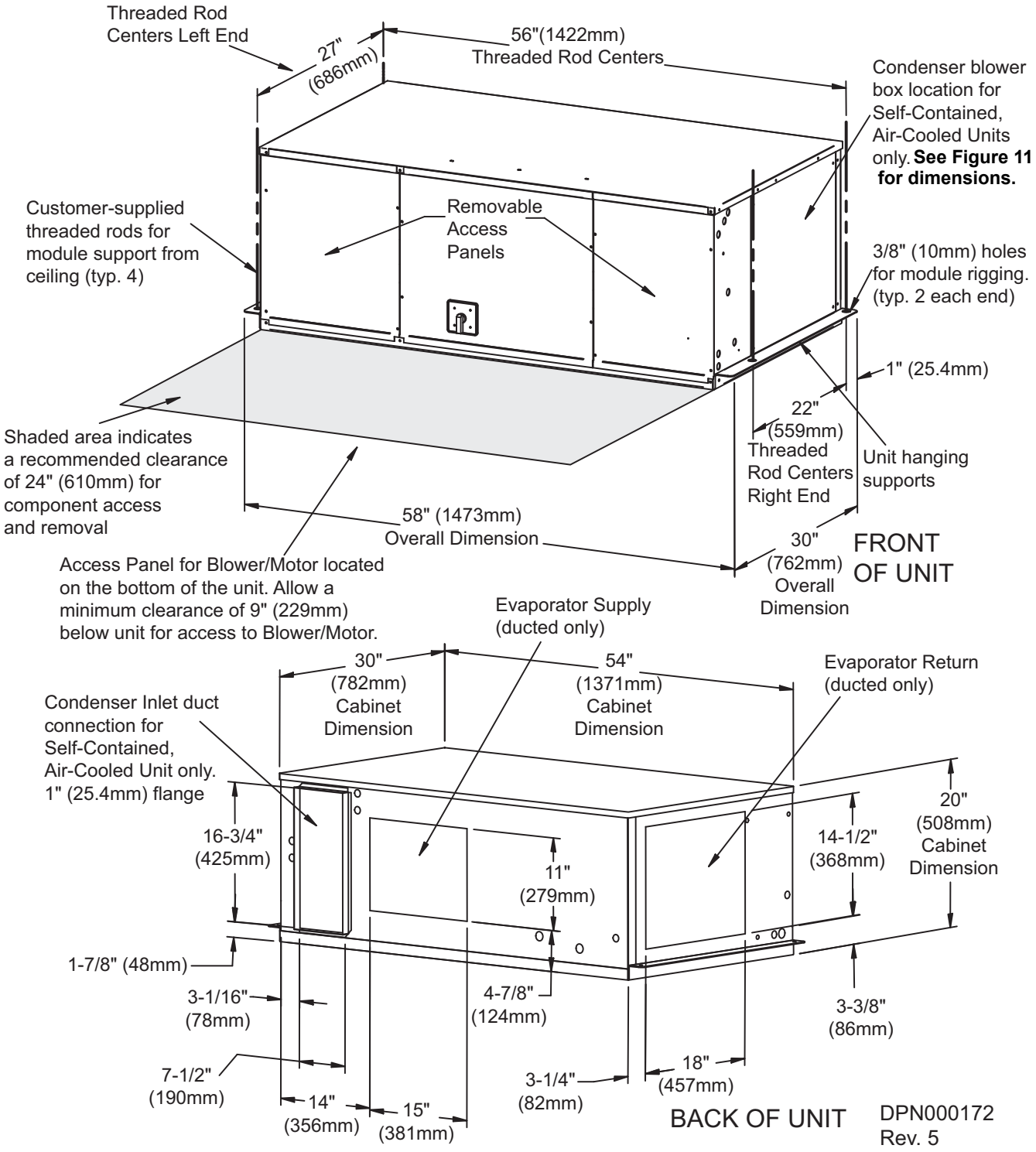


Table 6 Unit net weights—Water/glycol self-contained units

Model Numbers		Net Weight, lb (kg)
60Hz	50Hz	
MM*14W	N/A	260 (118)
MM*20W		295 (134)

Source: DPN000172, Rev. 5

Figure 17 Dimensions—Return filter box, all systems

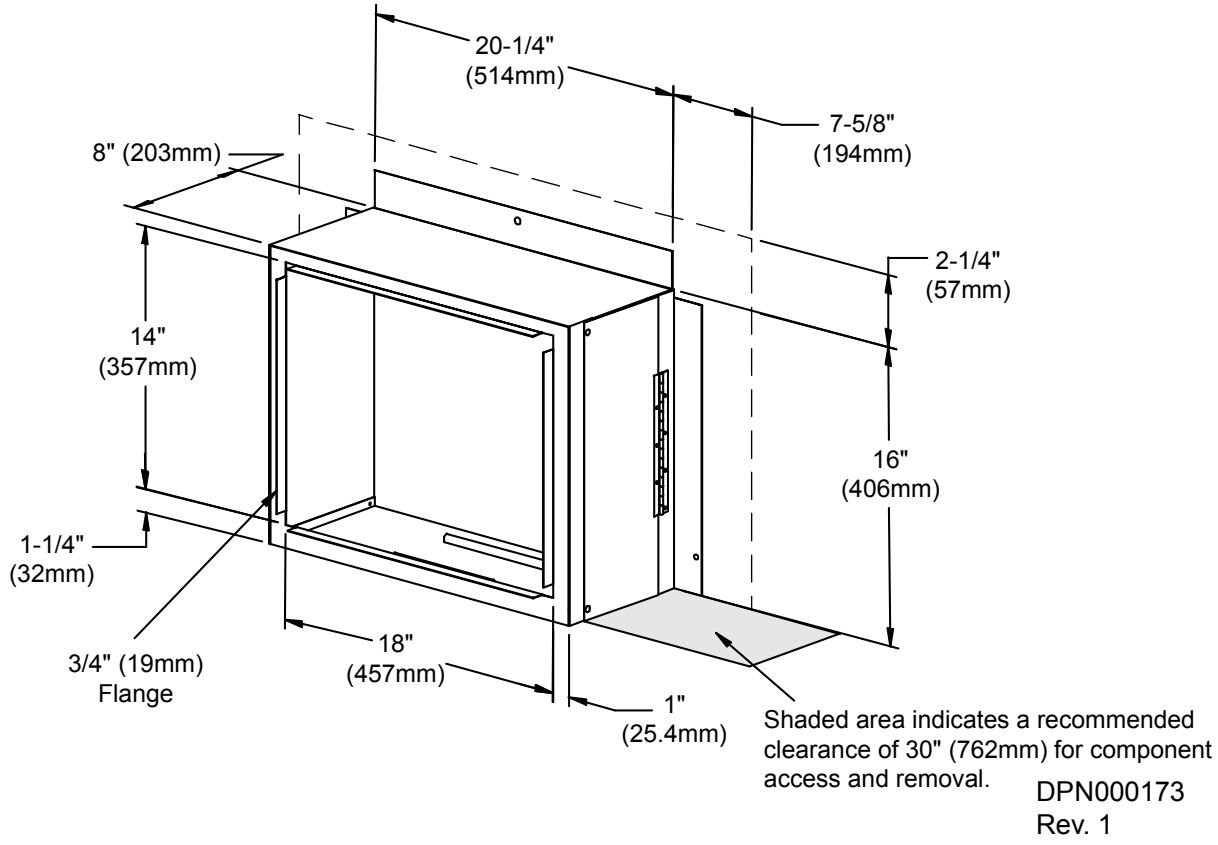
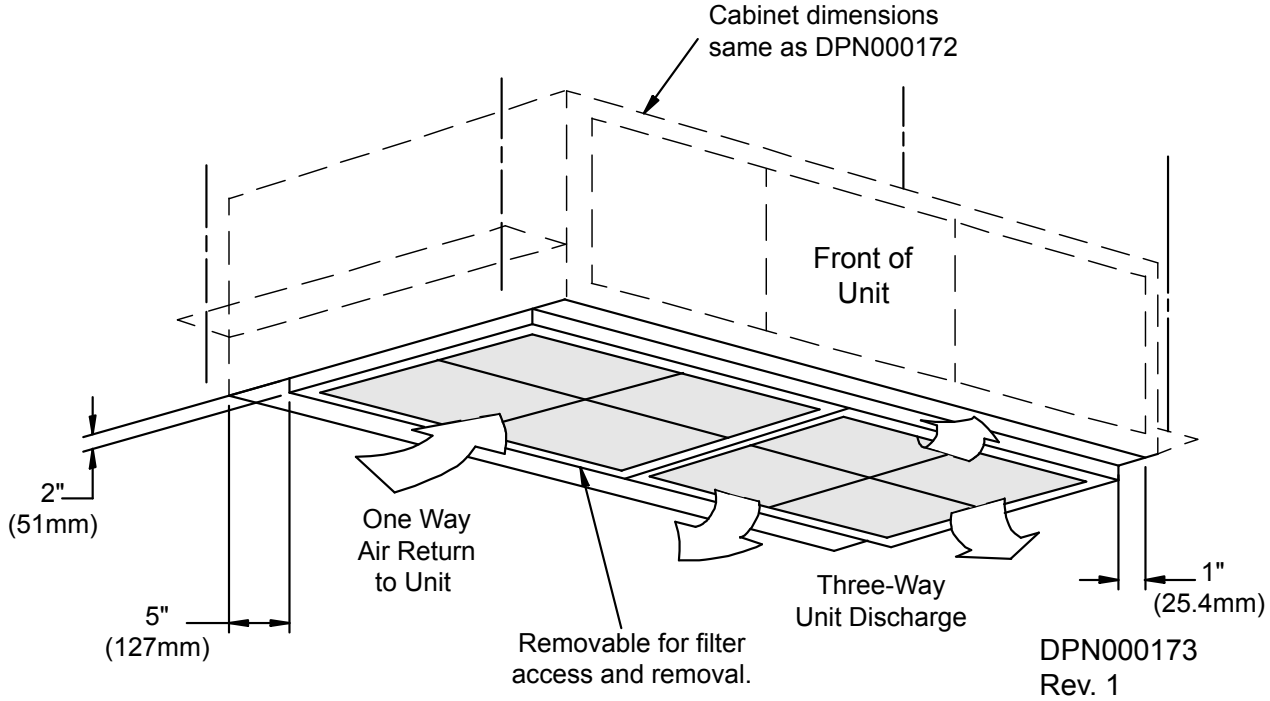


Figure 18 Dimensions—Supply/return grille kit, all systems



8.0 CHILLED WATER SYSTEMS—CAPACITIES AND DIMENSIONS

Table 7 Chilled water data, 50/60Hz

Model Number, 50 & 60 Hz		MMD23C/MMD22C
Net Capacity Data - kW (Btu/hr) based on 45°F (7.2°C) EWT & 10°F (5.6°C) temp. rise		
80°F DB, 62.8°F WB (26.7°C DB, 17.1°C WB) 38% RH	Total	4.85 (16,400)
	Sensible	4.80 (16,300)
Flow Rate - GPM (l/m)		3.4 (12.9)
Pressure Drop - ft. water (kPa)		10.7 (32.0)
75°F DB, 61°F WB (23.9°C DB, 16.1°C WB) 45% RH	Total	3.85 (13,100)
	Sensible	3.80 (13,000)
Flow Rate - GPM (l/m)		2.8 (10.6)
Pressure Drop - ft. water (kPa)		7.2 (21.5)
72°F DB, 60°F WB (22.2°C DB, 15.5°C WB) 50% RH	Total	3.20 (11,000)
	Sensible	3.20 (10,900)
Flow Rate - GPM (l/m)		2.3 (8.7)
Pressure Drop - ft. water (kPa)		5.3 (15.8)
Fan Data - Evaporator		
CFM (CMH) - High Speed		750 (1274)
CFM (CMH) - Low Speed		600 (1019)
Fan Motor hp (W)		0.2 (149)
External Static Pressure, in. (mm) water gauge		0.3 (8)
CW Coil - Copper Tube/Aluminum Fin		
Face Area ft.^{2} (m^2)		2.44 (0.23)
Coil Rows		2
Max Face Velocity-fpm (m/s)		291 (1.5)
Electric Reheat Capacity (Includes Fan Motor)-kW (Btu/hr)		
Input Voltage 208-1-60		3.6 (12160)
Input Voltage 230-1-60		4.4 (14875)
Input Voltage 277-1-60		4.8 (16285)
Input Voltage-220-1-50		4.0 (13640)
Hot Water Reheat Coil - Copper Tube/Aluminum Fin		
Capacity (with fan motor heat) using 180°F (82°C) EWT-kW (Btu/hr)		9.5 (32,400)
Flow Rate - GPM (l/m)		1.5 (5.7)
Pressure Drop - ft. water (kPa)		1.5 (4.5)
Face Area ft.^{2} (m^2)		2.44 (0.23)
Coil Rows		1
HWRH supply and return connections, in. (mm) OD		5/8 (15.9)
Humidifier Data - Steam Generator Type		
Steam capacity - lb./hr (kg/hr)		2.5 (1.14)
Electrical Input Power - kW		0.88
Unit Connection Sizes		
CW supply and return connections, in. (mm) OD		5/8 (15.9)
Humidifier Supply		1/4" OD Cu Compression Fitting
Evaporator/Condensate Drain		3/4" NPT-Female
Unit Internal Fluid Volume - gal (l)		1.7 (6.4)
MERV 8 Filter, Supply/Return Grille, qty. (1), Nom. Size-in. (mm)		1x20x20 (25x508x508)
MERV 8 Filter, Return Air Filter Box, qty. (1), Nom. Size-in. (mm)		1x16x20 (25x406x508)
Unit Operating Weight, lb. (kg.)		220 (99.8)
Unit Valve Types		On/Off Slow Close - 2 & 3-Way
Valve Size		1/2"
Valve Cv		2.5
Max. Static Operating Pressure, psi (kPa)		300 (2068)
Close-Off Pressure, psi (kPa)		25 (172)

The net capacity data has fan motor heat factored in for all ratings and the entering air conditions of 75°F (23.9°C), 45% RH, is the standard rating condition for ASHRAE 127-2007. All capacities are nominal values; actual performance will be ±5%.

Table 8 Capacity correction factors (based on 10°F (5.6°C) water rise)

EWT	72°F (22.2°C) 50% RH		75°F (23.9°C) 45% RH	
	TCC	SCC	TCC	SCC
42°F (5.6°C)	1.30	1.14	1.25	1.11
43°F (6.1°C)	1.19	1.10	1.17	1.07
44°F (6.7°C)	1.09	1.05	1.08	1.04
45°F (7.2°C)	1.00	1.00	1.00	1.00
46°F (7.8°C)	0.94	0.95	0.95	0.96
47°F (8.3°C)	0.88	0.89	0.90	0.90
48°F (8.9°C)	0.82	0.82	0.85	0.85
49°F (9.4°C)	0.75	0.75	0.80	0.81

Figure 19 General arrangement—Self-contained chilled water units

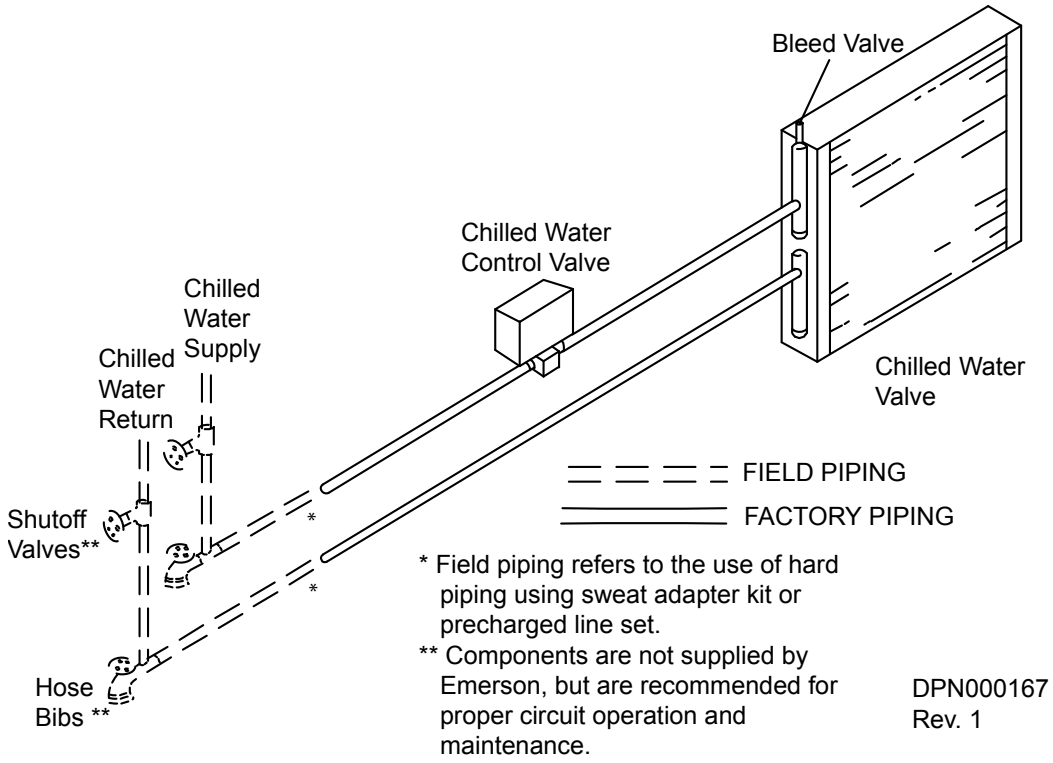


Figure 20 General arrangement—Hot water reheat coil, chilled water units

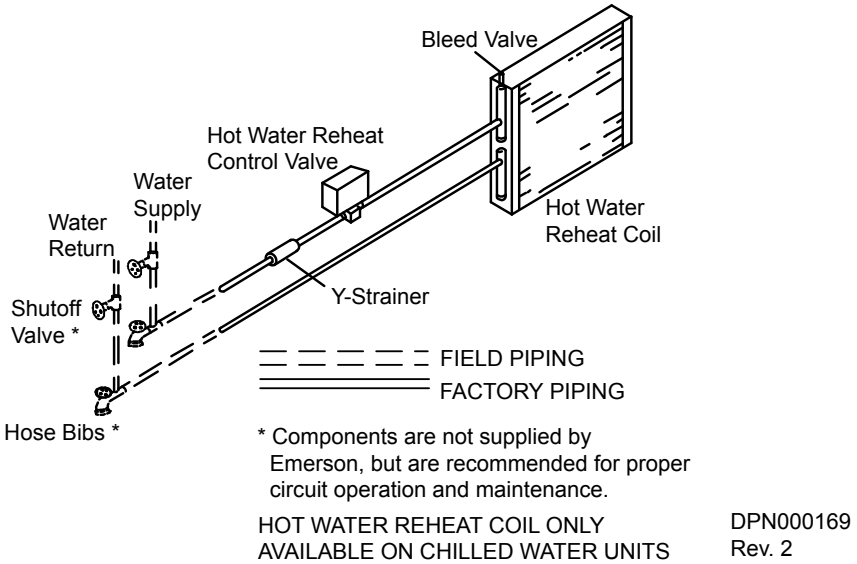


Figure 21 Dimensions—Chilled water unit

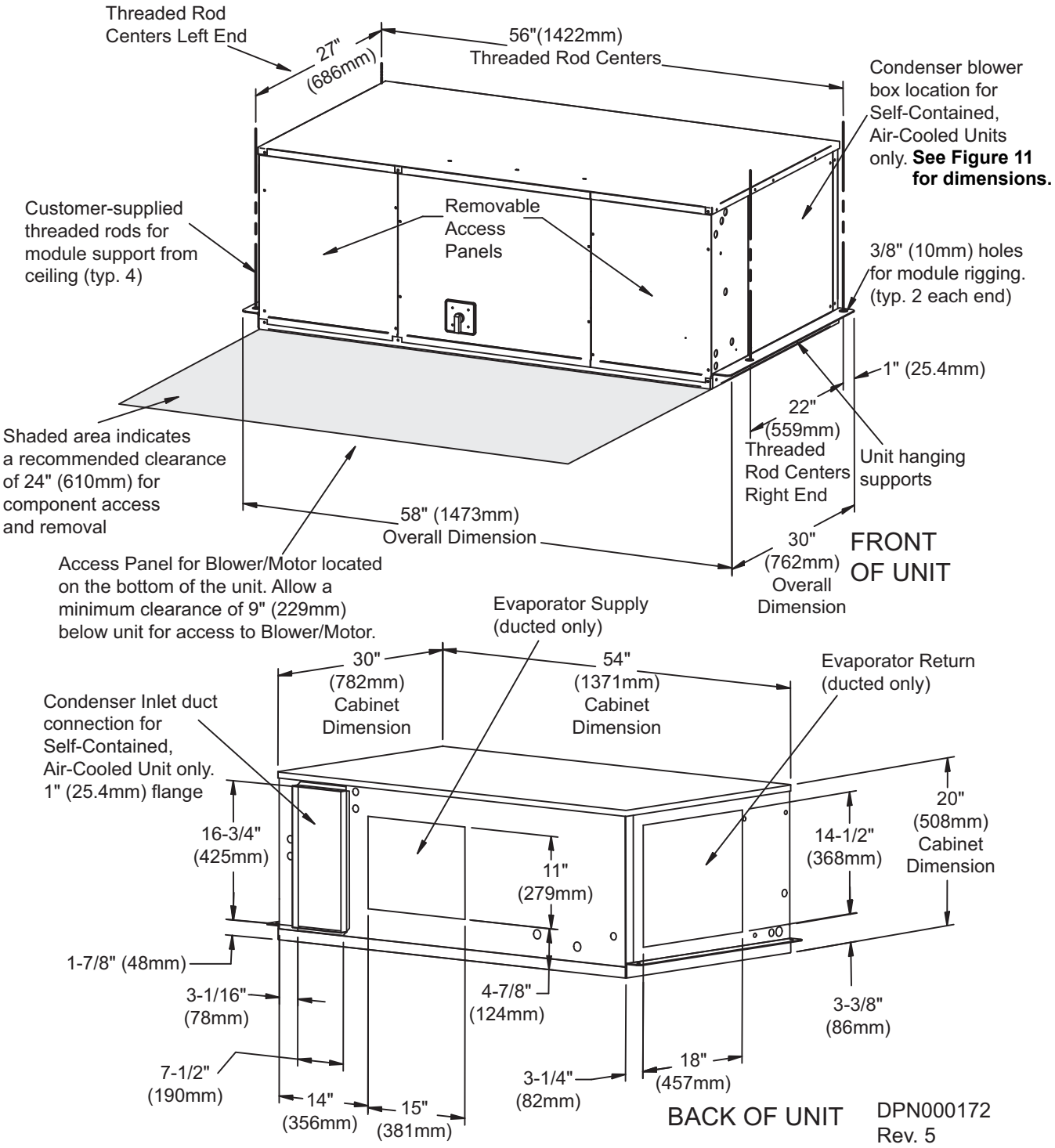


Table 9 Unit net weights—Chilled Water units

Model #		Net Weight lb (kg)
60Hz	50Hz	
MM*23C	MM*22C	220 (100)

Source: DPN000172, Rev. 5

Figure 22 Dimensions—Return filter box, all systems

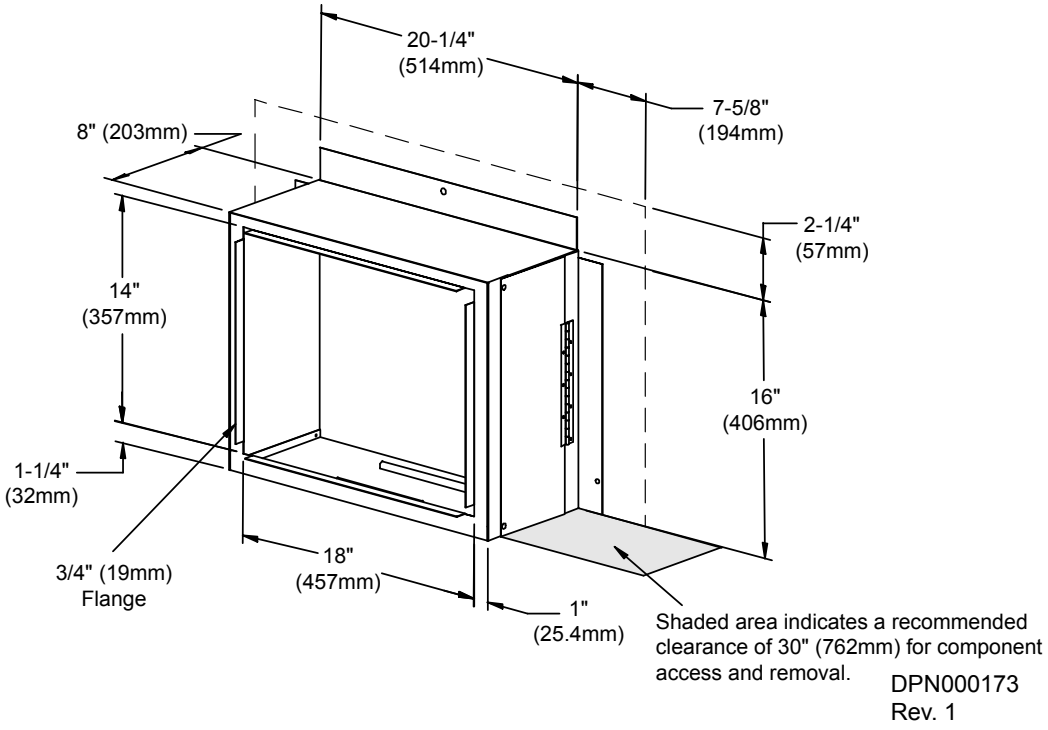
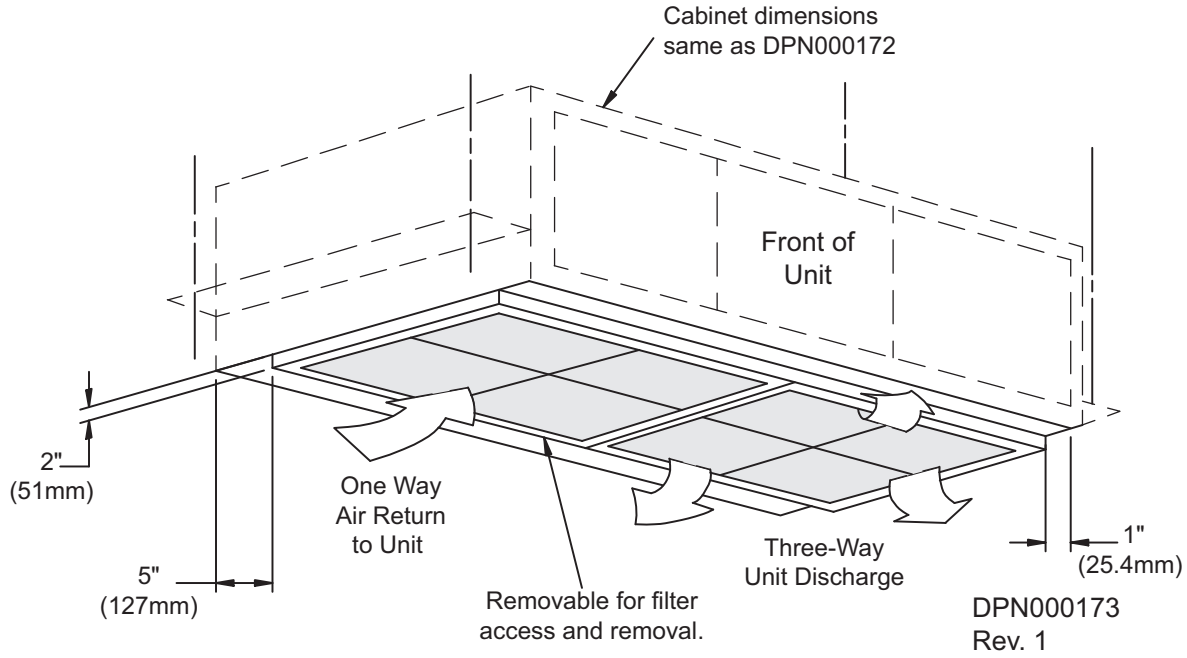


Figure 23 Dimensions—Supply/return grille kit, all systems



9.0 ELECTRICAL DATA

Table 10 Electrical data, self-contained air-cooled units, 60Hz

Base Evaporator Model Number	208/230 - 1Ph - 60Hz		277 - 1Ph - 60Hz	
	MM*12A	MM*18A	MM*12A	MM*18A
Cooling Only				
FLA	8.2	14.2	6.8	11.8
WSA	9.4	16.9	7.8	14.0
OPD	15	25	15	20
with Electric Reheat				
FLA	27.0	33.0	23.1	28.1
WSA	32.9	40.4	28.2	34.4
OPD	35	45	30	35
with SCR Reheat [6]				
FLA	27.0	33.0	23.1	28.1
WSA	32.9	40.4	28.2	34.4
OPD	35	45	30	35
with Humidifier				
FLA	13.0	19.0	10.4	15.4
WSA	14.2	21.7	11.4	17.6
OPD	15	30	15	25
with Electric Reheat and Humidifier				
FLA	27.0	33.0	23.1	28.1
WSA	32.9	40.4	28.2	34.4
OPD	35	45	30	35
with SCR Reheat and Humidifier [6]				
FLA	31.8	37.8	26.7	31.7
WSA	37.7	45.2	31.8	38.0
OPD	40	50	35	40

1. Electrical values are not affected by hot gas reheat or free-cooling options
2. FLA = Full Load Amps, WSA = Wire Size Amps, OPD = Maximum Overcurrent Protection Device
3. * = Specify “D” for disconnect, “0” for no disconnect.
4. Self-contained air-cooled units include MM2CF blower box.
5. Hot Gas Reheat not available with Electric or SCR Reheat or Free-cooling options
6. SCR Reheat not available with Free-cooling models.

Table 11 Electrical Data—Self-contained water/glycol-cooled units, 60Hz

Base Evaporator Model Number	208/230 - 1Ph - 60Hz		277 - 1Ph - 60Hz	
	MM*14W	MM*20W	MM*14W	MM*20W
Cooling Only				
FLA	6.1	12.1	5.3	10.3
WSA	7.3	14.8	6.3	12.5
OPD	15	25	15	20
with Electric Reheat				
FLA	24.9	30.9	21.6	26.6
WSA	30.8	38.3	26.7	32.9
OPD	35	40	30	35
with SCR Reheat [5]				
FLA	24.9	30.9	21.6	26.6
WSA	30.8	38.3	26.7	32.9
OPD	35	40	30	35
with Humidifier				
FLA	10.9	16.9	8.9	13.9
WSA	12.1	19.6	9.9	16.1
OPD	15	30	15	25
with Electric Reheat and Humidifier				
FLA	25.0	30.9	21.6	26.6
WSA	31.3	38.3	26.7	32.9
OPD	35	40	30	35
with SCR Reheat and Humidifier [5]				
FLA	29.7	35.7	25.2	30.2
WSA	35.6	43.1	30.3	36.5
OPD	40	45	35	40

1. Electrical values are not impacted by Hot Gas Reheat, and Free-cooling options
2. FLA = Full Load Amps, WSA = Wire Size Amps, OPD = Maximum Overcurrent Protection Device
3. * = Specify “D” for disconnect, “0” for no disconnect.
4. Hot Gas Reheat not available with Electric or SCR Reheat or Free-cooling options
5. SCR Reheat not available with free-cooling models.

Table 12 Electrical data—Split-evaporator or self-contained chilled water units, 50/60 Hz

Base Evaporator Model Number	208/230 - 1Ph - 60Hz	277 - 1Ph - 60Hz	220- 1Ph - 50Hz
	MM*12E; MM*18E; MM*23C	MM*12E; MM*18E; MM*23C	MM*22C
Cooling Only			
FLA	1.4	1.4	1.4
WSA	1.8	1.8	—
OPD	15	15	—
with Electric Reheat			
FLA	20.2	17.7	20.2
WSA	25.3	22.1	—
OPD	30	25	—
with SCR Reheat [5]			
FLA	20.2	17.7	20.2
WSA	25.3	22.1	—
OPD	30	25	—
with Humidifier			
FLA	6.2	5.0	6.0
WSA	7.8	6.3	—
OPD	15	15	—
with Electric Reheat and Humidifier			
FLA	25.0	21.3	24.8
WSA	31.3	26.6	—
OPD	35	30	—
with SCR Reheat and Humidifier [5]			
FLA	25.0	21.3	24.8
WSA	31.3	26.6	—
OPD	35	30	—

1. For units with Hot Water Reheat (available only on MM*22C & MM*23C), use appropriate values from “Cooling Only” or “with Humidifier” categories.
2. FLA = Full Load Amps, WSA = Wire Size Amps, OPD = Maximum Overcurrent Protection Device
3. * = Specify “D” for disconnect, “0” for no disconnect.
4. Use MM*12E or MM*18E values for models with Free-Cooling options, except with SCR Reheat.
5. SCR Reheat not available with Free-cooling models.

Table 13 Electrical data—Outdoor PFH condensing units, 60Hz

Model #	Nominal Capacity Tons	* Electrical Characteristic	Input Voltage Phase
			208/230-1
14	1	FLA	9.1
		WSA	11.0
		OPD	15
20	1.5	FLA	12.1
		WSA	14.8
		OPD	25

* **FLA** = Full Load Amps
WSA = Wire Size Amps (minimum supply circuit current capacity)
OPD = Maximum Overcurrent Protection Device (fuse or circuit breaker)

10.0 REFRIGERANT PIPING

Table 14 Refrigerant charge

Unit Type	Model #		Charge R-407C * oz (kg)
	60Hz	50Hz	
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 16** to determine charge to be added to field-fabricated refrigerant lines.

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

Table 15 Recommended line sizes, OD 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 16 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 17 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 18 Refrigerant charge in Liebert pre-charged R-407C line sets

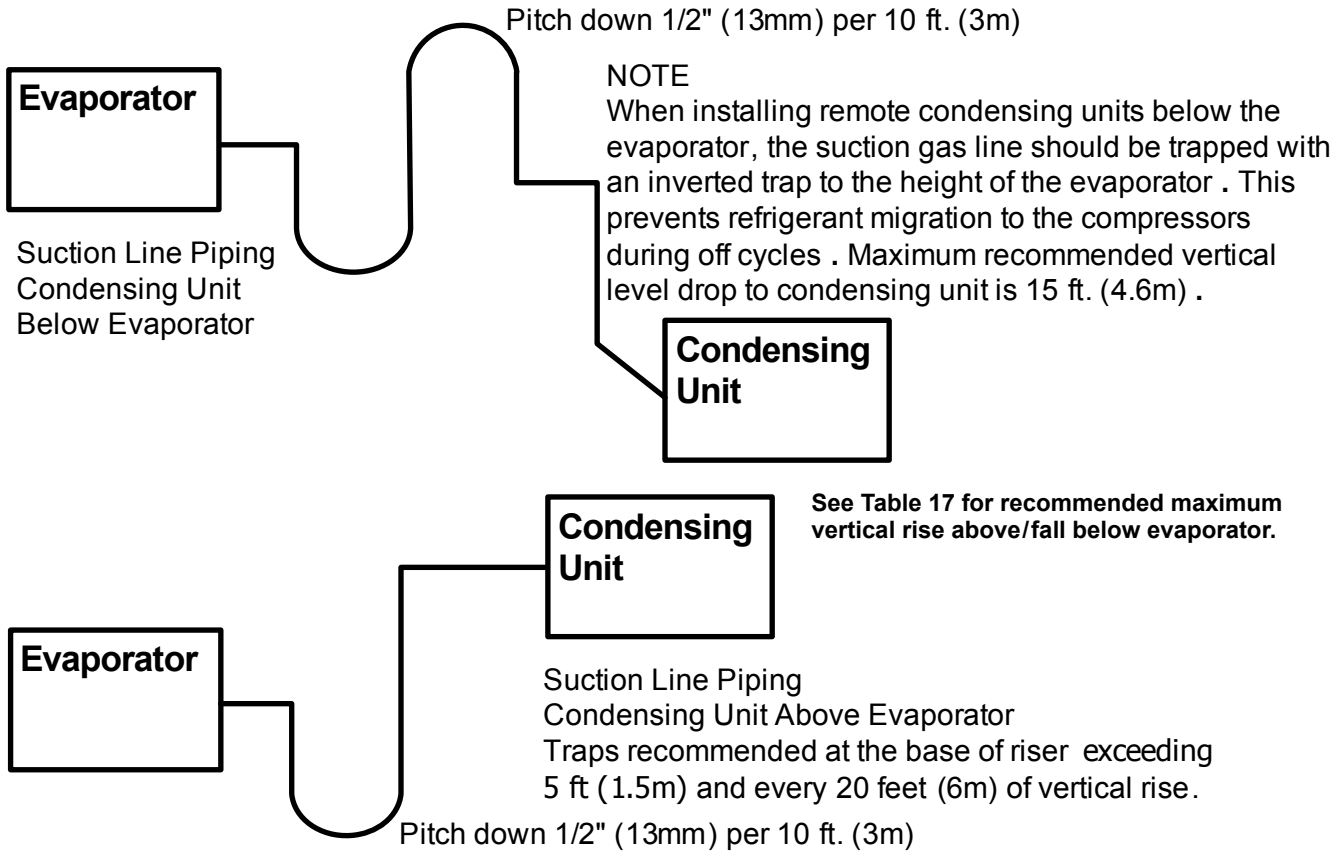
Line Size, in.	Length, ft. (m)	Charge R-407C, oz (kg)
3/8 liquid	15 (4.5)	5 (0.14)
	30 (9)	10 (0.28)
5/8 or 7/8 suction	15 (4.5)	5 (0.14)
	30 (9)	10 (0.28)

Table 19 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

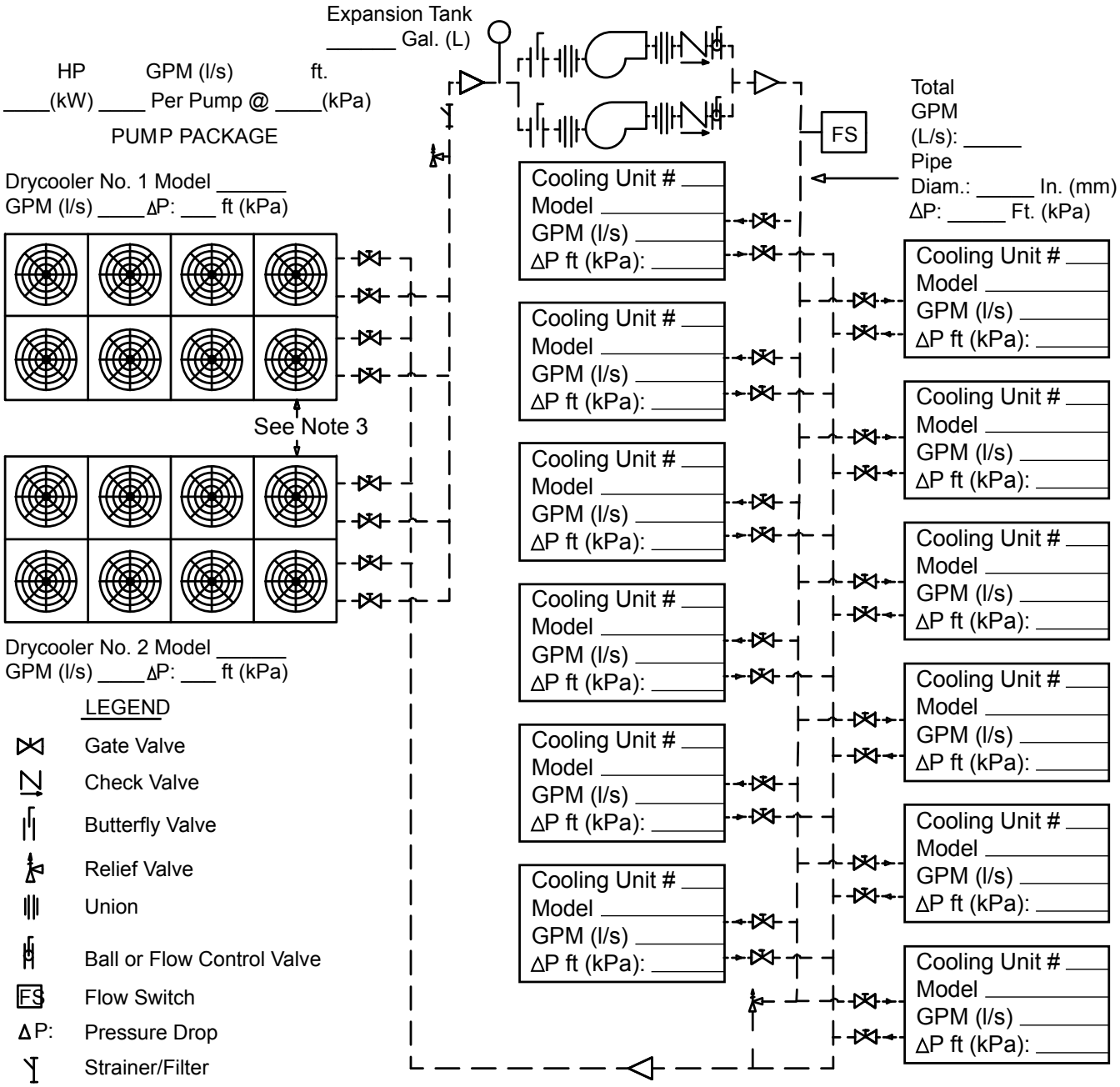
Figure 24 Refrigerant piping diagram



11.0 GLYCOL LOOP PIPING

Contact Emerson Application Engineering for assistance in choosing correct drycooler models. Refer to **Figure 25**.

Figure 25 Heat rejection loop, multiple drycoolers and multiple indoor units



Notes:
1. Pressure and temperature gauges (or ports for same) are recommended to monitor component pressure drops and performance.
2. Flow measuring devices, drain and balancing valves to be supplied by others and located as required.
3. See product literature for installation guidelines and clearance dimensions.
4. Drawing shows dual pump package. Alternate pump packages with more pumps may be considered; consult supplier

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12.0 MODEL NUMBER NOMENCLATURE—ALL SYSTEMS

Figure 26 Model number nomenclature—Self-contained, air-cooled units

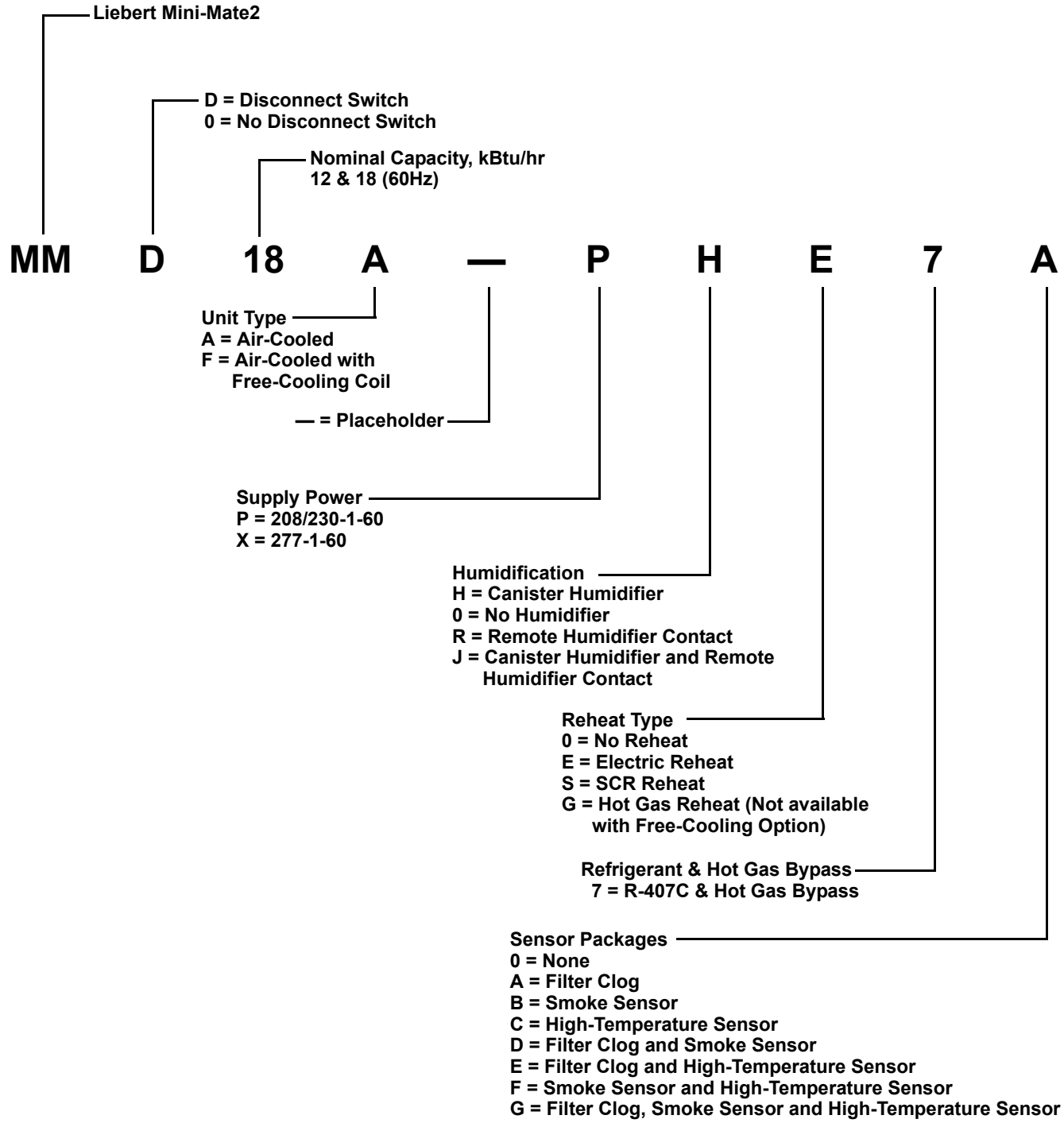


Figure 27 Model number nomenclature—Split evaporator air-cooled units

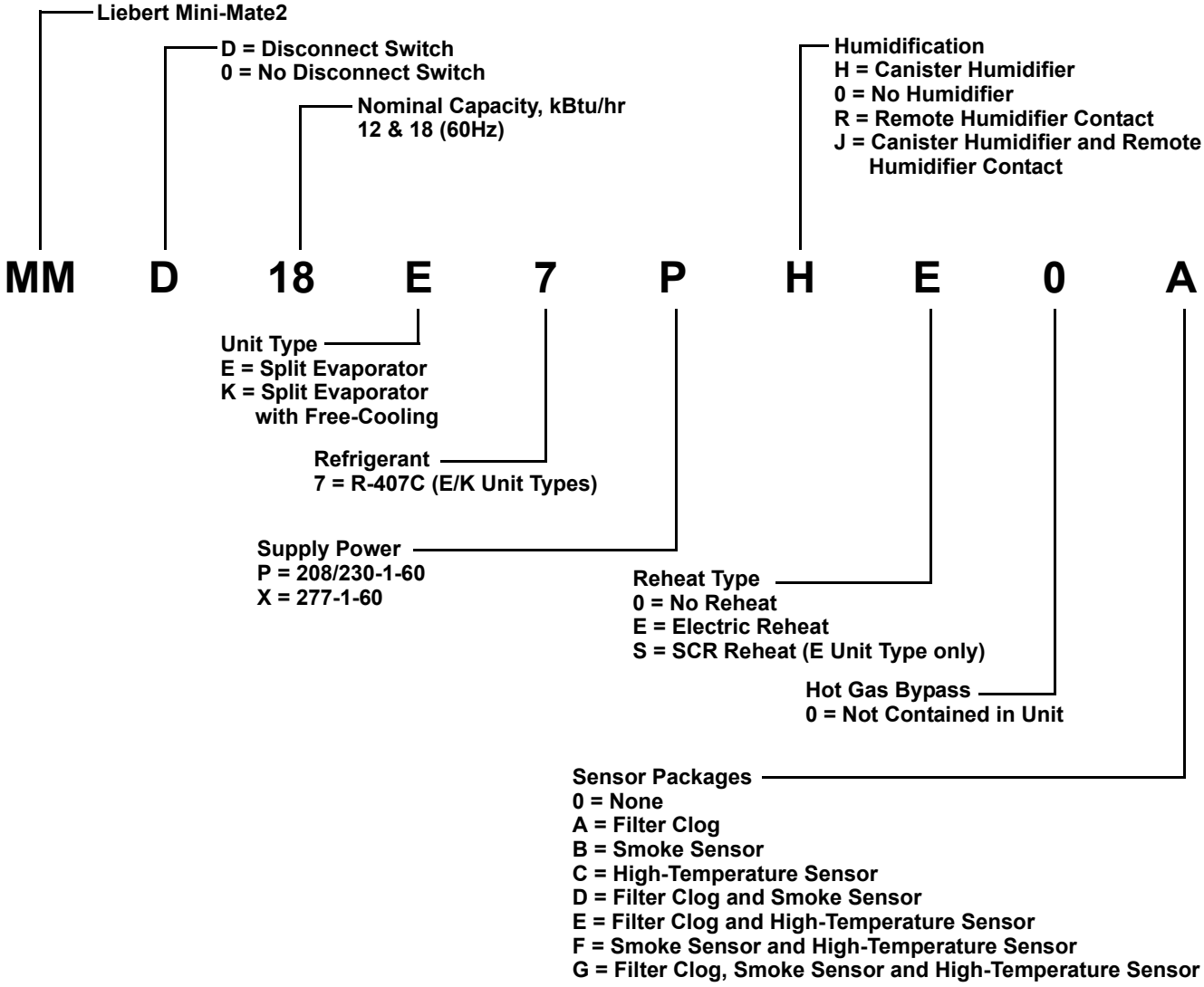


Figure 28 Model number nomenclature—Outdoor air-cooled prop fan condensing units

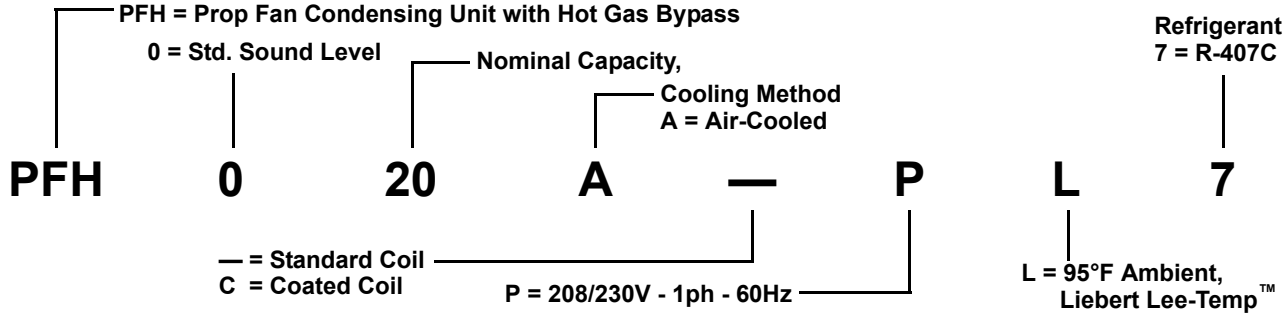


Figure 29 Model number nomenclature—Self-contained, water/glycol-cooled units

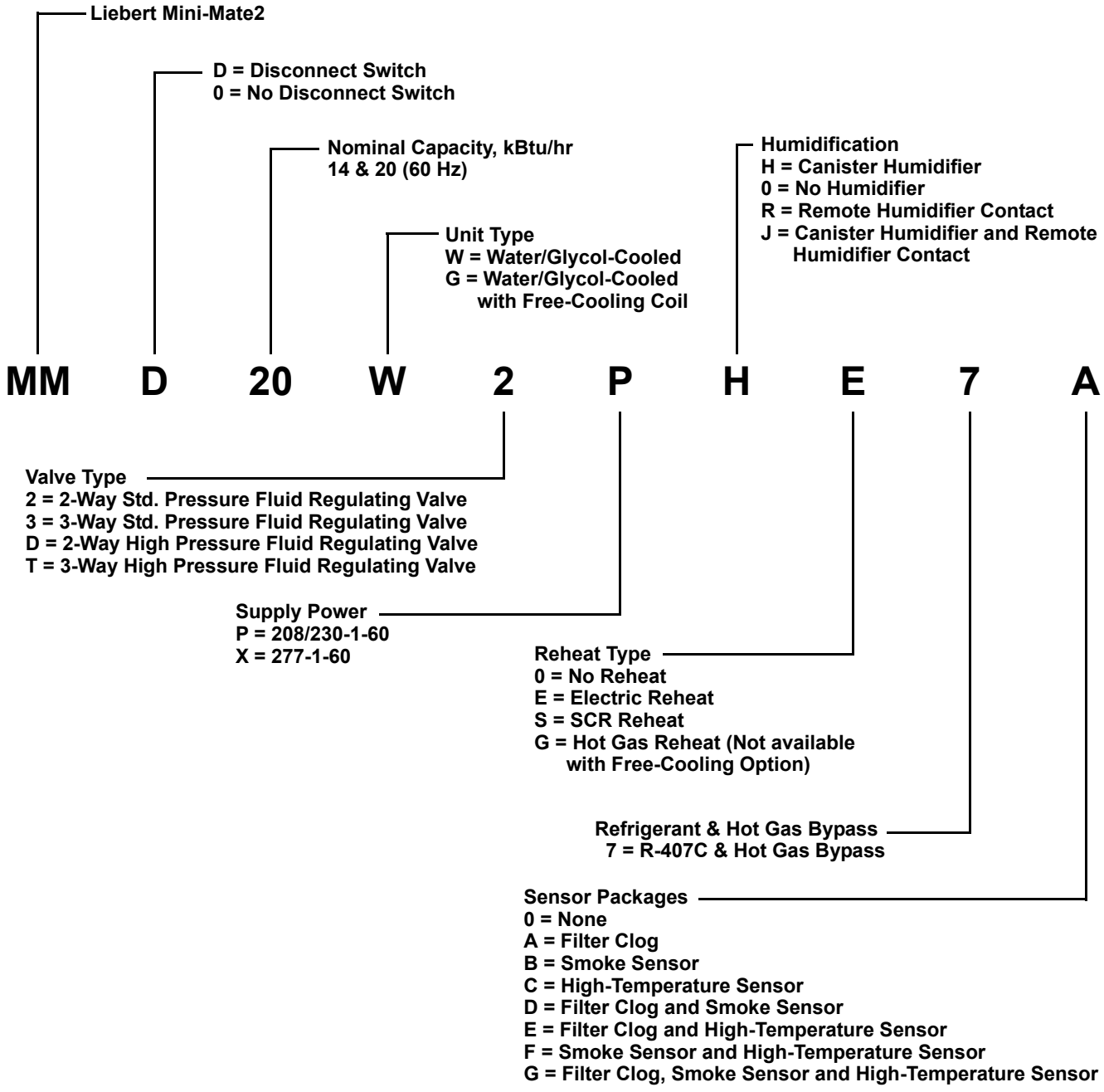
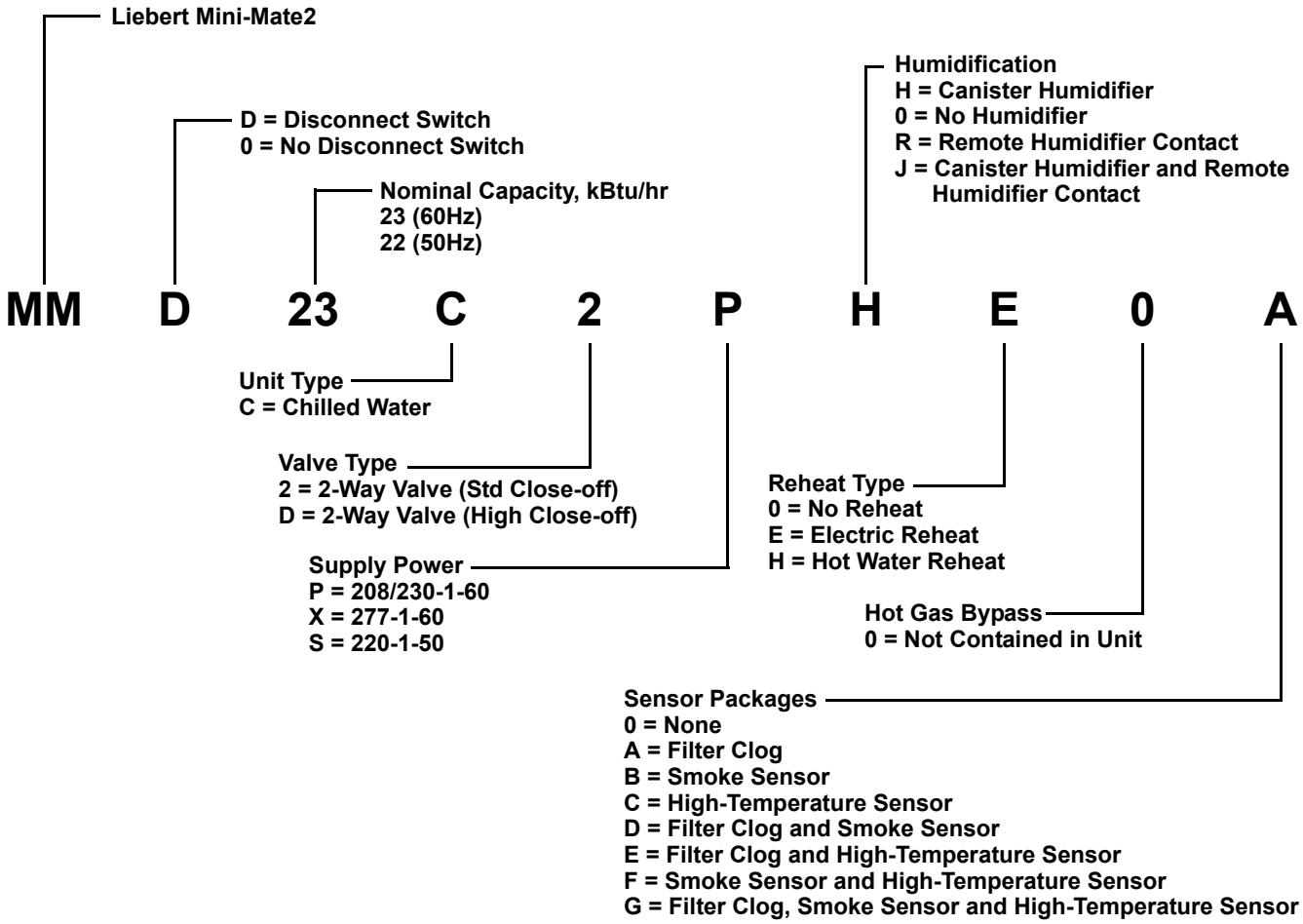


Figure 30 Model number nomenclature—Chilled water units



GUIDE SPECIFICATIONS FOR LIEBERT MINI-MATE2—1- AND 1.5-TON SYSTEMS

1.0 GENERAL

1.1 Summary

These specifications describe requirements for an environmental control system. The system shall be designed to control temperature and relative humidity conditions within the room.

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

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.

The system model number(s) shall be:

Self-Contained Unit:_____
Split Evaporator: _____
Condensing Unit: _____
Chilled Water Unit:_____

1.2 Design Requirements

The environmental control system shall be a Liebert Mini-Mate2 factory assembled unit. On direct expansion models, the refrigeration system shall be self-contained or shall be split, with the compressor located in a remote air-cooled condensing unit.

The self-contained and split evaporator units shall be designed for above-dropped-ceiling installation and serviceable from the front and bottom of the system. Condensing unit for split system shall be designed for outdoor installation.

The system shall have a total cooling capacity of _____ Btu/hr (kW), and a sensible cooling capacity of _____ Btu/hr (kW), based on the entering air condition of _____°F (°C) dry bulb, and _____°F (°C) wet bulb.

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

1.3 Submittals

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

1.4 Quality Assurance

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

2.0 PRODUCT

2.1 Standard Features/All Systems

2.1.1 Cabinet Construction

The cabinet and chassis shall be constructed of heavy gauge galvanized steel and designed for easy installation and service access from front and bottom of unit only (water cooled units require end access). Mounting brackets shall be factory-attached to the cabinet. Internal cabinet insulation shall meet ASHRAE 62.1 requirements for Mold Growth, Humidity & Erosion, tested per UL 181 and ASTM 1338 standards.

2.1.2 Air Distribution

The air distribution system shall be constructed with a quiet, direct-drive fan assembly equipped with double-inlet blower, self-aligning ball bearings and lifetime lubrication. Fan motor shall be 1/5hp (149W), permanent-split capacitor, high efficiency type, equipped with two speeds for air flow modulation for precise dehumidification control. Dehumidification shall utilize the lower fan speed.

Air delivery shall be minimum ____ CFM (____ CMH) at high fan speed. For ducted applications air delivery shall be ____ CFM (____ CMH) at _____ " (_____mm) external static pressure.

System shall be suitable for plenum or ducted air distribution. Refer to **2.4.2 - Supply and Return Grille**, **2.4.3 - Filter Box and Duct Kit** and **2.4.4 - Duct Collar Kit**.

2.1.3 Microprocessor Control

The control system shall be microprocessor-based, factory-wired into the system and tested prior to shipment. The wall-mounted control enclosure shall include a 2-line by 16-character LCD providing continuous display of operating status and alarm condition. An 8-key membrane keypad for setpoint/ program control, fan speed selection and unit On/Off shall be located below the display. The control display shall be field-wired to the control board using 4-conductor field-supplied thermostat wire.

Temperature and humidity sensors shall be located in the wall box, which shall be capable of being located up to 300 ft (91.4m) from the evaporator unit.

2.1.3.1 Monitoring

The LCD shall provide On/Off indication, operating mode indication (cooling, heating, humidifying, dehumidifying), fan speed indication and current day, time, temperature and humidity (if applicable) indication. The monitoring system shall be capable of relaying unit operating parameters and alarms to the Liebert SiteScan™ monitoring system.

2.1.3.2 Control Setpoint Parameters

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

2.1.3.3 Unit Controls

2.1.3.3.1 Compressor Short-Cycle Control

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

2.1.3.3.2 Common Alarm and Remote On/Off

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

2.1.3.3.3 Setback Control

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

2.1.3.3.4 Temperature Calibration

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

2.1.3.3.5 System Auto Restart

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

2.1.4 Alarms

2.1.4.1 Unit Alarm

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

- High Temperature
- Low Temperature
- High Humidity
- Low Humidity
- High Water Alarm - Lockout Unit Operation
- High Head Pressure
- Loss of Power
- Compressor Short Cycle

2.1.4.2 Custom Alarms (2x)

- Humidifier Problem
- Filter Clog
- Water Detected
- Smoke Detected
- Custom Alarm #1
- Custom Alarm #2

User-customized text can be entered for the two (2) custom alarms.

2.1.4.3 Alarm Controls

Each alarm (unit and custom) shall be separately enabled or disabled, selected to activate the common alarm (except for high head pressure).

2.1.4.4 Audible Alarm

The audible alarm shall annunciate any alarm that is enabled by the operator.

2.1.4.5 Common Alarm

A programmable common alarm shall be provided to interface user selected alarms with a remote alarm device.

2.1.4.6 Remote Monitoring

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

2.2 Chilled Water System Components

2.2.1 Chilled Water Control Valve

The control valve shall be a solenoid-operated, slow-close, spring-return type to reduce water hammer. Design pressure shall be 300psi (2067kPa) static pressure, with a maximum close-off pressure of 25psi (172kPa).

(Option) The control valve shall be a motorized, slow-close, non-spring-return type to reduce water hammer. Design pressure shall be 300psi (2067kPa) static pressure, with a maximum close-off pressure of 100psi (689kPa).

2.2.2 Chilled Water Coil

The cooling coil shall have a minimum of 2.4 sq.ft. (0.23 sq.m) face area, 2 rows deep. It shall be constructed of copper tubes and aluminum fins and have a maximum face velocity of ____ ft. per minute (___ m/s) at ____ CFM (____ CMH). The coil shall be supplied with 45°F (7.2°C) entering water temperature. The coil shall be supplied with _____ GPM (l/s) of chilled water and the pressure drop shall not exceed _____ PSI (kPa). The coil assembly shall be mounted in a condensate drain pan with an internally trapped drain line. The evaporator drain pan shall include a factory-installed float switch to shut down the evaporator upon high water condition.

2.2 Direct Expansion Self-Contained System Components

2.2.1 Refrigeration System

The refrigeration system shall consist of a (scroll) (rotary) compressor with vibration isolating grommets, evaporator coil, condenser coil, externally equalized thermostatic expansion valve, high pressure safety switch, filter drier, hot gas bypass circuit, factory R-407C refrigerant charge and externally equalized expansion valve. Hot gas bypass shall be provided to reduce compressor cycling and optimize performance under low load conditions.

2.2.2 Evaporator Coil

The evaporator coil shall have 2.4 sq.ft. (0.23 sq.m) face area, ____ rows deep. It shall be constructed of copper tubes and aluminum fins and have a maximum face velocity of ___ ft. per minute (____ m/s) at ___ CFM (____ CMH). The coil shall be provided with a condensate drain pan with an internally trapped drain line. The evaporator drain pan shall include a factory-installed float switch to shut down the evaporator upon high water condition.

2.2.3 Air-Cooled Condenser Coil

The air-cooled condenser section shall contain a factory mounted and piped condenser coil constructed of copper tubes and aluminum fins. No piping, brazing, dehydration or charging shall be required. The condenser coil shall be factory mounted within the unit cabinet.

2.2.3.1 Air-Cooled Condenser Fan

A factory-supplied condenser fan shall be field-mounted to the end of the evaporator cabinet. The system shall be provided with a fan speed control system to permit operation at -20°F (-28.9°C) inlet ambient air temperature and sized to provide full rated cooling capacity at 95°F (35°C) entering air from plenum space. The centrifugal condenser fan shall deliver ____CFM (____ CMH) at ____inches (___mm) external static pressure at maximum speed.

Condenser fan electrical and refrigerant pressure connections shall be field attached to the cooling chassis using factory provided wiring harness and capillary tube/fitting.

2.2.3 Water/Glycol-Cooled Condenser

The water/glycol-cooled condenser section shall contain a factory-mounted and piped coaxial condenser constructed of steel and copper tubing. No piping, brazing, dehydration or charging of refrigerant shall be required. The condenser coil shall be factory-mounted within the unit cabinet.

The total system pressure drop of the water/glycol system shall be_____ ft. of water (kPa) and a flow rate of _____ GPM (l/s) with _____ °F (°C) entering water/glycol temperature.

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

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

2.2 Direct Expansion Split System Components

2.2.1 Evaporator Unit

The evaporator section shall include evaporator coil, thermostatic expansion valve and filter drier. The evaporator coil shall have 2.4 sq.ft. (0.23 sq.m) face area, __ rows deep. It shall be constructed of copper tubes and aluminum fins and have a maximum face velocity of ___ ft. per minute (____ m/s) at ___ CFM (____ CMH). An externally equalized thermostatic expansion valve shall control refrigerant flow. The evaporator coil shall be factory-charged with R-407C refrigerant and sealed.The coil shall be provided with a condensate drain pan, with an internally trapped drain line. The evaporator drain pan shall include a factory-installed float switch to shut down the evaporator upon high water condition.

2.2.2 Outdoor Air-Cooled Prop Fan Condensing Unit

Condensing unit components shall include a condenser coil, a direct-drive propeller-type fan, a (scroll) (reciprocating) compressor with vibration-isolating grommets, high pressure switch, Liebert Lee-Temp™ receiver and head pressure control valve, hot gas bypass system and liquid line solenoid valve. The condenser coil shall be constructed of copper tubes and aluminum fins.

A hot gas bypass system shall be provided to reduce compressor cycling and improve operation under low load conditions.

All components shall be factory-assembled, charged with R-407C refrigerant, sealed and be capable of being connected to the evaporator section using pre-charged refrigerant line sets. No internal piping, brazing, dehydration or charging shall be required. Condensing unit shall be designed for 95°F (35°C) ambient and be capable of operation to -30°F (-34.4°C).

(Option) The coils shall be phenolic-coated for extended coil life in coastal areas.

2.3 Factory-Installed Options/All Cooling Units

2.3.1 Steam Generating Humidifier

The environmental control system shall be equipped with a steam generating humidifier that is controlled by the microprocessor control system. It shall be complete with disposable canister, all supply and drain valves, 1" (25.4mm) air gap on fill line, inlet strainer, steam distributor and electronic controls. The need to change canister shall be annunciated on the microprocessor wall box control panel. The humidifier shall have a capacity of 2.5 lb/hr (1.1 kg/h). An LED light on the humidifier assembly shall indicate cylinder full, overcurrent detection, fill system fault and end of cylinder life conditions.

2.3.2 Electric Reheat

The electric reheat shall be low-watt density, 304/304 stainless steel, finned-tubular and shall be capable of maintaining room dry bulb conditions when the system is calling for dehumidification. The reheat section shall include a UL-approved safety switch to protect the system from overheating. The capacity of the reheat coils shall be _____ Btu/hr (kW), with input power of _____ V, controlled in one stage.

2.3.3 Hot Water Reheat

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

2.3.4 SCR Electric Reheat

The electric reheat shall be low-watt density, 304/304 stainless steel, finned-tubular and shall be capable of maintaining room dry bulb conditions when the system is calling for dehumidification. The reheat section shall include a UL-approved safety switch to protect the system from overheating.

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

2.3.5 Hot Gas Reheat

The complete hot gas reheat system shall include a copper tube, aluminum fin coil, three-way solenoid valve, and refrigerant check valve. The capacity of the coil shall be _____ Btu/hr (kW). Hot gas reheat shall operate only during dehumidification and capacity shall be offset by cooling coil capacity. Hot gas reheat shall not be used for space heating.

2.3.6 Disconnect Switch, Non-Locking

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

2.3.7 High-Temperature Sensor

The high-temperature sensor shall immediately shut down the system when high temperatures are detected. The high-temperature sensor shall be mounted with the sensing element in the return air.

2.3.8 Smoke Sensor

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

2.3.9 Filter Clog Switch

The filter clog switch senses pressure drop across the filters and shall annunciate the wall box display upon reaching the adjustable setpoint.

2.3.10 Free-Cooling/Dual Cooling Source

A free-cooling coil shall be integral to the evaporator cabinet, and shall be constructed of copper tubes and aluminum fins. The coil shall be rated at _____ Btu/hr (kW) sensible cooling capacity with a 45°F (22°C), ___% glycol solution. The coil shall require _____ GPM (l/s) and the total unit pressure drop shall not exceed _____ feet of water (kPa) when in the free cooling mode. Free-cooling shall be activated by an adjustable aquastat, and shall include a factory-piped, three-way valve and separate supply and return piping.

Coil is designed for closed-loop applications using properly treated and circulated fluid. A field-supplied heat exchanger system is required to prevent premature corrosion if applied to open water tower loop. Not available with SCR reheat.

2.4 Ship-Loose Accessories

2.4.1 Remote Sensors

The unit shall be supplied with remote temperature and humidity sensors. The sensors shall be connected to the unit by a 30 ft. (9m) shielded cable.

2.4.2 Supply and Return Grille

A factory-supplied supply and return grille kit shall be provided for supply and return air delivery through a 2' x 4' (0.6m x 0.6m) T-bar ceiling grid. Kit shall include an air baffle plate, supply grille, hinged return grille, 1" x 20 x 20" (25.4mm x 508mm x 508mm) MERV 8 (ASHRAE 52.2-2007) filter and mounting frame.

2.4.3 Filter Box and Duct Kit

A return air filter box shall be provided with hinged filter access, and 1" (25.4 mm) duct flange. A 1" (25.4 mm) duct flange shall also be provided for air discharge. Filters shall be 1" x 16" x 20" (25.4mm x 406mm x 508mm) MERV 8 per ASHRAE 52.2-2007.

2.4.4 Duct Collar Kit

1" (25.4 mm) duct flanges shall be provided for each of the discharge and return air openings. Filters and filter box must be field supplied.

2.4.5 Condensate Pump

The condensate pump shall have the capacity of _____ GPH (___ l/h) at ___ ft. head (___ kPa). It shall be complete with integral float switch, discharge check valve, pump, motor assembly and reservoir. A secondary float switch shall be provided to permit field wiring to the unit control to shut down the evaporator upon a high water level condition.

2.4.6 Refrigerant Line Sets

Pre-charged refrigerant line sets shall be provided by Emerson in proper lengths for application to air-cooled split systems. Line set length shall be [(15 ft. (4.5m)) (30 ft. (9m))], not to exceed 45 ft. (13.5m) in total length.

2.4.7 Refrigerant Line Sweat Adapter Kit

Provide a sweat adapter kit to permit field brazing of refrigerant line connections for application to air-cooled split systems.

2.4.8 Liebert SiteScan™ Site Monitoring System

A Liebert SiteScan Site Monitoring System Model _____ shall be provided for remote monitoring of the Liebert Mini-Mate2 unit and monitoring of other Liebert support equipment. The Liebert SiteScan shall have the capability to monitor and change (at the user direction) the temperature and humidity setpoints and sensitivities of each unit. The printer shall provide the user with chronological alarm information. It shall also be capable of being programmed to print out environmental conditions or operating modes at each unit.

Provide indicated quantities of the following:

- Leak Detection System(s) Model
- Remote Monitor(s) Model
- Auto-changeover Control(s) Model

2.4.9 Drycooler

The Liebert drycooler shall be a low-profile, direct-drive propeller fan-type air-cooled unit. The drycooler shall be constructed with an aluminum cabinet and a copper-tube aluminum fin coil and single direct drive fan. All electrical connections and controls shall be enclosed in an integral, NEMA 3R rated electrical panel section of the drycooler. The drycooler shall be quiet and corrosion resistant. The drycooler shall be designed for _____°F (___°C) ambient.

2.4.10 Glycol Pump Package

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

3.0 EXECUTION

3.1 Installation of Air Conditioning Unit

3.1.1 General

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

3.1.2 Electrical Wiring

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

3.1.3 Piping Connections

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

3.1.4 Supply and Drain Water Piping

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

3.1.5 Field-Supplied Pan

A field-supplied pan with drain shall be installed beneath ducted cooling units.

3.2 Field Quality Control

Startup air conditioning unit in accordance with manufacturer's start up instructions. Test controls and demonstrate compliance with requirements.

NOTES

Ensuring The High Availability
Of Mission-Critical Data And Applications.

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