



HEDRICK ASSOCIATES
 2360 Oak Industrial Dr NE
 Grand Rapids, MI 49505
 P(616)454-1218 F(616)454-5336
www.hedrickassoc.com



Submittal Drawings and Information

MICHIGAN DIT LSHC – LIEBERT PDX

PDX Cooling System

Submittal Information		
Submitted To	ENGINEERING APPLICATIONS, INC – BRIAN KNOX	
Project Specification Section	M0.1	
Date	11/25/15	
Tag#	AC23	CND23
Model#	PX011	MCS028E
Quantity	1	1
Ref. Proposal#	N/A	
Submittal Provided By	KARL HUFFMAN / ALEX COLLINS	



Project Name: MICHIGAN DIT LSHC – LIEBERT PDX

Date: 11/25/15

Submitted By: KARL HUFFMAN / ALEX COLLINS

Liebert PDX Unit Model: PX011 **Qty:** 1

Liebert MC Condenser Model: MCS028E **Qty:** 1

Electrical Supply Requirements

Evaporator Unit Module: 460 Volt, 3 Phase, 60 Hertz, 10.4 Full Load Amps, 20 Amps Overcurrent Protection Device

Condensing Unit Module: 460 Volt, 3 Phase, 60 Hertz, 1.4 Full Load Amps, 15 Amps Overcurrent Protection Device

65,000 Amp Short Circuit Rating

Locking Disconnect

Indoor Net Capacity Data

Total Capacity: 37.5 kBtuh

Sensible Capacity: 34.1 kBtuh

75°F drybulb, 45% Relative Humidity

Econ-O-Coil Net Capacity Data

Total Capacity: 37.5 kBtuh

Sensible Capacity: 34.1 kBtuh

75°F drybulb, 45% Relative Humidity

45°F EWT, 8.1 GPM, 4.3 ft of water

ELECTRICAL SUPPLY REQUIREMENTS

HEAT REJECTION CAPACITY DATA

Design ambient outdoor air temperature of 95°F

STANDARD FEATURES

- Microchannel aluminum coil(s)
- Integrated fan motor/blade/guard assembly
- Electronic control of fan speed
- Factory wired and mounted NEMA 3R electrical panel/box
- Fused, locking and lockable electrical disconnect switch
- Variable fan speed motors
- Short Circuit Current Rating of 65,000 Amps, rms
- Factory wired and mounted NEMA 3R electrical panel/box

CABINET

- Bright aluminum exterior panels
- Bright aluminum NEMA 3R box containing electrical panel
- Bright aluminum legs

CONTROL/COMMUNICATION/FAN

- Variable speed EC fan
- Premium electronic control & communication board
- CANbus connection terminals for communication with iCOM

REFRIGERANT & CIRCUITS

- R-410A set points
- Single refrigerant circuit

Liebert PDX/PCW Detailed Description

Indoor Cabinet

Air Flow Configuration :

Downflow

Front Air Discharge

Color: RAL 7021,Black Gray Matte

Indoor Evaporator Section

Cooling System Type : Dual-Cool (air-cooled + free cooling)

Refrigerant: R410A

Compressor

Digital Scroll
Thermal Expansion Valve
CrankCase Heater

Fan and Motor

EC Fans
1.3 Hp
Air Volume: 2000 CFM
External Static Pressure: 0.2 Inches of Water

Filter

Filter Rating: MERV 8 per ASHRAE 52.2
Filter Clog Alarm

Control, Sensor, Monitoring

Integrated Controls and Color Touch Screen User Interface
Display Language is English
Supply Air Sensor
Common Alarm Contact

Optional Equipment

Dual-float condensate pump
One Remote Shut Down Contact
Three Alarm Contacts

Electrical Supply Requirements

Condensate pump

The dual-float condensate pump is complete with integral primary and secondary float switches, pump, motor assembly and reservoir. The secondary float sends a signal to the local alarm and shut down the unit upon high water condition.

Locking Disconnect Switch

A manual disconnect switch is mounted in the electrical panel and be capable of disrupting the flow of power to the unit operation from the outside of the unit. The electric panel compartment is accessible only with the switch in the Off position. The electric panel is conveniently located behind the Liebert iCOM® display door for quick access. The molded case switch disconnect models contain separate main fuses. Units with fused disconnect have main fuses within the disconnect.

Short Circuit Current Rating (SCCR)

All 60 Hz units with voltages of 575, 460, 208, 230, 380 are manufactured with components necessary to provide a 65,000 Amp RMS Short Circuit Current Rating for the entire unit.

Cabinet

Cabinet Description

The exterior panels are 20 gauge galvanized steel and powder coated with Black Gray Matte color paint to protect against corrosion. The double-wall constructed side panels separated with 1" (25.4mm) the 1-1/2 lb(0.68 kg) insulation from the airstream and increase unit rigidity. Front and side panels are captive, 1/4 turn fasteners. The cabinet is designed so that all components are serviceable and removable using the front and right sides of the unit. The front door can be opened for service without shutting off the system.

Indoor Evaporator Section

Cooling System

System Type

Dual Cool Air & CW

The dual-cooling (free-cooling) source system consists of an air-cooled system with the addition of a chilled water coil (Econ-O-Coil), a modulating control valve and a comparative temperature sensor. The system is able to function either as a modulating chilled water system or as a compressorized system, or a combination of both. The primary cooling mode is chilled water. The chilled water circuit is controlled by a two-way or three-way motorized ball valve and a comparative temperature sensor, to allow the use of primary chilled water cooling with the air-cooled system used as the back-up cooling source. The refrigeration circuit includes a liquid line filter drier, a refrigerant sight glass with moisture indicator, an externally equalized expansion valve, pressure safety switches, and a liquid line

solenoid valve. Switchover between the two cooling modes is performed automatically by the microprocessor control.

Refrigerant

The system is designed for use with R410A refrigerant, which meets the U.S. Clean Air Act for phaseout of HCFC refrigerants.

Compressor

Digital Scroll

The compressor is scroll-type with variable capacity operation from 20-100%, commonly known as a Digital Scroll. The compressor solenoid valve will unload the compressor to provide variable capacity operation. The controller engages and disengages the compressor on a 15 second control cycle. Includes a suction gas cooled motor, vibration isolators, internal thermal overloads, automatic reset high pressure switch, rotalock service valves, low pressure pressure transducer, crankcase heater, internal centrifugal oil pump and an operating speed of 3500 RPM at 60Hz. The crankcase heater and a discharge check valve is provided for additional system protection from refrigerant migration during Off cycles.

Coil description

The direct expansion tilted-slab cooling coil is constructed of copper tubes and hydrophilic coated aluminum fins. The hydrophilic coating significantly improves the speed of condensate drainage from the fins and provides superior water carryover resistance. One stainless steel condensate drain pan is provided.

Maximum System Pressure Rating

Fan and Motor

EC Fans

The unit is equipped with one plug fan: direct driven with backward curved blades and Electronically Commutated DC motors; commonly referred to as EC plug fans. The fan speed is variable and automatically regulated by the Liebert iCOM® control through all modes of operation. The fan has a dedicated motor, fault monitoring circuitry and speed controller which provides a level of redundancy. Both impellers are made of steel and balanced. This design uses less energy than standard centrifugal blowers by lowering motor kW. The EC Plug Fan uses 10-30% less energy on average than standard AC motors. The EC Plug Fan is located within the unit.

Air Flow Configuration

Downflow with front air discharge

The supply exits from the front of the unit. The EC plug fan is mounted in the bottom of the unit. The return air enters through the top of the unit

Filter

Filter Rating: MERV 8 per ASHRAE 52.2
Includes a Filter Clog Alarm

Control, Sensor, Monitoring

Liebert iCOM

The Liebert iCOM unit control is factory-set for Intelligent Control which uses 'fuzzy logic' and 'expert systems' methods. Proportional and Tunable PID are user selectable options. Internal unit component control includes the following: System Auto Restart, Sequential Load Activation, Hot Water Flush Cycles (if hot water coil is present), and Predictive Humidity Control. The control system and electronic circuitry is provided with self-diagnostics to aid in troubleshooting. The microcontroller board is diagnosed and reported as pass/not pass. Control inputs are indicated as on or off at the front monitor panel. Control outputs are able to be turned On or Off from the front monitor panel without using jumpers or a service terminal.

The display and housing are viewable while the unit panels are open or closed. The display is organized into three main sections: User Menus, Service Menus and Advanced Menus. The system displays user menus for: active alarms, event log, graphic data, unit view/status overview (including the monitoring of room conditions, operational status in % of each function, date and time), total run hours, various sensors, display setup, and service contacts. A password is required to make system changes within the service or advanced menus.

The Liebert iCOM control can activate an audible and visual alarm in event of any of the following conditions: High/Low Temperature, High/Low Humidity, Change Filters, Loss of Air Flow or Power, and four separate Custom Alarms.

Unit-to-Unit communication with other LiebertPDXPCW and two IntelliSlot communication card housings are included as standard.

Liebert iCOM Large Display

The standard user interface is the Large Graphical Display (320x240 pixels, backlit) which presents system information and allows all parameters to be viewed and adjusted. It features push-button navigation and operational status LEDs.

Supply Air Sensor

A factory installed and commissioned supply air sensor ships with the unit for sensor location in the field by others. The sensor is terminated on the Liebert iCOM unit controller terminal strip and the associated cable wiring is coiled within the unit for shipment. It is the responsibility of others to uncoil and locate the sensor in accordance with acceptable best practices and any local codes.

Common Alarm Contact

The common alarm contacts provide the customer with a set of normally open contacts for remote indication of unit alarms.

Optional Features

Unit with manual selector switch disconnect to allow dual power sources to unit and a center off position. Units will be marked with 65,000 Short Circuit Rating (SCCR).

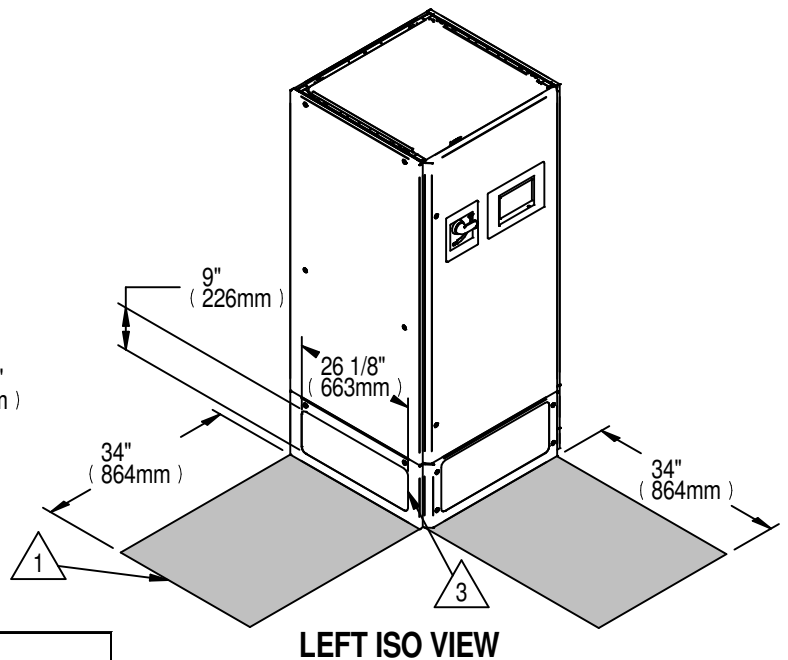
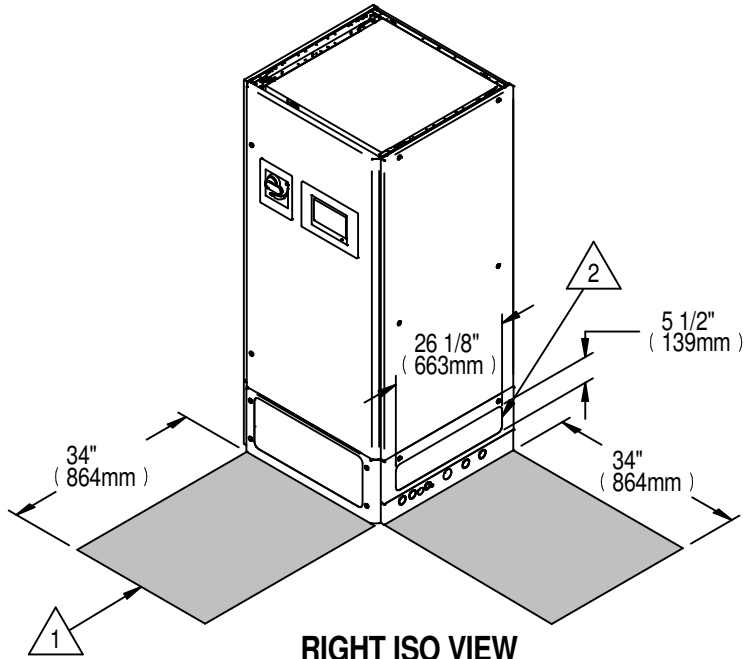
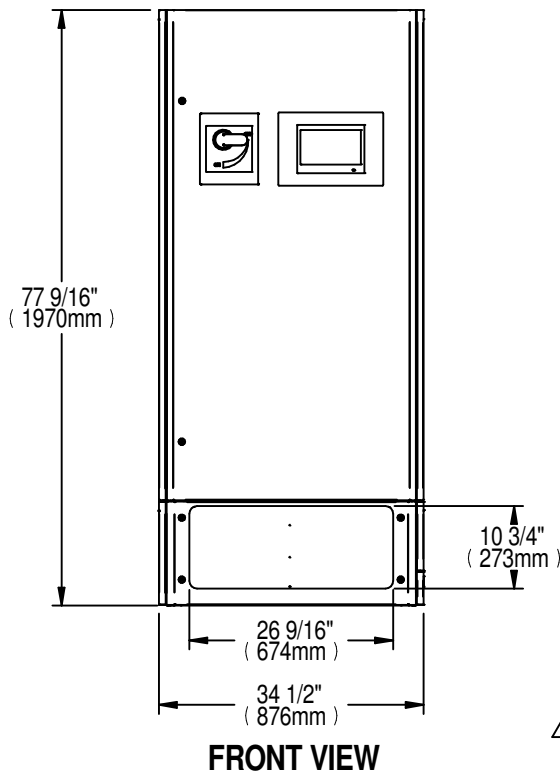
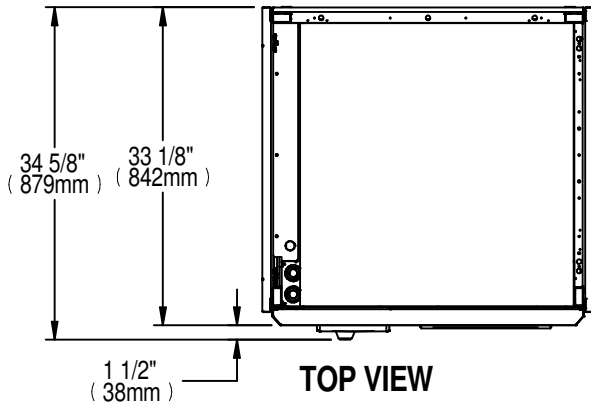
Liebert PDX with 80 amp switch – locking (panel interlocking) that includes the padlock device option.

Heat rejection unit powered from the indoor unit with single connection point to power heat rejection unit (30A Max OPD).



LIEBERT PDX/PCW

CABINET AND FLOOR PLANNING DIMENSIONAL DATA DOWNFLOW FRONT DISCHARGE MODELS



DRY WEIGHT lb (kg) APPROXIMATE			
Liebert PDX Model No.	PX011	PX018-023	PX029
Air Cooled	600 (272)	670 (304)	700 (317)
Air Cooled w/dual cool	700 (317)	750 (340)	790 (358)
Water/Glycol	620 (281)	690 (313)	720 (327)
Glycol or Water/Glycol w/dual cool	720 (326)	770 (349)	810 (367)
Liebert PCW Model No.	PW011	PW017	PW029
Chilled Water	575 (260)	600 (272)	650 (294)

Notes:

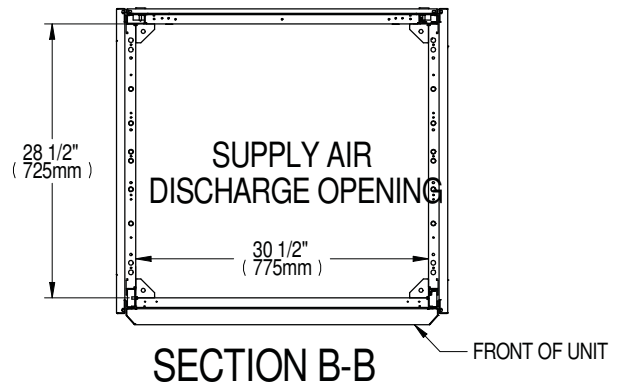
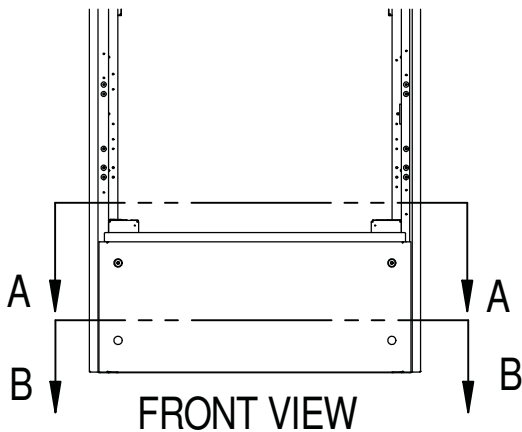
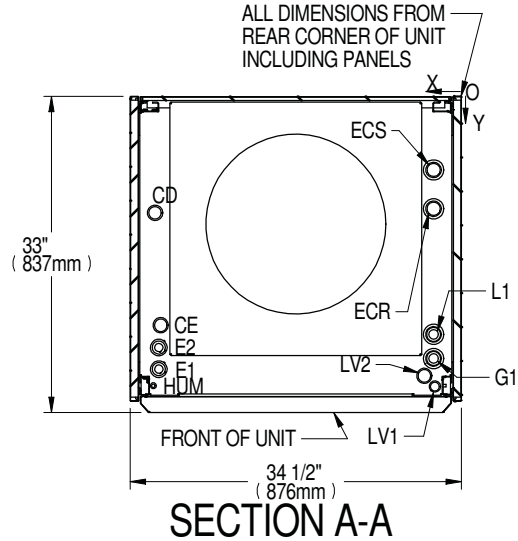
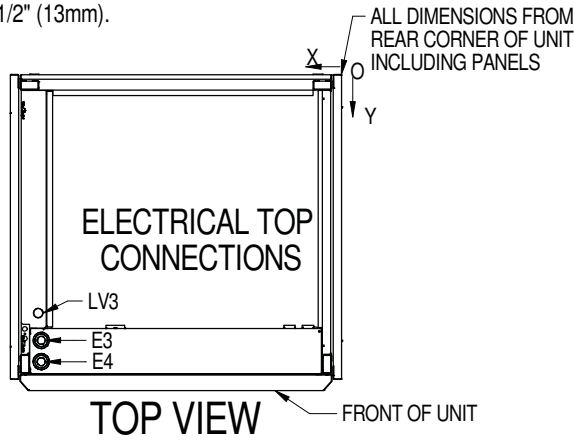
- 1. Shaded area indicates a recommended minimum clearance be provided for component access.
- 2. Optional opening for units with right side discharge or right and left side discharge.
- 3. Optional opening for units with left side discharge or right and left side discharge.



LIEBERT PDX

PRIMARY CONNECTION LOCATIONS DOWNFLOW AIR COOLED MODELS

NOTE: Drawing not to scale.
Tolerance on
all piping dimensions
is $\pm 1/2"$ (13mm).



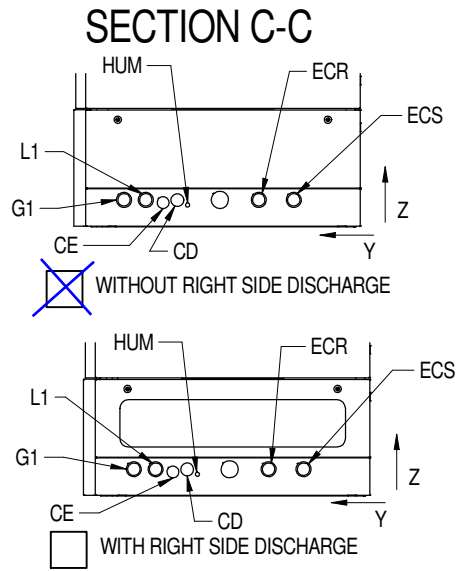
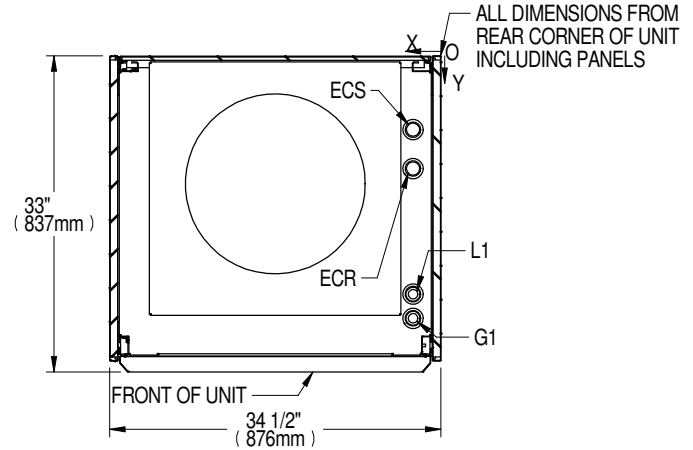
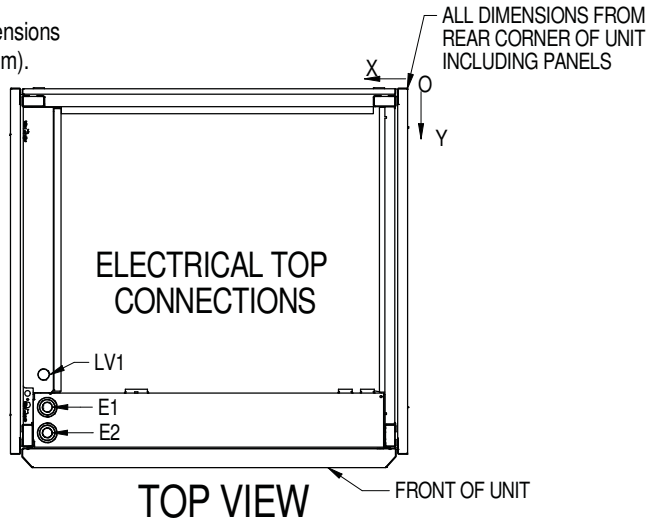
POINT	DESCRIPTION	X	Y	CONNECTION SIZE / OPENING		
				PDX011	PDX018, PDX023	PDX029
L1	LIQUID LINE SYSTEM 1	2-7/8" (73mm)	24-3/4" (630mm)	3/8" (10mm)	1/2"	5/8"
G1	HOT GAS DISCHARGE 1	2-7/8" (73mm)	27-3/8" (694mm)	1/2" (13mm)	5/8"	7/8"
CD	CONDENSATE DRAIN*	32" (811mm)	12-1/8" (309mm)	3/4"		
CE	CONDENSATE ELECTRICAL	31-1/4" (796mm)	23-3/4" (606mm)	1-1/2"		
HUM	HUMIDIFIER SUPPLY LINE	32" (815mm)	30-1/8" (766mm)	1/4"		
ECS	ECON-O-COIL SUPPLY **	2-7/8" (73mm)	7-5/8" (195mm)	7/8" (23mm)	1-1/8"	
ECR	ECON-O-COIL RETURN **	2-7/8" (73mm)	11-3/4" (298mm)	7/8" (23mm)	1-1/8"	
E1	ELECTRICAL CONN. (HIGH VOLT) BOTTOM	31-1/2" (801mm)	28-3/8" (722mm)	7/8", 1-3/8", 1-3/4"		
E2	ELECTRICAL CONN. (HIGH VOLT) BOTTOM	31-1/2" (801mm)	26-1/8" (665mm)	7/8", 1-3/8", 1-3/4"		
E3	ELECTRICAL CONN. (HIGH VOLT) TOP	31" (788mm)	27-3/4" (704mm)	7/8", 1-3/8", 1-3/4"		
E4	ELECTRICAL CONN. (HIGH VOLT) TOP	31" (788mm)	30" (760mm)	7/8", 1-3/8", 1-3/4"		
LV1	ELECTRICAL CONN. (LOW VOLT) BOTTOM	2-3/4" (70mm)	30-1/4" (768mm)	1-1/8"		
LV2	ELECTRICAL CONN. (LOW VOLT) BOTTOM	3-7/8" (98mm)	29-1/8" (740mm)	1-1/2"		
LV3	ELECTRICAL CONN. (LOW VOLT) TOP	31-5/8" (802mm)	24-7/8" (631mm)	1"		

* Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with all local codes.
** Supplied on Dual Cooling Systems only (4 pipe system)



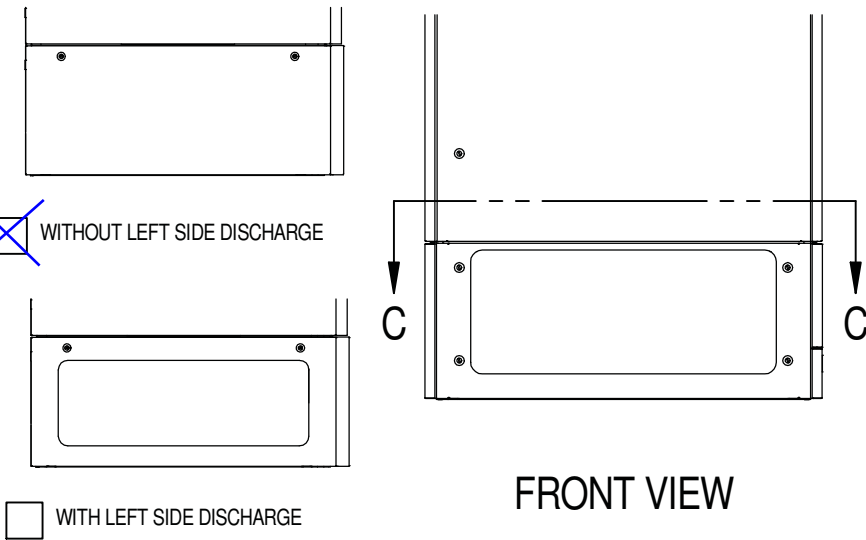
PRIMARY CONNECTION LOCATIONS DOWNFLOW FRONT DISCHARGE AIR COOLED MODELS

NOTE: Drawing not to scale.
Tolerance on all piping dimensions is $\pm 1/2"$ (13mm).



Notes:

1. Pipes at various heights to allow for tube cutter to be used. Will require stub tubes and elbows for connection at these locations.
2. Humidifier will need to be routed through this opening to the connection at the left hand side of the unit.

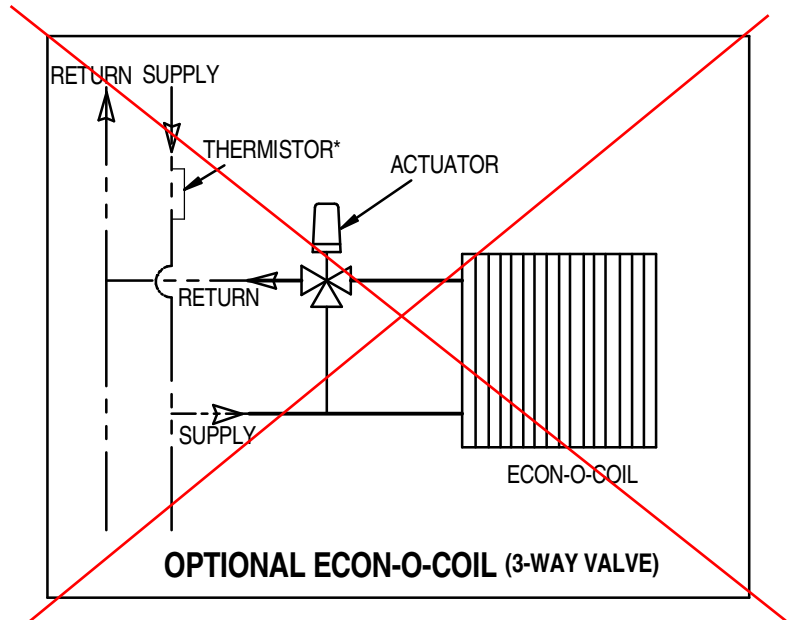
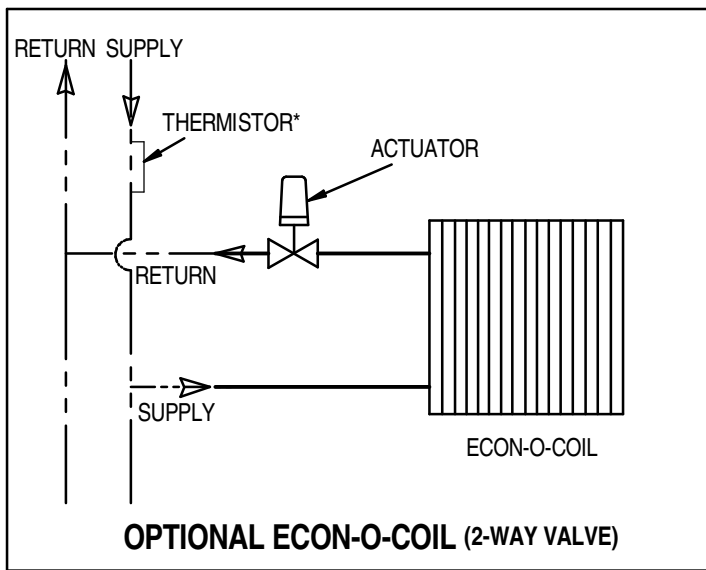


POINT	DESCRIPTION	X	Y	Z	CONNECTION SIZE / OPENING		
					PDX011	PDX018, PDX023	PDX029
L1	LIQUID LINE SYSTEM 1	2-7/8" (73mm)	24-3/4" (630mm)	3" (76mm)	3/8" (10mm)	1/2"	5/8"
G1	HOT GAS DISCHARGE 1	2-7/8" (73mm)	27-3/8" (694mm)	3" (76mm)	1/2" (13mm)	5/8"	7/8"
CD	CONDENSATE DRAIN*		12-1/8" (309mm)	3" (76mm)	3/4"		
CE	CONDENSATE ELECTRICAL		23-3/4" (606mm)	2-3/4" (70mm)	1-3/8"		
HUM	HUMIDIFIER SUPPLY LINE		30-1/8" (766mm)	2-1/2" (64mm)	1/4"		
ECS	ECON-O-COIL SUPPLY **	2-7/8" (73mm)	7-5/8" (195mm)	3" (76mm)	7/8" (23mm)	1-1/8"	
ECR	ECON-O-COIL RETURN **	2-7/8" (73mm)	11-3/4" (298mm)	3" (76mm)	7/8" (23mm)	1-1/8"	
E1	ELECTRICAL CONN. (HIGH VOLT) TOP	31" (788mm)	27-3/4" (704mm)		7/8", 1-3/8", 1-3/4"		
E2	ELECTRICAL CONN. (HIGH VOLT) TOP	31" (788mm)	30" (760mm)		7/8", 1-3/8", 1-3/4"		
LV1	ELECTRICAL CONN. (LOW VOLT) TOP	31-5/8" (802mm)	24-7/8" (631mm)		1"		

* Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with all local codes.
** Supplied on Dual Cooling Systems only (4 pipe system)

LIEBERT PDX OPTIONAL PIPING SCHEMATICS

OPTIONAL ECON-O-COIL SCHEMATICS



————— FACTORY PIPING
- - - - - FIELD PIPING

* SUPPLIED WITH 10 FEET EXTRA THERMISTOR WIRE FOR INSTALLATION ON FIELD SUPPLY LINE.

NOTE: 1) PLACE THERMISTOR IN LOCATION WHERE FLOW IS ALWAYS PRESENT.
2) THERMISTOR MUST BE LOCATED OUT OF THE SUPPLY AIR STREAM.



ELECTRICAL FIELD CONNECTIONS UPFLOW & DOWNFLOW MODELS

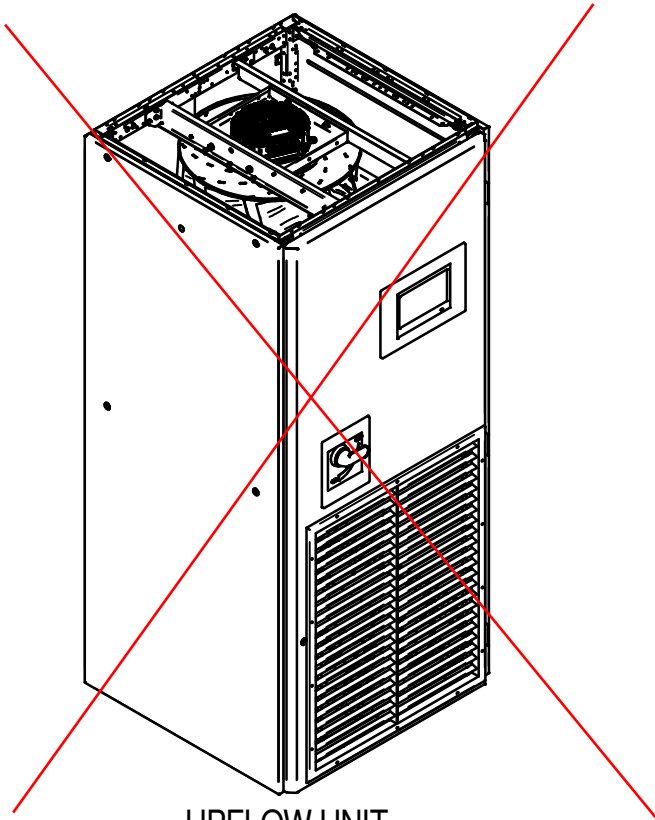
1. **High Voltage Entrance.** Supplied on top and bottom of electric box. Knockout size $\varnothing 1.75$ in (44.5mm).
2. **Low Voltage Entrance.** $\varnothing 1.375$ in. (34.9mm) hole located on bottom of Electric Box.
3. **Three phase Electric Service and earth ground.** Field supplied.
4. **Three phase connection.** Electric service connection terminals on disconnect.
5. **Factory installed disconnect switch.** Fused disconnect switch provided on units.
6. **Earth ground connection.** Connection terminals for field supplied earth grounding wire.
7. **Earth ground bar.** Connection terminals with factory ground from each high voltage component for field supplied earth grounding wire.
8. **Control and monitoring section** of electric box.
9. **Remote unit shutdown.** Replace existing jumper between terminals 37 & 38 with normally closed switch having a minimum 75VA, 24VAC rating. Use field supplied Class 1 wiring. Two additional contact pairs available as an option (labeled as 37B & 38B, 37C & 38C). Replace existing jumper for appropriate pair as done for 37 & 38.
10. **Remote Alarm Device (RAD) Connections.** Alarm connections may be factory wired or field wired. See schematic, RAD1-4, for factory wired alarms. For field wired alarms, use Class 1 wiring to connect normally open contacts between terminals 24 & 50, 24 & 51, 24 & 55, or 24 & 56. Suitable for 24VAC.
11. **Smoke detector alarm connections.** Field supplied Class 1 wiring to 1 Amp, 24VAC maximum remote alarm circuits. Factory wired contacts from optional smoke detector are #91-Common, #92-NO, and #93-NC. Optional smoke detector trouble (SDT) connections #80 & # 81.
12. **Common alarm connection.** Field supplied Class 1 wiring to common alarm terminals 75 & 76 (and optional 94 & 95, and 96 & 97), which are factory connected to normally open contacts, 1 Amp, 24VAC maximum on common alarm relay (R3).
13. **Heat rejection connection.** Field supplied Class 1 wiring to heat rejection interlock terminals 70 & 71 which are factory connected to normally open compressor side switch (self contained units only) or to GLYCOOL relay K11 (GLYCOOL units only). On Dual Cool units only, connect auxilliary cooling source terminals 72 & 73 to relay K11. See indoor and outdoor electric schematic for more information.
14. **Reheat and Humidifier Lockout.** Optional emergency power lockout of reheat and/or humidifier: Connections #82 & #83 are provided for remote 24VAC source and Class 1 wiring by others.
15. **Main Fan Auxiliary Switch.** Optional main fan auxiliary side switch. Terminals located on customer connection terminal block for remote indication that the evaporator fan motor/unit is on. Field to connect 24V maximum, Class 1 wiring to connections #84 & #85.
16. **Optional Condensate Alarm (Dual Float Condensate Pump only).** Relay terminals located on customer connection terminal block for remote indication. Field supplied Class 1 wiring to connections #88 & #89.
17. **Optional Remote Liquitect Indicator.** Optional remote liquitect indicator for unit shutdown. Terminals located on customer connection terminal block. Field to connect 24V maximum, Class 1 wiring to connections #58 & #59.
18. **Optional Analog Inputs #3 & #4.** Customer connection to terminals 41, 42, 43, 44 for analog inputs.
19. **Spare Terminals for Optional Devices.** Customer connection when optional device is supplied. See unit schematic.
20. **Heat Rejection CANBUS Connection (AIR Units only).** Customer connection to terminals 49-1, 49-3, & SH.

NOTE: Refer to specification sheet for total unit full load amps, wire size amps, and max overcurrent protective device size.

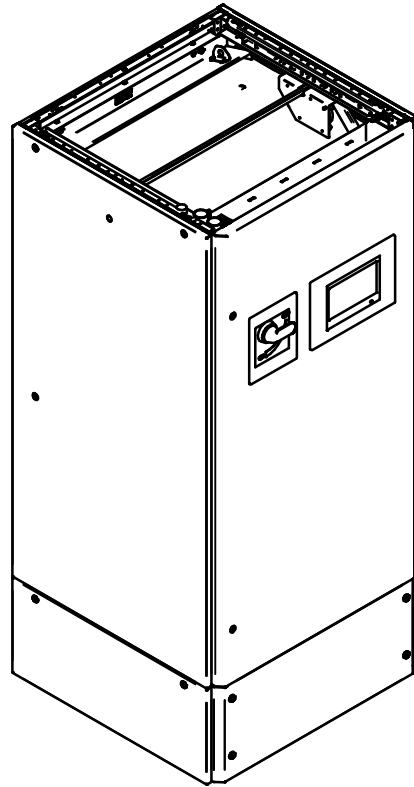


LIEBERT PDX & PCW

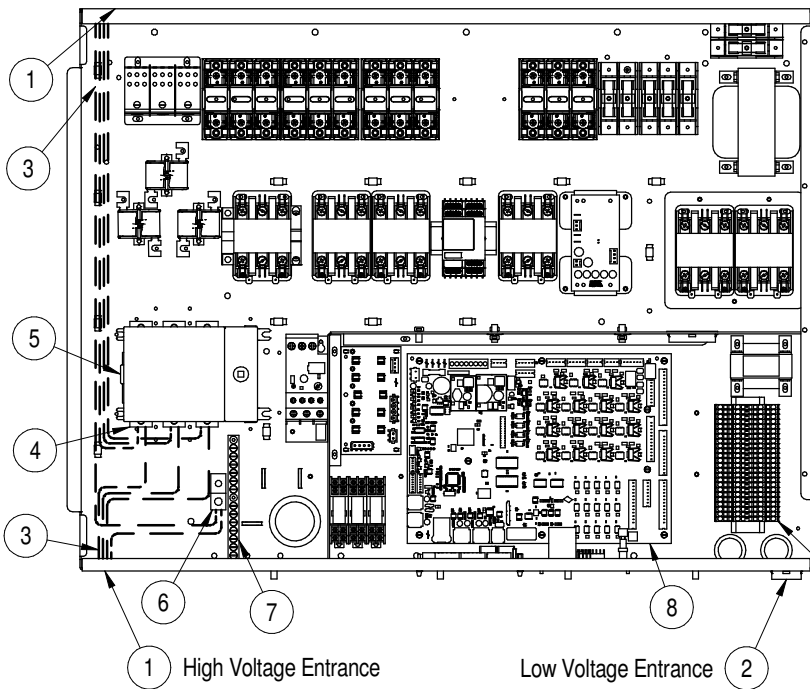
ELECTRICAL FIELD CONNECTIONS UPFLOW & DOWNFLOW MODELS



UPFLOW UNIT

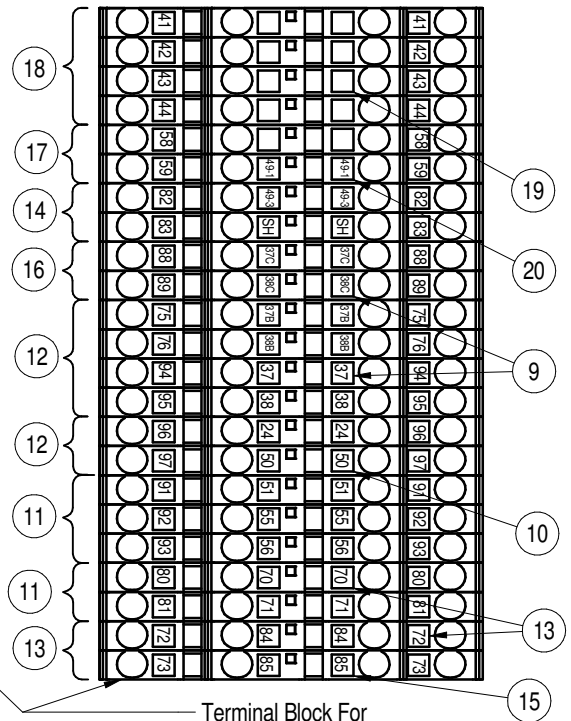


DOWNFLOW UNIT



1 High Voltage Entrance

Low Voltage Entrance 2

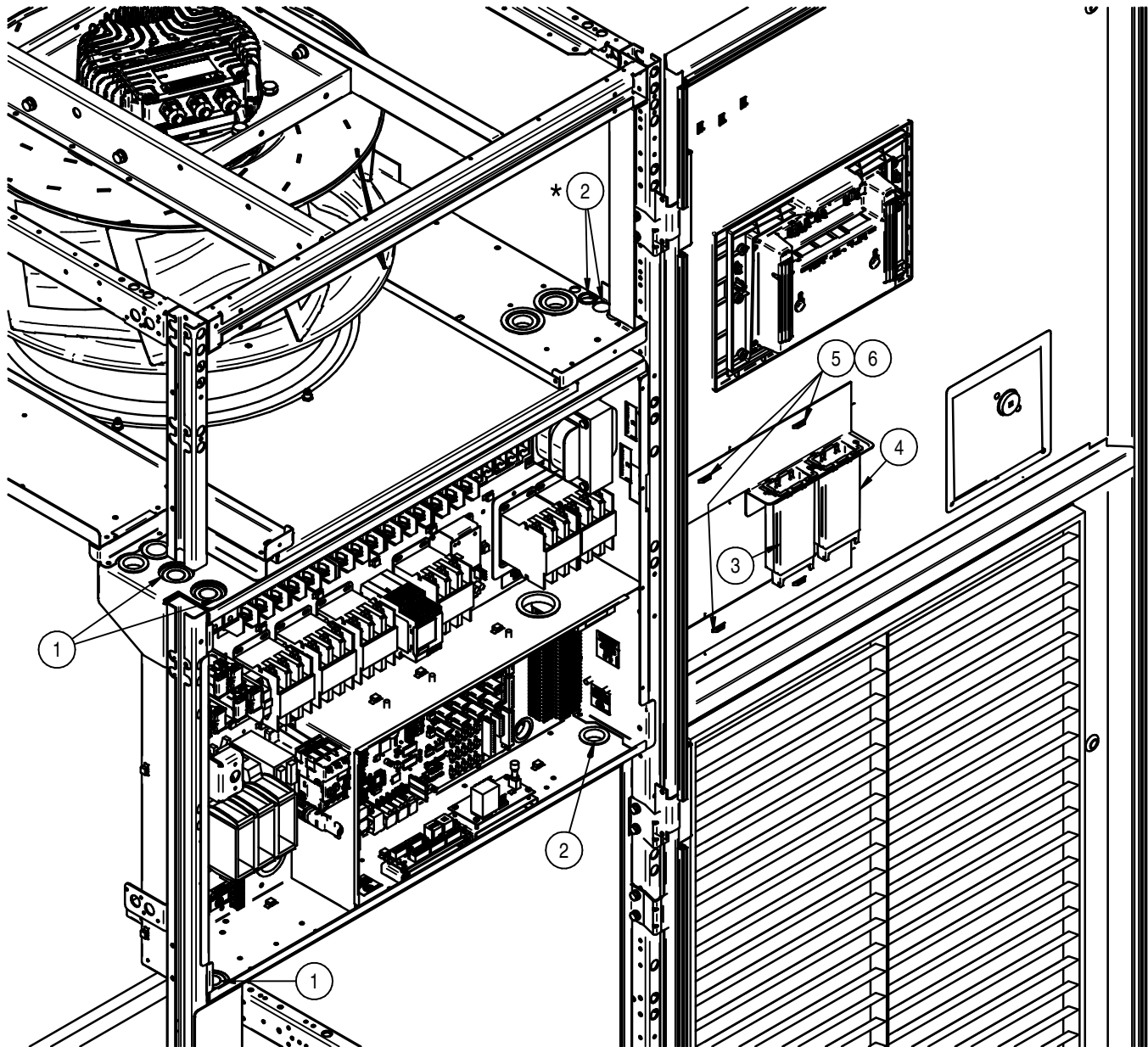


Terminal Block For
Customer Connection



LIEBERT PDX & PCW

ELECTRICAL FIELD CONNECTIONS UPFLOW MODELS



- ① Opening for field wiring. Suggested entry point for HV field wiring to unit.
- ② Opening for field wiring. Suggested entry point for LV field wiring to unit.
- ③ Vacant Intellislot. May contain optional Intellislot cards.
- ④ Populated Intellislot. Optional Intellislot cards may be placed in either of two supplied Intellislot locations.
- ⑤ Wire tie anchors. Use to secure field supplied network cables to Intellislot.
- ⑥ Wire tie anchors. Use to secure customer Ethernet wiring to control board and display.

* Wire needs to be routed outside Electric Box to Low Voltage knockout on bottom of Electric Box.

PRODUCT INFORMATION

Unit Mounted Display



The Liebert iCOM® display is a microprocessor 9 inch color touch screen in an ergonomic, aesthetically pleasing housing. The display and housing will be viewable while the unit accent panels are open or closed. The display can be easily detached to view while the panel is open.

Menu Layout- The menus will be broken out into two main menu screens: User screen and Service screen. The User screen contains the menus to access parameters required for basic unit control and setup. The Service screen is designed for service personal and provides access to advanced control setup features and diagnostic information.

Password Protection- The display will contain two unique passwords to protect against unauthorized changes. An auto hide/show feature allows the user to see applicable information based on the login used.

Unit Backup and Restore- The user shall have the ability to create safety copies of important control parameters. The display has the ability for the user to automatically backup unit configuration settings to internal memory or USB storage drive. Configuration settings may be transferred to another unit for a more streamlined unit startup.

Parameter Download- The display has the ability for the user to download a report that lists parameter names, factory default settings and user programmed settings in .csv format for remote reference.

Parameter Search- The display has search fields for efficient navigation and parameter lookup.

Setup Wizards- The display will contain step by step tutorials or wizards to provide easy setup of the control.

PRODUCT INFORMATION

Unit Mounted Display

Context Sensitive Help- The display will have an onboard help database. The database will provide context sensitive help to assist with setup and navigation of the menus.

Display Setup- The user has the ability to configure the display information based on the specific user's preference. Language, units of measure, screen contrast, home screen layout, back light timer and the hide/show of certain readouts will be configurable through the display.

Additional Readouts- The display has the ability for the user to configure custom widgets on the main screen. Widget options will include items such as fan speed, call for cooling, call for free cooling, maintenance status, call for hot water reheat, call for electric reheat, call for dehumidification, call for humidification, airflow, static pressure, fluid flow rate and cooling capacity.

Status LEDs- The display will provide the user with the unit's operating status using an integrated LED. The LED will indicate if the unit has an active alarm; if the unit has an active alarm that has been acknowledged; or if the unit is on, off, or in a standby status.

Unit Alarms – All unit alarms are annunciated through both audio and visual cues, clearly displayed on the screen, automatically recorded in the event log, and communicated to optional IntelliSlot monitoring cards.

Event Log – The display will automatically store the last 400 unit-only events (messages, warnings, and alarms).

Service Contact Information – The display has the ability to store the local service or sales contact information.

Upgradeable –Display upgrades are performed through a USB connection.

Unit-to-Unit (U2U) Communication – Communication via private Ethernet network allows for advanced control functionality (Teamwork modes, sharing sensor data, Standby Rotation, Lead-Lag, and Cascade operation).

LIEBERT MC

PREMIUM EFFICIENCY CONTROL



STANDARD FEATURES

COIL Liebert microchannel coils are all-aluminum construction. Tubes are created by extruding small parallel refrigerant flow paths into aluminum. Full-depth louvered aluminum fins fill spaces between the tubes. Tubes, fins and aluminum headers are oven-brazed to form a complete refrigerant-to-air heat exchange coil. Baffles are used in the headers to separate one coil slab into multiple passes as needed. Coils are factory leak tested at a minimum of 300 PSIG and dehydrated. Copper stub pipes are electric resistance welded to aluminum coils and joints are protected with polyolefin to seal joint from environmental corrosive elements. Hot gas and liquid lines are brazed to the stub pipes with spun closed ends for customer piping connections. Coil pipe assemblies are filled and sealed with a nitrogen holding charge for shipment. One coil is used per fan assembly.

FAN/MOTOR ASSEMBLY The fan/motor assembly is complete with external rotor motor, fan blades and fan/finger guard. Fan blades are constructed of stamped aluminum or steel extrusion coated with PP plastic. Fan guards are heavy gauge, close meshed, steel wire, coated with a black corrosion resistant finish. Fan terminal blocks located on the top of the fan guard with IP54 protection class. Fans are factory balanced and tested before shipment.

Fan Motors Fan motors are specifically designed for variable speed and have ball bearings. The EC fans provide internal overload protection through the built-in electronics. Each EC fan motor has built-in controller and communication module, linked via RS485 communication wire to each fan and the Premium Control Board. This allows each fan to receive and respond to precise fan speed inputs from the Premium control board.

PREMIUM EFFICIENCY FAN CONTROL The Liebert premium efficiency condenser control system is complete with control board, EC fan motor(s), refrigerant-pressure transducer(s), refrigerant-temperature thermistor(s), ambient-temperature thermistor, and motor overload protection in the factory wired control panel. The control board maintains EC fans on the same circuit to the same speed in order to maintain refrigerant head pressure. The control board receives a run signal from the compressor of the indoor unit via field-supplied low voltage interlock wires and field-supplied CANbus communication wires from the indoor unit iCOM. The control system provides refrigerant head pressure and system starting for outdoor ambient temperature as low as -30°F (-35 °C), provided the total temperature design range (from minimum to maximum) is 125°F (70°C) or less.

HOUSING The condenser housing is constructed of bright aluminum sheet and divided into individual fan sections by full width baffles. Internal structural support members, including coil support frame, are galvanized steel for strength and corrosion resistance. Panel doors are provided on two sides of each coil/fan section to provide for coil cleaning. Aluminum legs are provided with rigging holes for hoisting the unit into position.

COMMUNICATION The Premium Efficiency Control communicates with the iCOM control of the indoor Liebert unit using field supplied CANbus wires. The communication link allows for condenser alarm condition communication to iCOM, communication of other measurable items on the condenser, and fan control features to improve efficiency, sound and wintertime operation based on iCOM programming.

UNIT DISCONNECT SWITCH Locking unit disconnect switch is factory installed and wired in attached condenser control section.

OPTIONAL FEATURES

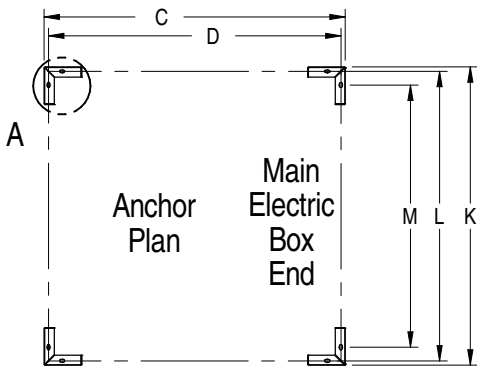
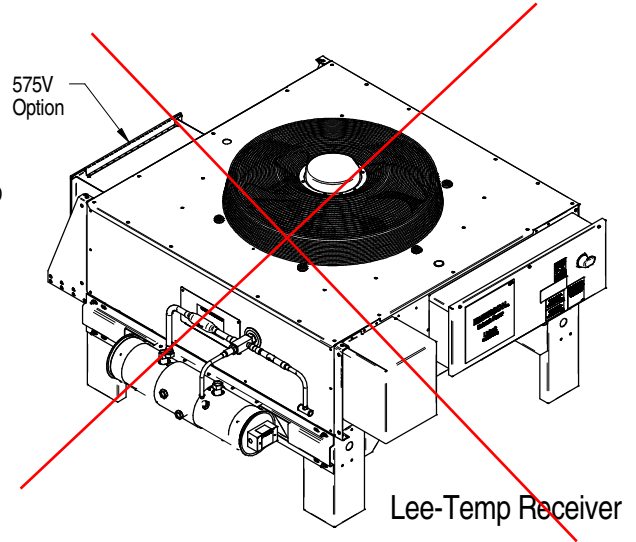
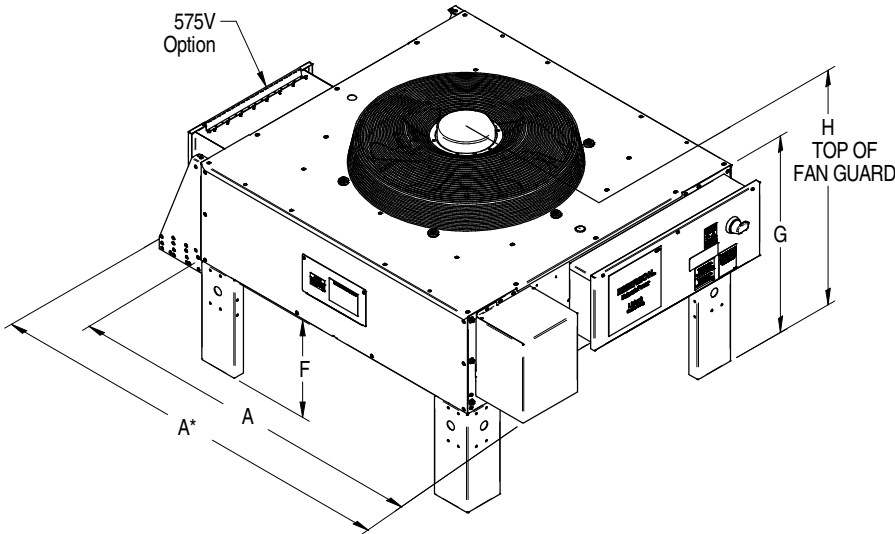
LIEBERT LEE-TEMP LOW AMBIENT CONTROL Lee-Temp receiver kits can be added to achieve head pressure control down to minimum ambient temperatures of -30 °F (-34 °C). The premium efficiency fan control when used with the Liebert Lee-Temp receiver kits runs the fan(s) at lower speeds during cold temperatures saving fan energy.

575V POWER SUPPLY The factory installed condenser option will include a secondary enclosure, a 575V-to-480V, 3 phase, step down transformer, secondary fuses for the transformer, and all wiring between the main and secondary electrical enclosures. Site power connections will be made in the main electrical enclosure and the secondary enclosure will be located on the condenser end opposite of the main electrical enclosure.

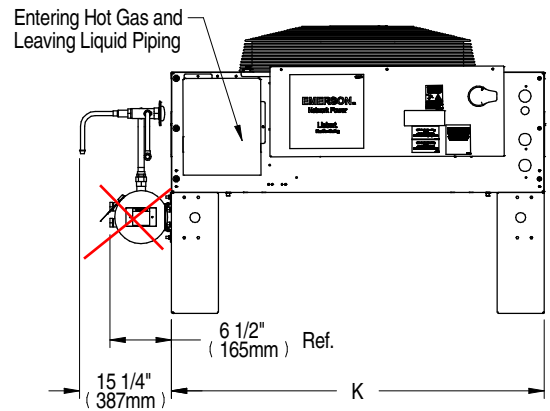


LIEBERT MC CONDENSER

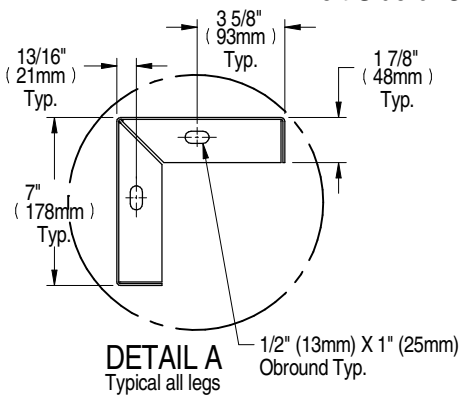
CABINET & ANCHOR DIMENSIONAL DATA 1 FAN (MCS028, MCM040, MCL055)



Left Side of Unit



Front View (Lee-Temp Shown)



DETAIL A
Typical all legs

All primary dimensions in tables are in inches (Secondary are in mm) unless specified.

LIEBERT MODEL NUMBER	F 2 (LEG HEIGHT DIMENSIONS)			
MCS028	18 (457)	36 (914)	48 (1219)	60 (1524)
MCM040				
DIM "G"	31-5/8 (803)	49-5/8 (1260)	61-5/8 (1565)	73-5/8 (1870)
DIM "H"	39-5/8 (1006)	57-5/8 (1464)	69-5/8 (1768)	81-5/8 (2073)
MCL055				
DIM "G"	35-7/8 (911)	53-7/8 (1368)	65-7/8 (1673)	77-7/8 (1978)
DIM "H"	43-5/8 (1108)	61-5/8 (1565)	73-5/8 (1870)	85-5/8 (2175)

Note:

1. Emerson recommends a clearance of 36" (915mm) on each side for proper operation and component access.

2. Cross Bracing required for legs longer than 18" (457.2mm). Quantity varies per model & options selected.

LIEBERT MODEL NUMBER	A	A* (575V ONLY)	C	D	K	L	M
MCS028	50-5/8 (1287)	58-7/8 (1495)	44-1/8 (1120)	42-1/2 (1080)	42-1/2 (1080)	40-7/8 (1038)	35-7/8 (910)
MCM040	57-3/16 (1453)	65-3/8 (1661)	48 (1219)	46-5/16 (1177)	46 (1168)	44-3/8 (1127)	39-5/16 (999)
MCL055	68 (1727)	77 (1956)	56 (1422)	54-3/8 (1381)	55-1/2 (1410)	53-7/8 (1368)	48-3/4 (1238)



LIEBERT MC

CONDENSER AND OPTION WEIGHT DATA, lb(kg)

SMALL (MCS)	Condenser Model		MCS028	MCS056	
	Refrigerant Circuits		1	2	
	Condenser Dry weight	18" Leg	154 (70)	270 (122)	
		36" Leg	286 (130)	419 (190)	
		48" Leg	318 (144)	451 (205)	
		60" Leg	349 (158)	482 (219)	
	Additional Weight for Options				
	Lee-Temp		55 (25)	110 (50)	
	Coated Coil		4 (2)	8 (4)	
	575V Transformer		52 (24)	63 (29)	

MEDIUM (MCM)	Condenser Model		MCM040	MCM080		MCM160	
	Refrigerant Circuits		1	1	2	2	
	Condenser Dry weight	18" Leg	231 (105)	441 (200)	441 (200)	860 (390)	
		36" Leg	363 (165)	590 (268)	590 (268)	1066 (484)	
		48" Leg	395 (179)	622 (282)	622 (282)	1114 (505)	
		60" Leg	426 (193)	653 (296)	653 (296)	1160 (526)	
	Additional Weight for Options						
	Lee-Temp		55 (25)	100 (45)	110 (50)	220 (100)	
	DSE Receiver DA080/085					88 (40)	
	DSE Receiver DA125/150/165					184 (83)	
Coated Coil		5 (2)	10 (5)	10 (5)	20 (9)		
575V Transformer		52 (24)	63 (29)	63 (29)	76 (34)		

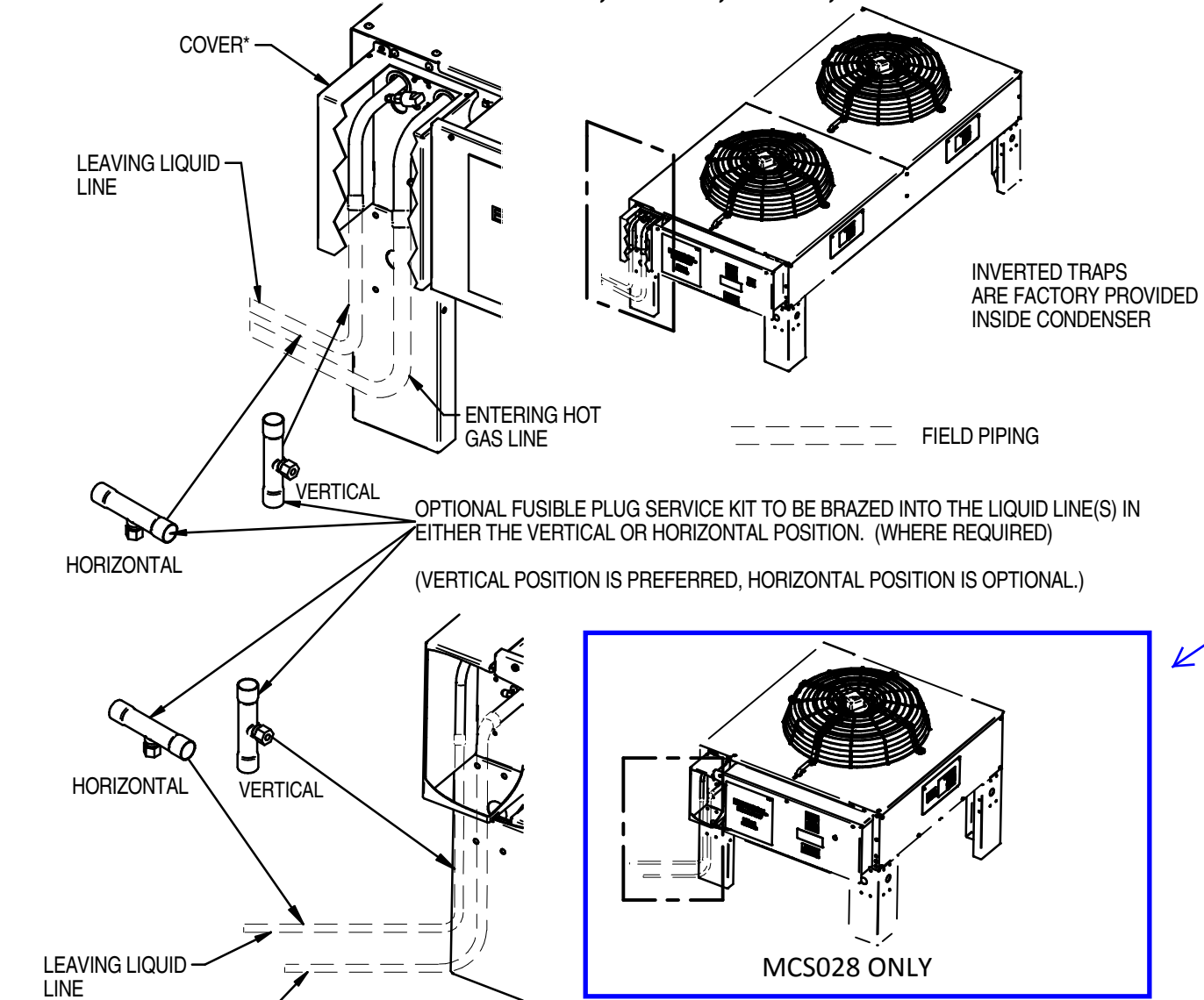
LARGE (MCL)	Condenser Model		MCL055	MCL110		MCL165	MCL220			
	Refrigerant Circuits		1	1	2	1	1	2		
	Condenser Dry weight	18" Leg	344 (156)	602 (273)	602 (273)	891 (404)	1186 (538)	1186 (538)		
		36" Leg	486 (220)	766 (347)	766 (347)	1136 (515)	1453 (659)	1453 (659)		
		48" Leg	518 (235)	798 (362)	798 (362)	1184 (537)	1501 (681)	1501 (681)		
		60" Leg	549 (249)	829 (376)	829 (376)	1230 (558)	1547 (702)	1547 (702)		
	Additional Weight for Options									
	Lee-Temp		60 (27)	115 (52)	120 (54)	175 (79)	215 (98)	240 (109)		
	DSE Receiver DA080/085				45 (20)	90 (41)			45 (20)	90 (41)
	DSE Receiver DA125/150/165				94 (43)	188 (85)	94 (43)	94 (43)	188 (85)	
Coated Coil		8 (4)	16 (7)	16 (7)	24 (11)	32 (15)	32 (15)			
575V Transformer		79 (36)	90 (41)	90 (41)	132 (60)	134 (61)	134 (61)			

Total weight is the sum of '**Condenser**' + ('**Lee-Temp**' or '**DSE Receiver 080-085**' or '**DSE Receiver 125-165**') + '**Coated Coil**' + '**575V Transformer**'.



LIEBERT MC CONDENSER

PIPING DIMENSIONAL DATA SINGLE CIRCUIT 1 FAN, 2 FAN, 3 FAN, & 4 FAN UNITS

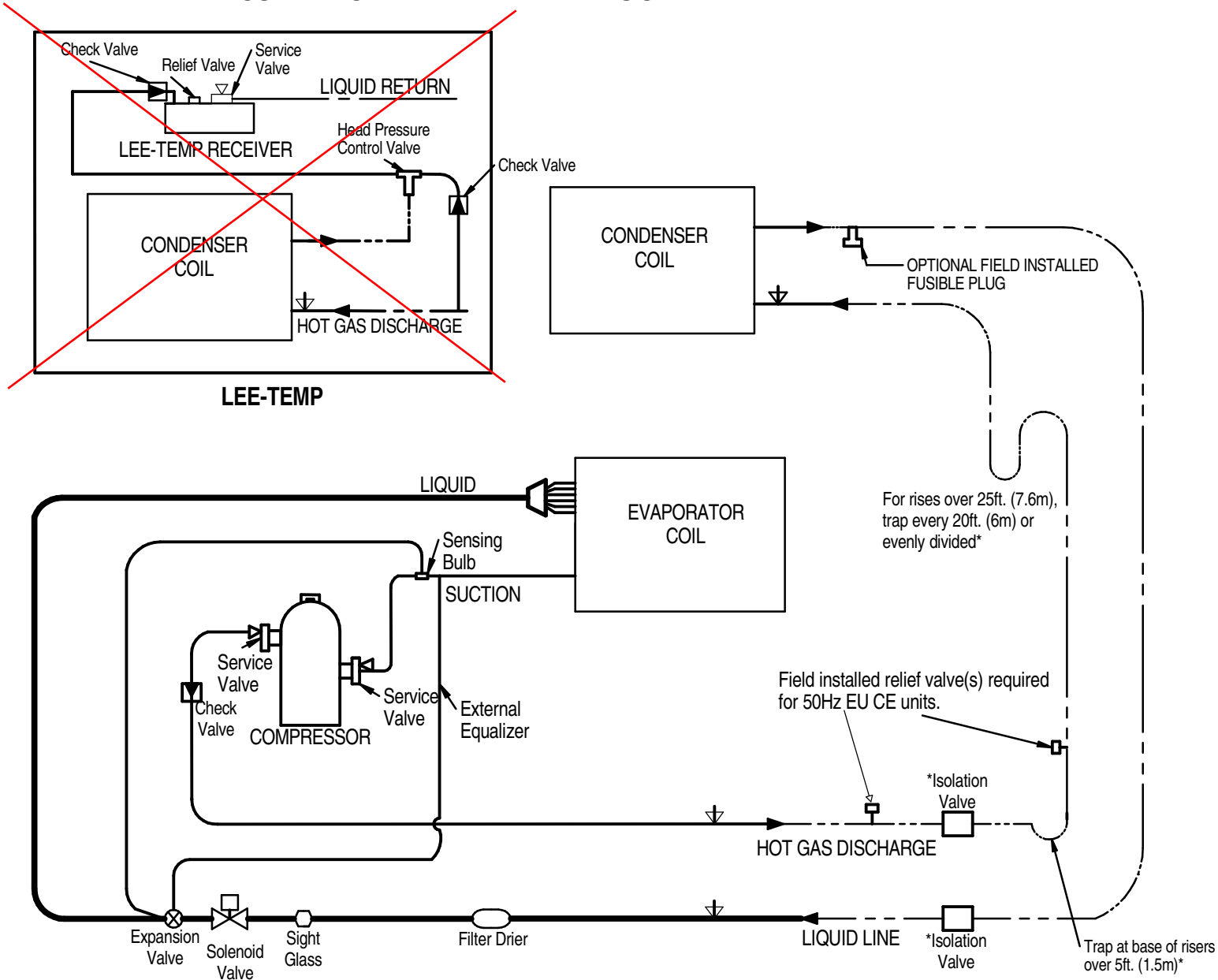


MODEL NO.	NUMBER OF FANS	CONDENSER CIRCUITS	CONNECTION SIZES, OD, IN	
			HOT GAS LINE	LIQUID LINE
MCS 028	1	1	7/8	5/8
MCM 040	1	1	7/8	5/8
MCM 080	2	1	1-1/8	7/8
MCL 055	1	1	1-1/8	7/8
MCL 110	2	1	1-3/8	1-1/8
MCL 165	3	1	1-3/8	1-1/8
MCL 220	4	1	1-5/8	1-3/8

* SHIPPING COVER IS NOT NECESSARY FOR PROPER CONDENSER OPERATION AND MAY BE RECYCLED IF FIELD PIPING INTERFERES WITH PROPER REATTACHMENT.

LIEBERT MC PIPING SCHEMATIC

CONDENSER WITH AND WITHOUT LIEBERT LEE-TEMP



NOTE: SINGLE REFRIGERATION CIRCUIT SHOWN FOR CLARITY.

- REFRIGERANT PIPING
- - - - FIELD PIPING
- ▽ SERVICE/SCHRADER (ACCESS) CONNECTION NO VALVE CORE
- ⬇ SERVICE/SCHRADER (ACCESS) CONNECTION WITH VALVE CORE

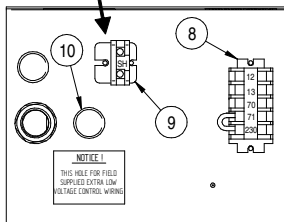
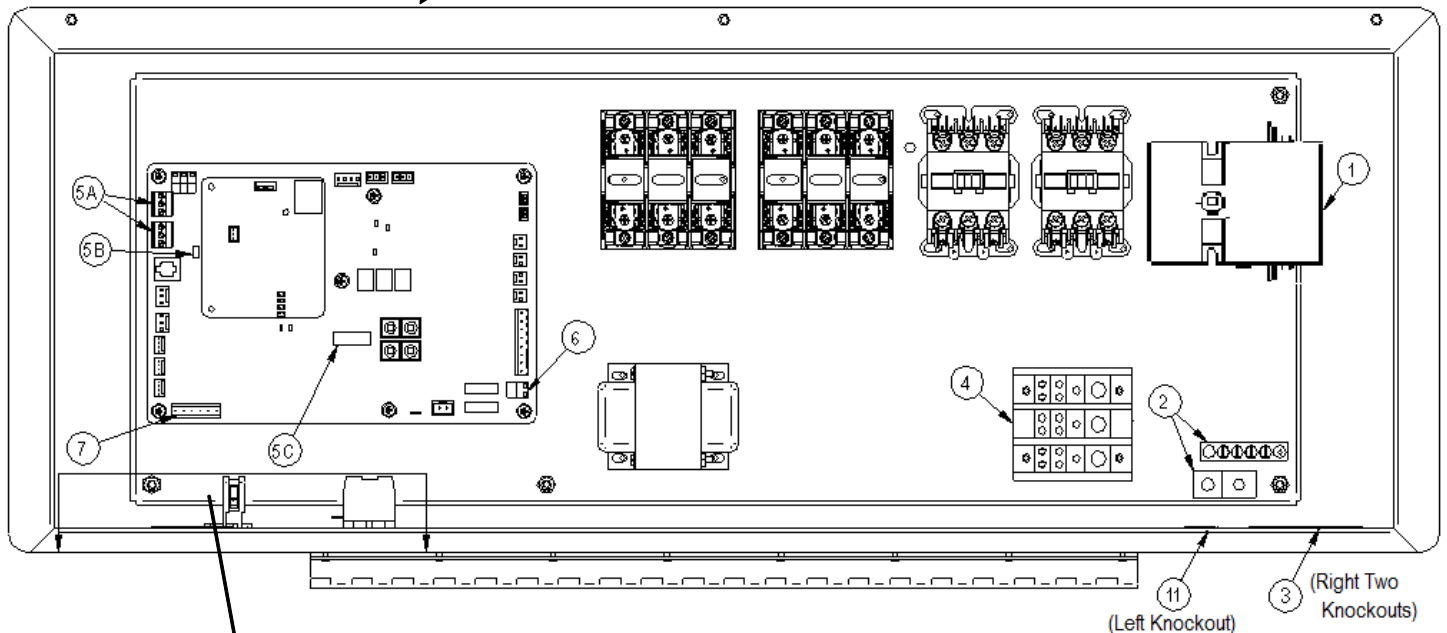
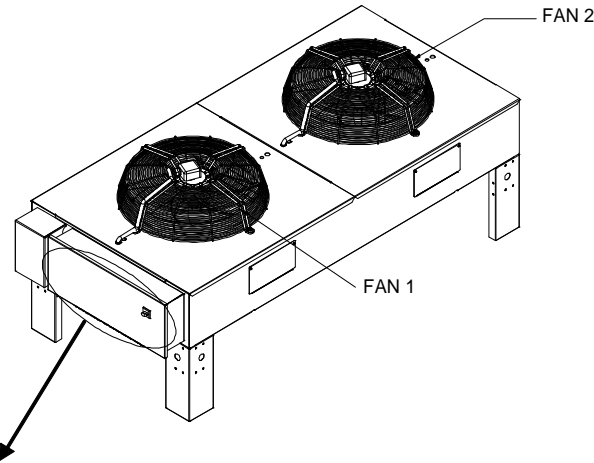
*Components are not supplied by Liebert but are required for proper circuit operation and maintenance

NOTE: SCHEMATIC REPRESENTATION SHOWN. DO NOT USE FOR SPECIFIC CONNECTION LOCATIONS.



LIEBERT MC

ELECTRICAL FIELD CONNECTIONS PREMIUM EFFICIENCY CONTROL



KEY ELECTRICAL DETAILS:

- 1) **Three phase electrical service** – Terminals are on top of disconnect switch for one and two fan units. Terminals are on bottom of disconnect switch for three and four fan units. Three phase service not by Liebert. See note 5.
- 2) **Earth ground** – Field lug terminal for earth ground connection. Ground terminal strip for fan motor ground connection.
- 3) **Primary high voltage entrance** – Two 7/8" (22.2mm) diameter knockouts located at the bottom of the enclosure.
- 4) **SPD field connection terminals** – High voltage surge protective device (SPD) terminals. SPD is an optional device.



ELECTRICAL FIELD CONNECTIONS PREMIUM EFFICIENCY CONTROL

- 5) **CANbus terminal connections** – Field terminals for CANbus cable connection.
- 5A is the CANbus connectors.
 - TB49-1 is the input terminal for CANbus high.
 - TB49-3 is the input terminal for CANbus low.
 - TB50-1 is output terminal for CANbus high.
 - TB50-3 is the output terminal for CANbus low.
 - Each CANbus cable shield is connected to terminal “SH”, item 9.
 - 5B is the “END OF LINE” jumper.
 - 5C is the CANbus “DEVICE ADDRESS DIP SWITCH”. CANbus cable not by Liebert. See Note 2. (below)
- 6) **Remote unit shutdown** – Replace existing jumper between terminals TB38-1 and TB38-2 with field supplied normally closed switch having a minimum 75VA 24VAC rating. Use field supplied Class 1 wiring. (This is an optional feature that may be owner specified.)
- 7) **Alarm terminal connections** –
- a. Common Alarm Relay indicates when any type of alarm occurs. TB74-1 is common, TB74-2 is normally open, and TB74-3 is normally closed. 1 Amp 24VAC is the maximum load. Use Class 1 field supplied wiring.
 - b. Shutdown Alarm Relay indicates when condenser loses power, or when a critical alarm has occurred that shuts down the condenser unit. TB74-4 is common, TB74-5 is normally open, and TB74-6 is normally closed. 1 Amp 24VAC is the maximum load. Use Class 1 field supplied wiring.
- 8) **Indoor unit interlock and SPD alarm terminals** –
- a. On any call for compressor operation, normally open contact is closed across terminals 70 and 71 for Circuit 1, and normally open contact is closed across terminals 70 and 230 for Circuit 2 from indoor room unit.
 - b. During SPD alarm, normally open contact is closed across terminals 12 & 13. SPD is an optional device.
- 9) **CANbus shield terminal** – Terminal for field shield connection of the CANbus field supplied cables. The shield of CANbus field supplied cables must not be connected to ground at the condenser.
- 10) **Primary low voltage entrance** – One 7/8” (22.2mm) diameter knockout that is free for customer low voltage wiring.
- 11) **SPD entrance** – One 7/8” (22.2mm) diameter knockout hole located at the bottom of the enclosure. High voltage surge protective device (SPD) is optional.

NOTES:

1. Refer to specification sheet for unit voltage rating, full load amp, and wire size amp ratings.
2. The CANbus wiring is field supplied and must be:
 - a) Conductors 22-18AWG stranded tinned copper
 - b) Twisted pair (minimum 4 twists per foot)
 - c) Braided shield or foil shield with drain wire
 - d) Shield must be wired to ground at indoor unit
 - e) Low Capacitance (15pF/FT or less)
 - f) UL approved temperature rated to 75°C
 - g) UL approved voltage rated to 300V
 - h) UV-resistant and moisture-resistant if not run in conduit
 - i) Examples: Belden part number 89207(plenum rated) or Alpha Wire part number 6454 (UV resistant outdoor rated) category 5, 5e or higher.



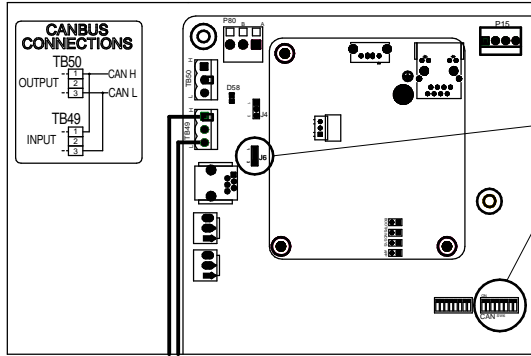
ELECTRICAL FIELD CONNECTIONS PREMIUM EFFICIENCY CONTROL

3. Do not run the CANbus cable in the same conduit, raceway, or chase as high voltage.
4. No special considerations are required when the total external cable connection between the indoor unit and outdoor unit(s) is less than 450FT (137M). For total external cable connections greater than 450FT (137M) but less than 800FT (243M) a CANbus isolator is required.
5. All wiring must be sized and selected for insulation case per NEC and other local codes.
6. Do not bend cables to less than four times the diameter of the cable.
7. Do not deform cables when securing in bundles or when hanging them.
8. Avoid running the cables by devices that may introduce noise, such as machines, fluorescent lights, and electronics.
9. Avoid stretching cables.
10. Separate high volt wires and other high voltage sources from CAN wires by 12 inches.
11. The electrically commutated (EC) motors included in the Liebert MC Condenser are suitable for connection to power supplies with a solidly grounded neutral. (Some platforms can accept power supplies listed under item b below. Contact the factory for more information.)
 - a) Acceptable power supplies for 208 to 575V nominal units-
 - i. 208V wye with solidly grounded neutral and 120V line to ground;
 - ii. 380V wye with solidly grounded neutral and 220V line to ground;
 - iii. 480V wye with solidly grounded neutral and 277V line to ground.
 - iv. 575V wye with solidly grounded neutral and 332V line to ground. (uses step-down transformer)
 - b) Non-acceptable power supplies for 208V to 575V nominal units –
 - i. wye with high resistance (or impedance) ground;
 - ii. delta without ground or with floating ground;
 - iii. delta with corner ground; or
 - iv. delta with grounded center tap.



LIEBERT PDX

CANbus & INTERLOCK CONNECTIONS BETWEEN LIEBERT PDX & MC CONDENSER (PREMIUM)



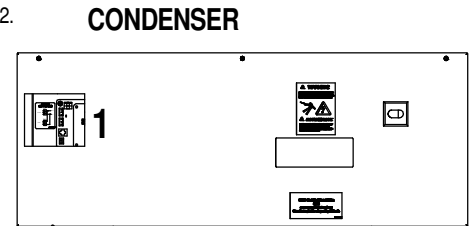
DETAIL 1
CAN CABLE CONNECTION (A)



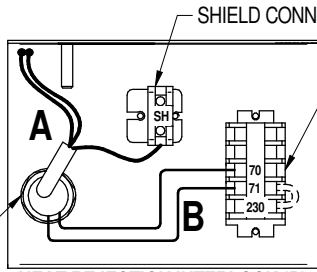
J6 TERMINATION JUMPER
MUST BE SET TO PINS 1 AND 2.



CANbus
ADDRESSING
SWITCH



CONDENSER



LOW VOLTAGE FIELD ENTRANCE
LOCATED ON BOTTOM LEFT OF
CONDENSER ENCLOSURE.

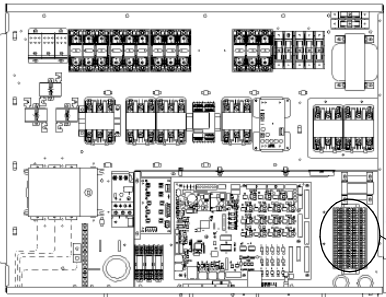
HEAT REJECTION INTERLOCK (B)

SHIELD CONNECTION

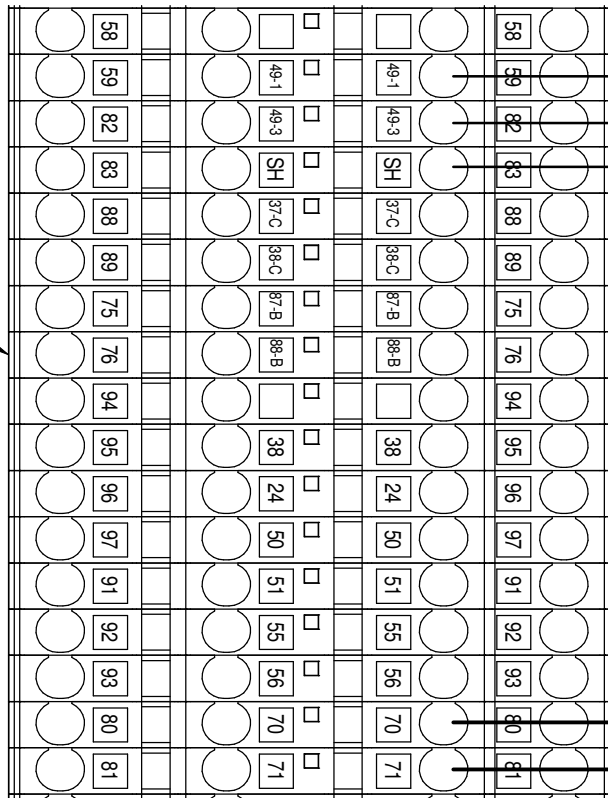
FACTORY WIRING BETWEEN
MC CONTROL BOARD AND
TERMINAL STRIP.

CANbus CABLE CONNECTION

B
HEAT REJECTION INTERLOCK WIRE



INDOOR UNIT



PARTIAL VIEW SHOWN FOR CLARITY



CANbus & INTERLOCK CONNECTIONS BETWEEN LIEBERT PDX & MC CONDENSER (PREMIUM)

COMPONENT NOTES:

1. COMPONENT APPEARANCE, ORIENTATION AND POSITIONING MAY VARY. TERMINAL NAMES AND CALLOUTS REMAIN CONSTANT.
2. ALL CIRCUITS TO THESE CONNECTION POINTS ARE CLASS 2.

CAN & CABLE NOTES (A):

1. FIELD SUPPLIED CABLE.
 - SHIELDED
 - 22-18AWG STRANDED TINNED COPPER
 - TWISTED PAIR (MINIMUM 4 TWISTS PER FOOT)
 - LOW CAPACITANCE (15pF/FT OR LESS)
 - MUST BE RATED TO MEET LOCAL CODES AND CONDITIONS.
 - EXAMPLES BELDEN 89207 (PLENUM RATED), OR ALPHA WIRE 6454 CATEGORY 5, 5E, OR HIGHER.
2. DO NOT RUN IN SAME CONDUIT, RACEWAY, OR CHASE AS HIGH VOLTAGE WIRING.
3. FOR CANBUS NETWORK LENGTHS GREATER THAN 350FT(107M), CONTACT LIEBERT FACTORY.

INTERLOCK WIRE NOTES (B):

1. FIELD SUPPLIED WIRE
 - 18AWG OR GREATER
 - RATED 600V
2. RUN TWO WIRES FROM INDOOR UNIT TO CONDENSER.



LIEBERT MC Condenser

REFRIGERANT CHARGING INSTRUCTIONS

For DX Systems without Lee-Temp Receivers

Liebert MC Condenser Charging (Basic and Premium Efficiency control)

The Liebert MC (microchannel) condensers are charge sensitive and require accurate calculation of the system charge to avoid overcharging. To avoid overcharge, additional guidelines are recommended to ensure trouble free operation.

- When charging system in an outdoor ambient below 50°F (10°C), re-check the subcooling against **Table 3** when the ambient is above 60°F (15.6°C)
- The indoor space should be maintained at 70 – 80°F (21-26.7°C) return air before final charge adjustments are made.
- Charging unit at greater than 80°F (26.7°C) return air may result in the unit being overcharged.
- Charge by subcooling measurement at the indoor unit. See **Table 3** for target subcooling temperatures.
- Pressure and temperature measuring instruments should be capable of measuring to ±10 psig (68.9kPa) and ± 2°F (1.1°C) for best subcooling measurement.

1. Check indoor nameplate for refrigerant type to be used. Unit control configurations differ depending on refrigerant type.
2. Refrigerant charging requires unit operation. Refer to indoor unit user manual for **Checklist for Completed Installation**.
3. Calculate the amount of charge for the system. Refer to the indoor unit user manual, and condenser and refrigerant line charge data in **Tables 1 and 2**.
4. Accurately weigh in as much of the system charge as possible before starting the unit. Do not exceed the calculated charge by more than 0.5 lb (.23kg).

NOTICE

Risk of improper refrigerant charging. Can cause equipment damage.

Refrigerant R-407C and R-410A are blended refrigerants and must be introduced and charged from the cylinder only as a liquid.

When adding liquid refrigerant to an operating system, it may be necessary to add the refrigerant through the compressor suction service valve. Care must be exercised to avoid damage to the compressor. Emerson recommends connecting a sight glass between the charging hose and the compressor suction service valve. This will permit adjustment of the cylinder hand valve so that liquid can leave the cylinder while allowing vapor to enter the compressor.

NOTICE

Risk of refrigerant overcharge, Can cause equipment damage.

Do not charge Liebert MC condenser systems using clear sight glass as an indicator.

5. Turn on the Liebert MC disconnect switch.
6. Turn on the indoor unit disconnect switch. Operate the unit for 30 minutes using the charging function of the indoor unit control for each circuit of the system. The charging function is in the diagnostic section of the Liebert iCOM control (see Liebert iCOM user manual, SL-18835). The charging function operates the compressor(s) at full capacity and energizes the liquid line solenoid valve(s). The reheat and humidifier are disabled. Manual operation of the indoor fans from the diagnostic menu of the iCOM is required. A minimum 20psig (138kPa) must be established and maintained for the compressor to operate. The charging function can be reset as many times as required to complete unit charging.

Table 1 R-407C (R-22) and R-410A interconnecting piping refrigerant charge

Line Size O.D., in.	R-407C (R-22), lb/100 ft. (kg/30m)		R-410A, lb/100 ft. (kg/30m)	
	Hot Gas Line	Liquid Line	Hot Gas Line	Liquid Line
3/8	—	3.6 (1.6)	—	3.2 (1.4)
1/2	0.5 (0.2)	6.7 (3.0)	0.7 (0.3)	5.9 (2.7)
5/8	0.8 (0.4)	10.8 (4.8)	1.1 (0.5)	9.6 (4.3)
3/4	1.2 (0.5)	16.1 (7.2)	1.6 (0.7)	14.3 (6.4)
7/8	1.7 (0.8)	22.3 (10.0)	2.3 (1.0)	19.8 (8.8)
1-1/8	2.9 (1.3)	38.0 (17.0)	3.9 (1.7)	33.8 (15.1)
1-3/8	4.4 (2.0)	57.9 (25.9)	5.9 (2.6)	51.5 (23.0)
1-5/8	6.2 (2.8)	—	8.4 (3.7)	—

Data based on 50°F evap, 15°F superheat, 125°F SCT, 10°F subcooling

LIEBERT MC Condenser

REFRIGERANT CHARGING INSTRUCTIONS

For DX Systems without Lee-Temp Receivers

Table 2 R-407C (R-22) and R-410A refrigerant required, approximate

Condenser models	Single Circuit lb (kg)	Dual Circuit lb/circuit (kg/circuit)
Approximate R-407C (R-22) Refrigerant Needed		
MCS 028	2.2 (1.0)	N/A
MCS 056	NA	2.2 (1.0)
MCM 040	3.0 (1.4)	N/A
MCM 080	7.5 (3.4)	3.0 (1.4)
MCL 055	5.0 (2.3)	N/A
MCL 110	10.5 (4.8)	5.1 (2.3)
MCM160	NA	7.5(3.4)
MCL 165	18.3 (8.3)	N/A
MCL 220	27.0 (12.3)	12.2 (5.6)
Approximate R-410A Refrigerant Needed		
MCS 028	2.5 (1.2)	N/A
MCS 056	NA	2.5(1.2)
MCM 040	3.5 (1.6)	N/A
MCM 080	8.5 (3.8)	3.5 (1.6)
MCL 055	5.0 (2.3)	N/A
MCL 110	10.7 (4.9)	5.2 (2.4)
MCM160	NA	8.5(3.8)
MCL 165	18.4 (8.4)	N/A
MCL 220	27.0 (12.3)	12.3 (5.6)

7. Attach pressure and temperature instruments to the liquid line of the indoor unit. Measure the initial subcooling and continue to add charge until recommended subcooling for the current outdoor ambient temperature is reached. See **Table 3**. The outdoor ambient can be read from the Liebert MC condenser control menu ID F02



NOTE:

To determine subcooling measurement, a liquid line pressure reading (at the factory installed Schrader tap) needs to be measured along with obtaining a temperature reading on the liquid line. Convert the liquid line pressure reading into a temperature by utilizing a Pressure-Temperature Guide. The difference between this converted temperature and the actual temperature will determine the system's subcooling. For R-407C make sure to use the saturated liquid temperature to calculate subcooling.

Table 3 Target subcooling for ambient outdoor temperature.

Ambient Temp	Subcooling	Ambient Temp	Subcooling
°F (C°)	°F (C°)	°F (C°)	°F (C°)
0 (-17.8)	22 (12.0)	80 (26.7)	13 (7.2)
10 (-12.2)	22 (12.0)	90 (32.2)	9 (5.0)
20 (-6.7)	22 (12.0)	95 (35.0)	7 (3.9)
30 (-1.1)	22 (12.0)	100 (37.8)	5 (2.9)
40 (4.4)	22 (12.0)	105 (40.6)	3 (1.8)
50 (10.0)	21 (11.7)	110 (43.3)	1 (0.7)
60 (15.6)	19 (10.8)	125 (51.7)	0 0.0
70 (21.1)	17 (9.3)		

8. As head pressure builds, the variable fan speed controlled condenser fan begins rotating. The fan will run at full speed when sufficient head pressure is developed.



LIEBERT MC Condenser

REFRIGERANT CHARGING INSTRUCTIONS

For DX Systems without Lee-Temp Receivers

Table 4 Liquid pressure and temperature chart

Pressure		R407C *		R410A *		R22	
Psig	Bar	°F	°C	°F	°C	°F	°C
170	11.7	81.5	27.5	59.8	15.4	90.6	32.6
180	12.4	85.1	29.5	63.1	17.3	94.3	34.6
190	13.1	88.6	31.5	66.3	19.1	97.9	36.6
200	13.8	92.0	33.3	69.5	20.8	101.4	38.6
210	14.5	95.2	35.1	72.5	22.5	104.7	40.4
220	15.2	98.3	36.8	75.4	24.1	108.0	42.2
230	15.9	101.4	38.5	78.2	25.7	111.1	44.0
240	16.6	104.3	40.2	80.9	27.2	114.2	45.7
250	17.2	107.2	41.8	83.6	28.7	117.1	47.3
260	17.9	109.9	43.3	86.2	30.1	120.0	48.9
270	18.6	112.6	44.8	88.7	31.5	122.8	50.4
280	19.3	115.3	46.3	91.1	32.8	125.5	52.0
290	20.0	117.8	47.7	93.5	34.2	128.2	53.4
300	20.7	120.3	49.1	95.8	35.5	130.8	54.9
310	21.4	122.8	50.4	98.1	36.7	133.3	56.3
320	22.1	125.2	51.8	100.3	38.0	135.8	57.7
330	22.8	127.5	53.1	102.5	39.2	138.2	59.0
340	23.4	129.8	54.3	104.6	40.3	140.6	60.3
350	24.1	132.1	55.6	106.7	41.5	142.9	61.6
360	24.8	134.3	56.8	108.7	42.6	145.2	62.9
370	25.5	136.4	58.0	110.7	43.7	147.4	64.1
380	26.2	138.6	59.2	112.7	44.8	149.6	65.4
390	26.9	140.6	60.3	114.5	45.9	151.8	66.5
400	27.6	142.7	61.5	116.4	46.9	153.9	67.7
500	34.5	161.3	71.8	133.5	56.4	173.1	78.4
600	41.4	177.4	80.8	148.1	64.5	189.5	87.5

* Values are for saturated liquid