Precision Cooling
For *Business-Critical Continuity™*

Liebert® MC™

User Manual, 60Hz Air-Cooled Microchannel Condensers

EMERSON
Network Power

TABLE OF CONTENTS

FIGURES

TABLES

IMPORTANT SAFETY GUIDELINES

SAVE THESE INSTRUCTIONS

This manual contains important safety instructions that should be followed during the installation and maintenance of the Liebert MC. Read this manual thoroughly before attempting to install or operate this unit.

Only qualified personnel should move, install or service this equipment.

Adhere to all warnings, cautions and installation, operating and safety instructions on the unit and in this manual. Follow all operating and user instructions.

WARNING

Risk of improper handling, installation, and service. Can cause property damage, injury, or death.

Only trained and qualified personnel should work on this unit. Read all installation, operation and safety alerts and instructions and wear appropriate protective headgear, safety glasses, gloves and clothing before installing, operating or servicing this unit.

WARNING

Risk of arc flash and electric shock hazard. Disconnect all local and remote electric power supplies and wear appropriate personal protective equipment per NFPA 70E before working within the electric control enclosure or the fan motor connection box(es). Failure to comply can cause serious injury or death.

This unit contains lethal voltage. The line side of the unit disconnect switch remains energized when the unit disconnect switch is in the "Off" position. Use a voltmeter to verify that the line side input electric power to the unit disconnect switch is off before working on any electrical components or connections.

WARNING

Risk of high-speed, rotating fan blades. Can cause serious personal injury or death.

Fan blades can automatically start rotating without warning at any time during a cooling cycle or after power is restored after a power failure. Disconnect all local and remote electric power supplies and verify with a voltmeter that the power is off and that the fan blades have stopped rotating before working within the cabinet or servicing fan motors.

WARNING

Risk of electric shock. Can cause injury or death.

The variable speed control may contain a stored electrical charge. Disconnect all local and remote electrical power supplies and wait 10 minutes before working within condenser main electrical enclosure or fan electrical enclosure.

WARNING

Risk of heavy condenser falling or tipping over. Can cause property damage, serious injury or death.

Confirm that all components of the lifting system are rated for the weight of the condenser by an OSHA Certified rating organization before attempting to lift and/or move the condenser. See **2.2 - Dimensions and Weights** for the condenser weights.

CAUTION

Risk of hot surfaces. Can cause injury.

Fan motors, transformers, piping and other components may become extremely hot during normal operation. Wear thermally insulated gloves and appropriate protective clothing and allow time for components to cool when working within the cabinet or electric control enclosure.

CAUTION

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

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

CAUTION

Risk of explosive discharge of high-pressure gas. Can cause injury.

Relieve system pressure and verify that the indoor and outdoor units are Off before making piping connections/disconnections.

NOTICE

Risk of overhead interference. Can cause unit and/or structure damage.

Refer to the installation plans before moving the unit to verify clearances.

NOTICE

Risk of improper storage. Can cause unit damage.

Keep unit upright and protected from contact damage.

LIEBERT MC NOMENCLATURE

Model Number – Part 1/2										Model Details											Part 2/2			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
M	C	M	0	4	0	E	1	A	D	0	A	0	V	U	0	0	0	0	0	0	*	*	*	*

1-2. Unit Family; MC = Microchannel Condenser	**12. Panel Material**
3. Platform Size	A = Bright Aluminum
S = Small	**13. Connection Pipe Unit of Measurement**
M = Medium	0 = Inches (Std. ACR Copper)
L = Large	**14. Legs Included**
4-6. Nominal Condenser Capacity, kW	V = 18" Tall Legs (Std.)
Example: 040 = 40kW @ 95°F(35°C) & 27°R (15°K) ITD	X = 36" Tall Legs with Bracing
7. Control/Fan Type	Y = 48" Tall Legs with Bracing
E = Premium & EC Fan	Z = 60" Tall Legs with Bracing
8. Refrigerant Circuits/System Refrigerant type	**15. Agency Certification**
1 = Single Refrigerant Circuit, R-410A	U = CSA Listed, Marked with CSA c-us logo
2 = Dual Refrigerant Circuit, R-410A	1 = CSA listed, IBC/OSHPD Seismic Certification
7 = Single Refrigerant Circuit, R-407C, R-22	0 = No Agency Listing
8 = Dual Refrigerant Circuit, R-407C, R-22	**16. Sound Level**
9. Power Supply	0 = Standard Sound
A = 460V / 3ph/60Hz	**17. Liebert Lee-Temp™ Configuration**
Y = 208/230V/3ph/60Hz	0 = None (Standard)
2 = 380/415V/3ph/60Hz	
10. Packaging	1 = Factory Set for Liebert Lee-Temp Kits
D = Domestic, Non-Stackable (Horizontal Airflow Orientation)	**18-21. Undefined - Reserved For Future Use**
E = Export Crating - Non-Stackable (Horizontal Airflow Orientation)	**22-25. Factory Configuration Number**
11. Coil Coating	
0 = None	
E = E-Coat (Epoxy)	

1.0 INTRODUCTION

1.1 Product Description and Features

The Liebert MC condenser is a low-profile, direct-drive propeller fan-type air-cooled unit suitable for mounting outdoors. It provides heat rejection for either one or two separate refrigeration circuits, matches the heat rejection capacity corresponding with the outdoor ambient temperature, and with each corresponding compressor heat rejection requirements. Constructed with an aluminum cabinet, galvanized steel frame and microchannel coil, the unit is quiet and corrosion resistant. The condenser is quickly and easily installed, because all internal wiring is completed at the factory with only electrical connections to be made at the job site. All electrical connections and controls are enclosed in an integral weatherproof section of the condenser.

Figure 1 Two-fan Liebert MC condenser

1.1 Control/Fan Types

1.1.1 Premium Efficiency Control/EC Fan

Premium Efficiency Controls and EC fans are matched to provide superior system energy efficiency. The premium control board allows CANbus communication with the indoor unit's Liebert iCOM® control. This communication feature provides compressor run signals, condenser operating mode changes, condenser alarm monitoring, simplified system charging procedures and outdoor ambient temperature monitoring. The EC fan is an integral assembly of an electronically commutated motor, quiet fan blade assembly and finger/hail guard. The fans are controlled by the premium control board using pressure transducer signals from the refrigerant circuit and factory programming to control the refrigerant head pressure.

The premium control board uses inputs from the indoor unit, condenser refrigerant pressures and temperatures and ambient temperatures to modulate the EC fan motor speed from 0 to 100% RPM, maintaining refrigerant head pressure setpoints. The control board, EC fan(s) and transducer(s) are factory-wired. Dual refrigeration circuit condensers adjust fans of each circuit independently to match each circuit's head pressure conditions. Multiple fan single refrigeration circuit condensers adjust all fans to the same RPM to maintain head pressure. The control system provides refrigerant head pressure control for outdoor ambient temperatures as low as -30°F (-35°C), provided that the total design range (from minimum to maximum) is 125°F (70°C) or less. Liebert Lee-Temp™ kits are required only when the design temperature ranges exceed 125°F (70°C) for standard match ups and 115°F (65°C) for Liebert Quiet-Line™ match ups.

1.1.2 Liebert Lee-Temp™ Refrigerant Control

The Liebert Lee-Temp head pressure control system utilizes head pressure control valve(s), extra refrigerant and insulated refrigerant receiver(s) with heater pads to assist system starting and to maintain proper operating head pressures in outdoor ambient temperatures below the rating point of the Liebert MC control type. The system works by flooding the condenser coil with liquid refrigerant to a level that balances the system condensing requirements with the condenser coil surface available to reject the system heat. During the summer, the system requires the entire condenser coil surface for heat rejection and most of the refrigerant is stored in the receiver. In the winter, the same amount of heat can be rejected by only a fraction of the coil surface. As head pressure begins to fall, the control valve restricts the flow of liquid refrigerant existing from the condenser. This extra liquid refrigerant reduces the effective condenser surface area available for heat transfer. The head pressure control valve also bypasses hot gas into the receiver to warm the liquid and maintain liquid pressure for proper operation of the expansion valve. Liebert Lee-Temp kit is optional for condensers and is field-installed. Condenser control boards are factory-configured for Liebert Lee-Temp if ordered with Liebert Lee-Temp receivers. They can be field-configured if Liebert Lee-Temp system is added later.

1.2 Sound Level

Liebert MC condensers utilize low air resistance coil(s) and slower speed fan motors to yield the required heat rejection at significantly lower sound levels. EC fans are designed to yield the same maximum sound levels at summer design conditions to help your facility meet noise codes with moderate operating sound levels.

1.2.1 Liebert Quiet-Line Match Up

Special match ups of premium condensers are available for applications needing to meet even lower governmental sound regulations. Lower sound levels are achieved by oversizing the condenser, which will decrease the maximum airflow and sound level produced by the condenser at design outdoor air temperatures. This feature requires special setup of the indoor unit. Liebert Lee-Temp may be required for these applications.

1.3 Surge Protection Device (Optional)

An optional surge protection device (SPD) can be field-wired to protect the condenser from surges that threaten sensitive equipment. The condenser's electrical panel provides a terminal block to allow the SPD to be wired in parallel with the high-voltage power. An additional low-voltage terminal block is provided on condensers with Premium Control Boards to allow monitoring of the SPD alarm circuit.

The Liebert PowerSure CM™ surge protection device provides 50kA per mode of surge current protection. An illuminated green LED indicates the SPD is On and providing full protection. An illuminated red LED indicates that the device's protection may have been reduced and may require replacement.

Both lights extinguished indicates there is no power to the condenser or the condenser disconnect is in the Off position.

2.0 SITE PREPARATION

2.1 Site Considerations

- Condensers should be installed in a location offering maximum security and access for maintenance.
- Avoid ground-level sites with public access and areas prone to heavy snow or ice accumulations.
- To ensure adequate air supply, Emerson® recommends that condensers be installed in an area with clean air, away from loose dirt and foreign matter that might clog the coil. In addition, condensers should be located no closer than 3 feet (1m) from a wall, obstruction or adjacent unit.
- For roof installation, mount the condenser on suitable curbs or other supports in accordance with local codes.
- Condensers must not be installed in a pit.
- Condensers must be installed on a level surface to ensure proper refrigerant flow.
- Use caution when installing condensers below the indoor unit. Condensers must not be installed more than 15ft. (4.6m) below the indoor unit. Condensers with Liebert Lee-Temp™ receivers must be installed at or above the level of the indoor units to maintain proper subcooling.
- Liebert Lee-Temp receiver tanks should be mounted on the condenser legs for proper operation. Contact Emerson Application Engineering Department for assistance with applications requiring remote mounting of receivers.
- Condensers must be installed in vertical airflow orientation to maintain the electrical box's NEMA 3R rating.

2.2 Dimensions and Weights

Table 1 Condenser net weights, shipping weights, dimensions and volume, approximate

Model #	Number of Fans	Condenser Net Weight lb (kg)	Domestic Packaging			Export Packaging		
			Packaged Weight lb (kg)	Dimensions (LxWxH) in. (cm)	Volume ft^3 (m^3)	Packaged Weight lb (kg)	Dimensions (LxWxH) in. (cm)	Volume ft^3 (m^3)
MCS028	1	154 (70)	335 (152)	76x36x63 (193x91x160)	100 (2.8)	455 (206)	77x37x64 (196x94x163)	106 (3.0)
MCM040	1	231 (105)	410 (186)	76x36x63 (193x91x160)	100 (2.8)	535 (243)	77x37x64 (196x94x163)	106 (3.0)
MCM080	2	441 (200)	750 (340)	136x36x63 (345x91x160)	179 (5.0)	945 (429)	137x37x64 (348x94x163)	188 (5.3)
MCM120	3	672 (305)	1110 (503)	196x36x63 (498x91x160)	257 (7.3)	1380 (626)	197x37x64 (413x66x142)	270 (7.7)
MCM160	4	860 (390)	1425 (646)	256x36x63 (650x91x160)	336 (9.5)	1770 (803)	257x37x64 (653x94x163)	352 (10)
MCL055	1	344 (156)	525 (238)	76x36x63 (193x91x160)	100 (2.8)	645 (293)	77x37x64 (196x94x163)	106 (3.0)
MCL110	2	602 (273)	910 (413)	136x36x63 (345x91x160)	179 (5.0)	1110 (503)	137x37x64 (348x94x163)	188 (5.3)
MCL165	3	891 (404)	1330 (603)	196x36x63 (498x91x160)	257 (7.3)	1600 (726)	197x37x64 (413x66x142)	270 (7.7)
MCL220	4	1186 (538)	1755 (796)	256x36x63 (650x91x160)	336 (9.5)	2095 (950)	257x37x64 (653x94x163)	352 (10)

Net and packaged weights will increase with factory options: legs taller than 18", coated coils and seismic options. Field-installed receivers also add to net weights. Consult factory for additional information.

Table 2 Condenser net weight addition—taller legs

Leg Height In. (mm)	Additional Weight by Condenser Model, lb. (kg)								
	MCS028	MCM040	MCM080	MCM120	MCM160	MCL055	MCL110	MCL165	MCL220
36 (914)	120	120	139	242	236	127	148	222	242
48 (1219)	151	151	171	304	283	159	179	269	289
60 (1524)	183	183	202	367	330	190	210	316	336

Figure 2 Typical footprint dimensions, all units

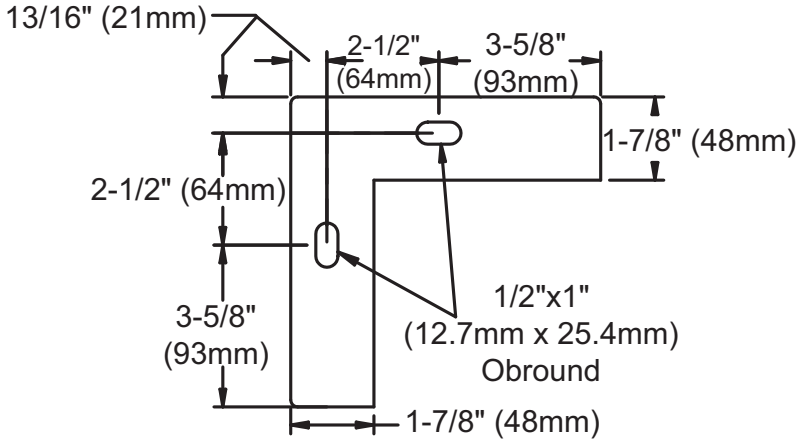
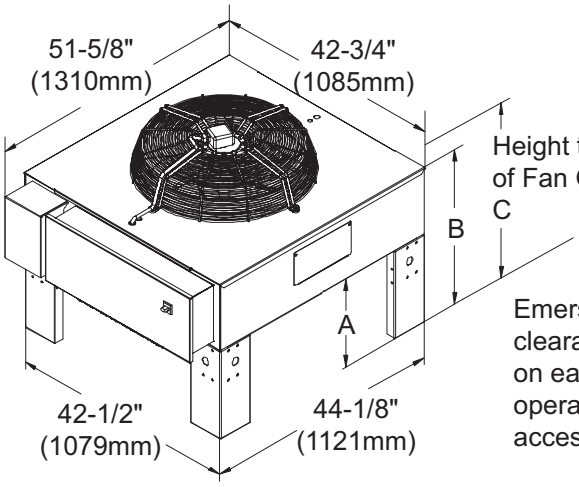
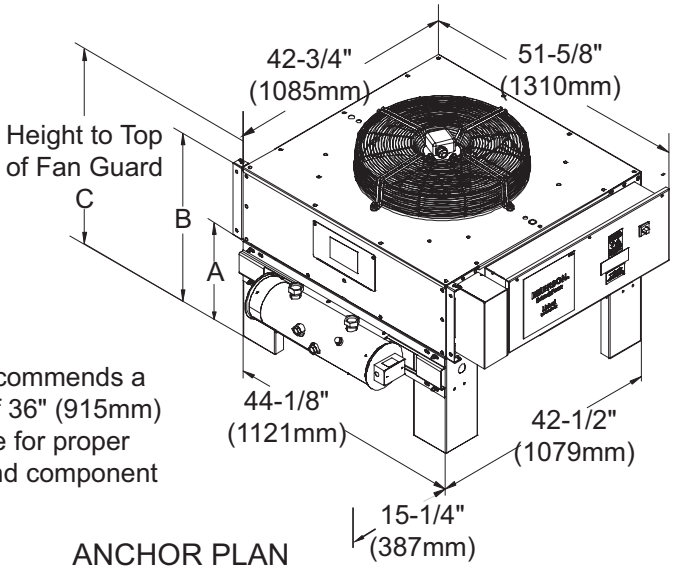


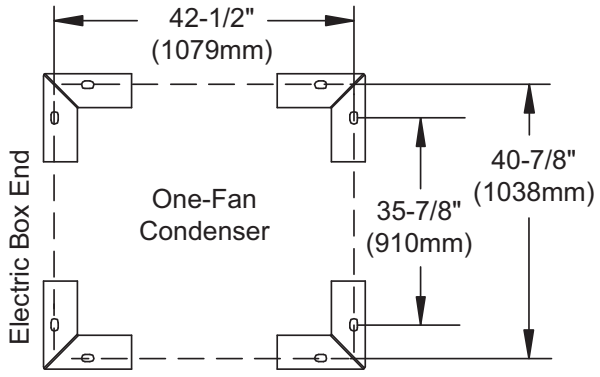
Figure 3 Condenser planning dimensional data—MCS028



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



ANCHOR PLAN



For typical footprint dimensions, see Figure 2

DPN002372 Rev. 2 DPN002373 Rev. 3

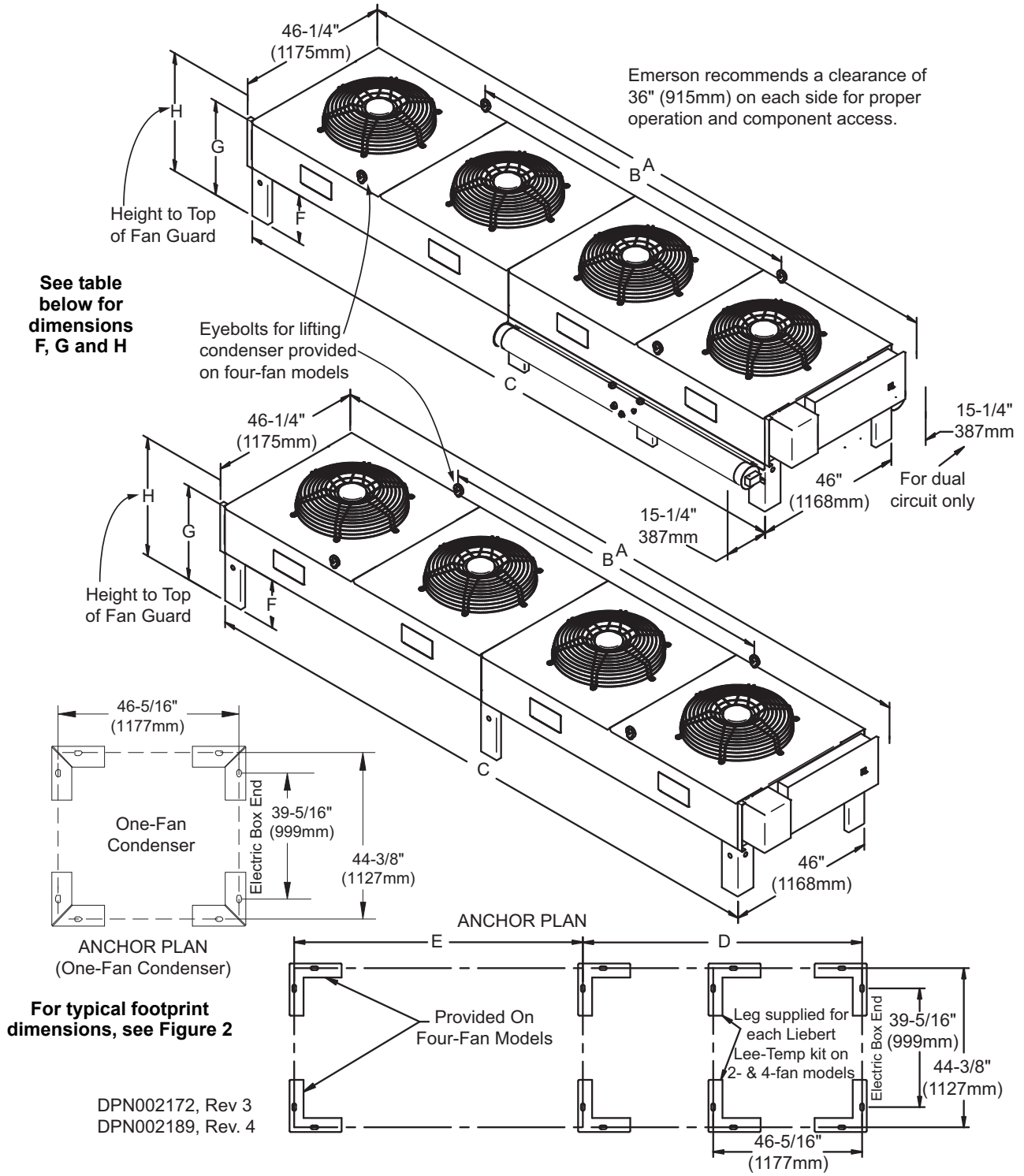
Leg Height A *, In. (mm)	B In. (mm)	C In. (mm)
18 (457)	31-5/8 (803)	39-5/8 (1006
36 (914)	49-5/8 (1260)	57-5/8 (1464)
48 (1219)	61-5/8 (1565)	69-5/8 (1768)
60 (1524)	73-5/8 (1870)	81-5/8 (2073)

* 18" legs standard for all models. Cross-bracing is required for legs longer than 18" (457mm). Number varies according to model and options.

See **Tables 1** and **2** for weights, including added weight for legs of various lengths.

Source: DPN002372, Rev. 2; DPN002373, Rev. 3

Figure 4 Condenser planning dimensions—MCM040, MCM080, MCM160 with/without Liebert Lee-Temp™



Liebert Model #	No. Fans	A In. (mm)	B In. (mm)	C In. (mm)	D In. (mm)	E In. (mm)
MCM040	1	57-3/16 (1453)	—	48 (1219)	46-5/16 (1177)	—
MCM080	2	105-1/4 (2674)	—	96-1/16 (2440)	94-7/16 (2398)	—
MCM160	4	202-7/16 (5142)	113-1/2 (2883)	192-1/4 (4883)	94-7/16 (2398)	96-3/16 (2444)

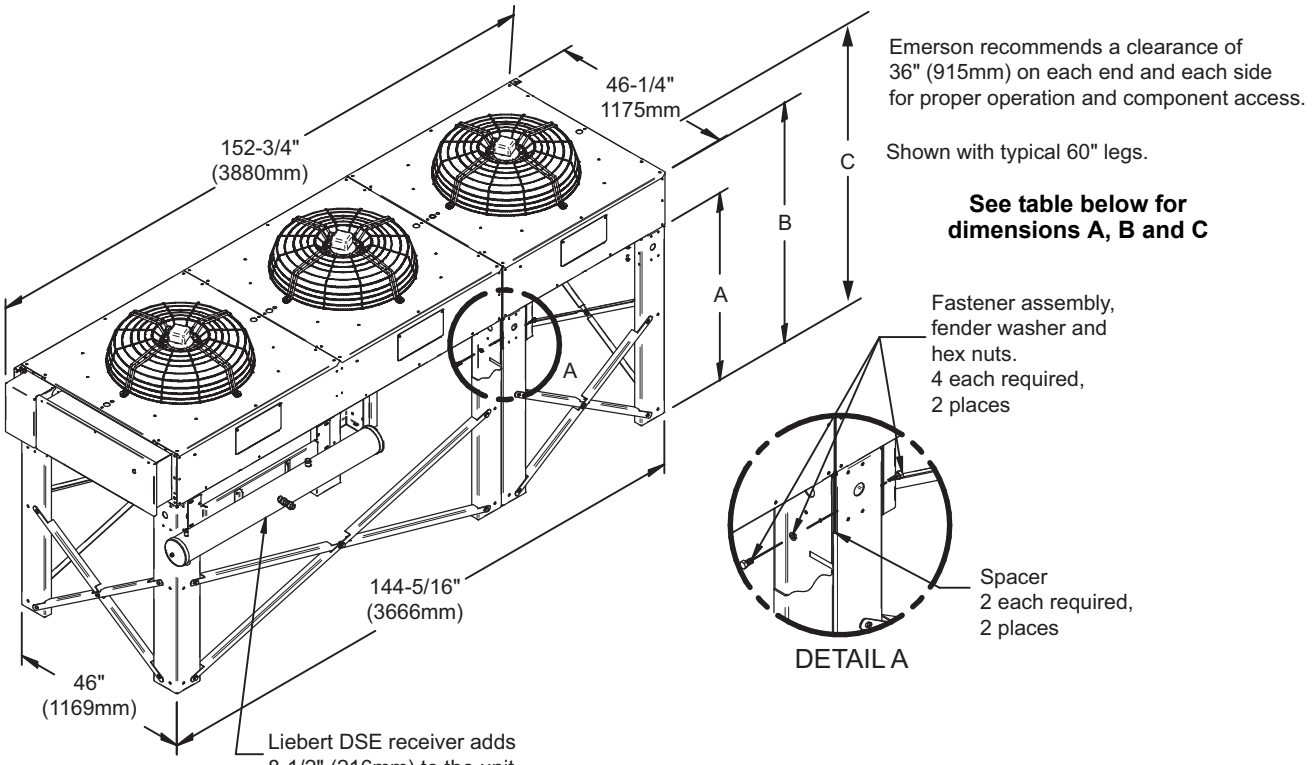
Leg Height F * In (mm)	G	H
18 (457)	31-5/8 (803)	39-5/8 (1006
36 (914)	49-5/8 (1260)	57-5/8 (1464)
48 (1219)	61-5/8 (1565)	69-5/8 (1768)
60 (1524)	73-5/8 (1870)	81-5/8 (2073)

Source: DPN002172, Rev. 3; DPN002189, Rev. 4

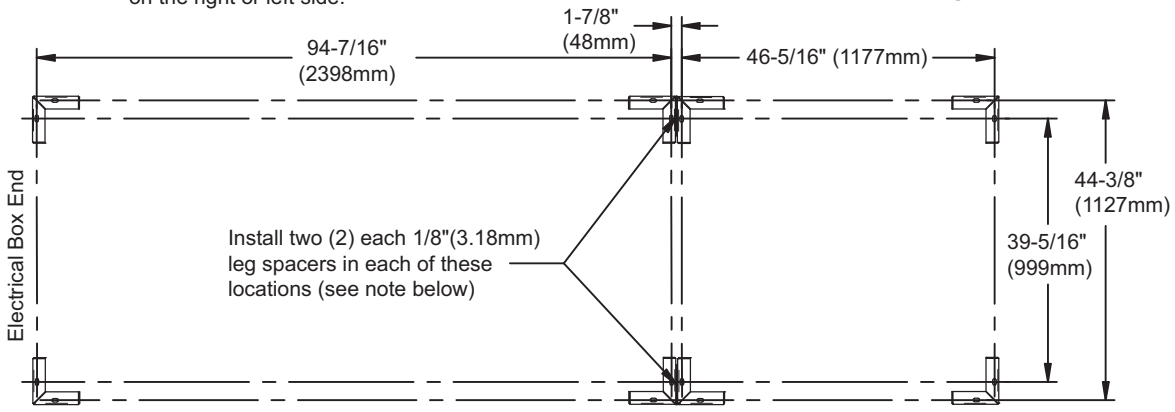
* 18" legs standard for all models. Cross-bracing required for legs longer than 18". Number varies according to model and options.

See **Tables 1** and **2** for weights, including added weight for legs of various lengths. Source: DPN002172, Rev. 3; and DPN002189, Rev. 4.

Figure 5 Condenser planning dimensions–MCM120



For typical footprint dimensions, see Figure 2



ANCHOR PLAN

NOTE:
Install (2) two condenser leg spacers, part number 304679P1, in two places where shown, between each pair of legs that adjoin each other.
Use (4) four of part number: 301375G1 (fastener assembly), 301369P1 (washer fender) and 301392P1 (nut hex), to secure each pair of legs and spacers together.

DPN002555
Rev. 1

Leg Height A *, In. (mm)	B In. (mm)	C In. (mm)
18 (457)	31-5/8 (803)	39-5/8 (1006
36 (914)	49-5/8 (1260)	57-5/8 (1464)
48 (1219)	61-5/8 (1565)	69-5/8 (1768)
60 (1524)	73-5/8 (1870)	81-5/8 (2073)

* 18" legs standard for all models. Cross-bracing required for legs longer than 18". Number varies according to model and options. See **Tables 1** and **2** for weights, including added weight for legs of various lengths.
Source: DPN002555, Rev. 1

Figure 6 Condenser planning dimensions—MCL055, MCL110, MCL165 and MCL220

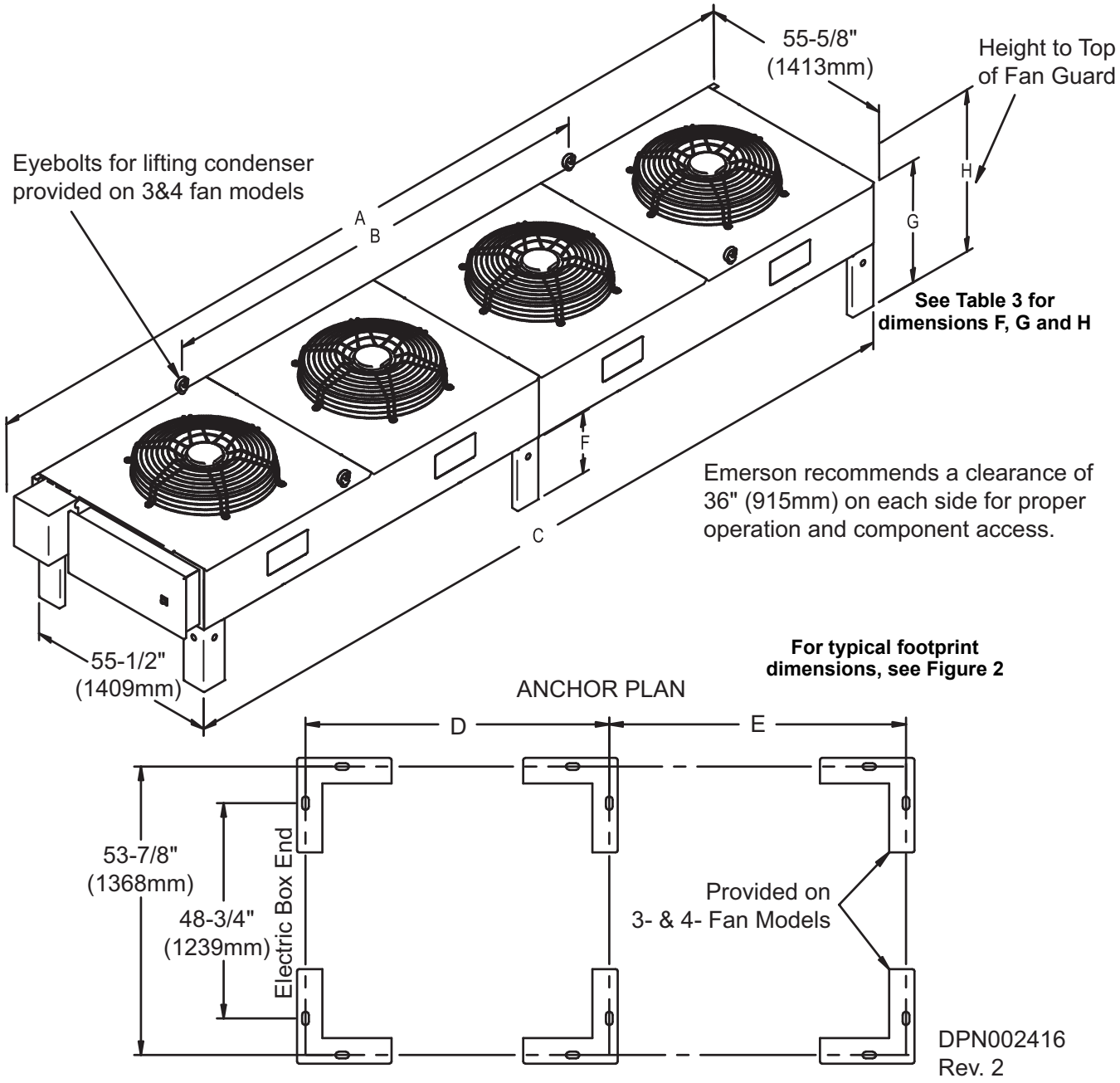


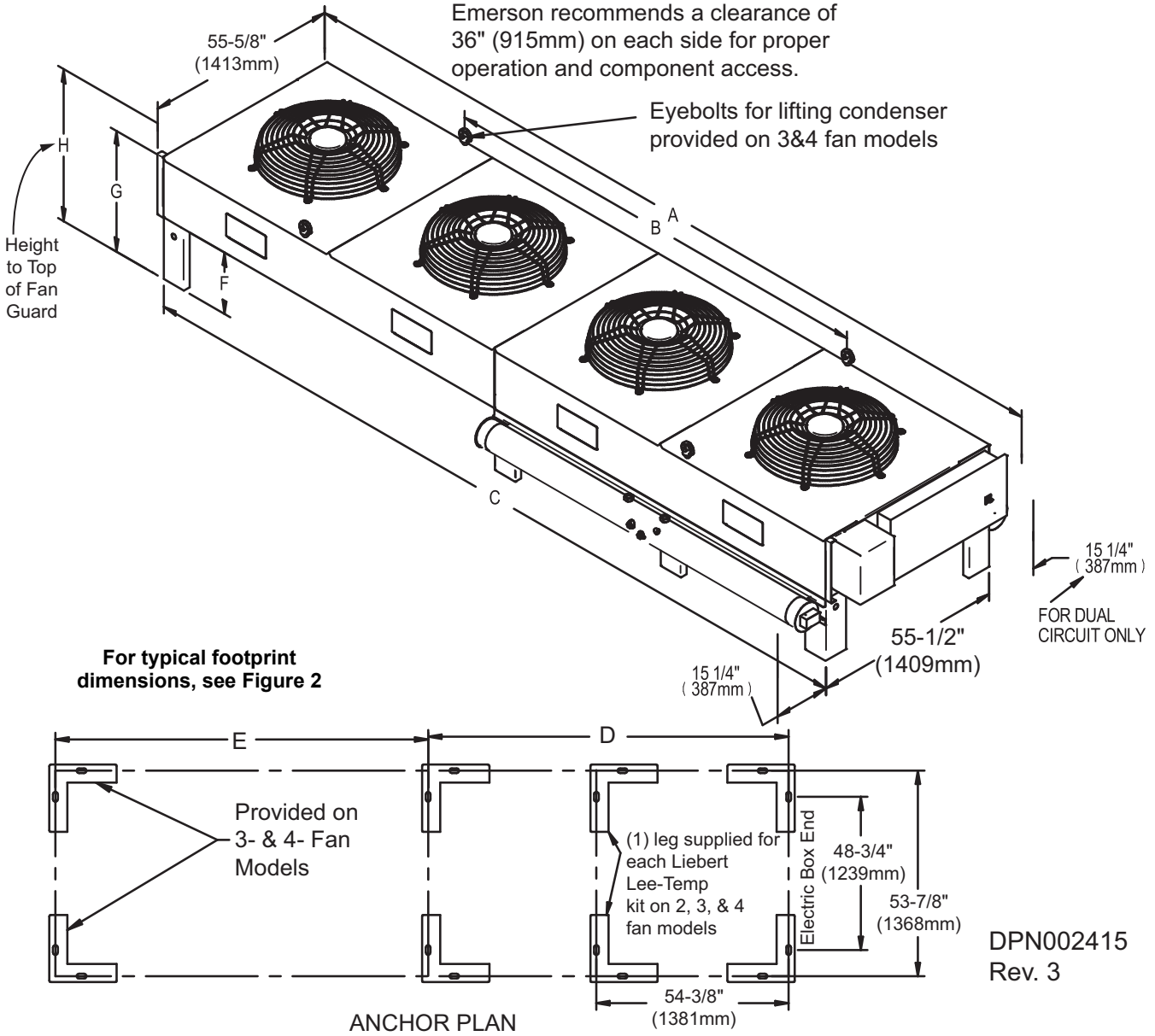
Table 3 Condenser leg height and additional weight, MCL055, MCL110, MCL165 and MCK220

Model #	# of Fans	A in. (mm)	B in. (mm)	C in. (mm)	D in. (mm)	E in. (mm)
MCL055	1	68 (1727)	—	56 (1423)	54-3/8 (1381)	—
MCL110	2	124-1/8 (3152)	—	112-1/8 (2848)	110-1/2 (2806)	—
MCL165	3	180-1/4 (4578)	73-7/16 (1866)	168-1/4 (4274)	110-1/2 (2806)	56-1/8 (1425)
MCL220	4	236-5/16 (6003)	129-9/16 (3291)	224-3/8 (5699)	110-1/2 (2806)	112-1/4 (2851)

Leg Height F * In. (mm)	G In. (mm)	H In. (mm)
18 (457)	35-7/8 (911)	43-5/8 (1108)
36 (914)	53-7/8 (1368)	61-5/8 (1565)
48 (1219)	65-7/8 (1673)	73-5/8 (1870)
60 (1524)	77-7/8 (1978)	85-5/8 (2175)

* 18" legs standard for all models. Cross-bracing required for legs longer than 18" (457mm). Number varies according to model and options. See **Tables 1** and **2** for weights, including added weight for legs of various lengths.
Source: DPN002416, Rev. 2

Figure 7 Cabinet and anchor dimensions—MCL055, MCL110, MCL165 and MCL220 with Liebert Lee-Temp™ receiver



Model #	# of Fans	A in. (mm)	B in. (mm)	C in. (mm)	D in. (mm)	E in. (mm)
MCL055	1	68 (1727)	—	56 (1423)	54-3/8 (1381)	—
MCL110	2	124-1/8 (3152)	—	112-1/8 (2848)	110-1/2 (2806)	—
MCL165	3	180-1/4 (4578)	73-7/16 (1866)	168-1/4 (4274)	110-1/2 (2806)	56-1/8 (1425)
MCL220	4	236-5/16 (6003)	129-9/16 (3291)	224-3/8 (5699)	110-1/2 (2806)	112-1/4 (2851)

Leg Height F * In. (mm)	G In. (mm)	H In. (mm)
18 (457)	35-7/8 (911)	43-5/8 (1108
36 (914)	53-7/8 (1368)	61-5/8 (1565)
48 (1219)	65-7/8 (1673)	73-5/8 (1870)
60 (1524)	77-7/8 (1978)	85-5/8 (2175)

* 18" legs standard for all models. Cross-bracing required for legs longer than 18" (457mm). Number varies according to model and options. See **Tables 1** and **2** for weights, including added weight for legs of various lengths.
Source: DPN002415, Rev. 3

3.0 INSPECTION AND INSTALLATION

3.1 Equipment Inspection

Before unpacking the condenser, verify that the labeled equipment matches the bill of lading. Carefully inspect all items for damage, either visible or concealed. Report any damage immediately to the carrier and your local Emerson representative. File a damage claim with the carrier and send a copy to your local Emerson representative.

3.1.1 Packing Material

All material used to package this unit is recyclable. Save it for future use or dispose of the material appropriately.

SAFETY INFORMATION

WARNING

Risk of improper handling. Can cause equipment damage, injury or death.

Read all of the following instructions before attempting to move, lift, remove packaging from or preparing unit for installation.

WARNING

Risk of heavy condenser falling or tipping over. Can cause property damage, serious injury or death.

Confirm that all components of the lifting system are rated for the weight of the condenser by an OSHA Certified rating organization before attempting to lift and/or move the condenser. See **2.2 - Dimensions and Weights** for the condenser weights.

CAUTION

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

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

NOTICE

Risk of overhead interference. Can cause unit and/or structure damage.

Refer to the installation plans before moving the unit to verify clearances.

NOTICE

Risk of improper forklift handling. Can cause unit damage.

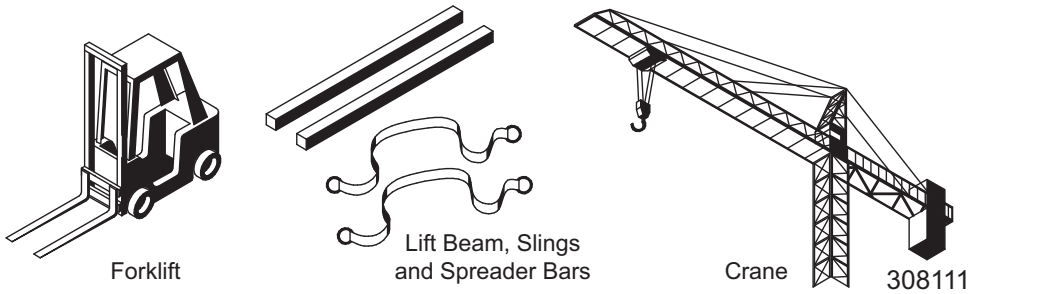
Keep the forklift tines level and at a height that will fit under the skid.

NOTICE

Risk of improper storage. Can cause unit damage.

Keep unit upright and protected from contact damage.

Figure 8 Equipment recommended for handling a Liebert condenser

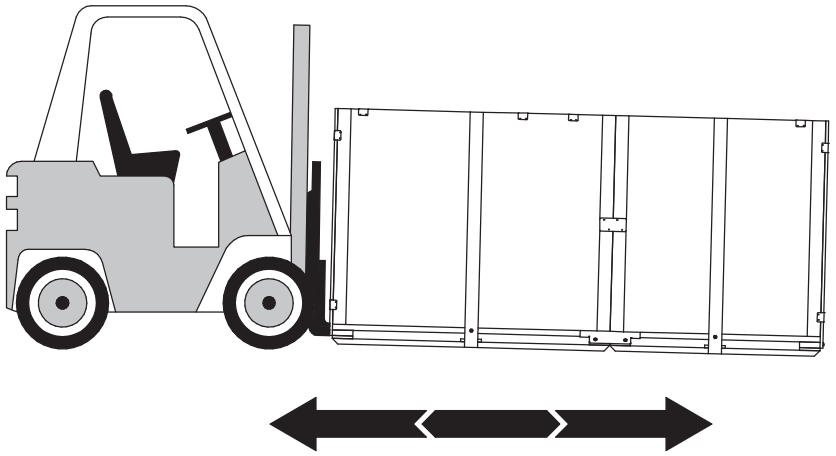


3.2 Handling Unit on the Skid

Transport unit using a forklift or a crane with sling and spreader bars.

- If using a fork lift, make sure the forks (if adjustable) are spread to the widest allowable distance to still fit under the skid.
- Type of fork lift used will be dependent on the terrain the unit to be moved across during handling.
- Minimum fork lift fork length for use on 1 and 2 fan units to be 48" (1219mm).
- When moving the packaged unit, do not lift the unit any higher than 6"(152mm) off the ground. If circumstances require the unit to be lifted higher than 6" (152mm), great care must be exercised and all personnel not involved in moving the unit must be at least 20' (5m) from the lift point of the unit.

Figure 9 Forklift position with one-fan or two-fan condensers



- When using a forklift to off-load or move for installation, it is recommended to lift one narrow end off the ground no more than 6" (152mm). Use the forklift to push or pull the unit.
- When using a crane to lift the unit from a flat bed or to move for installation, using slings rated for the unit weight is recommended.
- Spreader bars are to be used for sling stability and to prevent unit pinching. Make sure spreader bars are wider than the unit.
- Slings are to be placed near the ends of the unit, under the top deck boards of the skid.

3.3 Unit Storage

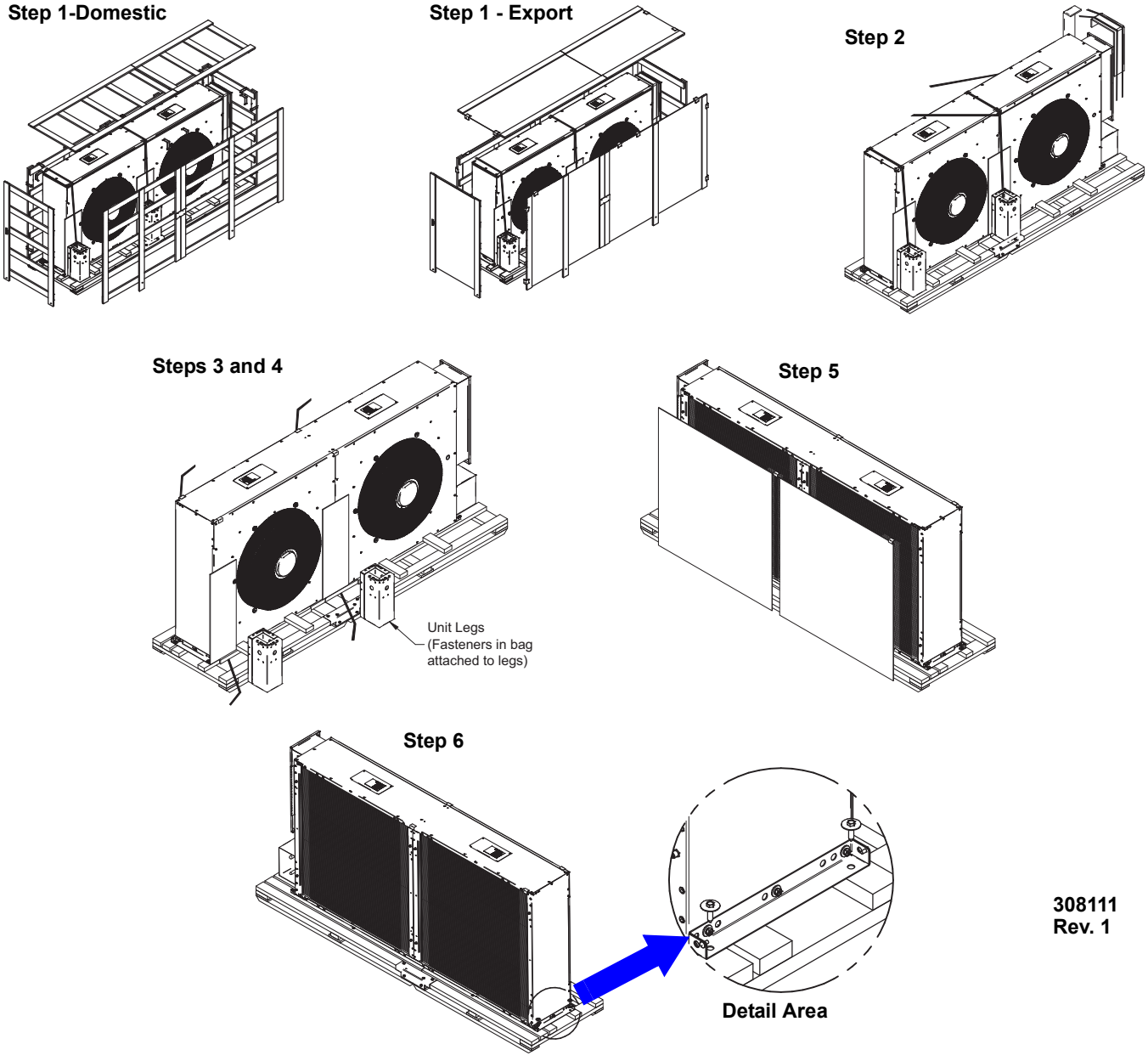
- Store the fan in the original shipping packaging in a dry area protected from the weather, or protect it from dirt and weather until final installation.
- Avoid temperatures below -30°F (-34°C) and above 150°F (65°C).
- Avoid storing the Liebert MC condenser for longer than one year.

3.4 Unpacking the Condenser—All Unit Sizes

To unpack a condenser with one to two fans:

1. Remove the fence for domestic packaging (for export packaging, remove the crate).
2. Remove corner and side foam planks from around the unit.
3. Remove the steel band holding the unit to the skid.
4. Set unit legs aside for use later.
5. Remove corrugated panels covering the Liebert MC's coil(s).
6. Remove the bolts securing unit to the skid.

Figure 10 Removing protective material



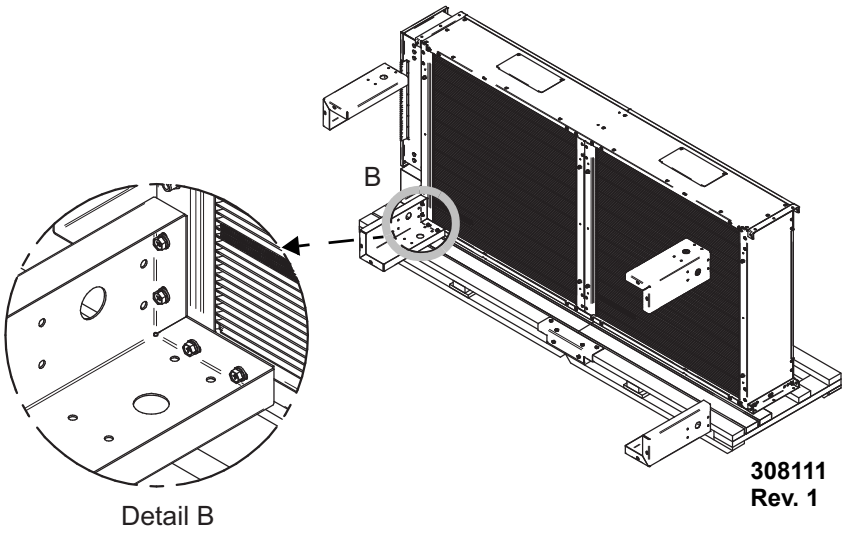
3.5 Preparing a Condenser for Moving and Installation—Units with One or Two Fans

The following procedure is one recommended method for removing a Liebert condenser from its shipping skid. Other methods may be used, provided that they are safe for personnel, the condenser and equipment.

3.5.1 Attaching Legs, Removing the Skid and Attaching Slings-Units with One or Two Fans

1. Attach legs to the unit at indicated locations.
   Use the fasteners provided with the legs.
   Recommended tools for attachment is a 5/8" socket and ratchet.
   More legs may be available for installation than shown. This will depend on the unit type and number of fans.

Figure 11 Attaching legs to one-fan or two fan condensers



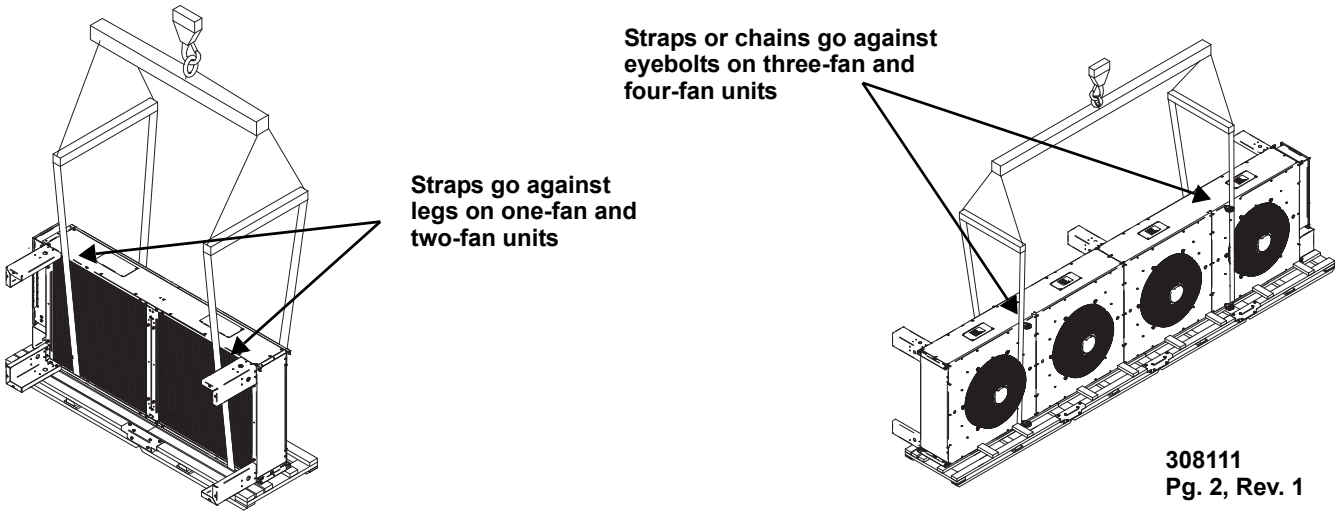
2. Place slings around the unit between the unit and the top deck boards of the skid:
   - **One-fan and two-fan units**: against the inside of the attached legs.
   - **Three-fan and four-fan units**: against the outside of the attached eye bolts.
3. Use spreader bars, a lift beam and a crane to lift the unit off the skid.

NOTICE

Risk of improper lifting. Can cause equipment damage.

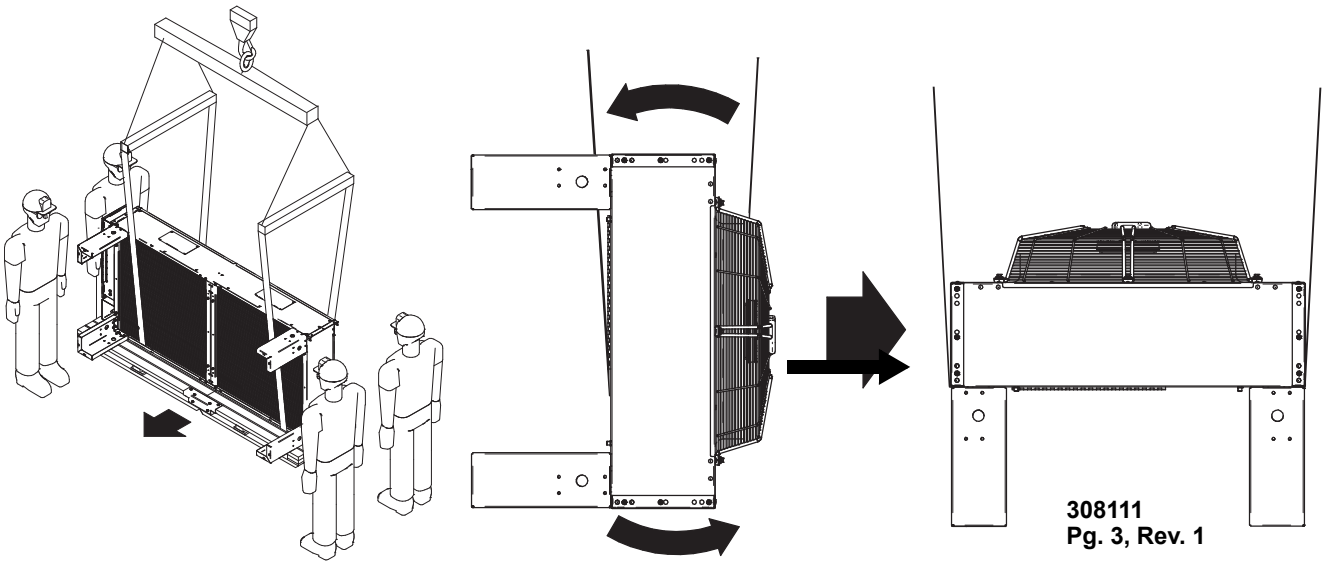
Make sure that the spreader bars wider are than the unit. If the spreader bars are too short, the slings may crush the unit.

Figure 12 Securing slings to condensers for lifting off skid



4. Lift the unit 24" (610mm) off the top deck of the skid.
5. Move the skid from under the unit.
6. A mechanized method is preferred, but if not available, uses a minimum of four properly protected individuals to turn the unit upright so that the legs point down.
   Unit legs must be pointing toward the ground.

Figure 13 Remove skid, set condenser on floor



7. Set the upright unit on the ground so the legs support unit weight.
8. Remove the straps from around unit.
9. **One-fan and two-fan units:** Route the straps through the large holes in the side of the legs. Spreader bars are still required.
   On three-fan and four-fan units: Secure straps or chains to the eyebolts on top of the unit. Spreader bars are still required.

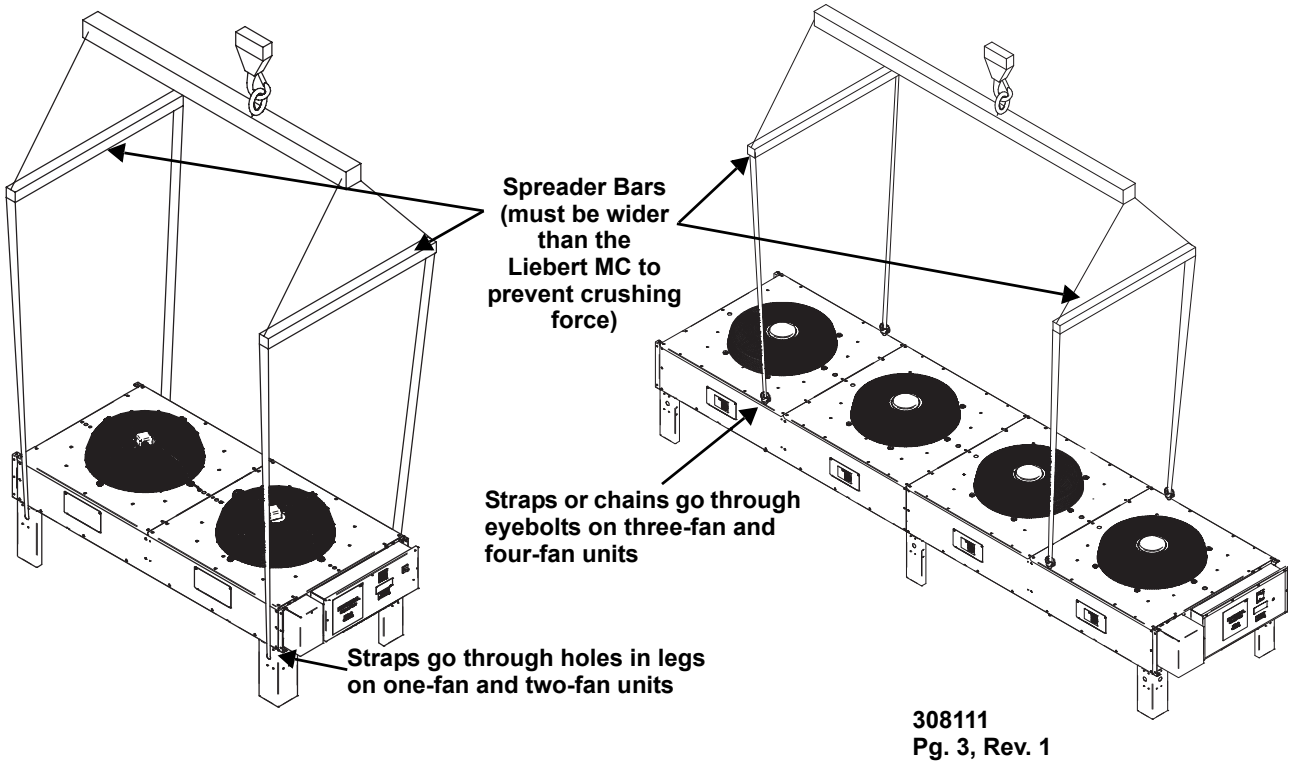
NOTICE

Risk of improper lifting. Can cause equipment damage.

Make sure that the spreader bars wider are than the unit. If the spreader bars are too short, the slings may crush the unit.

The unit is ready to be lifted and moved to its installation location.

Figure 14 Lifting condensers with one, two, three or four fans



3.6 Mounting the Condenser

The condenser must be installed so that it is level within 1/2" (13mm) to ensure proper refrigerant flow. For roof installation, mount the condenser on suitable curbs or other supports; follow all local and national codes. Secure the legs to the mounting surface using a field-supplied 1/2" (13mm) diameter bolt in each of the two 1/2" x 1" (12.7x25.4mm) obround holes in each leg. See **Figures 3** through **7** for anchor dimensions.

4.0 ELECTRICAL CONNECTIONS

Line voltage electrical service is required for all models. Refer to equipment nameplate regarding wire size and circuit protection requirements. Electrical service must conform to national and local electrical codes. Refer to **Figure 16** for electrical service entrances into unit. Refer to electrical schematic when making connections.

A manual electrical disconnect switch should be installed in accordance with local codes. Consult local codes for external disconnect requirements.

All internal wiring is completed at the factory.

WARNING

Risk of electrical shock. Can cause injury or death.

The variable speed control may contain a stored electrical charge. Disconnect all local and remote electrical power supplies and wait 10 minutes before working within the condenser's main electrical enclosure or fan electrical enclosure.

The Liebert MC contains lethal voltage in some circuits. The line side of the disconnect remains energized when the condenser unit disconnect is switched to the Off position.

Use a voltmeter to verify that the line-side electrical power is Off before making any electrical connections or performing any electrical and/or mechanical service and/or maintenance operations.

WARNING

Risk of high-speed, rotating fan blades. Can cause serious injury or death.

Fan blades can automatically start rotating without warning at any time during a cooling cycle or after power is restored after a power failure. Disconnect all local and remote electric power supplies and verify with a voltmeter that the power is off and that the fan blades have stopped rotating before working within the cabinet or servicing fan motors.

Each unit is shipped from the factory with all internal wiring completed. Refer to the electrical schematic supplied with the condenser when making line voltage supply, low-voltage indoor unit interlock and any low-voltage alarm connections. All wiring must be done in accordance with all applicable local, state and national electrical codes.

NOTE

Installation and service of this equipment should be done only by properly trained and qualified personnel who have been specially trained in the installation of air conditioning equipment.

NOTE

Use copper wiring only. Make sure that all connections are tightened to the proper torque mentioned on the component.

4.1 Line Voltage Wiring

WARNING

Risk of electrical fire and short circuit. Can cause property damage, injury or death.

Select and install the line side electrical supply wire and overcurrent protection device(s) according to the specifications on the unit nameplate(s), per the instructions in this manual and according to the applicable national, state, and local code requirements. Use copper conductors only.

Make sure all electrical connections are tight. Unit-specific wiring diagrams are provided on each unit.

NOTE

The Liebert MC Condenser is designed to operate with Wye-connected power. It will not operate properly with Delta-connected power. Refer to ***4.1.1 - Wye vs. Delta Connection Power Supply****.*

Condenser-rated voltage should be verified with available power supply before installation. Refer to the unit's electrical schematic and serial tag for specific electrical requirements.

Line voltage electrical service is required for all condensers at the location of the condenser. The voltage supply to the condenser may not be the same voltage supply as required by the indoor unit. Consider using UPS equipment on both data center cooling units and Liebert MC condensers to maintain uninterrupted cooling capability. Refer to the unit's serial tag for specific condenser electrical requirements. A unit disconnect is standard. However, a site disconnect may be required per local code to isolate the unit for maintenance. Route the supply power to the site disconnect switch and then to the unit. Route the conduit to the knockout provided in the bottom right end of the electrical control enclosure. Connect the earth ground wire lead to the marked earth ground connection terminal provided near the factory-installed disconnect switch (see **Figure 16**).

NOTE

Liebert Lee-Temp™ kits require a separate line voltage electrical supply for the heated receivers. See ***Table 5*** *for power requirements.*

Table 4 Electrical data, three-phase, 60Hz condenser, Premium Version (EC control)

Model #	Number of Fans	Power Requirements								
		FLA			WSA			OPD		
		208/230V	380/415V	460V	208/230V	380/415V	460V	208/230V	380/415V	460V
MCS028	1	3.0	1.4	1.4	3.8	1.8	1.8	15	15	15
MCM040	1	2.3	1.4	1.4	3.2	1.9	1.9	15	15	15
MCM080	2	4.6	2.8	2.8	5.5	3.3	3.3	15	15	15
MCM120	3	6.9	4.2	4.2	7.5	4.6	4.6	15	15	15
MCM160	4	9.2	5.6	5.6	9.8	6.0	6.0	15	15	15
MCL055	1	5.7	2.8	2.8	7.1	3.5	3.5	15	15	15
MCL110	2	11.4	5.6	5.6	12.8	6.3	6.3	15	15	15
MCL165	3	17.1	8.4	8.4	18.5	9.1	9.1	20	15	15
MCL220	4	22.8	11.2	11.2	24.2	11.9	11.9	25	15	15

1. FLA = Full Load Amps; WSA = Wire Size Amps; OPD = Maximum Overcurrent Protection Device.
2. 208V–460V premium models must be connected to Wye 3-phase systems.

Table 5 Electrical data, Liebert Lee-Temp™ receiver, 60Hz

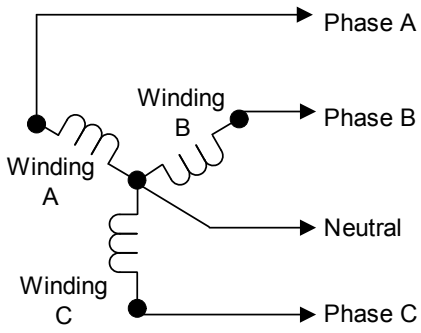
Rated Voltage - Single-Phase	120		208/230	
Watts/Receiver	150	300	150	300
Amps	1.4	2.8	0.7	1.4
Wire Size Amps	1.8	3.5	0.9	1.8
Maximum Overcurrent Protection Device, Amps	15	15	15	15

The Liebert Lee-Temp receiver requires a separate power feed for heaters. The condenser is not designed to supply power to the receiver heater pads.

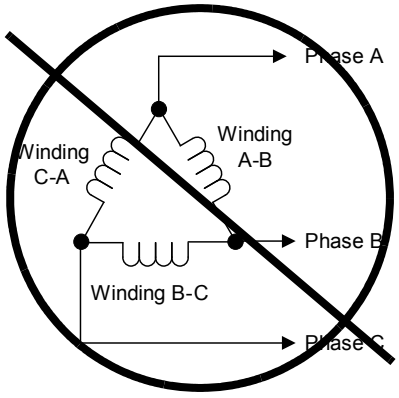
4.1.1 Wye vs. Delta Connection Power Supply

Figure 15 Wye vs. Delta power supply connection diagram

Wye Power Supply Connection



Delta Power Supply Connection



NOTE

The Liebert MC Condenser is designed to operate with Wye-connected power with a solidly grounded neutral.

The Liebert MC condenser Premium EC Fan Models will not operate properly with Delta-connected power. A field-supplied isolation transformer or other power solutions will be needed to for proper condenser function.

NOTE

The electronically commutated motors included in the Liebert MC are suitable for connection to power supplies with a solidly grounded neutral.

Acceptable Power Supplies—208V to 480V Nominal Units

- 208V wye with solidly grounded neutral and 120V line-to-ground
- 380V wye with solidly grounded neutral and 220V line-to-ground
- 480V wye with solidly grounded neutral and 277V line-to-ground

Unacceptable Power Supplies—208V to 480V Nominal Units

- Wye with high-resistance (or impedance) ground
- Delta without ground or with floating ground
- Delta with corner ground
- Delta with grounded center tap

4.2 Low-Voltage Control Wiring—Premium Efficiency Control Condenser

NOTICE

Risk of control malfunction. Can cause improper unit operation.

Make sure that all low-voltage electrical wiring has been performed per the schematic diagram provided and that all low-voltage wiring connections are tight.

Premium Efficiency Control condensers are designed to use CANbus communication between Liebert MC and Liebert iCOM® control on indoor unit. The CANbus wiring is field-supplied and must be:

- shielded
- 24-18AWG stranded tinned copper
- twisted pair (minimum 8 twists per foot)
- low capacitance (17pf/ft or less)
- plenum rated (NEC type CMP) if required by local codes
- UV and moisture resistant or run within conduit once in an outdoor environment, and must be temperature and voltage rated for conditions present.

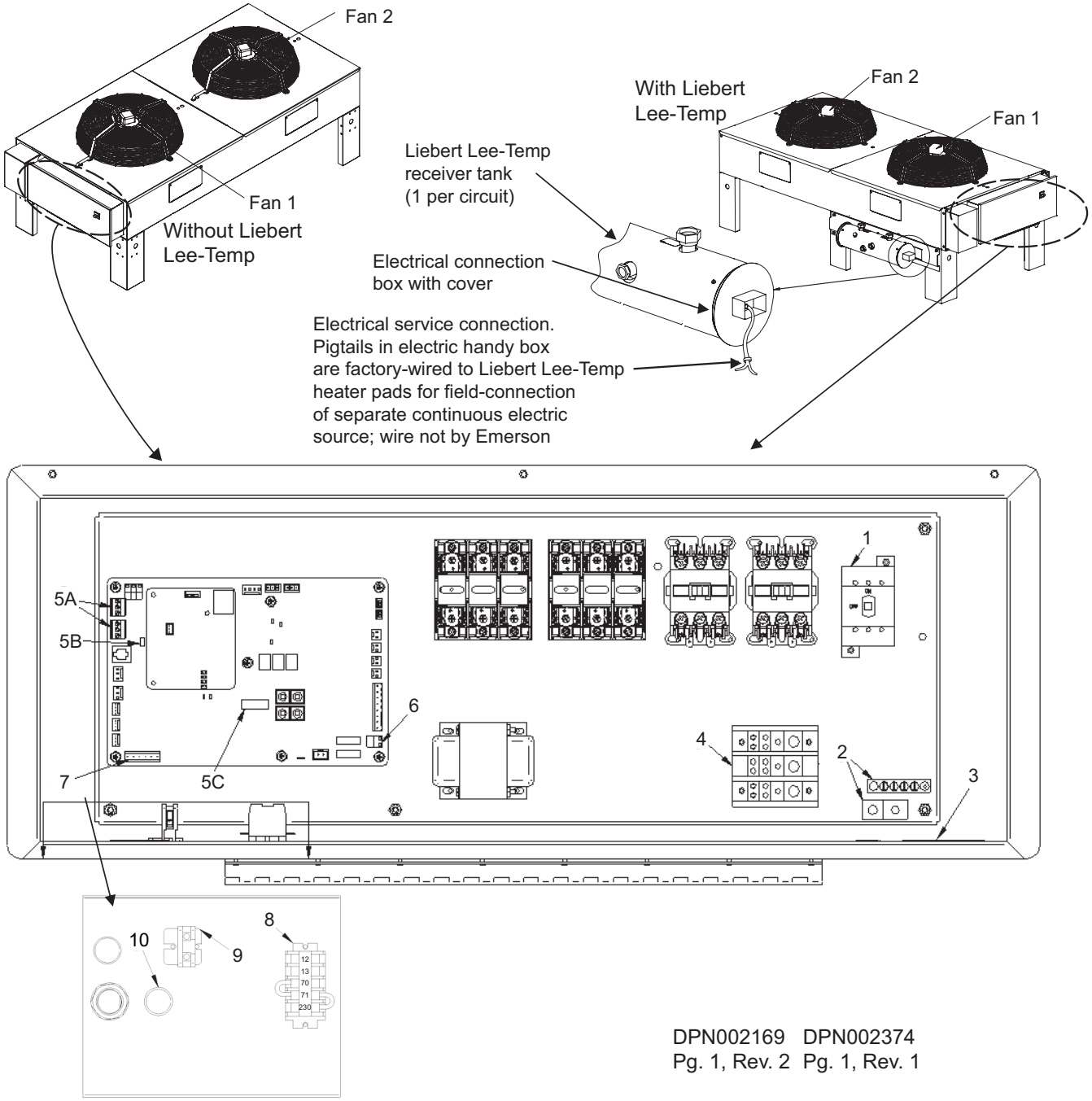
  Examples: Belden part number 89207(plenum rated) or Alpha Wire part number 6454 (UV resistant outdoor rated) category 5, 5e or higher.

Do not run the CANbus cable in the same conduit, raceway or chase used for high-voltage wiring. For CANbus network lengths greater than 350ft (107m), contact Emerson for assistance. The CANbus wiring is for communicating directly with future versions of the Liebert iCOM, but is not currently active. When CANbus wiring is installed, place a jumper between Terminals 70/71/230. Contact Liebert Precision Cooling Support for additional information relative to availability of iCOM software versions that communicate directly to the condenser.

Premium Efficiency Control condensers are also designed to operate with Terminals 70 and 71 wired to indoor unit compressor contactor side switch to indicate compressor on signal. For dual circuit condensers, also use Terminal 230. These signals are required if CANbus communication with Liebert iCOM is not used.

4.2.1 Electrical Field Connection Descriptions

Figure 16 Typical connections, Premium Efficiency Control



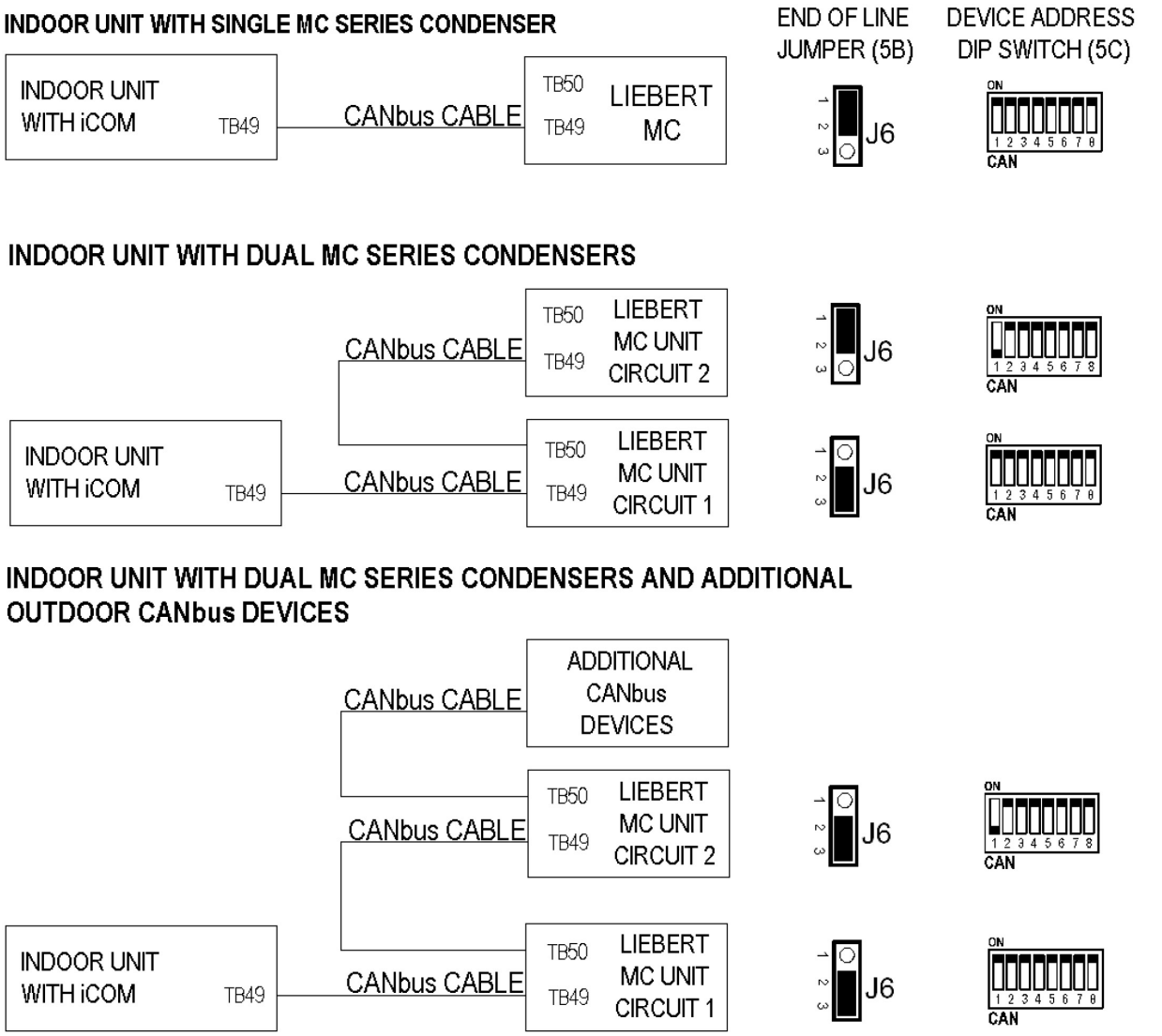
DPN002169 Pg. 1, Rev. 2

DPN002374 Pg. 1, Rev. 1

Key Electrical Details—Typical Connections, Premium Efficiency Control

1. **Three-Phase Electrical Service**—Terminals are on the top of the disconnect switch for one-fan and two-fan units. Terminals are on the bottom of the disconnect switch for three-fan and four-fan units. Three-phase service not by Emerson. See **4.1.1 - Wye vs. Delta Connection Power Supply**.
2. **Earth Ground**—Field lug terminal for earth ground connection. Ground terminal strip for fan motor ground connection.
3. **Primary High-Voltage Entrance**—Three 7/8" (22.2mm) diameter knockouts located at the bottom of the enclosure.
4. **SPD Field Connection Terminals**—High-voltage surge protection device (SPD) terminals. SPD is an optional device.
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 the output terminal for CANbus high.
     - TB50-3 is the output terminal for CANbus low.
     - Each CANbus cable shield is connected to terminal "SH;" see **9** below.
   - 5B is the "END OF LINE" jumper.
   - 5C is the CANbus "DEVICE ADDRESS DIP SWITCH." CANbus cable not by Liebert. See requirements in **4.2 - Low-Voltage Control Wiring—Premium Efficiency Control Condenser**.
6. **Remote Unit Shutdown**—Replace exiting 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.
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 field-supplied Class 1 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 field-supplied Class 1 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 and 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.

Figure 17 Field configurations and setting adjustments, Premium Efficiency Control



DPN002374
Pg. 2, Rev. 1

5.0 PIPING

WARNING

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

Relieve pressure before working with or cutting into piping.

WARNING

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

Local building and plumbing codes may require that a fusible plug or other type of pressure relief device be installed in the system. Do not install a shutoff valve between the compressor and the field-installed relief device.

Consult local building and plumbing codes for installation requirements of additional pressure relief devices when isolation valves are installed as shown in **Figure 18**. Do not isolate any refrigerant circuits from overpressurization protection.

NOTE

POE (polyol ester) oil, required with R407C/R410A and used with some R22 systems, is much more hygroscopic than mineral oils. This means that POE oil absorbs water at a much faster rate when exposed to air than previously used mineral oils. Because water is the enemy of a reliable refrigeration system, extreme care must be used when opening systems during installation or service. If water is absorbed into the POE oil, it will not be easily removed and will not be removed through the normal evacuation process. If the oil is too wet, it may require an oil change. POE oils also have a property that makes them act as a solvent in a refrigeration system. Maintaining system cleanliness is extremely important because the oil will tend to bring any foreign matter back to the compressor or plug the microchannel coil. Always use a flow of dry nitrogen when brazing.

5.1 Piping Guidelines

Indoor units and condensers both ship with holding charges of inert gas. Do not vent the condenser until all refrigerant piping is in place, ready for connection to indoor unit and condenser.

- Use copper piping with a brazing alloy with a minimum temperature of 1350°F (732°C), such as Sil-Fos. Avoid soft solders such as 50/50 or 95/5.
- Use a flow of dry nitrogen through the piping during brazing to prevent formation of copper oxide scale inside the piping. When copper is heated in the presence of air, copper oxide forms. POE oil will dissolve these oxides from inside the copper pipes and deposit them throughout the system, clogging filter driers and affecting other system components.
- A pure dry nitrogen flow of 1-3 ft^3/min (0.5-1.5 l/s) inside the pipe during brazing is sufficient to displace the air. Control the flow using a suitable metering device.
- Ensure that the tubing surfaces to be brazed are clean and that the ends of the tubes have been carefully reamed to remove any burrs.
- Ensure that all loose material has been cleaned from inside the tubing before brazing.
- Protect all refrigerant line components within 18" (460mm) of the brazing site by wrapping them with wet cloth or suitable heat sink compound.
- Isolate piping from building using vibration isolating supports.
- Refer to the indoor unit's user manual for appropriate piping sizes.
- Install traps on the hot gas (discharge) lines at the bottom of any rise over 5 feet high. If the rise exceeds 25 feet (7.5m), then install a trap in 20 foot (6m) increments or evenly divided.
- Pitch horizontal hot gas piping down at a minimum rate of 1/2" per 10 ft. (42mm per 10m) so that gravity will aid in moving oil in the direction of refrigerant/oil flow.
- Consult factory if Liebert Lee-Temp™ condenser is below the evaporator or if a condenser not equipped with Liebert Lee-Temp is more than 15 ft (4.6m) below the evaporator.
- Consult factory if piping run exceeds 150 feet (46m) equivalent length on traditional DX units.

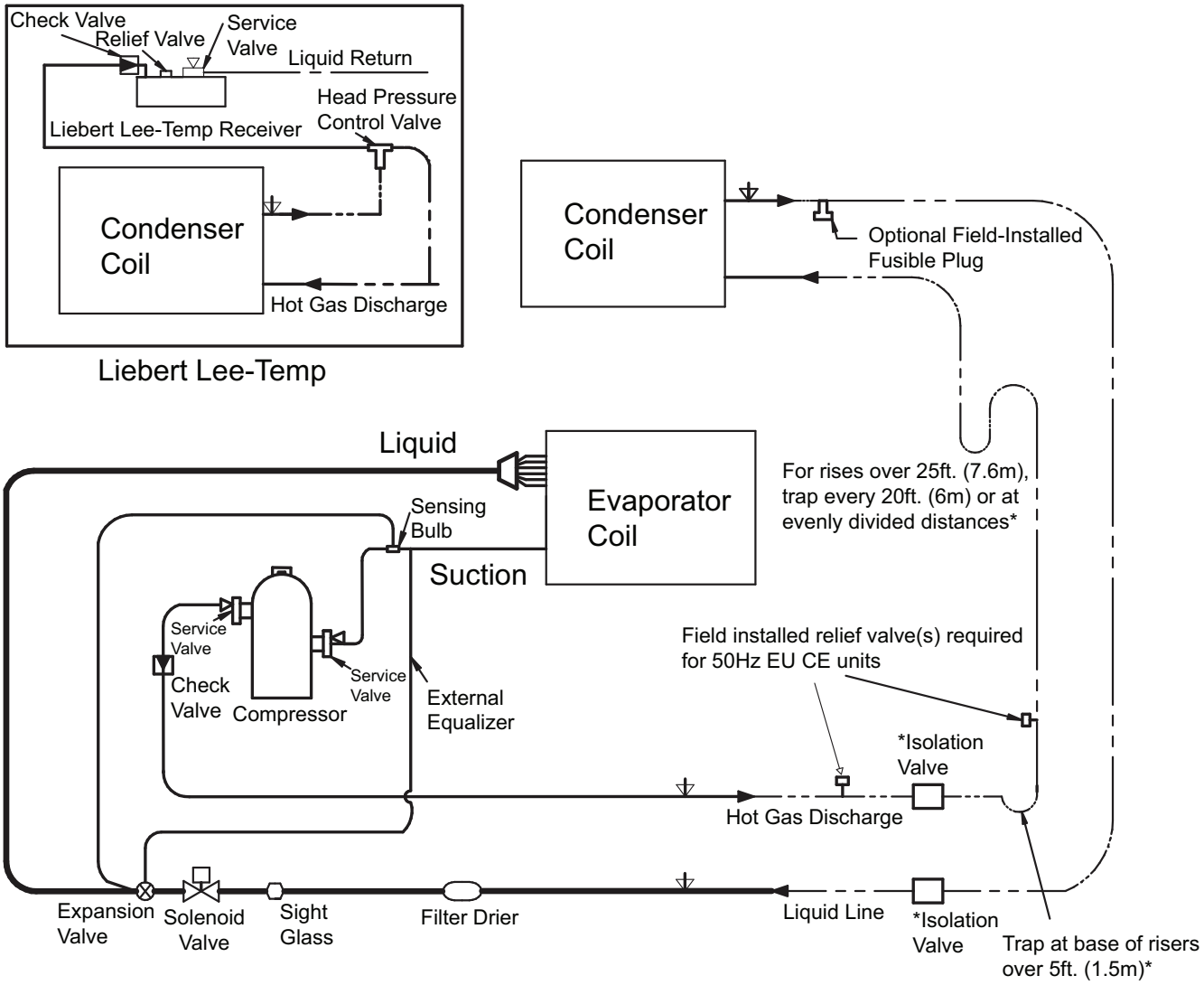
- Consult factory if piping run exceeds 300 feet (91m) actual length, or 450 feet (137m) equivalent length on units installed with Liebert EconoPhase units.
- Keep piping clean and dry, especially on units with POE oil (R407C, R410A or R22 refrigerant).
- Avoid piping runs through noise-sensitive areas.
- Do not run piping directly in front of indoor unit discharge airstream.
- Refrigerant oil – do not mix oil types or viscosities. Consult indoor unit for refrigerant type and oil requirements.

NOTE

Failure to use compressor oils recommended by compressor manufacturer will void compressor warranty. Consult Emerson or the compressor manufacturer for further recommendations or if you have questions about compressor oils.

Refer to ASHRAE Refrigeration Handbook for general good practices for refrigeration piping. The Liebert indoor cooling unit has a factory-installed high-pressure safety switch in the high side refrigerant circuit. A pressure relief valve is provided with Liebert Lee-Temp™ receivers. A fusible plug is factory installed in the Liebert DSE™ receivers. Consult local building codes to determine if condensers without receivers will require field-provided pressure relief devices. A fusible plug kit is available for field installation.

Figure 18 Piping schematic



NOTES
Single refrigeration circuit shown for clarity.
Schematic representation shown. Do not use for specific connection locations.

DPN002188
Rev. 1

5.2 Field Piping Guidelines

One discharge line and one liquid line must be field-installed for each circuit of the indoor unit and the outdoor condenser(s). Dual circuit condensers are available for most dual circuit indoor unit applications. Refer to **Figures 18**, through **20** for additional field-installed piping needed at the condenser. This piping is needed for proper system performance and for installation/interconnecting receivers and head pressure control valves for Liebert Lee-Temp™ systems.

NOTE

Keep the evaporator unit and condenser closed with their factory charge of inert gas while all field piping is installed. Keep the field piping clean and dry during installation, and do not allow it to stand open to the atmosphere.

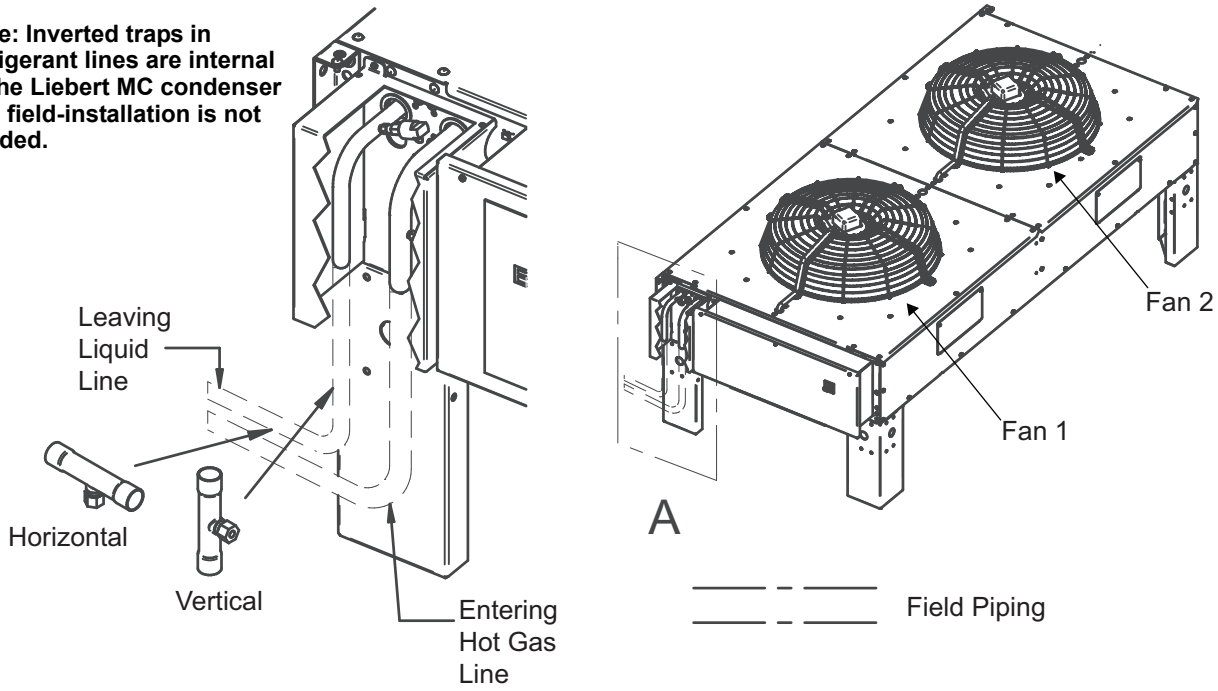
When all the field interconnecting piping is in place, vent the condenser's inert gas charge and connect to the field piping. Finally, vent the evaporator unit's charge of inert gas and make its piping connection last.

Follow all proper brazing practices, including a dry nitrogen purge to maintain system cleanliness.

The condenser connection pipes must be wrapped with a wet cloth to keep the pressure and temperature sensors cool during any brazing.

Figure 19 Liebert MC Condenser piping—Single-circuit units

Note: Inverted traps in refrigerant lines are internal to the Liebert MC condenser and field-installation is not needed.



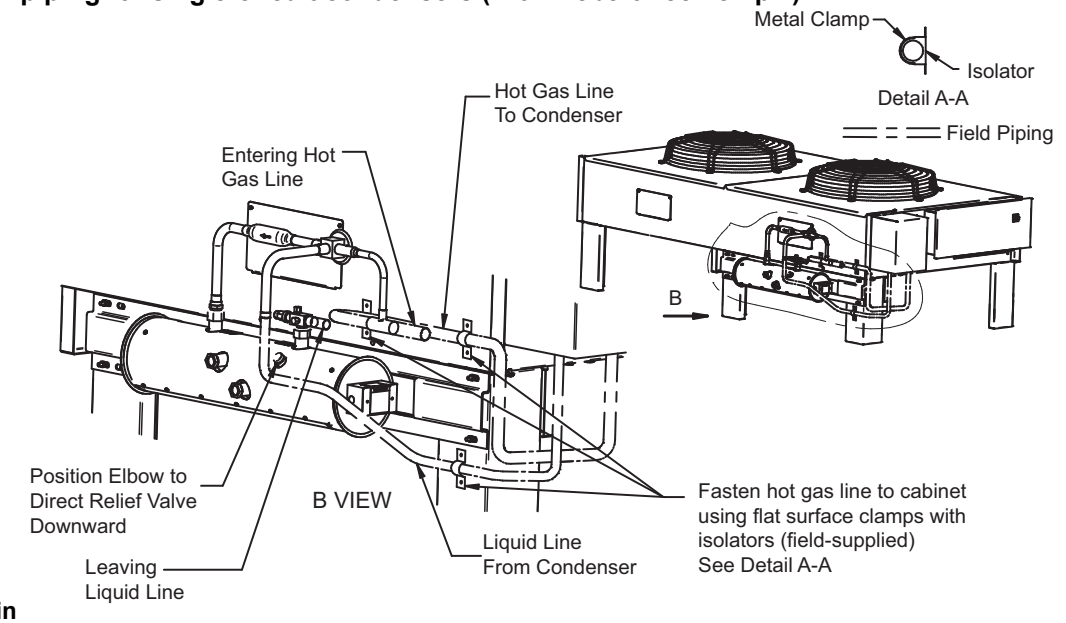
Optional fusible plug service kit to be brazed into the liquid line(s) in either the vertical or horizontal position (where required). Vertical position is preferred; horizontal position is optional.

DPN002166
Rev. 1

Table 6 Liebert MC Condenser piping sizes, single-circuit units

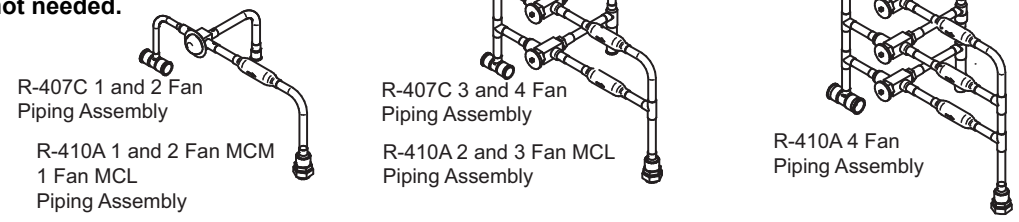
Model No.	Number of Fans	Connection Sizes, OD, in (mm)	
		Hot Gas Line	Liquid Line
MCS028	1	7/8	5/8
MCM040	1	7/8	5/8
MCM080	2	1-1/8	7/8
MCM120	3	1-3/8	7/8
MCL055	1	1-1/8	7/8
MCL 110	2	1-3/8	1-1/8
MCL 165	3	1-3/8	1-1/8
MCL 220	4	1-5/8	1-3/8

Figure 20 Condenser piping for single-circuit condensers (with Liebert Lee-Temp™)



Note: Inverted traps in refrigerant lines are internal to the condenser and field-installation is not needed.

GENERAL ARRANGEMENT



NOTE:
1.The following materials are supplied by liebert for each circuit(shipped loose with condenser)for field installation: insulated Libert Lee-Temp storage tank with sight glasses, head pressure control valve, check valve, rotalock valve and pressure relief valve. All other piping to be supplied and installed by others.
2. Consult factory for proper line sizing for runs longer than 150ft.(45.7m) equivalent length.

DPN002167
REV 2

Table 7 Condenser piping connection sizes—single-circuit condensers with Liebert Lee-Temp

	Condenser Connections, OD.In		Liebert Lee-Temp Connections		
Model #	Hot Gas	Liquid	Hot Gas Tee IDS In.	Liquid Line to Lee-Temp Valve ODS, In.	Receiver Out IDS In.
MCS028	7/8	5/8	7/8	5/8	5/8
MCM040	7/8	5/8	7/8	5/8	5/8
MCM080	1-1/8	7/8	1-1/8	7/8	1-1/8
MCL055	1-1/8	7/8	1-1/8	7/8	7/8
MCL110	1-3/8	1-1/8	1-3/8	1-1/8	1-1/8
MCL165	1-3/8	1-1/8	1-3/8	1-1/8	1-1/8
MCL220	1-5/8	1-3/8	1-5/8	1-3/8	1-3/8

Source: DPN002167, Rev. 2

Figure 21 Piping: dimensions—dual circuit two-fan and four-fan units

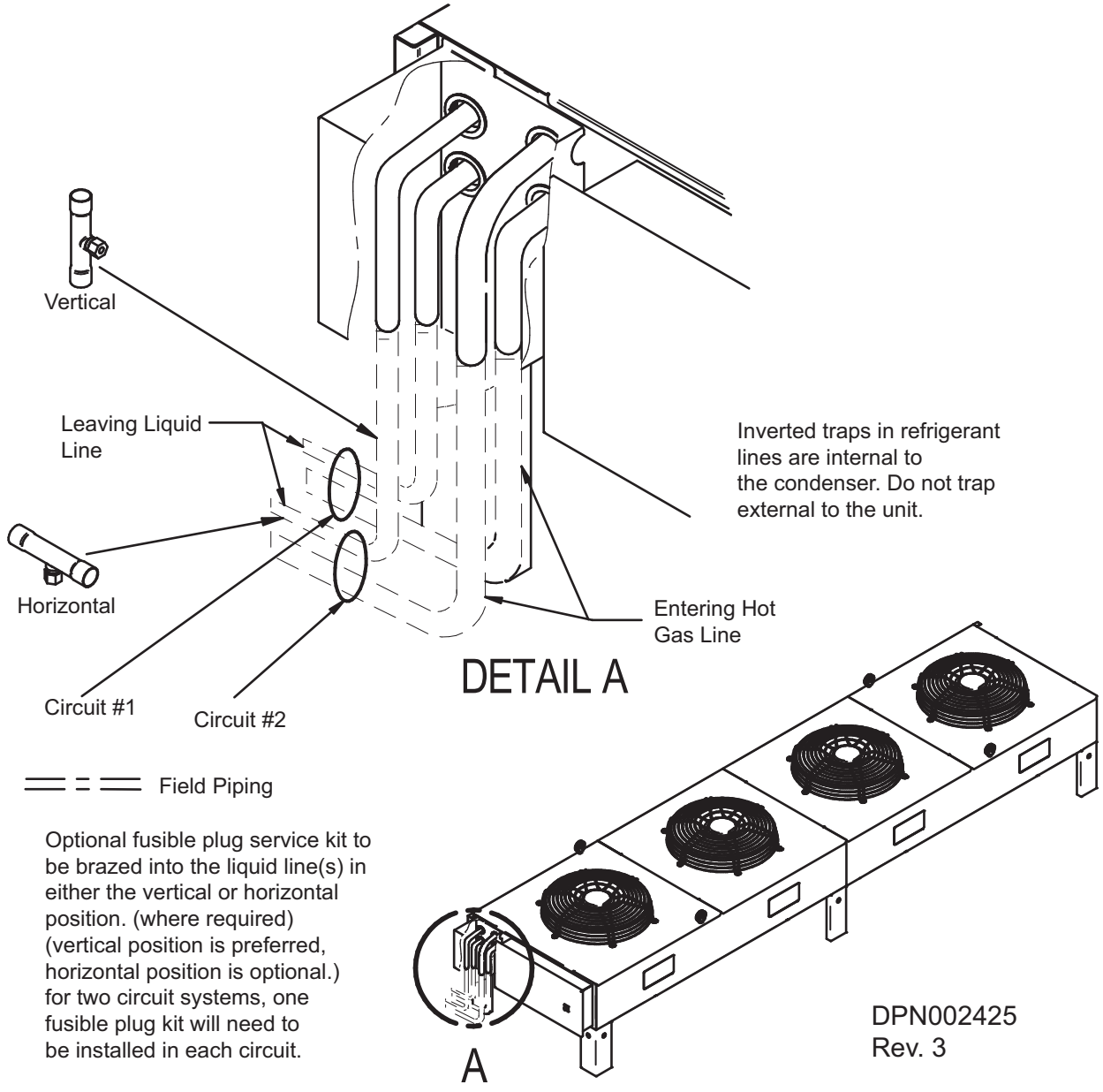
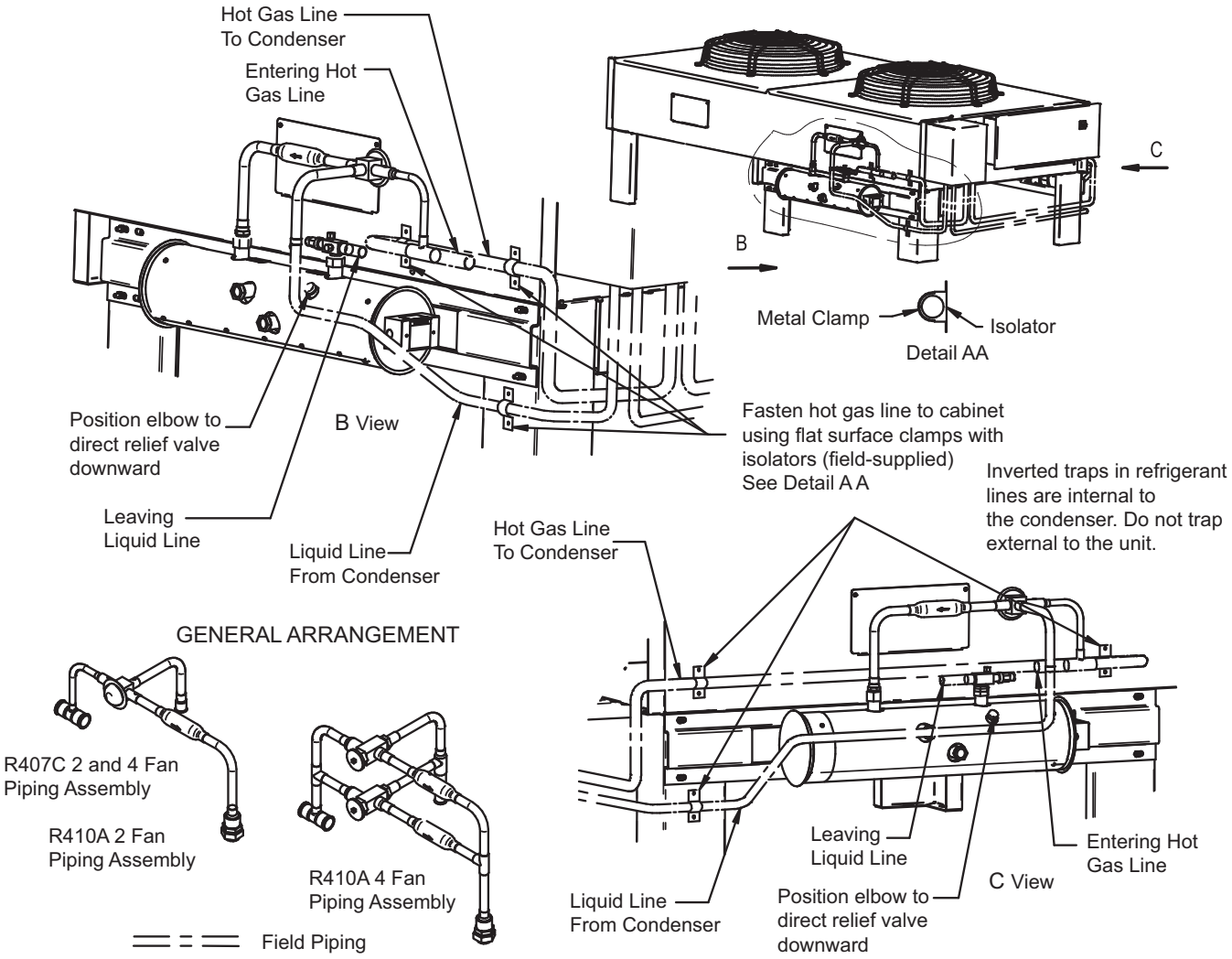


Table 8 Piping: dimensions—dual-circuit, two-fan and four-fan units

Model #	# of Fans	Connection Sizes, OD, in	
		Hot Gas Line	Liquid Line
MCM080	2	7/8	5/8
MCL110	2	1-1/8	7/8
MCM160	4	1-1/8	7/8
MCL220	4	1-3/8	1-1/8

Source: DPN002425, Rev. 3

Figure 22 Piping: dimensional data with Liebert Lee-Temp™—dual circuit condensers



Note:
1. The following materials are supplied by Emerson for each circuit (shipped loose with condenser) for field installation: insulated Liebert Lee-Temp storage tank with sight glasses, head pressure control valve, check valve, rotalock valve and pressure relief valve. All other piping to be supplied and installed by others.
2. Consult factory for proper line sizing for runs longer than 150ft. (45.7m) equivalent length.

DPN002426
REV. 3

Table 9 Piping dimensions—dual circuit condensers with Liebert Lee-Temp

	Condenser Connections ODS, in.		Liebert Lee-Temp Connections		
Model #	Hot Gas	Liquid	Hot Gas Tee IDS, in.	Liquid Line to Lee-Temp Valve ODS, In.	Receiver Out IDS, in.
MCM080	7/8	5/8	7/8	5/8	5/8
MCL110	1-1/8	7/8	1-1/8	7/8	7/8
MCM160	1-1/8	7/8	1-1/8	7/8	1-1/8
MCL220	1-3/8	1-1/8	1-3/8	1-1/8	1-1/8

Source: DPN002426, Rev. 3

5.3 Refrigerant Planning Values

Planning for the refrigerant requirements of the completed system is the total of the charges from Indoor Unit, Condenser (including Liebert Lee-Temp™ receiver, if used) and the interconnecting piping. **Tables 10**, **11** and **12** provide the approximate charge required for the condensers and the interconnecting piping. Consult indoor unit manuals for indoor unit charge requirements.

These values can be used for obtaining adequate refrigerant for the system, but should not be used for final charging.

NOTE

Due to the much smaller coil volume, the performance, especially subcooling, of a Liebert MC condenser is quite sensitive to the amount of refrigerant charge. Ensure that an accurate amount of refrigerant charge is added.

Table 10 Refrigerant required, R-407C, approximate

Condenser Models	Single Circuit, lb/circuit (kg/circuit)		Dual Circuit, lb/circuit (kg/circuit)	
	Condensers without Liebert Lee-Temp	Condensers with Liebert Lee-Temp	Condensers without Liebert Lee-Temp	Condensers with Liebert Lee-Temp
Approximate R-407C Refrigerant Needed				
MCS028	2.2 (1.0)	21.0 (9.5)	N/A	N/A
MCM040	3.0 (1.4)	21.8 (9.9)	N/A	N/A
MCM080	7.5 (3.4)	44.5 (20.2)	3.0 (1.4)	21.8 (9.9)
MCM120	N/A	N/A	N/A	N/A
MCM160	N/A	N/A	7.5 (3.4)	44.5 (20.2)
MCL055	5.0 (2.3)	25.9 (11.7)	N/A	N/A
MCL110	10.5 (4.8)	52.1 (23.7)	5.1 (2.3)	26.0 (11.8)
MCL165	18.3 (8.3)	84.8 (38.5)	N/A	N/A
MCL220	27.0 (12.3)	108.9 (49.4)	12.2 (5.6)	53.8 (24.4)

* Model MCM120 is available with Liebert DSE™ receiver; a Liebert Lee-Temp receiver is not available with the unit.
Source: DPN002411, Rev. 3

Table 11 Refrigerant required, R-410A, approximate

Condenser Models	Single Circuit, lb/circuit (kg/circuit)			Dual Circuit, lb/circuit (kg/circuit)		
	Condensers w/o Liebert Lee-Temp	Condensers with Liebert Lee-Temp	Condensers with Liebert DSE	Condensers w/o Liebert Lee-Temp	Condensers with Liebert Lee-Temp	Condensers with Liebert DSE
MCS028	2.5 (1.2)	18.3 (8.4)	N/A	N/A	N/A	N/A
MCM040	3.5 (1.6)	19.3 (8.8)	N/A	N/A	N/A	N/A
MCM080	8.5 (3.8)	39.6 (18.1)	N/A	3.5 (1.6)	19.3 (8.8)	N/A
MCM120	N/A	N/A	26.0 (11.8) *	N/A	N/A	N/A
MCM160	N/A	N/A	N/A	8.5 (3.8)	39.6 (18.1)	13 (5.9)
MCL055	5.0 (2.3)	24.2 (11.0)	N/A	N/A	N/A	N/A
MCL110	10.7 (4.9)	49.0 (22.2)	N/A	5.2 (2.4)	24.4 (11.1)	N/A
MCL165	18.4 (8.4)	79.9 (36.2)	33 (15)	N/A	N/A	N/A
MCL220	27.0 (12.3)	102.9 (46.7)	39 (17.7)	12.3 (5.6)	50.6 (23.0)	18 (8.2)

* Model MCM120 is available with Liebert DSE™ receiver; a Liebert Lee-Temp receiver is not available with the unit.
Source: DPN002411, Rev. 3

Table 12 Interconnecting piping refrigerant charge

Line Size O.D., in.	R-407C, lb/100 ft. (kg/30m)		R-410A, lb/100 ft. (kg/30m)	
	Hot Gas Line	Liquid Line	Hot Gas Line	Liquid Line
3/8	—	3.7 (1.7)	—	—
1/2	—	6.9 (3.1)	—	5.0 (2.1)
5/8	2.2 (1.0)	11.0 (5.0)	1.1 (0.51)	10.0 (4.2)
3/4	3.1 (1.3)	15.7 (7.1)	1.5 (0.67)	13.0 (5.7)
7/8	4.5 (1.9)	23.0 (10.4)	2.3 (1.0)	21.0 (9.5)
1-1/8	7.8 (3.5)	39.3 (17.8)	3.9 (1.8)	34.9 (15.6)
1-3/8	11.8 (5.4)	59.8 (27.1)	5.5 (2.5)	53.2 (23.8)
1-5/8	16.7 (7.6)	—	—	—

Charge based on Type ACR/Type L copper pipe
Source: DPN002411, Rev. 3

5.4 Equipment Application Guidelines

Pump-down must be disabled on the indoor unit when using the Liebert MC condenser, due to the reduced volume in the condenser coil. When applying the Liebert MC condenser to existing Liebert indoor units, Emerson® recommends adding a discharge line check valve and crankcase heater to provide suitable compressor protection. Additional liquid line Schrader ports are required at the indoor unit to properly charge systems with Liebert MC condensers applied.

5.5 Refrigerant Oil Addition Procedures

Consult the user manual for the indoor unit to determine whether additional oil is required for each circuit. Factors such as compressor, condenser type, piping lengths, and total circuit refrigerant charge influence this requirement.

5.6 System Dehydration/Leak Test

Procedures for leak check and evacuation of the entire refrigeration system are contained in the indoor unit's installation manual. Use the proper manual section corresponding to the winter control system used on the condenser (with or without Liebert Lee-Temp™ or Liebert DSE™ receivers) and the refrigerant to be charged into the system.

5.7 Liebert MC Condenser Charging, Units with Liebert Lee-Temp™ Systems

Consult the indoor unit's manual for charging systems with Liebert Lee-Temp receivers. These procedures will be identical to systems with fin/tube condenser coils, but the refrigerant volumes will be much lower. Consult **Tables 10** and **11** for condenser with Liebert Lee-Temp refrigerant required.

5.8 Liebert MC Condenser Charging with Liebert DSE™ Units

Consult the Liebert DSE's manual (SL-18925) for charging Liebert DSE systems. All Liebert DSE units require installation of a Liebert DSE receiver on each condenser circuit, with or without a Liebert EconoPhase pump module installed. Consult **Table 11** for condenser and receiver refrigerant requirements.

5.9 Liebert MC Condenser Charging, Units without Liebert Lee-Temp™ Systems

Liebert MC 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), recheck the subcooling against **Table 13** when the ambient is above 60°F (15.6°C)
- The indoor space should be maintained at 70 to 80°F (21 to 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 13** for target subcooling temperatures.
- Pressure and temperature measuring instruments should be capable of measuring to ±10 psig (103.4kPa) 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 the indoor unit's user manual for details regarding indoor unit operation and **6.0 - Checklist for Completed Installation** for the Liebert MC condenser operation.
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 10** and **12**.
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 (.37kg).

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 use the sight glass as an indicator when charging Liebert MC condenser systems.

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 Liebert 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.
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 13**. 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 or **Table 15**. *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 13 Target subcooling for ambient outdoor temperature

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

DPN002411, Rev. 3

8. Verify the subcooling calculated from measured values at the evaporator against the subcooling reading of the Liebert MC control [menu ID F50 & F51]. If the subcooling calculated with gauges differs from the Liebert MC subcooling by more than 3°F (1.7°C), then adjust the charge amount to achieve the target subcooling per **Table 13** based the Liebert MC control subcooling. Failure to check measured subcooling with refrigerant gauges vs. Liebert MC subcooling may result in an overcharged system. See **Note** below and **Table 14** for corrections to Liebert MC subcooling that may be required based on condenser elevation above the indoor evaporator.

NOTE

The evaporator subcooling will be greater than the condenser subcooling when the Liebert MC is mounted higher than the indoor evaporator. Subcooling adjustment is needed when the Liebert MC is more than 40 ft. (12m) above evaporator.

NOTE

Subcooling should be viewed at the Liebert MC condenser for a minimum of 1 minute and the subcooling should be approximately ±2°F before recording subcooling to be compared against subcooling from the field refrigerant gauges and thermometers.

Sample Calculations

The Liebert MC is 40 ft (12.2m) above the evaporator of an R-407C system. The outdoor ambient from the Liebert MC condenser control menu ID F02, is 94.8°F (34.9°C). The liquid pressure is 300psig (2068kPa) and 113°F (45°C). The subcooling from the Liebert MC control is 5°F (2.8°C). Determine the subcooling and verify the calculated subcooling against the reading of the Liebert MC control [menu ID F50 & F51].

Evaporator Subcooling Calculation

Refrigerant Type	R-407C
1. Ambient Temperature	94.8°F (34.9°C)
2. Condenser Elevation	40 ft (12.2m)
3. Condenser Elevation Temperature Correction	4°F (2.2°C)
4. Liquid Line Pressure	300psig (2068kPa)
5. Liquid Pressure Converted to Temperature	120.3°F (49.0°C)
6. Measured Liquid Line Temperature	113.2°F (45.1°C)
7. MC Condenser Subcooling Reading (Menu ID F50 for Circuit #1 or Menu ID F51 for Circuit #2)	5°F (2.8°C)

Subtract Line 6 (Measured Line Temperature) from Line 5 (Liquid Pressure converted to Temperature) to obtain Calculated Subcooling.

Line 5	120.3°F	(49.0°C)
Line 6	-113.2°F	(45.1°C)
8. Calculated Subcooling	**7.1°F or 7°F**	**(3.9°C or (4°C)**

Elevation Correction

Subtract Line 3 (Correction for Condenser Elevation above Evaporator) from Line 8 (Calculated Subcooling) to obtain Corrected Subcooling.

Line 8	7°F	(3.9°C)
Line 3	-4°F	- (2.2°C)
9. Corrected Subcooling	**3°F**	**(1.7°C)**

Verification Against MC Condenser

Subtract Line 7 (MC Condenser Subcooling Reading) from Line 9 (Corrected Subcooling) to obtain Difference.

Line 9	3°F	(1.7°C)
Line 7	-5°F	-(2.8°C)
10. Difference	**-2°F**	**(-1.1°C)**

- If Line 10 (Difference value) is less than ± 3°F (±1.7°C), NO charge adjustment is needed.
- If Line 10 (Difference value) is less than -3°F (-1.7°C), add additional charge.
  If Line 10 (Difference value) is greater than +3°F (+1.7°C), the system is overcharged and some of the charge must be removed.

Table 14 Difference in subcooling measurements—Indoor minus outdoor

Liebert MC Elevation Above Evaporator, ft (m)		Subcooling Elevation Correction - °F (°C)			
		80 (24)	60 (18)	40 (12)	20 (6)
Refrigerant	R-407C	10 (5.5)	7 (3.8)	4 (2.2)	1 (0.6)
	R-410A	6 (3.3)	4 (2.2)	2 (1.1)	0 (0.0)

* Assumes liquid line is sized for no more than 2°F (1.1°C)pressure drop.

DPN002411, Rev. 3

9. 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.

Table 15 Liquid pressure and temperature chart

Pressure		R-407C *		R-410A *		R-22 *	
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

DPN002411, Rev. 3

Evaporator Subcooling Calculation Worksheet

	Circuit 1	Circuit 2
Refrigerant Type		
1. Ambient Temperature		
2. Condenser Elevation		
3. Condenser Elevation Temperature Correction		
4. Liquid Line Pressure		
5. Liquid Pressure converted to Temperature		
6. Measured Liquid Line Temperature		
7. MC Condenser Subcooling Reading		
(Menu ID F50 for Circuit #1 or		
Menu ID F51 for Circuit #2)		

Subtract Line 6 (Measured Line Temperature) from Line 5 (Liquid Pressure converted to Temperature) to obtain Calculated Subcooling.

	Circuit 1	Circuit 2
Line 5		
Line 6		
8. Calculated Subcooling		

Elevation Correction

Subtract Line 3 (Correction for Condenser Elevation above Evaporator) from Line 8 (Calculated Subcooling) to obtain Corrected Subcooling.

	Circuit 1	Circuit 2
Line 8		
Line 3		
9. Corrected Subcooling		

Verification Against MC Condenser

Subtract Line 7 (MC Condenser Subcooling Reading) from Line 9 (Corrected Subcooling) to obtain Difference.

	Circuit 1	Circuit 2
Line 9		
Line 7		
10. Difference		

- If Line 10 (Difference value) is less than ± 3°F, NO charge adjustment is needed.
- If Line 10 (Difference value) is greater than -3°F, add additional charge.
- If Line 10 (Difference value) is greater than +3°F, remove charge.

6.0 CHECKLIST FOR COMPLETED INSTALLATION

6.1 Moving and Placing Equipment

___ 1. Unpack and check received material.

___ 2. Proper clearance for service access has been maintained around the equipment.

___ 3. Equipment is level and mounting fasteners are tight.

6.2 Electrical

___ 1. Line voltage connected and matches equipment nameplate.

___ 2. Power line circuit breakers or fuses have proper ratings for equipment installed.

___ 3. Control wiring connections completed between indoor cooling unit and condenser.

___ 4. All internal and external high-voltage and low-voltage wiring connections are tight to the proper torque ratings shown on the components.

___ 5. Confirm that unit is properly grounded to an earth ground.

___ 6. Electrical service conforms to national and local codes.

___ 7. Monitoring wiring connections completed, when equipped, to indoor cooling unit or external monitoring panel.

___ 8. Check to confirm Premium EC Fan Condenser is not connected to Delta Power Supply.

___ 9. Check that the CANbus wiring, CANbus "END of Line" jumper position, and the CANbus "Device Address DIP Switch" setting is correct according to the application at the job site.

___ 10. If Terminals 70, 71 and 230 are used, verify they are properly wired with special attention paid to systems that use two condensers for one indoor unit.

6.3 Piping

___ 1. Piping is completed to corresponding indoor cooling unit refrigeration circuit.

___ 2. Piping is leak-checked, evacuated, and charged with specified refrigerant.

___ 3. Additional refrigerant oil added, if required, per circuit.

___ 4. Piping is properly sized, sloped, and trapped for proper oil return.

___ 5. Piping is routed to reduce potential of rub-through or chaffing.

___ 6. Hot gas line on Liebert Lee-Temp™ is fastened to the side of the cabinet and isolated for vibration reduction.

6.4 Other

___ 1. Fans rotate freely and in proper direction. EC fans rotate counterclockwise in operation as viewed from the fan guard side.

___ 2. Foreign material removed from in and around all equipment installed (construction materials, construction debris, etc.).

___ 3. Installation materials and tools have been removed from in and around all equipment (literature, shipping materials, tools, etc.).

___ 4. Blank startup sheet located, ready for completion by installer or start-up technician.

7.0 INITIAL STARTUP CHECKS AND COMMISSIONING

WARNING

Risk of electric shock. Can cause injury or death.

Disconnect all local and remote electric power supplies and wait 10 minutes before working within condenser main electrical enclosure or fan electrical enclosure. Unit contains potentially lethal electrical voltage. Line side of factory disconnect remains energized when disconnect is Off. Use a voltmeter to make sure power is turned Off before checking any electrical connections or functions.

Only properly trained and qualified personnel may perform repair, maintenance, and cleaning operation.

WARNING

Risk of high-speed, rotating fan blades. Can cause injury or death.

Fan blades can start rotating without warning at any time during a cooling cycle or after power is restored after a power failure. Disconnect all electrical power supplies to the unit, verify with a voltmeter that the power is Off and verify that all fan blades have stopped rotating before working on or near the fans.

7.1 Startup Checklist

Refer to **6.0 - Checklist for Completed Installation** and verify that all installation items have been completed before beginning to start the condenser.

7.2 Initial Startup

1. Locate *Liebert Condensers Warranty Inspection Check Sheet*, Document # PSWI-8542-407-CO.
2. Turn the condenser disconnect On.
3. Turn the indoor unit ON and set for cooling to allow operation of condenser.
4. Check the fans for proper rotation: Counterclockwise when viewing the unit from the fan guard (top) side.
5. Check that air is being drawn through the coil and discharged out the fan assembly.
6. Complete *Liebert Condensers Warranty Inspection Check Sheet*, Document # PSWI-8542-407-CO.

NOTE

This document must be completed and forwarded to your local Emerson sales office to validate warranty.

- Contact your local Emerson sales representative or Emerson Network Power® Liebert Services support about any questions or problems during unit startup and commissioning.

  Local Emerson sales offices and Liebert Precision Cooling support contacts can be found at **www.liebert.com** or by calling 1-800-LIEBERT.

8.0 CONTROL OPERATION

The Liebert MC Premium Efficiency Control takes approximately 30 seconds to boot up once power is applied to the condenser. The LED on the Premium Efficiency Control Board reads “888” while the board is booting up. Once the control has booted up, the display shows “F00” and then the value for F00. With the control operational, the condenser fan(s) turn in less than 5 seconds after receiving a signal from the indoor unit that the compressor(s) are On. Consider using UPS equipment on both data center cooling units and Liebert MC condensers to maintain uninterrupted cooling capability.

For the first 60 seconds of operation after the compressor turns on, the condenser fan(s) will run at a fixed speed, set at the factory, based on ambient temperature: faster at higher temperatures, slower at lower temperatures. After 60 seconds, the control adjusts the fan speed based on the liquid pressure transducer. If the liquid pressure transducer fails, the condenser uses temperature sensors to control the fan speed based on the liquid line temperature. The condenser fans continue to operate for approximately 30 seconds after compressors turn Off.

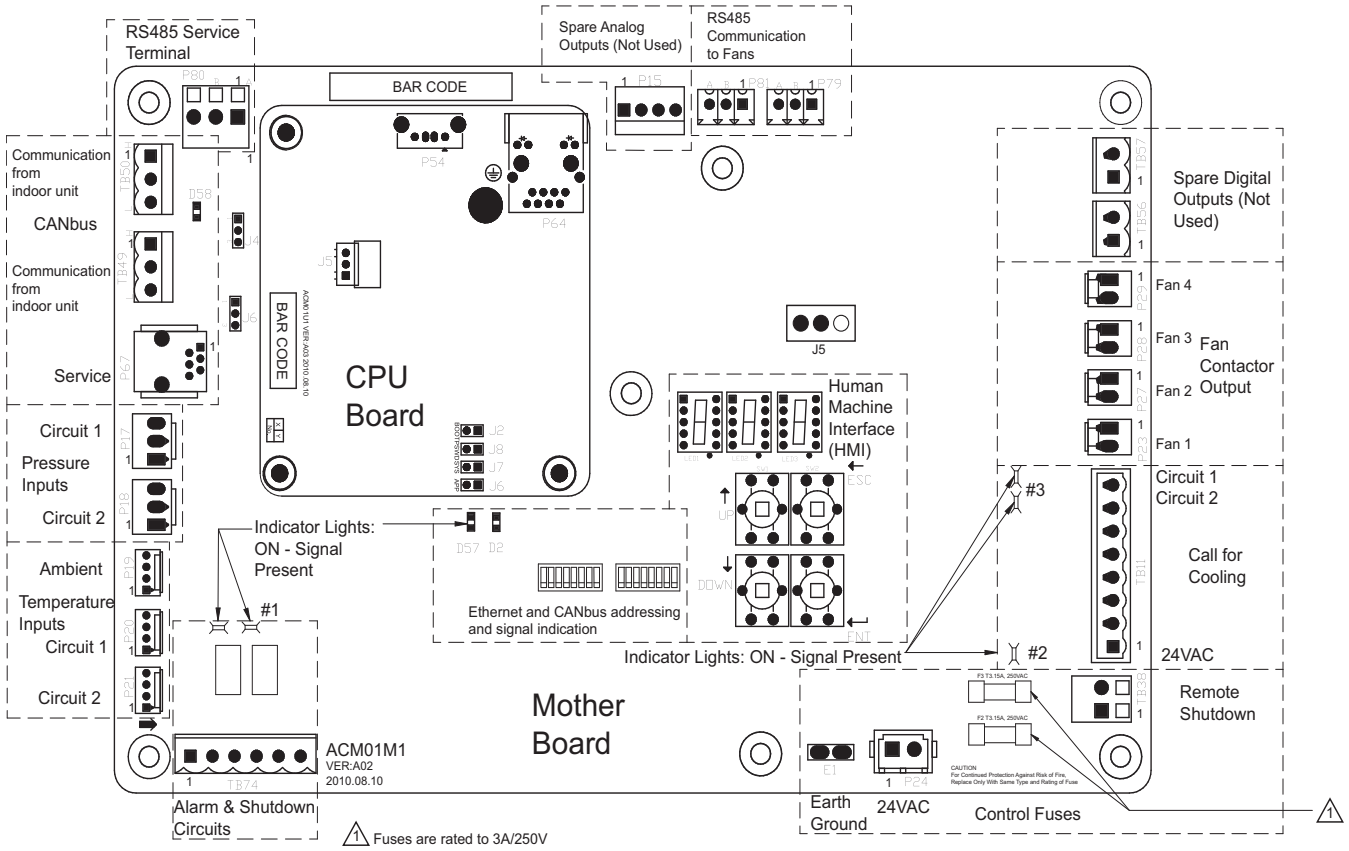
The Liebert MC fans have various alarm conditions, such as loss of voltage and loss of control signal, that will stop the condenser fans. Once the alarm condition is no longer present the Liebert MC fans will turn on automatically if compressors are On.

8.1 Premium Efficiency Control Board and Interface

The Liebert MC Premium Efficiency Control board has a stacked board arrangement. There are three seven-segment LED’s and four keys as human machine interface (see **Figure 24**).

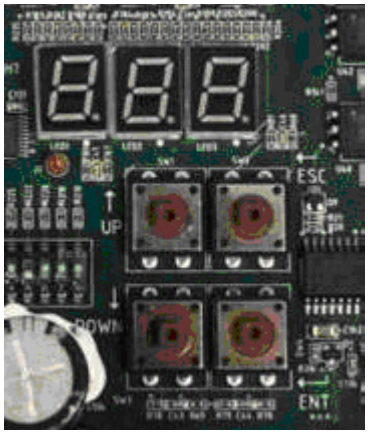
NOTE
*Indicator lights should be on, to indicate signal is present. See **Figure 23**, #1, 2 and 3.*

Figure 23 Premium efficiency fan control board



301471
Pg. 2, Rev. 3

Figure 24 Premium Efficiency Control Interface - Human Machine Interface (HMI)

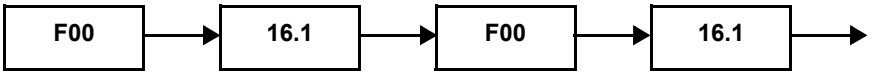


The Premium Efficiency Controls are factory-configured for refrigerant type and whether the condenser was sold with a Liebert Lee-Temp™ system. No field-configuration is necessary for proper and efficient condenser operation.

8.1.1 Initial Screen Upon Power-On

The controller displays the initial screen after it is powered On. The initial screen shows the first item of analog signals menu. The *F00* and value of condenser pressure *1* are displayed alternatively and *F00* means the item ID of condenser pressure *1*. The display sequence is shown **Figure 25**. In the figure, *16.1* is an example and the value is dependent on the sampling result).

Figure 25 Initial controller display



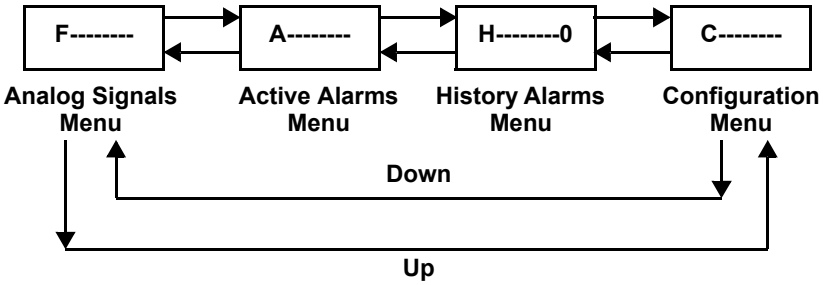
8.1.2 Main Menu Description

In initial screen, presses ESC key, the LED enters the first menu of the main menu. The main menu includes four menus:

- Analog Signals Menu
- Active Alarms Menu
- History Alarms Menu
- Configuration Menu

In the Main Menu, press Up and Down keys to switch to different menus, and press the ENT key to enter the submenus of the current menu. The operation and structure of main menu are shown in the following figure.

Figure 26 Main Menu operation and structure



NOTICE

Risk of improperly altered configuration menu settings. Can compromise equipment operation.

Changing the configuration menu settings can cause unanticipated results. These settings should be changed only by properly trained and qualified personnel or as directed by the factory.

8.1.3 Analog Signals Menu Description

In analog signals menu F----------, press the ENT key to enter its items. The information of analog signal items includes condenser pressure, temperature and EC Fan actual speed. The display mode is that the item ID and signal value are displayed alternatively. The operation and item structure of analog signals menu are shown in the following figure.

Figure 27 Analog Signals Menu

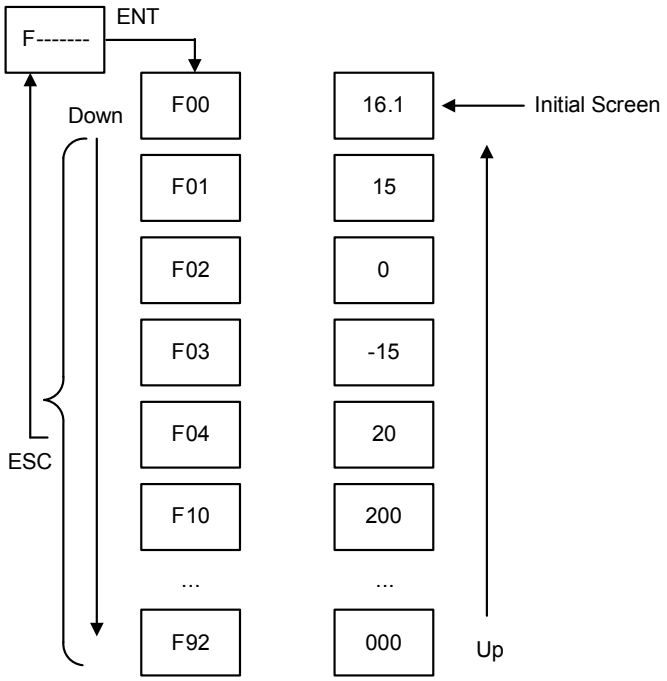


Table 16 Analog signal definitions

Item ID	Meaning	Units (C90)	
		Imperial	Metric
F00	Condenser pressure 1	psi	bar
F01	Condenser pressure 2	psi	bar
F02	Ambient temperature	°F	°C
F03	Refrigerant temperature 1	°F	°C
F04	Refrigerant temperature 2	°F	°C
F10	EC Fan 1 actual speed	RPM	RPM
F11	EC Fan 1 requested speed	%	%
F20	EC Fan 2 actual speed	RPM	RPM
F21	EC Fan 2 requested speed	%	%
F30	EC Fan 3 actual speed	RPM	RPM
F31	EC Fan 3 requested speed	%	%
F40	EC Fan 4 actual speed	RPM	RPM
F41	EC Fan 4 requested speed	%	%
F50	Subcooling 1	°F	°C
F51	Subcooling 2	°F	°C
F90	Firmware Version Major		1.02.004
F91	Firmware Version Minor	—	
F92	Firmware Version Build	—	

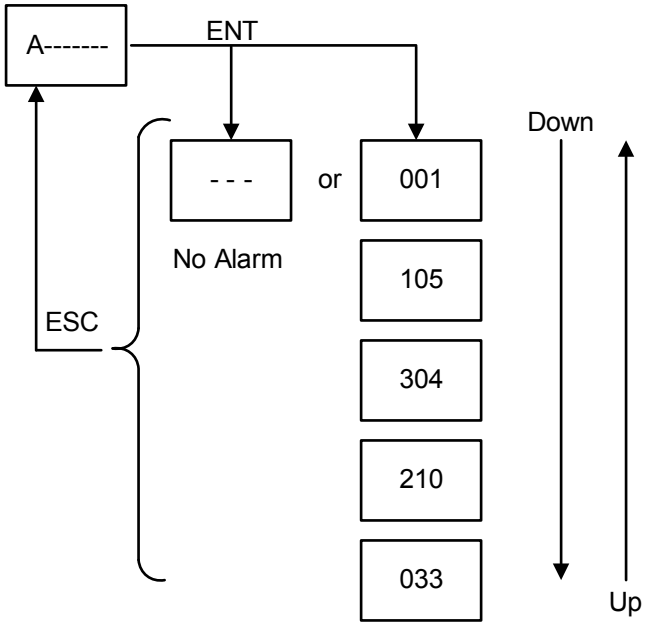
8.2 Premium Efficiency Condenser Alarm Codes

The following procedure and chart details the alarm codes that may be displayed from the Active and History Alarm registers.

8.2.1 Active Alarms Menu Description

In active alarms menu "A——," press the ENT key to enter its items. The active alarm item displays all the active alarms of condenser. When there is an active alarm, the alarm information ID will be directly displayed. When there is no alarm, "---" is displayed. When there are multiple alarms, the alarm information ID's will be displayed according to the time sequence (the most-recent alarm will be displayed first). The operation and items structure of active alarms menu are shown in the following figure. The meanings of alarm information ID are found in **Tables 17** and **18**.

Figure 28 Active alarms menu



8.2.2 History Alarms Menu Description

In history alarms menu "H——?", press ENT key to enter its items. The history alarm items display 100 history alarm records of the condenser. The item ID is for the sequence number of the history alarms. The display mode is that the item ID and alarm information ID are displayed alternatively. When there is no alarm, "---" is displayed. Alarm history can be cleared using the C98 configuration menu item. The operation and items structure of history alarms menu are shown in the following figure. The meanings of alarm information ID are given in **Tables 17** and **18**.

Figure 29 History alarms menu

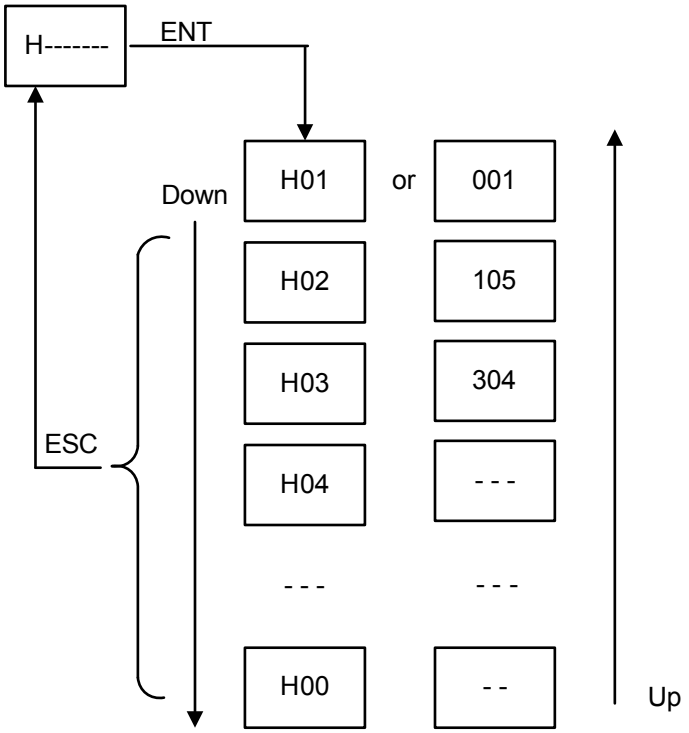


Table 17 System alarm information

Alarm ID	Meaning	Possible Cause	Handling Method
000	CAN communication failure	Communication circuit missing or damaged	Check communication circuit. Ignore alarm on condensers without CAN connections
001	Ethernet communication failure	Ethernet hardware or connection failure	Ignore alarm, Ethernet connection is not present
002	USB communication failure	USB device or file is damaged.	Replace USB device or file.
003	Data corruption	Memory chip is damaged	Replace PCB board
004	System error	Internal error	Reboot. If reboot fails, consult factory.
005	Remote shutdown	1. Remote shutdown signal is available 2. TB38 is not connected	For Cause 1, check the remote shutdown signal. For Cause 2, connect TB38.
006	Shutdown due to EC Fan alarm	All fans have failed	Consult factory
007	SPD alarm	SPD damaged	Replace SPD
008	Condenser pressure Sensor 2 failure	Condenser pressure Sensor 1 damaged	Replace condenser pressure Sensor 1
009	Condenser pressure Sensor 2 failure	Condenser pressure Sensor 2 damaged	Replace condenser pressure Sensor 2
010	Condenser pressure 1 high alarm	High pressure: Fan failure, clogged coils. Low pressure: Loss of charge	High-pressure alarms: Fix fan and clean coil. Low-pressure alarms: Check for refrigerant leak.
011	Condenser pressure 2 high alarm		
012	Condenser pressure 1 low alarm		
013	Condenser pressure 2 low alarm		
014	EC Fan speed mode maximum must be overridden due to condenser pressure 1 high	Condenser pressure 1 high	No action is needed.
015	EC Fan speed mode maximum must be overridden due to condenser pressure 2 high	Condenser pressure 2 high	No action is needed.
016	Ambient temperature sensor failure	Ambient temperature sensor damaged	Replace ambient temperature sensor
017	Ambient temperature high alarm	Ambient temperature high	No action is needed.
018	Ambient temperature low alarm	Ambient temperature low	No action is needed.
019	Condenser temperature Sensor 2 failure	Condenser temperature Sensor 2 damaged	Replace condenser temperature Sensor 1
020	Condenser temperature Sensor 2 failure	Condenser temperature Sensor 2 damaged	Replace condenser temperature Sensor 2
021	Condenser temperature 1 high alarm	High temperature: Fan failure, clogged coils. Low temperature: Consult factory	High-temperature alarms: Fix fan and clean coils. Low-temperature alarms: consult factory.
022	Condenser temperature 2 high alarm		
023	Condenser temperature 1 low alarm		
024	Condenser temperature 2 low alarm		
025	EC Fan speed mode maximum must be overridden due to refrigerant temperature 1 high	Refrigerant temperature 1 high	No action is needed.
026	EC Fan speed mode maximum must be overridden due to refrigerant temperature 2 high	Refrigerant temperature 2 high	No action is needed.

Table 18 EC Fan alarm information

Alarm ID	Meaning	Possible Cause	Handling Method
(1-4) 00	EC Fan high link current	1. EC Fan is locked. 2. EC Fan is damaged.	For cause 1, check if EC Fan is locked. For cause 2, replace EC Fan
(1-4) 01	EC Fan drive error	EC Fan is damaged.	Replace EC Fan
(1-4) 02	EC Fan earth to ground fault	EC Fan is damaged.	Replace EC Fan
(1-4) 03	EC Fan electronics heat sink thermal overload	1. EC Fan is locked. 2. EC Fan is damaged. 3. Ambient temperature is too high	For cause 1, check if EC Fan is locked. For cause 2, replace EC Fan For cause 3, check ambient temperature.
(1-4) 04	EC Fan Hall failure	EC Fan is damaged.	Replace EC Fan
(1-4) 05	EC Fan IGBT failure	EC Fan is damaged.	Replace EC Fan
(1-4) 06	EC Fan line fault	Power supply abnormal	Check power supply
(1-4) 07	EC Fan motor locked	Motor is locked	Check if EC Fan is locked.
(1-4) 08	EC Fan motor thermal overload	1. EC Fan is locked. 2. EC Fan is damaged. 3. Ambient temperature is too high	For cause 1, check if EC Fan is locked. For cause 2, replace EC Fan For cause 3, check ambient temperature.
(1-4) 09	EC Fan phase failure alarm	Phase failure	Check power supply
(1-4) 10	EC Fan-specific uncategorized alarm detected	Internal EC Fan issue	Re-boot condenser if fans not running. If alarm persists and fans not running, replace fan.
(1-4) 11	EC Fan-specific uncategorized warning detected		
(1-4) 12	EC Fan electronics high-temperature condition.	1. EC Fan is locked. 2. EC Fan is damaged. 3. Ambient temperature is too high	For cause 1, check if EC Fan is locked. For cause 2, replace EC Fan For cause 3, check ambient temperature.
(1-4) 13	EC Fan high link voltage	1. EC Fan input power supply high voltage 2. EC Fan is damaged.	For cause 1, measure power supply voltage and check if the voltage is normal For cause 2, replace EC Fan
(1-4) 14	EC Fan low link voltage	1. EC Fan input power supply low voltage 2. EC Fan detection error	
(1-4) 15	EC Fan 485 communication failure	1. Communication between EC Fan and PCB board failure 2. EC Fan 485 communication failure 3. Board has problems 4. EC fan not receiving power	For cause 1, check EC Fan communication circuit For cause 2, replace EC Fan For cause 3, replace PCB board For cause 4, check fan model is not set for “0”, check that the contactor for the particular fan is energized, and check fan fuses.

NOTE

(1-4) means the EC Fan addresses. For example, (1-4) 00 means 100 for EC Fan1, and means 200 for EC Fan2, and means 300 for EC Fan3, and means 400 for EC Fan4.

9.0 SYSTEM MAINTENANCE

WARNING

Risk of electrical shock. Can cause injury or death.

Unit contains potentially lethal voltage in some circuits.

Disconnect all local and remote electric power supplies and wait 10 minutes before working in the unit. The line side of the unit disconnect switch remains energized when the switch is in the Off position. Use a voltmeter to make sure power is turned Off before making any electrical connections.

Only properly trained and qualified personnel may perform repair, maintenance, and cleaning operations.

WARNING

Risk of high-speed, rotating fan blades. Can cause injury or death.

The fan blades can start rotating without warning any time during a cooling cycle or after power is restored after a power failure. Disconnect all local and remote electrical power supplies to the unit, wait 10 minutes and verify with a voltmeter that the power is Off and that all fan blades have stopped rotating before working on or near the fans.

9.1 General Procedures

NOTE

When ordering replacement parts for equipment, it is necessary to specify unit model number, serial number and voltage. Please record those numbers in the spaces below.

- Model Number _____
- Serial Number _____
- Voltage / Phase / Frequency _____

Periodic attention is necessary for continued satisfactory operation of your unit. Restricted air flow through the condenser coil, reduced airflow from non-functioning fans and low refrigerant system charge levels will reduce the operating efficiency of the unit and can result in high condensing temperatures and loss of cooling. In winter, do not permit snow to accumulate around the sides or underneath the condenser coil.

Monthly and semi-annual inspections and maintenance are recommended for proper system operation. Use copies of **9.4.3 - Maintenance Inspection Checklist** for each of these inspections.

If performance or operation problem are detected at anytime, refer to **8.2 - Premium Efficiency Condenser Alarm Codes** for required action.

9.2 Condenser Cleaning

Keeping the outdoor condenser coils clean is an important factor in maintaining peak efficiency, reliability and long life of the equipment. The unit will operate more efficiently with frequent cleanings. Delaying cleaning until heavy buildup occurs may create head pressure problems with the evaporator units.

9.2.1 When to Clean the Condenser Coil

Normal conditions typically dictate cleaning twice a year, spring and fall. On-site or area conditions such as cottonwood trees, construction, etc., can increase cleaning frequency. On your standard monthly preventive maintenance schedule, Emerson recommends a visual inspection of the coil to monitor conditions.

9.2.2 What to Use to Clean the Condenser Coil

The best overall condenser coil cleaner to use is plain water. If the coil has been maintained and cleaned at regular intervals, water is sufficient to remove dirt and debris from the fins. Heavy build up on the exterior of the fins can be removed with a brush. Water pressure from a garden hose and sprayer usually works well. If a pressure washer is used, make sure the equipment is set to a lower pressure setting and that the nozzle is set to the fan spray, not stream. Otherwise, damage to the fins could result. If a cleaner is required, Emerson recommends using a neutral cleaner, neither acidic nor base. Acid-type cleaners can damage the coil fins and surrounding areas. Many sites do not allow the use of acidic cleaners for environmental reasons.

9.2.3 How to Clean the Condenser Coil

The Liebert MC coil is accessible for cleaning through the innovative cleaning window design, allowing you to clean the coil without removing the fans from the unit. First, this requires disconnecting the power supply before working on the unit and then opening the cleaning window(s) on the side of the unit by loosing the mounting screws. Then insert a spray nozzle on the end of a suitable extension and apply the water/cleaning solution, working back and forth across the coil face. The solution will push the dirt and debris out the bottom of the coil. If you are using a cleaner along with the spraying process, follow recommended manufacturer instructions and be sure to rinse the coil thoroughly. Any residue left on the coil can act as a magnet to dirt. Reinstall the cleaning window(s) and reconnect the power supply to the condenser.

Spraying the coil from the outside repeatedly can push a majority of the dirt to the inner section of the fins and continue to restrict air flow. Keep in mind you may not have the luxury of shutting the unit(s) down for an extended time. A scheduled shutdown with the operator may be in order.

NOTICE

Risk of using damaging cleaning agents, including non-base paint solvents. Can cause equipment damage and damage to property and loss of refrigerant charge.

Using acid-based or sodium hydroxide-based cleaners can damage the Liebert MC condenser coil and cause a loss of charge. This could cause equipment damage as well as damage to the surrounding structure.

NOTE

Clean the EC fan with water only when temperatures are greater than 50°F (10°C)

- *Make sure that no water gets into the inside of the motor.*
- *Do not hold the jet spray directly on the motor openings and seals.*
- *During cleaning work using a jet spray, no guarantee is assumed regarding corrosion formation/paint adhesion for unpainted/painted fans.*

9.3 Fan Replacement

WARNING

Risk of electric shock. Can cause injury or death.

Disconnect all local and remote electric power supplies and wait 10 minutes before working within condenser main electrical enclosure or fan electrical enclosure. Unit contains potentially lethal electrical voltage. Line side of factory disconnect remains energized when disconnect is Off. Use a voltmeter to make sure power is turned Off before checking any electrical connections or functions.

Only properly trained and qualified personnel may perform repair, maintenance, and cleaning operation.

WARNING

Risk of high-speed, rotating fan blades. Can cause injury or death.

Fan blades can start rotating without warning at any time during a cooling cycle or after power is restored after a power failure. Disconnect all electrical power supplies to the unit, verify with a voltmeter that the power is Off and verify that all fan blades have stopped rotating before working on or near the fans.

CAUTION

Risk of contact with hot surface. Can cause injury.

Use proper skin protection when touching the electronics housing or allow time for the housing to cool before replacing parts. The electronics housing can get hot and can cause severe burns.

CAUTION

Risk of improper moving, lifting and handling. Can cause equipment damage or injury.

Only properly trained and qualified personnel should work on this equipment. Fan modules for MCL models weigh in excess of 92lb. (40.8kg) each and fan modules for MCS and MCM models weigh in excess of 40lb. (18.1kg.) each. Use OSHA-approved lifting techniques, proper body mechanics and extreme caution to avoid injury and dropping of fans during removal and installation.

NOTE

*If at any time a parameter is entered and the display does not show **888** or it displays **Err**, try to re-enter the parameter. If the display still shows **Err** after ENT is pressed, power cycle the control board by unplugging P24, waiting 15 seconds and plugging P24 back in. Contact the factory if the parameter still displays **Err** after ENT is pressed.*

NOTE

If replacing a Ziehl-Abegg fan with an EBM fan, the existing ferrule must be removed from the end of the wires on the communication cable for all fans except the last fan. Twist wires together before inserting into the terminal block.

Example:

Twist RSA labeled conductor of the input cable to RSA labeled conductor of the output cable. Insert the wires into the properly marked terminal on the fan, two wires per RSA, RSB, and GND terminal as shown in detail "A" on EBM MCS/MCM series drawing.

1. Turn off power to the unit using the disconnect. With a voltmeter verify that voltage is no longer present at the unit. Wait a minimum of 10 minutes to allow the EC Fan capacitors to discharge before proceeding.
2. Remove fan cover, disconnect electrical connections internal to EC fan and remove cable glands from EC fan (see **Figures 31**, **32** and **33**).
3. Remove hardware that mounts EC fan to condenser body.
4. Reinstall electronic cover. Maximum torque for the fan cover screws is 2.3Nm (20 in-lb).

5. Install a spreader bar over the EC fan

NOTICE

Risk of improper fan rigging. Can cause equipment damage.

MCL model EC fans weigh over 90lb. (40.8kg) each and MCS and MCM EC fans weigh over 40lb. (18.1kg) each. Make sure that the wire harness is secured out of the way before lifting the fan.

6. Verify that lifting cable/chains are not coming into contact with fan blades before lifting.
7. Install new fan in unit and connect mounting hardware; connect electrical cable glands. Torque for cable glands is 2.5Nm (22 in-lb). Make sure fan blades rotate freely when installed in unit.

   Reconnect wiring to proper terminals and verify that run jumper is in place. Refer to **Figures 30**, **31** and **32** for wiring details. Torque for electrical terminals are 1.3Nm (11.5 in-lb).
8. Turn power On.
9. The control board will flash *F00* on the display when it has completed its boot cycle. Refer to **Figures 23** and **24**.
10. Press the ESC button.
11. Use the Up or Down arrow until *C*-- is on the display.
12. Press ENT button.
13. Use the Up or Down arrow until C03 is on the display.
14. Press ENT button.
15. Use the Up or Down arrow to select one of three options.

Configuration Code	Fan #	Value
C03	Fan 1	0 = No Fan 1 = EBM Papst 2 = Ziehl-Abegg
C04	Fan 2	
C05	Fan 3	
C06	Fan 4	

16. Press the ENT button.
17. If the new value was entered into the control board, the display will flash *888*.
18. Press the ESC button for C03 to show on the display.

18. Repeat **Steps 11** thru **18** for the remaining fans' configuration codes, C04, C05 and C06.
19. Unplug all the contactor output plugs except for the fan to be addressed. Plugs listed below.
    - P23 = Fan 1
    - P27 = Fan 2
    - P28 = Fan 3
    - P29 = Fan 4
20. Wait 30 seconds.
21. Use the Up or Down arrow to select one of the following parameters.
    The correct parameter depends on the supplier of the fan that will be addressed.
    - C00—EBM Papst fan
    - C01—Ziehl Abegg fan
22. Press the ENT button.
23. Use the Up or Down arrow to the correct fan address number. Fan 1 should be 1 (fan closest to electric panel end). Fan 2 should be 2, etc.
24. Press ENT button. The display will flash *888* when the command is accepted.
25. Press the ESC button for the parameter to be shown on the display.
26. Repeat **Steps 19** through **25** for the rest of the fans that need to be addressed.
27. After the last fan is addressed, unplug the power plug, P24, from the control board.
28. Wait 30 seconds.
29. Plug all the contactor output plugs back into the board in their correct positions.
30. Plug P24 back into the control board.
31. Once the control board has completed its boot cycle and all the contactors are energized, wait 5 seconds.
32. Press the ESC button.
33. Use the Up or Down arrow until *A*-- is on the display.
34. Press ENT button.
35. Use the Up or Down arrow to see if any of the following errors are shown.
    - 115: Unable to communicate with Fan 1.
    - 215: Unable to communicate with Fan 2.
    - 315: Unable to communicate with Fan 3.
    - 415: Unable to communicate with Fan 4.
36. If any of these errors appear, check the communication wiring at the problem fan and the fan before it.
37. If the wiring is correct and properly wired to the terminal, and none of the errors mentioned in **Step 35** are displayed, press the ESC button.

Verify the Fan Address

Verify that each fan has a unique address by:

1. Use the Up or Down arrow until *C--* is on the display.
2. Press the ENT button.
3. In the Manual/System Control Selection parameter use the Up or Down arrow until *C24* is on the display.
4. In the Manual Control configuration parameter press ENT button.
5. Use the Up or Down arrow to select *0*.
6. Press the ENT button. The display will read *888* if the command was accepted.
7. Press the ESC button for *C24* to show on the display.
8. Use the Up or Down arrow until C34 is on the display.
9. Press ENT button.
10. If Fan 1 is currently running, the fans speed should be displayed in terms of percentage of full speed. If Fan 1 is not running, *0.00* should be displayed.
11. Use the Up or Down arrow to enter 100% speed.
12. Press the ENT button. The display will read *888* if the command was accepted.
13. Fan 1 should speed up to 100% and all the other fans should stay the same.
14. If Fan 1 is not running or any of the other fans also speed up to 100%, the fan-addressing procedure (**Steps 19** through **25**) must be repeated.
15. Press the ESC button for the parameter to be shown on the display.
16. Repeat **Steps 4** through **9** for the rest of the fans, if present.
    - C35: for Fan 2.
    - C36:. for Fan 3.
    - C37: for Fan 4.
17. All fans should be at 100% speed.
18. 5Use the Up or Down arrow until *C24* is on the display.
19. Press the ENT button.
20. In the System Control configuration parameter, use the Up or Down arrow to select *1*.
21. Press the ENT button. The display will flash *888* if the command was accepted.
22. Press the ESC button for *C24* to be shown on the display.
23. All fans should return to a normal speed based on the pressure input and the state of indoor unit's compressor.

PCB Notes

- J4 and J6 are the CANbus termination jumpers. If the condenser is the last device in the CANbus communication line, the jumper must be placed between pins 1 and 2 of J6, and between pins 2 and 3 on J4. If the condenser is not the last device in the CANbus communication line, then both jumpers on J4 and J6 must be placed on Pins 2 and 3. If the jumpers are not in the correct positions, CANbus communication errors may occur.
- A jumper must be present at J2. If no jumper is present, the control board will not boot properly during power startup

Figure 30 EBM small and medium fan, Liebert MC series MCS/MCM

Connect uninsulated drain wires from communication cables to ground connection (GND) as shown below. The drain wires must be tied together with cable ties and routed away from the high-voltage terminals.

NOTE
If replacing a Ziehl-Abegg fan with an EBM fan, the existing ferrule must be removed from the end of the wires on the communication cable for all fans except the last fan. Twist wires together before inserting into the terminal block.
Example:
Twist RSA-labeled conductor of the input cable to RSA-labeled conductor of the output cable.
Insert the wires into the properly marked terminal on the fan, two wires per RSA, RSB and GND terminal as shown in Detail A.

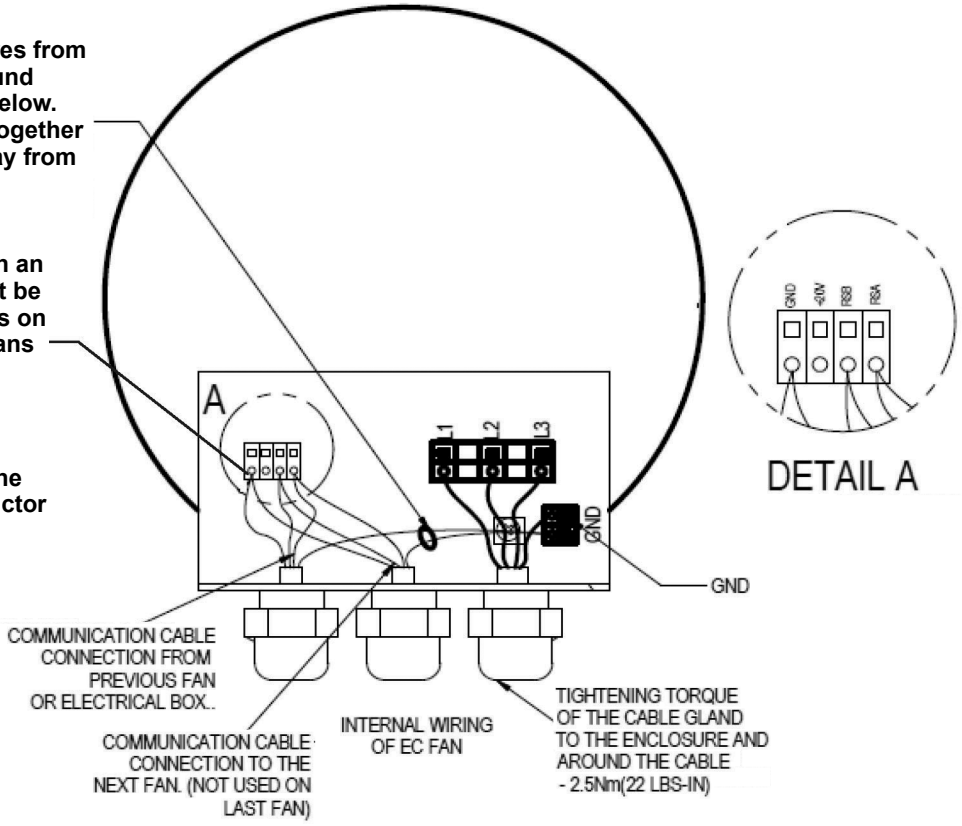


Figure 31 EBM large fan—Liebert MC series MCL

Connect uninsulated drain wires from communication cables to ground connection (GND) as shown below. The drain wires must be tied together with cable ties and routed away from the high-voltage terminals.

NOTE
If replacing a Ziehl-Abegg fan with an EBM fan, the existing ferrule must be removed from the end of the wires on the communication cable for all fans except the last fan. Twist wires together before inserting into the terminal block.
Example:
Twist RSA-labeled conductor of the input cable to RSA-labeled conductor of the output cable.
Insert the wires into the properly marked terminal on the fan, two wires per RSA, RSB and GND terminal as shown in Detail B.

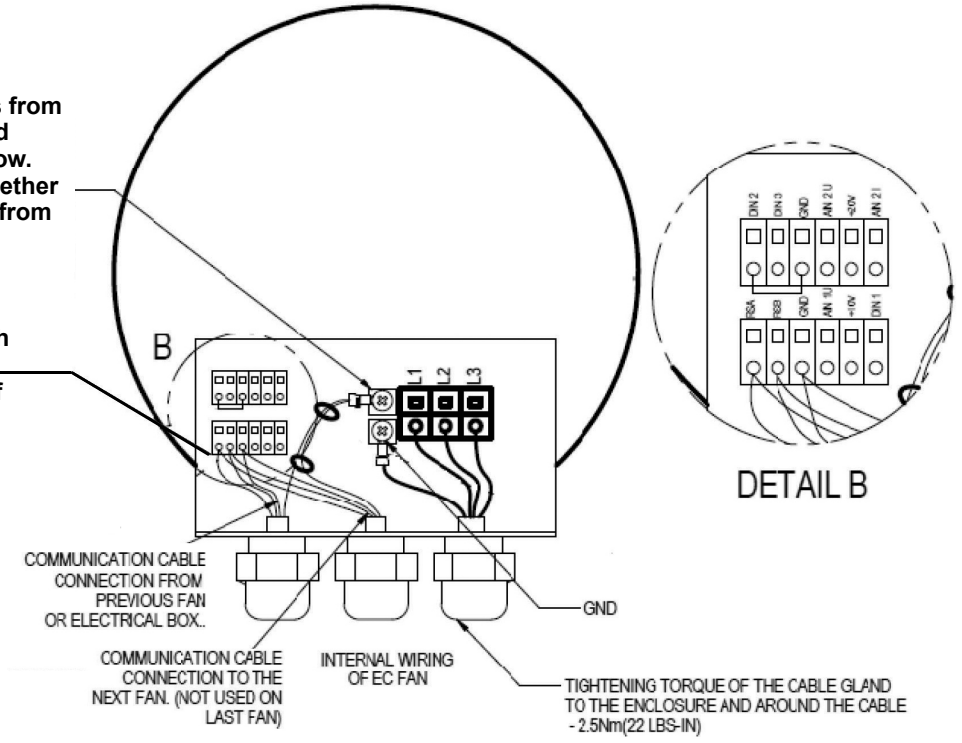
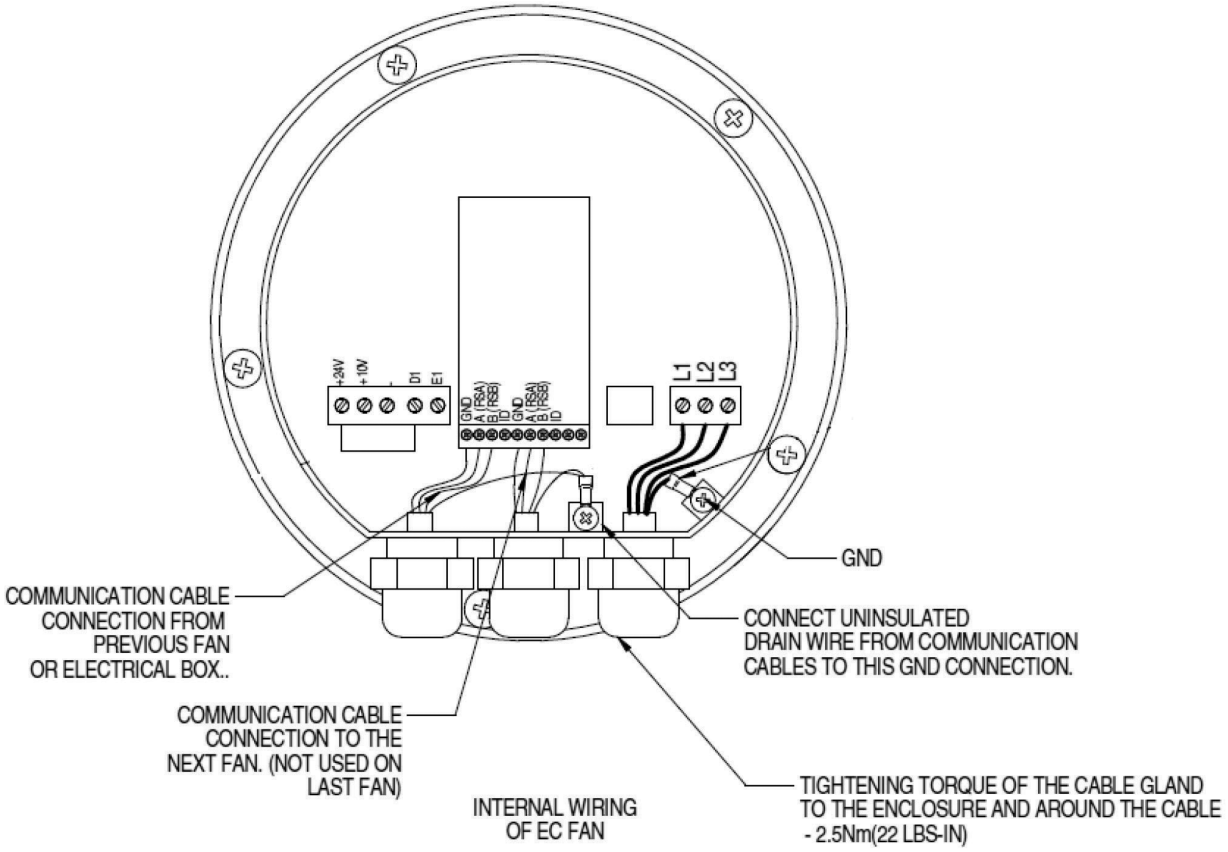


Figure 32 Ziehl-Abegg small, medium and large fan, Liebert MC series MCS, MCM and MCL

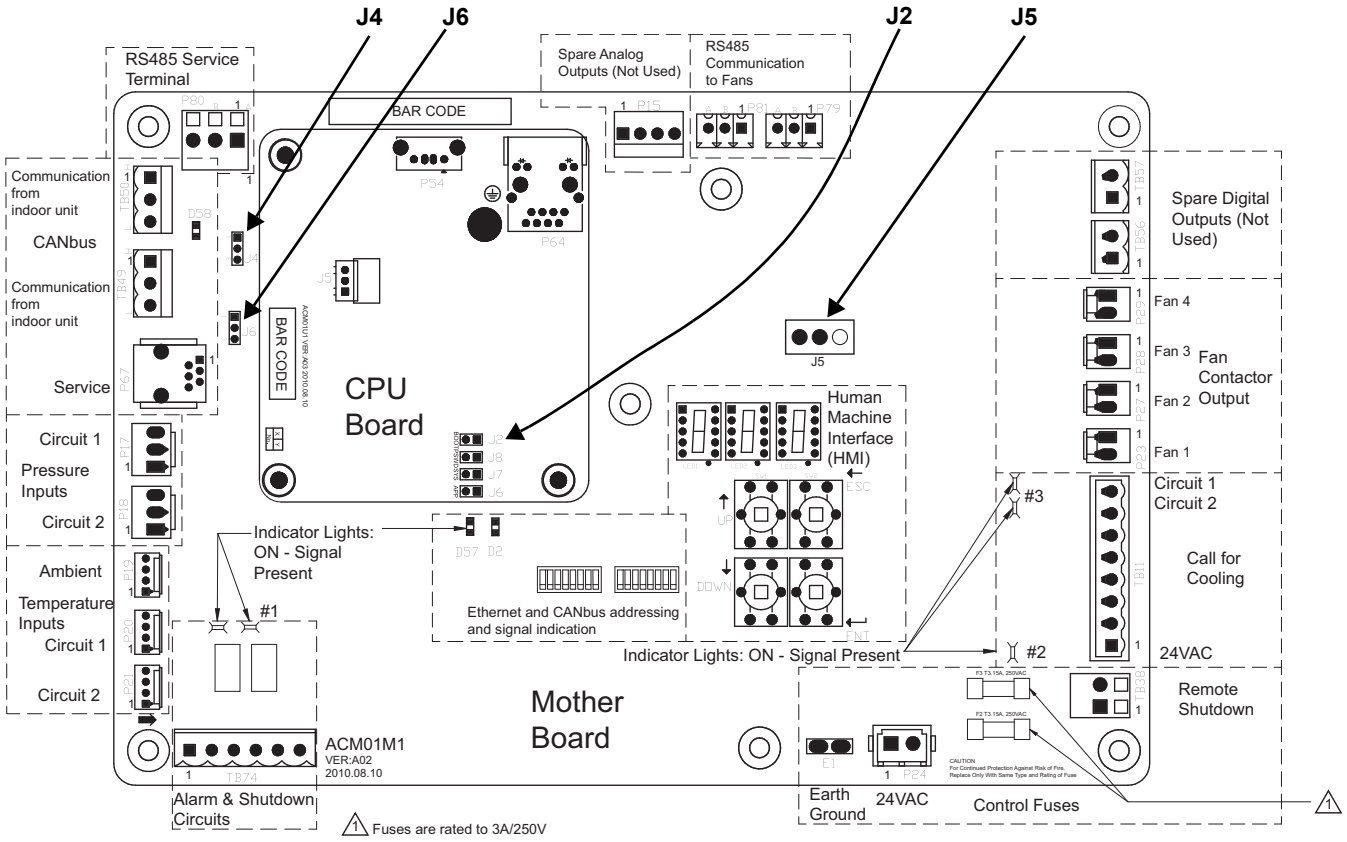


9.4 Premium Efficiency Control Board Replacement

9.4.1 Replacement Preparation

1. Verify that the following jumpers are installed on the new board (see **Figure 33**):
   - Jumper at J4 and J6 on Pins 2 and 3.
   - Jumper on J2.
   - Jumper on J5 on Pins 1 and 2.
2. Locate the latest revision of the HMI parameters label, 303847P1, included with new control board.

Figure 33 Jumper locations on Control Board



301471
Pg. 2, Rev. 3

9.4.2 Installation

WARNING

Risk of arc flash and electric shock hazard. Disconnect all local and remote electric power supplies and wear appropriate personal protective equipment per NFPA 70E before working within the electric control enclosure or the fan motor connection box(es). Failure to comply can cause serious injury or death.

This unit contains lethal voltage. The line side of the unit disconnect switch remains energized when the unit disconnect switch is in the "Off" position. Use a voltmeter to verify that the line side input electric power to the unit disconnect switch is off before working on any electrical components or connections.

1. Turn Off the disconnect switch on the enclosure cover.
2. Open the control enclosure cover.
3. Manually turn On the disconnect switch. Power is On and a shock hazard exists with exposure to hazardous voltage components.
4. If the board can still be powered up and has a display, record the parameter settings. To obtain parameters go to the *C--* menu and press the Up or Down button to read and record the values for C03-09, and C27.
5. Record all of the DIP switch positions for the CANbus dip switch package. Retain these for setting up the new board.
6. Record positions of the jumpers for J2, J4, J5, and J6 on control board in unit. Retain these for set-up of new board.
7. Disconnect power from the Liebert MC Condenser unit by turning Off the main disconnect switch.
8. Use a voltmeter to check the unit and ensure that voltage is no longer present in the unit.
9. Remove the plugs and field-installed wires from the old board. Note the polarity for the CANbus wiring going to P49 and P50, if present.
10. Mark wires P49-1, P49-3, etc, if they are not already marked as such.
11. Remove the mechanical fasteners holding the control board in place and remove the old control board.
12. Install the new control board using the fasteners removed in **Step 11**.
13. Reattach the plugs. Reference the hot-stamps on the wire harnesses that correspond to the correct plug on the board. Verify that the plugs are installed properly.
14. Change the CANbus DIP switch positions so they match the old control board that is being removed. If the Liebert MC condenser is the second condenser on the CANbus communication line, set Position 1 of the CANbus DIP switch from On to Off.
15. Change the jumper positions for J2, J4, J5, and J6 to match the old control board. If the Liebert MC condenser is the last device on the CANbus communication line, move the jumper at J6 from Pins 2 and 3 to Pins 1 and 2 (see **Figure 33**).
16. Power up the unit.
17. Change the parameters to match the parameters from the old control board if they can be obtained from the old board. See **Step 18** if parameters were unavailable.
18. If the old board parameters were unavailable, use the new HMI label included in kit to obtain the proper settings. Parameters C03, C04, C05 and C06 must be programmed with the proper EC fan supplier used on the unit, then address the fans (refer to **9.3 - Fan Replacement**).
19. Compare the HMI label that is on the unit with the latest revision.

    If there are differences, clean and dry the surface of the old HMI label; stick the new label on top of the old label. Completely cover the old label with the new.
20. Verify that the control board is reading pressure and temperature.
21. Verify that there are no communication alarms with the fans or the with the cooling unit the Liebert MC is serving.
22. Verify proper fan operation by adjusting the cooling unit that this condenser serves so that it calls for cooling.

9.4.3 Maintenance Inspection Checklist

Date: _____ **Prepared By:** _____

Model #: _____ **Serial Number:** _____

NOTE

Regular inspections are necessary to ensure that the cooling fins are clean. Should inspection reveal dirt or corrosion, appropriate cleaning should be performed.

Monthly	Semiannually
Condenser	**Condenser**
___ 1. Coil surfaces free of debris.	___ 1. Complete all monthly items.
___ 2. Fans free of debris.	___ 2. Piping in good condition.
___ 3. Fans securely mounted.	___ 3. Inspect refrigerant lines for signs of oil leaks. Repair leaks as found.
___ 4. Motor bearings in good condition.	___ 4. Check refrigerant charge level in each receiver tank (if required), based on procedures in the indoor unit's manual. Continuous system operation required.
___ 5. Check all refrigerant lines and capillaries for vibration isolation. Support as necessary.	___ 5. Wash coil as needed.
___ 6. No refrigerant leaks.	___ 6. Repair bent or damaged fins.
Surge Protection Device (If Installed)	**Condenser Electrical Panel**
___ 1. Check SPD protection status indicator lights.	___ 1. Check all electrical connections.
	___ 2. Check contactors for pitting.
	___ 3. Operational sequence/set points.
	Fan Motors
	___ 1. Motor # 1 amp draw __ amps
	___ 2. Motor # 2 amp draw __ amps
	___ 3. Motor # 3 amp draw __ amps
	___ 4. Motor # 4 amp draw __ amps

Notes

Signature _____

Make photocopies of this form for your records.

10.0 TROUBLESHOOTING

Table 19 Troubleshooting

Symptom	Possible Cause	Check or Remedy
Condenser will not start	No power to condenser.	Check voltage at input terminal block.
	Circuit breaker or fuse for low-voltage transformer in condenser is tripped.	Locate problem in condenser electrical panel and repair.
	No low-voltage signal to/from indoor unit.	Locate open circuit and repair.
Low discharge pressure	Faulty head pressure control valve or condenser control board (PEC/BEC).	Replace if defective.
High discharge pressure	Dirty condenser fins.	Clean coil.
	Condenser fans not operating.	Check for low-voltage signal from indoor unit.
		Check fan motors and fuses.
	High refrigerant charge	Check refrigerant charge.
SPD green and red LEDs are extinguished	No voltage or improper phasing exists at condenser.	Check voltage at input terminal block.
	Electrical connections to SPD are faulty.	Locate connection problem and repair.
	Condenser disconnect is turned Off.	Recheck lights with disconnect switch in the On position.
SPD red LED is illuminated	A surge exceeding the rating of the SPD has occurred.	Replace SPD and inspect other components for damage and replace them if necessary.
Control Board LEDs do not light.	Connection to P24 is loose or disconnected.	Check the connection to P24 to verify that is connected securely.
		Check the connector from the transformer for loose terminals.
	Fuse located next to P24 has blown.	Verify that the fuses next to P24 have not blown. Replace as needed.
	24V transformer has failed.	With a voltmeter verify that the output from the transformer is 24Vac ±10%. If the value exceeds ±10%, verify that the correct primary leads are being used.
	Control Board (PEC/BEC) has failed.	If there is no output voltage, verify that the primary connections are secure and receiving the correct voltage. If they are, replace the transformer.
Fan will not run	Jumper not installed between 24V and DIN1 (for Ziehl-Abegg fan motor).	Install jumper between 24V and DIN1 (for Ziehl Abegg fan motor).

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