

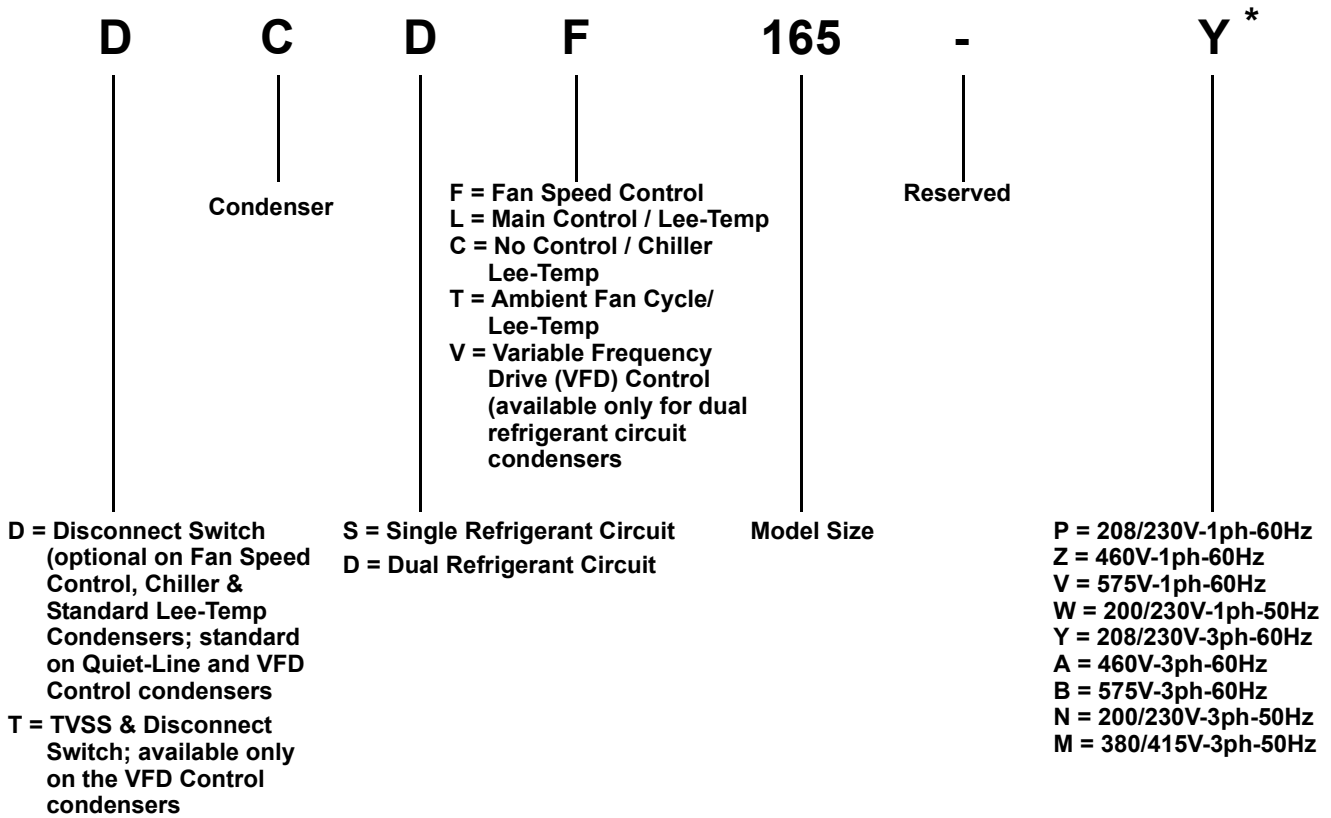
Liebert® Air Cooled, Direct Drive Condensers

Installation, Operation and Maintenance Manual - 50/60Hz



Figure i Product model nomenclature

Example: DCDF165-Y



NOT ALL POSSIBLE COMBINATIONS OF MODELS, CONTROLS AND VOLTAGES ARE AVAILABLE.

- * Single-phase voltage is only voltage available as standard on Fan Speed Control 1-fan condensers
- * Three-phase voltage is only voltage available as standard on condensers with VFD Control, Lee-temp receivers, and Fan Speed Control (2-8 fan models only).
- * VFD Control Condensers are not available in 575-3-60.

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1.0 INTRODUCTION

1.1 Product Description and Features

The Liebert condenser is low-profile direct-drive propeller fan-type air cooled unit suitable for mounting outdoors. It provides for the heat rejection of either one or two separate refrigeration circuits, matching heat rejection capacity varying with the outdoor ambient temperatures with each corresponding compressors heat rejection requirements. Constructed with an aluminum cabinet and a copper-tube aluminum fin 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 Liebert two-fan condenser



1.2 Head Pressure Control Types

1.2.1 Fan Speed

Fan speed control utilizes a wave-chopper control to vary the air volume over the condenser coil, based on refrigerant head pressure. The fan motor next to the electrical panel (two fans on 6-fan and 8-fan models) is a single-phase, permanent split capacitor motor with motor speed adjusted in response to refrigerant pressure. The balance of fans on multi-fan units cycle on ambient thermostats. The control system provides refrigerant head pressure control for outdoor ambients as low as -20°F (-28.9°C).

1.2.2 Variable Frequency Drive

VFD Condenser control system utilizes a variable frequency drive, inverter duty fan motor operating from 0% to 100% motor RPM based on head pressure, sensed by refrigerant pressure transducers. VFD, ambient-temperature thermostat(s), motor overload protection and electrical control circuit are factory-wired in the integral control panel. VFD controls the fan adjacent to the connection end of the condenser and remains energized with active compressor operation. The balance of fans on multi-fan units cycle on ambient thermostats. This system provides refrigerant head pressure control for outdoor ambients as low as -20°F (-28.9°C).

1.2.3 Liebert Lee-Temp™ Refrigerant Control

The Liebert Lee-Temp head pressure control system is designed to maintain proper operating head pressures in outdoor temperatures down to -30°F (-34.4°C). The condensers utilize head pressure control valves, extra refrigerant and insulated refrigerant receivers with heater pads. It 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 a 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 exiting 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. Condenser fan controls are either fan cycling on ambient temperature or constant on. Lee-Temp control is required for Quiet-Line Condensers.

1.3 Sound Level Options

1.3.1 Standard Condenser

All Fan Speed and VFD Condensers are standard condensers with moderate operating sound levels. Lee-Temp Condensers with standard-size coils matching Fan Speed and VFD coil sizes are standard sound level condensers.

1.3.2 Quiet-Line Condenser

Quiet-Line condensers can help your facility meet the strictest noise codes and do so at less cost than traditional condensers with acoustical shielding. The Quiet-Line condensers utilize the same reliable construction features of the standard condensers and have oversized coils and slower speed fan motors which yield the required heat rejection needed at significantly lower sound levels. Lee-Temp control is required for Quiet-Line Condensers.

1.4 Transient Voltage Surge Suppression Option

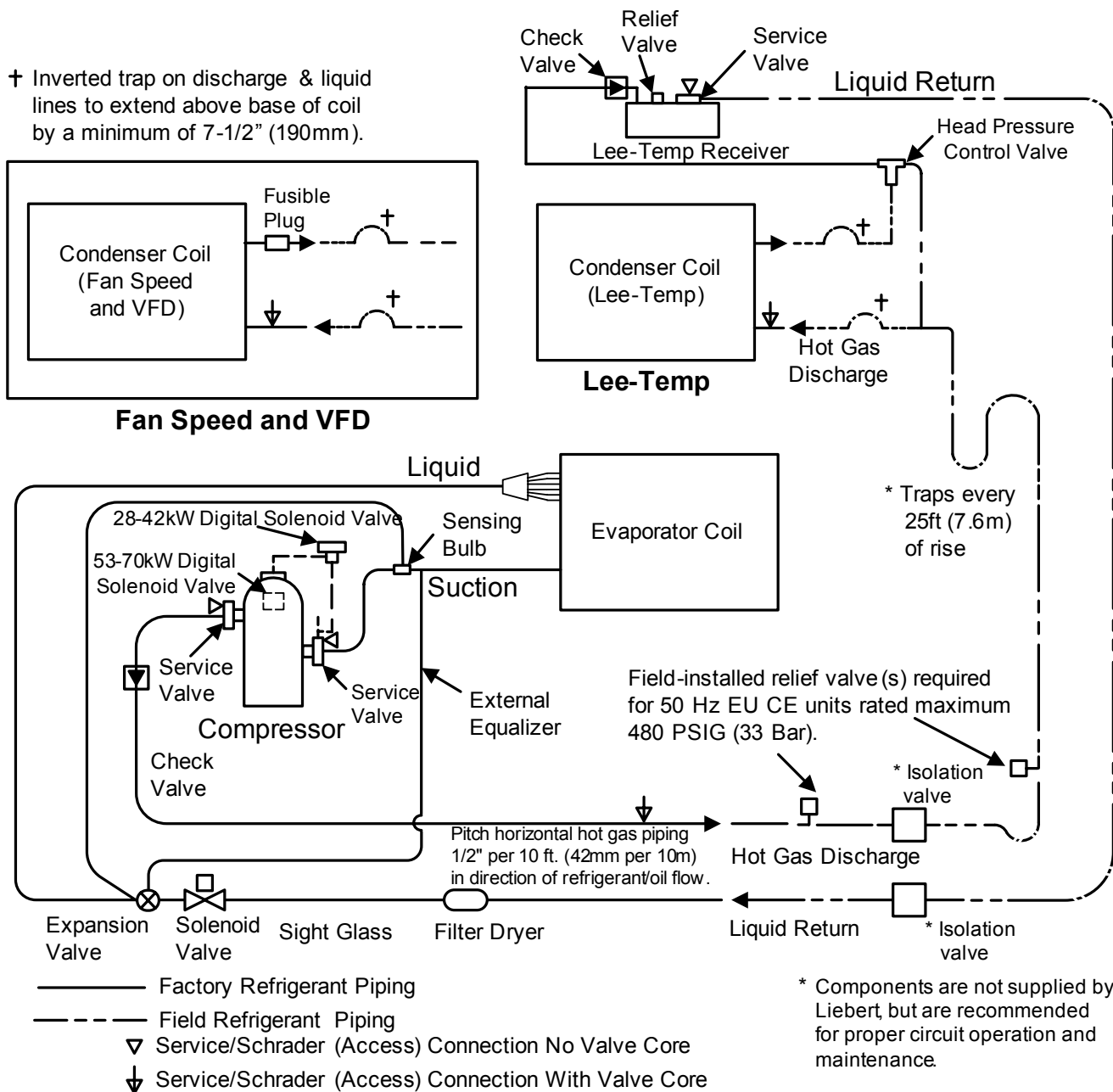
Transient Voltage Surge Suppression (TVSS) panel is standard in the VFD Condenser models only. Surge protection is necessary because rooftop voltage supply often is not conditioned the same as the voltage supply inside the data center. The TVSS is designed to protect sensitive electronic condenser components from high voltage transients, up to 25kVA/phase.

An illuminated green LED indicates power supply is On and panel status is OK. An illuminated red LED indicates conditions require service and the TVSS may require replacement to restore surge protection to the condenser.

1.5 Typical System Configurations

Figure 2 shows a single refrigeration circuit diagram, displaying the indoor air conditioning unit, the outdoor condenser (VFD, Fan Speed Control or Lee-Temp) and field supplied interconnection piping.

Figure 2 Typical system configuration—indoor unit and outdoor condenser and field piping



Note: Schematic representation shown. Do not use for specific connection locations. Two refrigeration circuits provided. Single refrigeration circuit shown for clarity.

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2.0 SITE PREPARATION

2.1 Site Considerations

The condensers should be installed in a location offering maximum security and access for maintenance.

Avoid ground-level sites with public access and areas that contribute to heavy snow or ice accumulations. Utilize Piggyback condensers whenever interior building locations must be used. To ensure adequate air supply, Liebert 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 not be located near steam, hot air or fume exhausts. Also, the condensers should be located no closer than 3 feet (1m) from a wall, obstruction or adjacent unit.

The condenser must not be installed in a pit.

The condenser must be installed on a level surface to ensure proper refrigerant flow.

For roof installation, mount the condenser on suitable curbs or other supports in accordance with local codes.

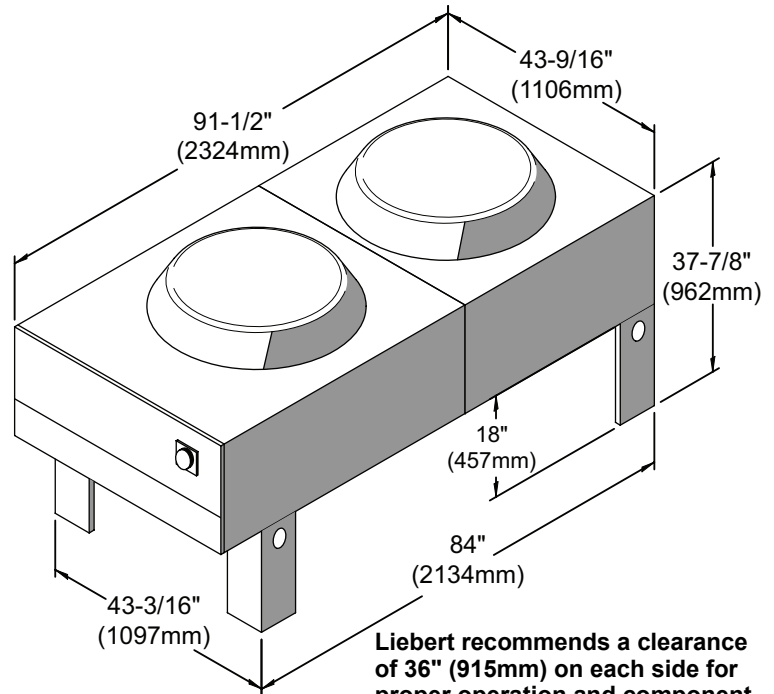
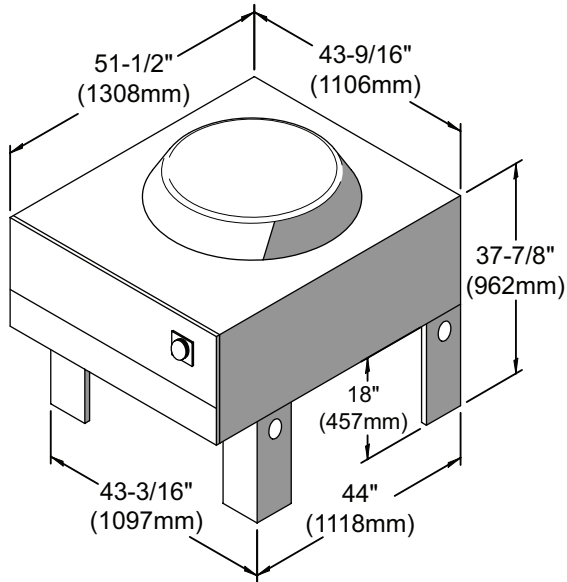
Lee-Temp receiver tanks should be mounted on the condenser legs for proper operation. Remote mounting of tanks must be within 10 feet of the condenser—Contact Liebert Application Engineering Department for assistance.

2.2 Dimensions and Weights

Table 1 Condenser shipping weights, dimensions and volume, approximate

Model	Number of Fans	Domestic Packaging			Export Packaging		
		Weight lb (kg)	Dimensions (LxWxH) in. (mm)	Volume ft ³ (m ³)	Weight lb (kg)	Dimensions (LxWxH) in. (mm)	Volume ft ³ (m ³)
*C**083	1	330 (150)	59x30x51 (1500x760x1300)	52 (1.4)	415 (188)	60x31x52 (1520x790x1320)	56 (1.5)
*C**104	1	350 (159)			435 (197)		
DC**063	1	350 (159)			435 (197)		
*C**165	2	490 (222)	97x30x51 (2460x760x1300)	86 (2.4)	690 (313)	98x31x52 (2490x790x1320)	91 (2.5)
*C**205	2	560 (254)			760 (345)		
DC**119	2	490 (222)			690 (313)		
DC**127	2	560 (254)			760 (345)		
DC**143	2	655 (297)			855 (388)		
*C**251	3	590 (268)	139x30x51 (3530x760x1300)	123 (3.4)	870 (395)	140x31x52 (3560x790x1320)	131 (3.5)
*C**308	3	760 (345)			1040 (472)		
DC**214	3	885 (401)			1165 (528)		
*C**415	4	935 (424)	179x30x51 (4550x760x1300)	158 (4.4)	1235 (560)	180x31x52 (4570x790x1320)	168 (4.5)
*C**510	4	1230 (558)			1530 (694)		
DC**286	4	1185 (537)			1485 (674)		
*C**616	6	1560 (708)	144x36x97 (3660x910x2460)	291 (8.3)	2010 (912)	145x37x97 (3680x940x2460)	301 (8.4)
DC**409	6	1620 (735)			2070 (939)		
*CD*830	8	1930 (875)	184x36x97 (4670x910x2460)	372 (10.)	2430 (1102)	185x37x97 (4700x940x2460)	384 (10.)
*CD*1010	8	2910 (1321)			3410 (1548)		
DC**572	8	2575 (1168)			3075 (1395)		

Figure 3 Condenser planning dimensional data—One-fan and two-fan units



Note:
Overall height to the top of fan guard
43-1/8" (1095mm)

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

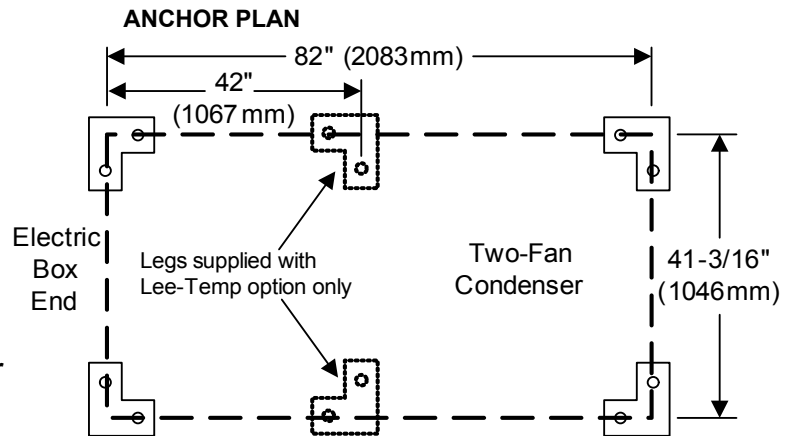
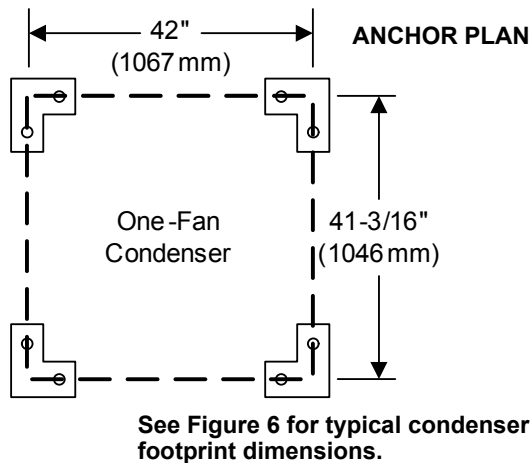
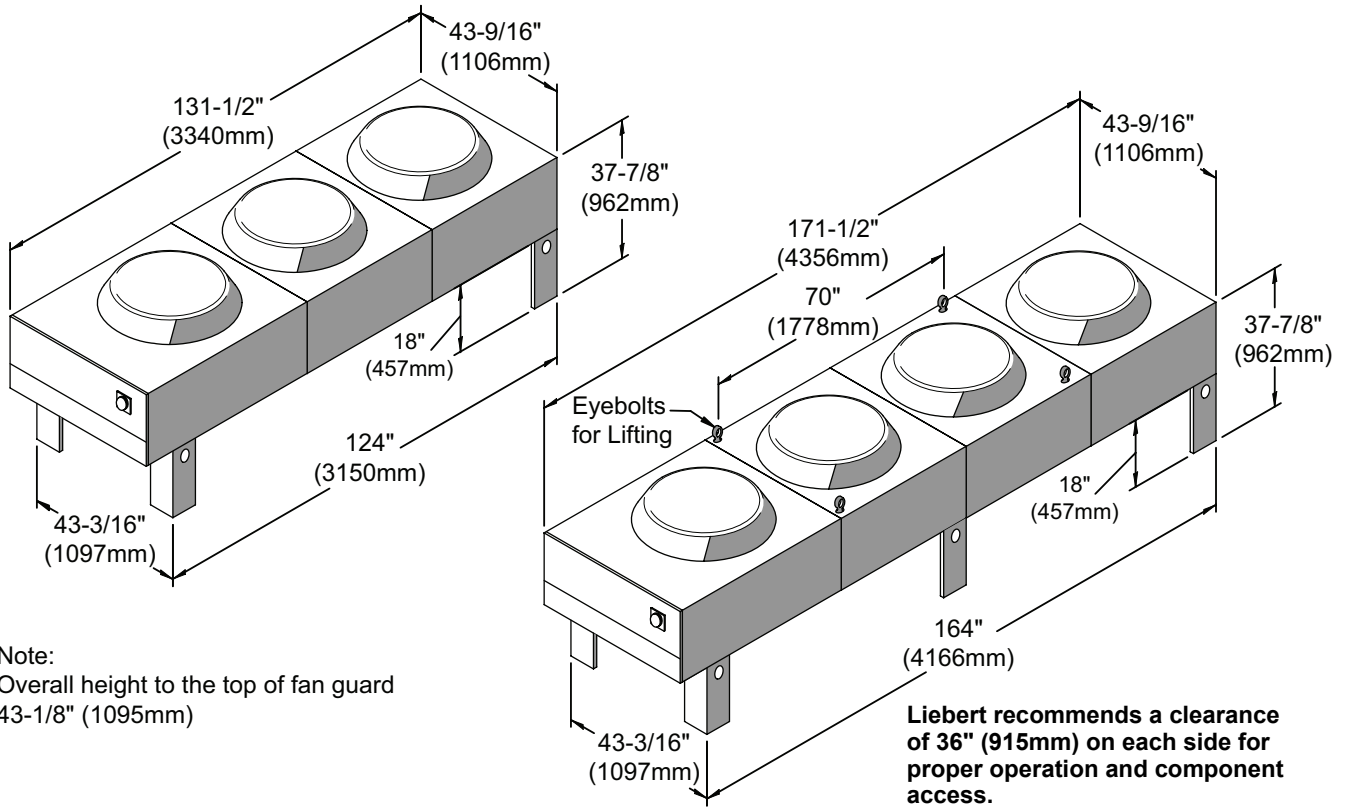


Figure 4 Condenser planning dimensional data—Three-fan and four-fan units



Note:
Overall height to the top of fan guard
43-1/8" (1095mm)

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

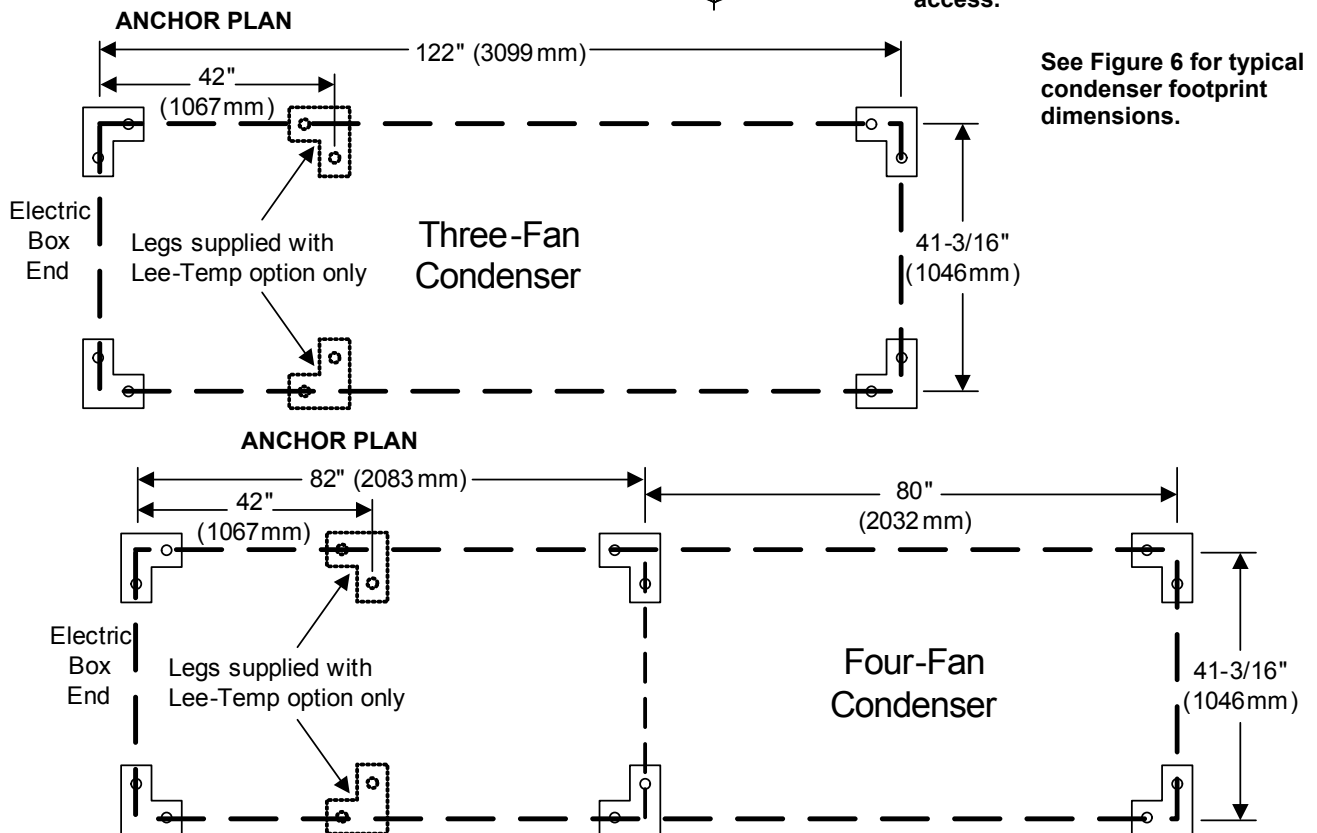


Figure 5 Condenser planning dimensional data—Six- and eight-fan units

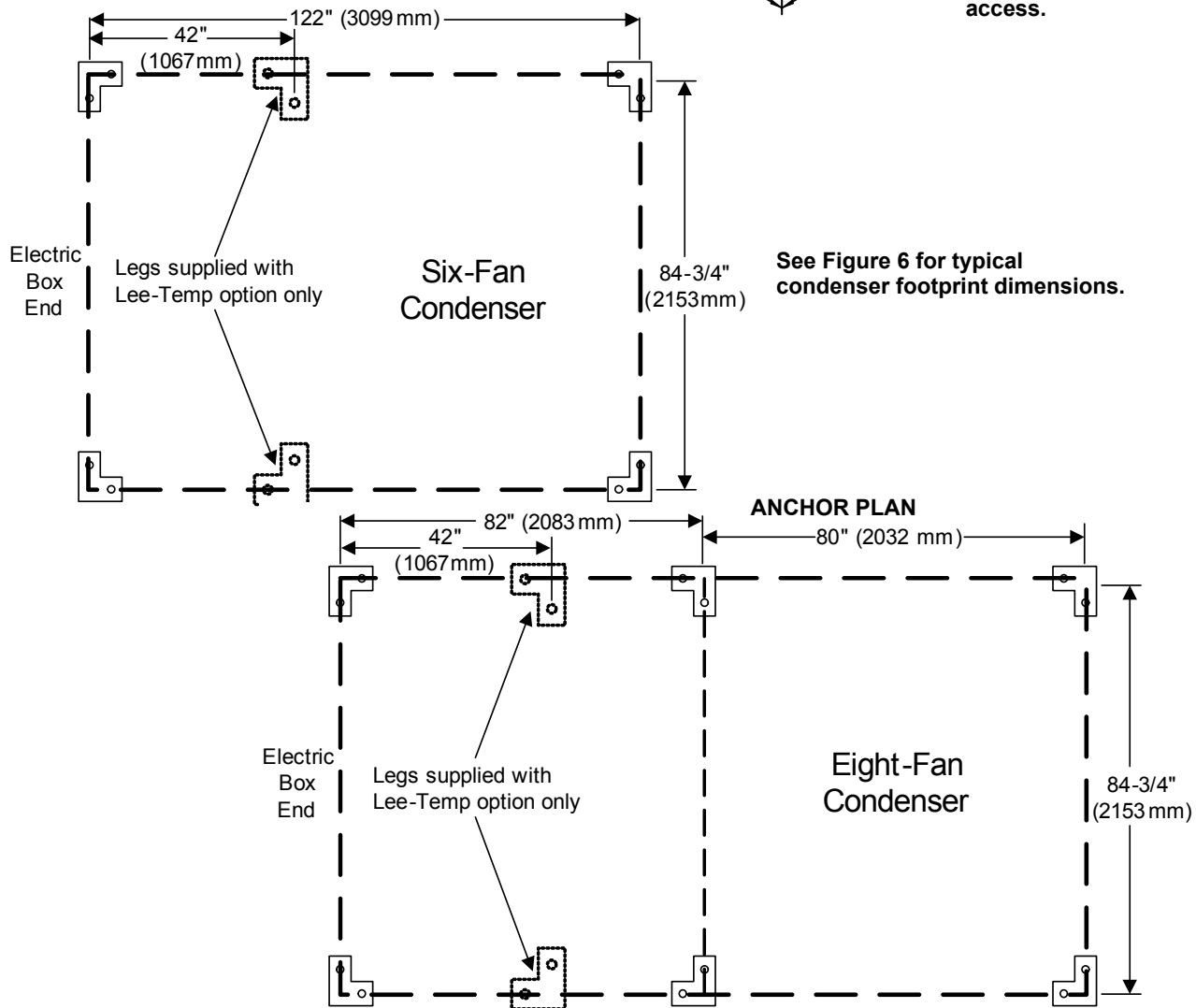
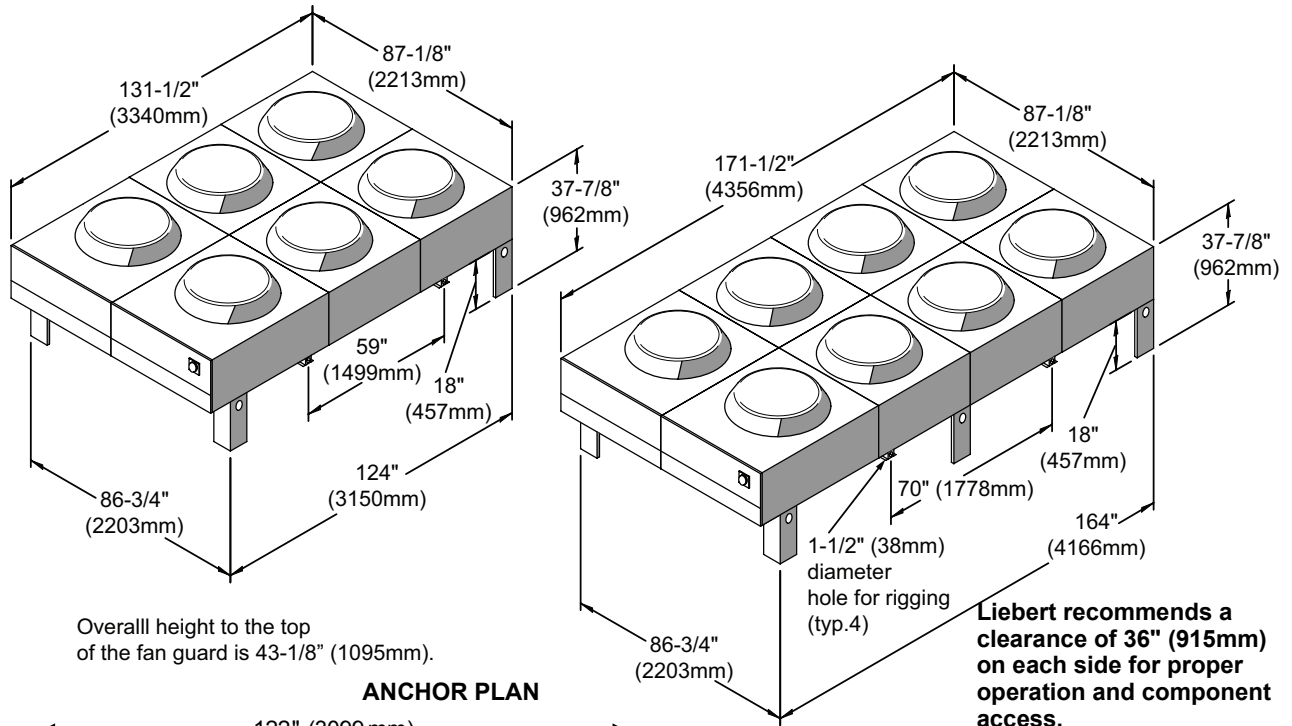


Figure 6 Typical condenser footprint—dimensions

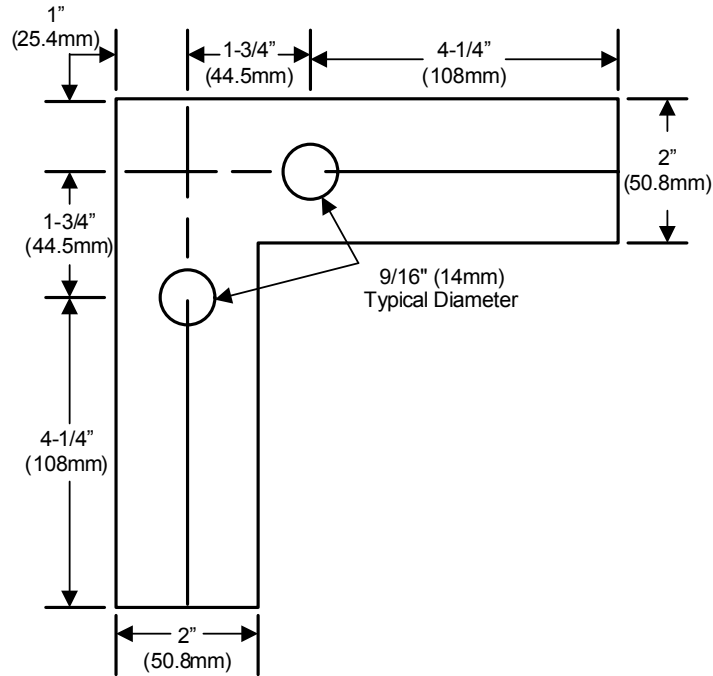


Figure 7 Piping connection locations for 1-, 2-, 3- and 4-fan VFD Control and Fan Speed Condensers

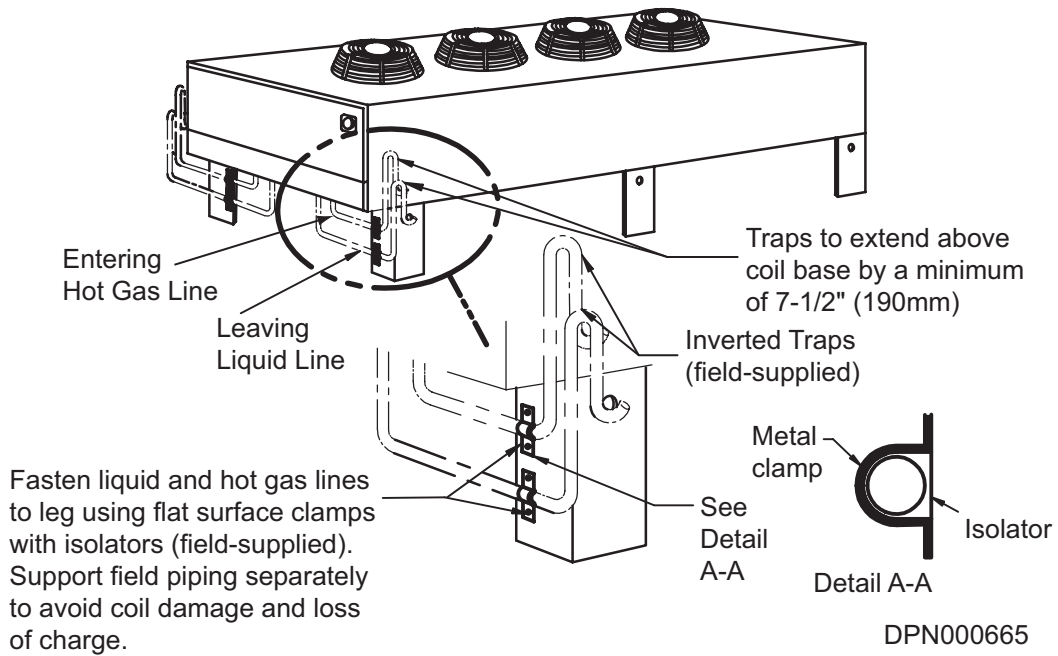


Figure 8 Piping connections for 1-, 2-, 3- and 4-fan Lee-Temp and Quiet-Line Condensers

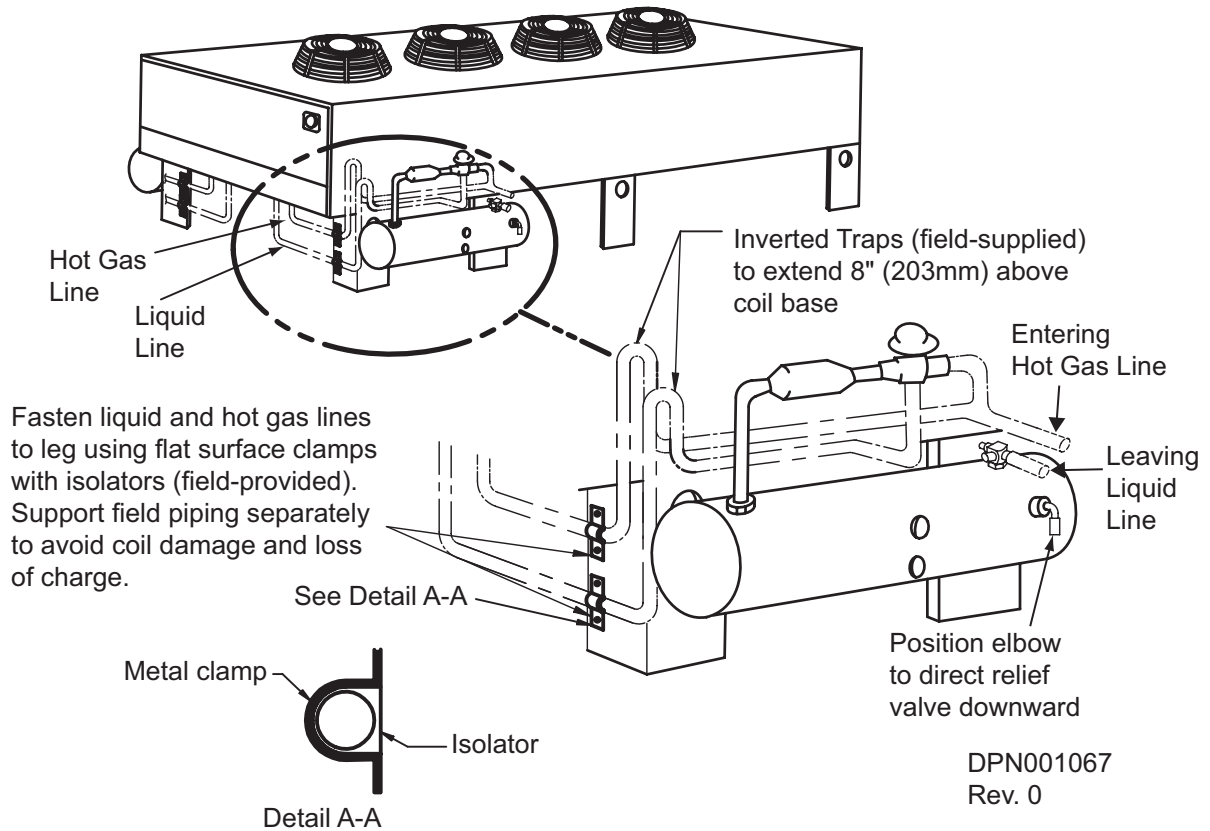


Figure 9 Piping connections for 6- and 8-fan Fan Speed Condensers

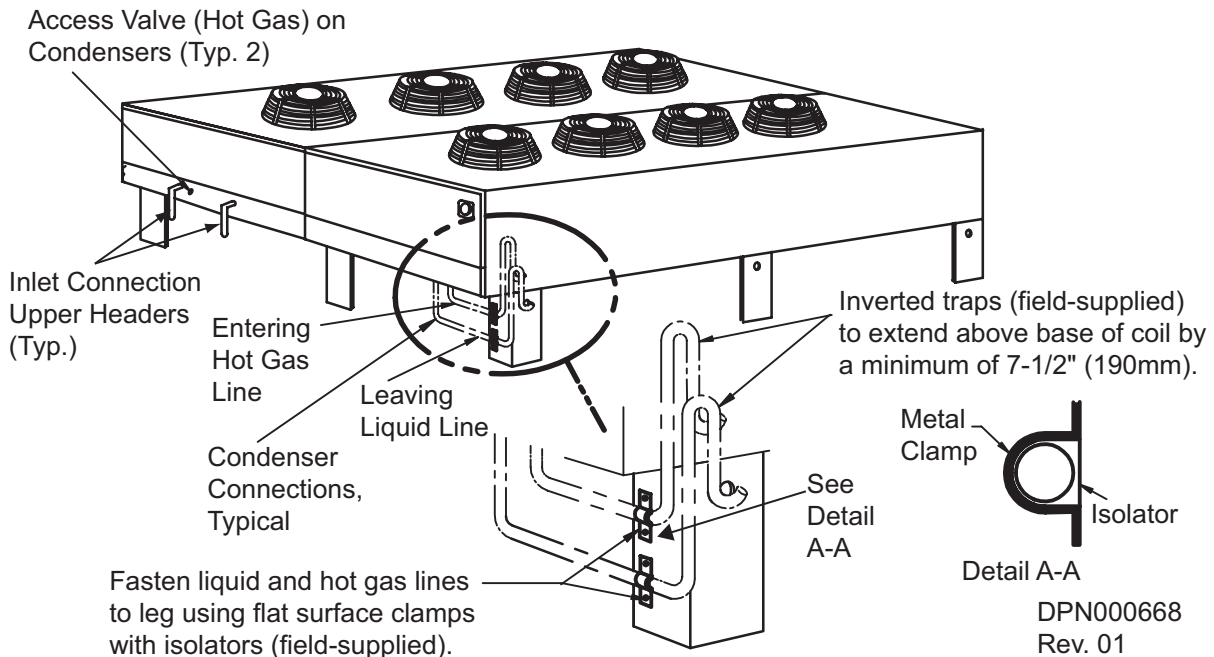
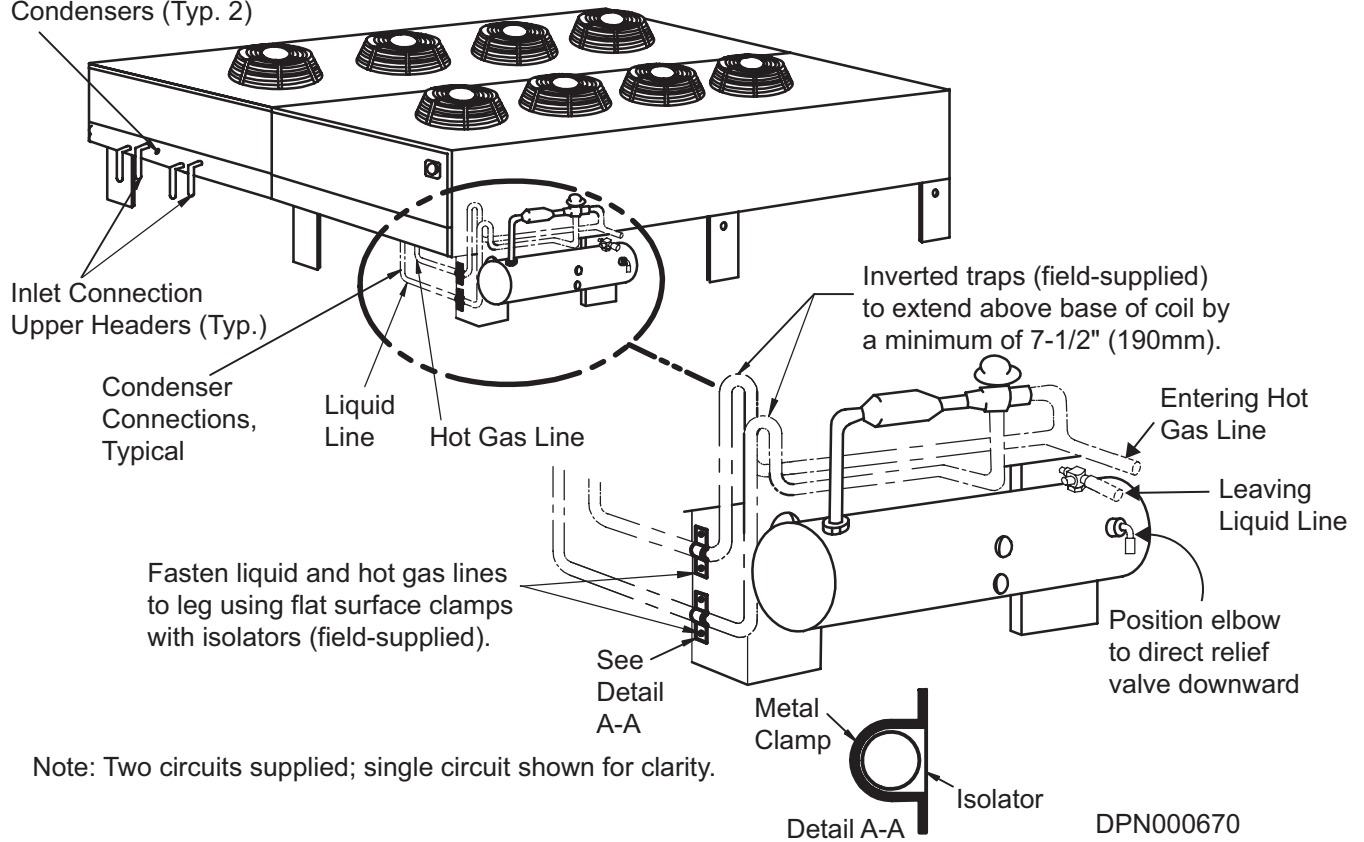


Figure 10 Piping connections for 6- and 8-fan Lee-Temp and Quiet-Line Condensers

Access Valve (Hot Gas) on
Condensers (Typ. 2)



Note: Two circuits supplied; single circuit shown for clarity.

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Table 2 Condenser physical data

Model #	Number of Fans	Number of Circuits	Connection Size, OD, In.		Net Weight lb (kg)
			Hot Gas	Liquid	
Standard Models					
CS*083	1	1	7/8	5/8	295 (134)
CD*104	1	2	7/8	1/2	315 (143)
CS*104	1	1	1-1/8	5/8	315 (143)
CD*165	2	2	7/8	5/8	425 (193)
CS*165	2	1	1-1/8	7/8	425 (193)
CD*205	2	2	1-1/8	7/8	495 (225)
CS*205	2	1	1-1/8	7/8	495 (225)
CD*251	3	2	1-1/8	7/8	500 (227)
CS*251	3	1	1-3/8	1-1/8	500 (227)
CD* 308	3	2	1-3/8	1-1/8	670 (304)
CS*308	3	1	1-5/8	1-1/8	670 (304)
CD* 415	4	2	1-3/8	1-1/8	840 (381)
CS*415	4	1	1-5/8	1-1/8	840 (381)
CD*510	4	2	1-5/8	1-1/8	1188 (539)
CD*616	6	2	1-5/8	1-1/8	1380 (626)
CS*616 ¹	6	1	(2)1-5/8	(2)1-1/8	1380 (626)
CD*830	8	2	1-5/8	1-1/8	1750 (794)
CD*1010	8	2	2-1/8	1-5/8	2640 (1197)
Quiet-Line Models					
DCS*063	1	1	1-1/8	5/8	315 (143)
DCD*063	1	2	7/8	1/2	315 (143)
DCS*119	2	1	1-1/8	7/8	425 (193)
DCD*119	2	1	1-1/8	7/8	425 (193)
DCS*127	2	1	1-1/8	7/8	495 (225)
DCD*127	2	2	1-1/8	7/8	495 (225)
DCS*143	2	1	1-1/8	7/8	515 (234)
DCD*143	2	2	1-1/8	7/8	515 (234)
DCS*214	3	1	1-5/8	1-1/8	840 (381)
DCD*214	3	2	1-1/8	7/8	840 (381)
DCS*286	4	1	2-1/8	1-1/8	1105 (501)
DCD*286	4	2	1-1/8	7/8	1105 (501)
DCD*409	6	2	1-5/8	1-1/8	1380 (626)
DCD*572	8	2	2-1/8	1-1/8	2430 (1102)

1. Interconnection piping (field-supplied and installed) required. Configure piping for parallel refrigerant flow between condenser sections.

2.3 Refrigerant Planning Values

Planning for the refrigerant requirements of the completed system is the addition of the charges from Indoor Unit, Condenser (including Lee-Temp receiver, if used) and the interconnecting piping.

Tables 3 and 4 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. Consult indoor unit manual for charging procedures.

Table 3 R-22 and R-407C refrigerant required, approximate

Standard Condenser Models	Approximate R-22 Refrigerant Needed				Approximate R-407C Refrigerant Needed			
	Single Circuit lb (kg)		Dual Circuit lb/circuit (kg/circuit)		Single Circuit lb (kg)		Dual Circuit lb/circuit (kg/circuit)	
	FSC or VFD	Lee-Temp (includes receiver)	FSC or VFD	Lee-Temp (includes receiver)	FSC or VFD	Lee-Temp (includes receiver)	FSC or VFD	Lee-Temp (includes receiver)
83	5 (2.3)	27 (12.3)	3 (1.4)	15 (6.8)	5 (2.3)	26 (11.8)	3 (1.4)	15 (6.8)
104	8 (3.6)	39 (17.7)	7 (3.2)	21 (9.5)	8 (3.6)	37 (16.8)	7 (3.2)	20 (9.0)
165	15 (6.8)	53 (24.0)	5 (2.3)	27 (12.3)	15 (6.8)	50 (22.7)	5 (2.3)	26 (11.8)
205	20 (9.1)	76 (34.5)	7 (3.2)	38 (17.2)	19 (8.6)	72 (32.7)	7 (3.2)	36 (16.3)
251	19 (8.6)	75 (34.0)	10 (4.6)	38 (17.2)	18 (8.2)	71 (32.23)	10 (4.6)	36 (16.3)
308	29 (13.2)	113 (51.3)	11 (5.0)	58 (26.3)	28 (12.7)	107 (48.5)	11 (5.0)	55 (24.9)
415	54 (24.5)	182 (82.6)	15 (6.8)	75 (34.0)	51 (23.1)	173 (78.4)	15 (6.8)	71 (32.2)
510	72 (32.7)	N/A	30 (13.6)	149 (67.6)	68 (30.8)	N/A	29 (13.2)	142 (64.4)
616	N/A	267 (121.3)	27 (12.3)	113 (51.3)	N/A	254 (115.2)	26 (11.8)	108 (49.0)
830	N/A	N/A	30 (13.6)	149 (67.6)	N/A	N/A	29 (13.2)	142 (64.4)
1010	N/A	N/A	60 (27.2)	154 (69.9)	N/A	N/A	57 (25.9)	147 (66.7)
Quiet-Line Condenser Models								
63	N/A	39 (17.7)	N/A	21 (9.5)	N/A	37 (16.8)	N/A	20 (9.1)
119	N/A	50 (22.7)	N/A	27 (12.3)	N/A	48 (21.8)	N/A	26 (11.8)
127	N/A	76 (34.5)	N/A	38 (17.2)	N/A	72 (32.6)	N/A	36 (16.3)
143	N/A	126 (57.2)	N/A	64 (29.0)	N/A	120 (54.5)	N/A	61 (27.7)
214	N/A	161 (73.0)	N/A	81 (36.7)	N/A	153 (69.4)	N/A	77 (34.9)
286	N/A	196 (88.9)	N/A	125 (56.7)	N/A	186 (84.4)	N/A	119 (54.0)
409	N/A	N/A	N/A	129 (58.5)	N/A	N/A	N/A	125 (55.8)
572	N/A	N/A	N/A	196 (88.9)	N/A	N/A	N/A	186 (84.4)

Table 4 Interconnecting piping refrigerant charge

Line Size, O.D., in.	R-22, lb/100 ft. (kg/30m)		R-407C, lb/100 ft. (kg/30m)	
	Liquid Line	Hot Gas Line	Liquid Line	Hot Gas Line
3/8	3.8 (1.7)	—	3.7 (1.7)	—
1/2	7.3 (3.3)	—	6.9 (3.1)	—
5/8	11.7 (5.3)	2.1 (1.0)	11.0 (5.0)	2.2 (1.0)
3/4	16.6 (7.5)	3.0 (1.4)	15.7 (7.1)	3.1 (1.3)
7/8	24.4 (11.1)	4.4 (2.0)	23.0 (10.4)	4.5 (1.9)
1-1/8	41.4 (18.9)	7.8 (3.5)	39.3 (17.8)	7.8 (3.5)
1-3/8	63.3 (28.7)	11.8 (5.4)	59.8 (27.1)	11.8 (5.4)
1-5/8	—	16.7 (7.6)	—	16.7 (7.6)

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 Liebert representative. File a damage claim with the carrier and send a copy to your local Liebert representative.

3.1.1 Packing Material

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



SAFETY INFORMATION



WARNING

Risk of top-heavy unit falling over. 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 sharp edges, splinters and exposed fasteners. Can cause personal injury.

Only properly trained and qualified personnel wearing appropriate safety headgear, gloves, shoes, glasses and protective clothing 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 prior to moving the unit to verify clearances.

NOTICE

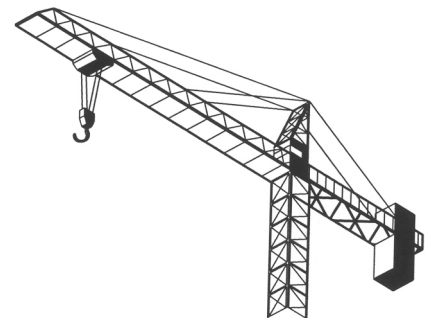
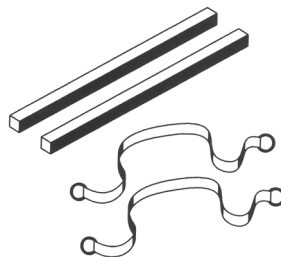
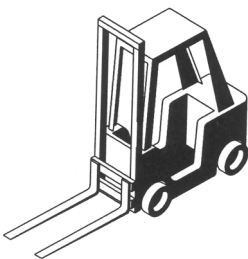
Risk of damage from forklift. Improper handling with the forklift. Can cause exterior and/or underside damage.

Keep tines of the forklift level and at a height suitable to fit below the skid.

NOTICE

Risk of unit damage if improperly stored. Keep the unit upright, indoors and protected from dampness, freezing temperatures and contact damage.

Figure 11 Equipment recommended for handling a Liebert condenser



3.2 Handling Unit on the Skid

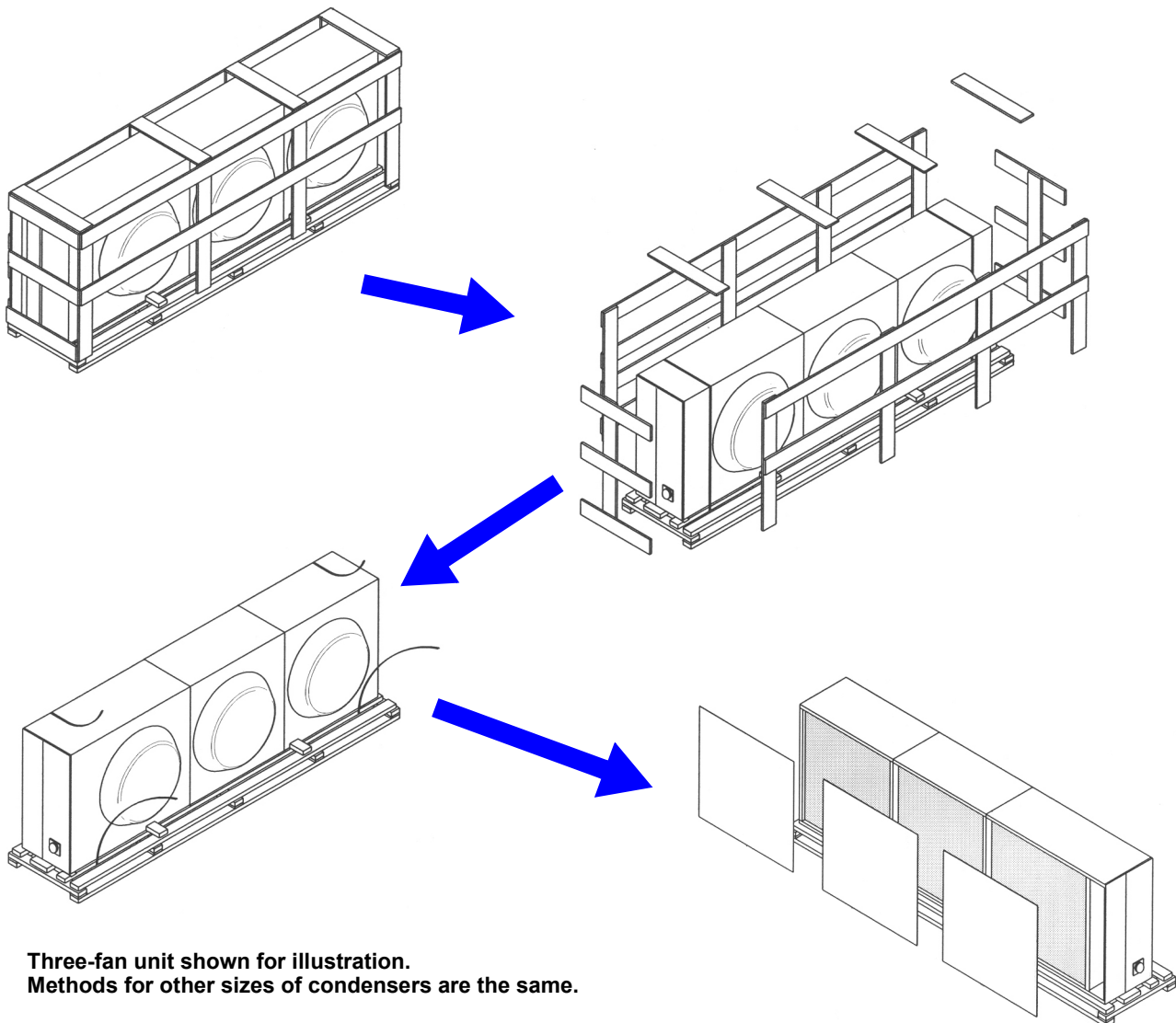
Transport the unit using a fork lift or a crane with sling and spreader bars.

- If using a fork lift, make sure the forks (if adjustable) are spread to the widest allowable distance to still fit under the skid.
- Ensure the fork length is suitable for the unit length.
- When moving the packaged unit, do not lift the unit any higher than 6" (152mm) off the ground. Exercise great care if the unit must be lifted higher than 6" (152mm). Personnel not involved in moving the unit must be at least 20' (6m) from the lift point of the unit.

3.3 Unpacking the Unit

Remove outer packaging when ready to install the unit. Be sure to locate, and set aside, the bag of mounting hardware that is to be used for mounting the support legs on the unit.

Figure 12 Removing shipping crate

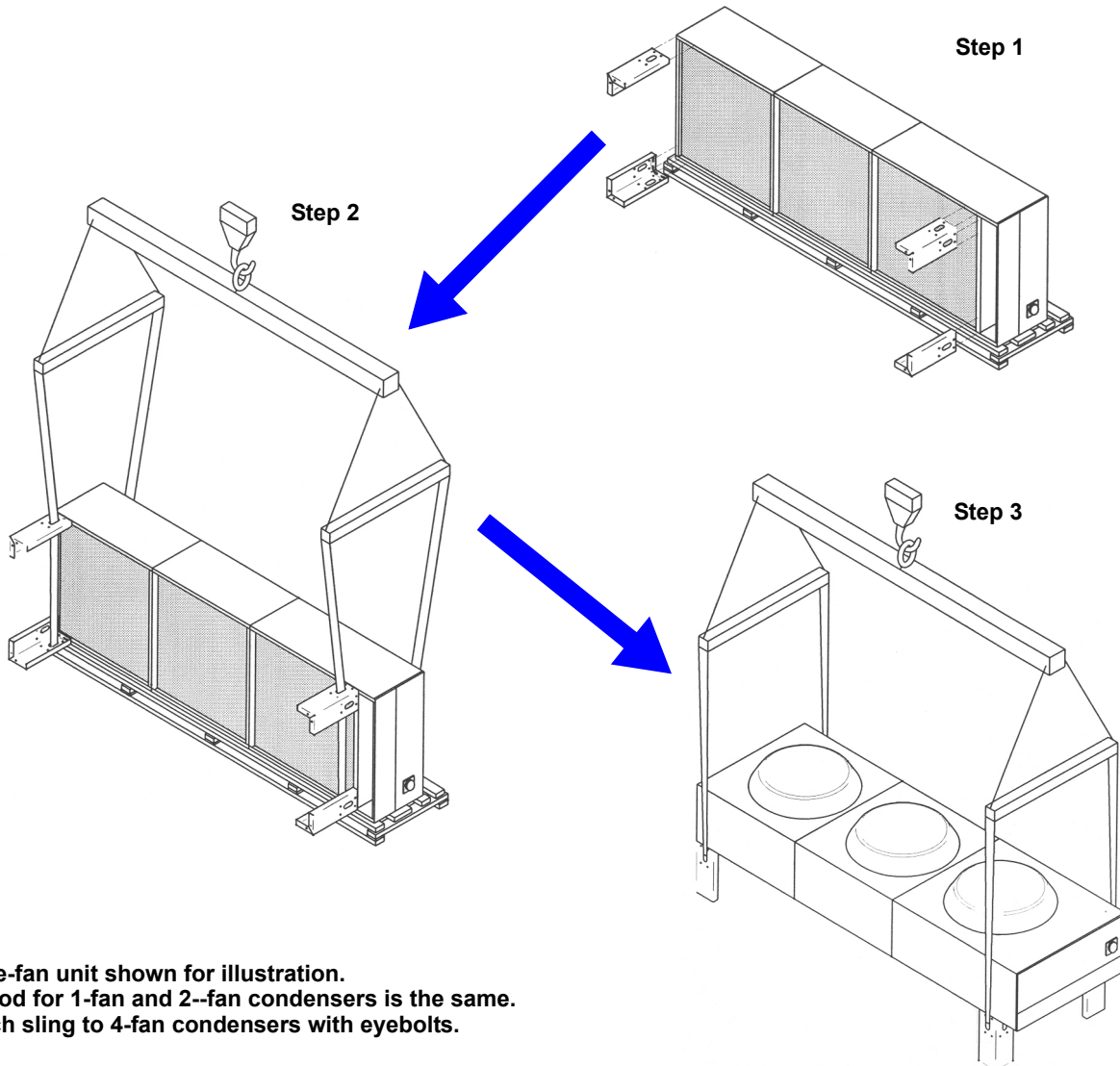


3.4 Preparing a 1-, 2-, 3- or 4-Fan Condenser for Moving and Installation

3.4.1 Removing the Skid and Attaching Slings

1. Install the legs, provided by Liebert, on the condenser with the mounting bolts, also provided by Liebert. Liebert recommends using a 5/8" socket and ratchet.
2. Place slings or equivalent items through holes in the legs on 1, 2- and 3-fan condensers (see **Step 2** and **Step 3** in **Figure 13**). Use eyebolts for attaching a sling or similar equipment to 4-fan units.
3. Using spreader bars and a crane, or similar lifting equipment, lift the condenser off the skid to allow safely turning the condenser upright.
4. Lift the condenser and move it to the installation location.

Figure 13 Attaching legs and sling to a 1-, 2-, 3- or 4-fan condenser for moving



**Three-fan unit shown for illustration.
Method for 1-fan and 2--fan condensers is the same.
Attach sling to 4-fan condensers with eyebolts.**

3.5 Preparing a 6-Fan or 8-Fan Condenser for Moving and Installation

3.5.1 Removing the Skid and Attaching Slings

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

1. Place a sling through to rigging attachment points as shown in **Step 1** in **Figure 14**.
2. Raise the condenser high enough that the skid can be safely removed.
3. Place protective material under the unit to protect it from scrapes and gouges. Lower the condenser onto the material.
4. Lower the condenser to an angle and distance that will allow attaching the legs to one side of the condenser. The number of legs varies according to the condenser model.
5. Install the legs, provided by Liebert, on the condenser with the mounting bolts, also provided by Liebert. Liebert recommends using a 5/8" socket and ratchet.
6. Turn the condenser so that the legs just installed support one side of the unit as shown in **Step 3** in **Figure 14**.
7. Remove the sling and attach it to the opposite side of the condenser as shown in **Step 4** in **Figure 15**.
8. Raise the condenser to an angle to safely install legs on the opposite side of the condenser.
9. Lower the condenser so all legs support it.
10. Place slings on both sides of the condenser to lift and move it to the installation location.

Figure 14 Attaching legs to a 6-fan or 8-fan unit

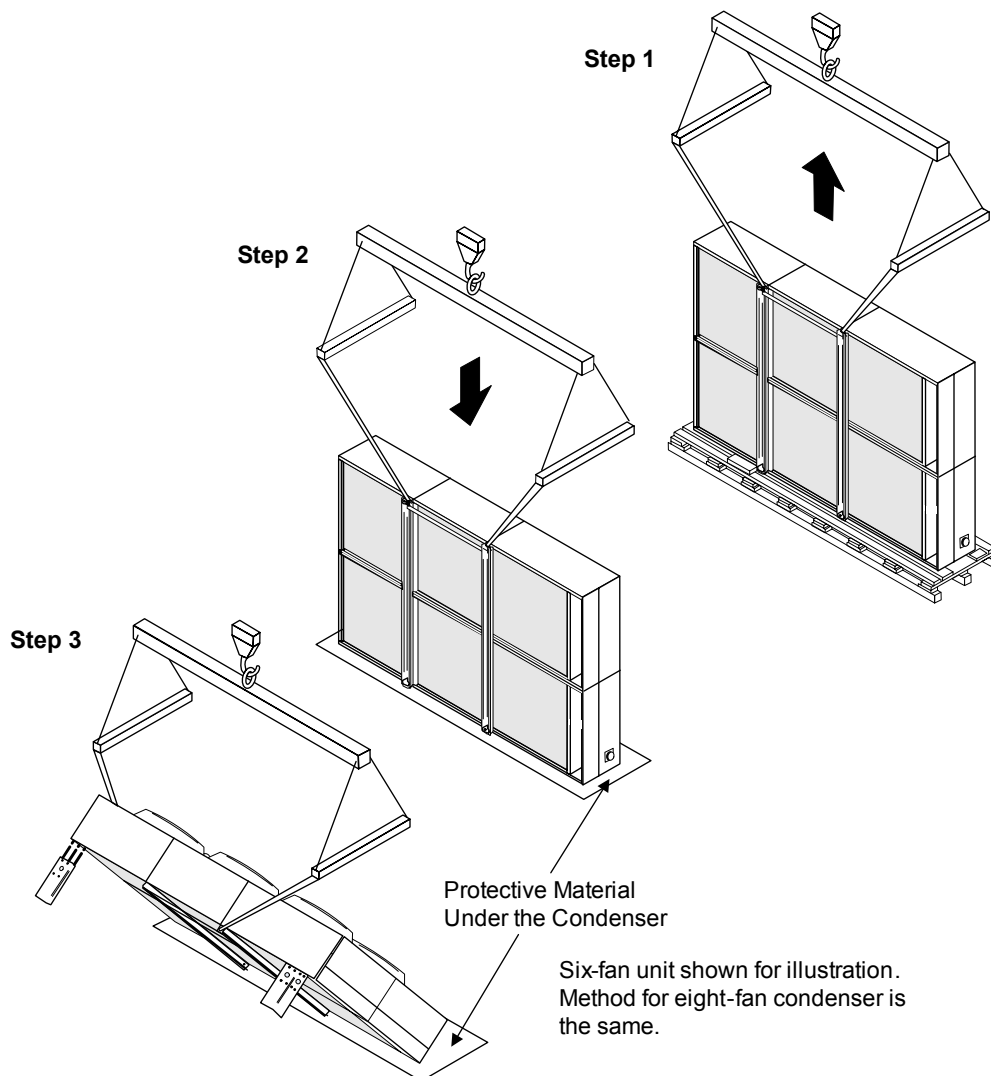
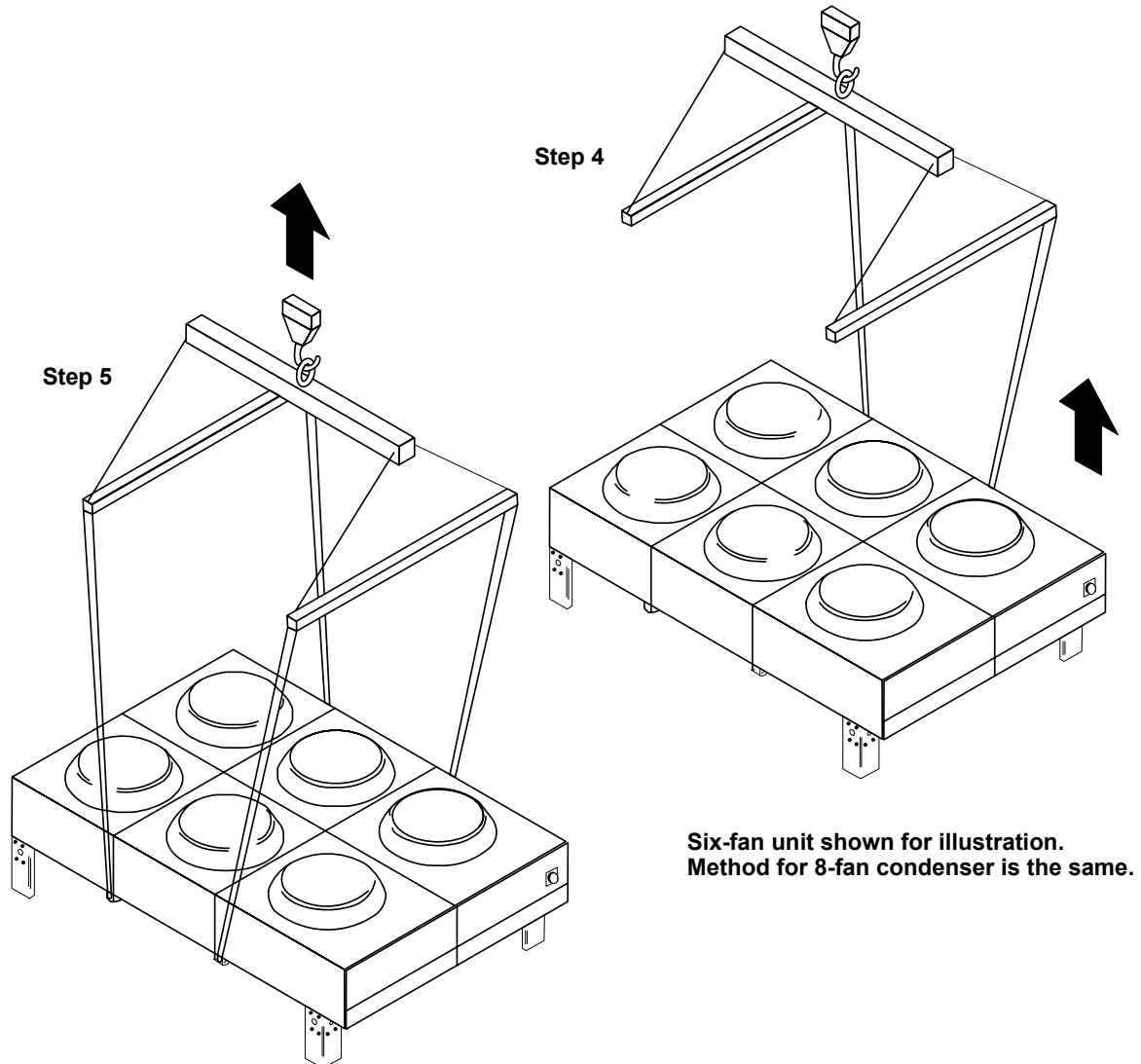


Figure 15 Attaching sling to a 6-fan or 8-fan unit for moving



3.5.2 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 5/8" (16mm) holes in each leg. See **Figures 3, 4 and 5** for anchor dimensions.

3.6 Electrical Supply Preparation

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 **Figures 19, 20 and 21** for electrical service entrances into unit. Refer to electrical schematic when making connections.

Each unit is shipped from the factory with all internal unit wiring completed.



WARNING

Risk of electric shock. Can cause injury or death.

Disconnect all local and remote electrical power supplies before working within the electrical enclosure.

The line side of the disconnect remains energized when the disconnect is Off.

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



WARNING

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

The fan(s) blades can start to rotate unexpectedly when the power is On. Disconnect all local and remote electrical power supplies before working within the fan compartment.

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

Each unit is shipped from the factory with all internal unit 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.

3.6.1 Line Voltage Wiring



WARNING

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

Select and install the 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.

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 power supply does not necessarily have to be the same voltage supply as required by the indoor unit connected to the condenser. See the unit's serial tag for specific condenser electrical requirements. A unit disconnect is standard on VFD and Quiet-Line Condensers and is optional on Fan Speed Control and standard Lee-Temp condensers. 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 through the hole provided in the cabinet. Connect earth ground to lug provided near terminal board.



NOTE

*Lee-Temp and Quiet-Line Condensers require a separate line voltage electrical supply for the heated receivers. See **Table 8** for power requirements.*

Table 5 60Hz condenser data

Model #		83, 104			165, 205			251, 308			415, 510			616			830, 1010		
# of Fans		1			2			3			4			6			8		
Input Voltage	ph	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD
Fan Speed Controlled																			
208/230	1	4.8	6.0	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
460		2.5	3.1	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
575		1.9	2.4	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
208/230	3	—	—	—	8.3	9.5	15	11.8	13.0	15	15.3	16.5	20	23.6	24.8	25	30.6	31.8	35
460		—	—	—	4.2	4.8	15	5.9	6.5	15	7.6	8.2	15	11.8	12.4	15	15.2	15.8	20
575		—	—	—	3.3	3.8	15	4.7	5.2	15	6.1	6.6	15	9.4	9.9	15	12.2	12.7	15
VFD Controlled																			
208/230	3	3.7	4.6	15	7.2	8.1	15	10.7	11.6	15	14.2	15.1	20	N/A	N/A	N/A	N/A	N/A	N/A
460		1.8	2.3	15	3.5	4.0	15	5.2	5.7	15	6.9	7.4	15	N/A	N/A	N/A	N/A	N/A	N/A
Lee-Temp Controlled/Fan-Cycling																			
208/230	3	3.5	4.4	15	7.0	7.9	15	10.5	11.4	15	14.0	14.9	15	21.0	21.9	25	28.0	28.9	30
460		1.7	2.1	15	3.4	3.8	15	5.1	5.5	15	6.8	7.2	15	10.2	10.6	15	13.6	14.0	15
575		1.4	1.8	15	2.8	3.2	15	4.2	4.6	15	5.6	6.0	15	8.4	8.8	15	11.2	11.6	15

FLA = Full Load Amps; WSA = Wire Size Amps; OPD = Maximum Overcurrent Protection Device

Table 6 60Hz condenser data, Quiet-Line (Lee-Temp controlled/fan-cycling)

Model #		ph	63			119, 127, 143			214			286			409			572		
# of Fans			1			2			3			4			6			8		
Input Voltage	ph	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD	
208/230	3	1.8	2.3	15	3.6	4.1	15	5.4	5.9	15	7.2	7.7	15	10.8	11.3	15	14.4	14.9	15	
460		0.9	1.1	15	1.8	2.0	15	2.7	2.9	15	3.6	3.8	15	5.4	5.6	15	7.2	7.4	15	
575		0.7	0.9	15	1.4	1.6	15	2.1	2.3	15	2.8	3.0	15	4.2	4.4	15	5.6	5.8	15	

FLA = Full Load Amps; WSA = Wire Size Amps; OPD = Maximum Overcurrent Protection Device

Table 7 50Hz condenser full load amp values

Condenser Control Type		Fan Speed Controlled			VFD Controlled			Lee Temp Controlled/Fan-Cycling			Quiet-Line (Lee Temp Controlled/Fan-Cycling)		
Model #	# of Fans	Input Voltage - Phase			Input Voltage - Phase			Input Voltage - Phase			Model #	Input Voltage - Phase	
		200/230-1	380/415-3		200/230-3	380/415-3		200/230-3	380/415-3			200/230-3	380/415-3
83, 104	1	4.0	-		3.7	1.8		3.5	1.7		63	1.8	0.9
165, 205	2	—	3.7		7.2	3.5		7.0	3.4		119, 127, 143	3.6	1.8
251, 308	3	—	5.4		10.7	5.2		10.5	5.1		214	5.4	2.7
415, 510	4	—	7.1		14.2	6.9		14.0	6.8		286	7.2	3.6
616	6	—	10.8		—	—		21.0	10.2		409	10.8	5.4
830, 1010	8	—	14.2		—	—		28.0	13.6		572	14.4	7.2

Table 8 Lee-Temp receiver electrical data, 50Hz and 60Hz

Rated Voltage - Single Phase	120			200/208/230		
	Watts/Receiver	150	300	450	150	300
Full Load Amps	1.4	2.8	4.2	0.7	1.4	2.1
Wire Size Amps	1.8	3.5	5.3	0.9	1.8	2.7
Maximum Overcurrent Protection Device, Amps	15	15	15	15	15	15

3.6.2 Low Voltage Control Wiring

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.

A control interlock between the condenser and the indoor cooling units is required. Field-supplied copper wire (Class 1 for TCDV models and Class 2 for all other condenser models) is required for connection between like-numbered terminals 70 & 71 on both units. Wiring must be sized so that the voltage drop in the circuit does not exceed 1 volt. See **Figures 19, 20 and 21** and indoor unit manual for location of terminals on condensers and indoor units.

3.6.3 Low Voltage Monitoring Wiring—TCDV Only

Condensers with monitoring terminals may be wired with Class 1 copper wire to the indoor cooling unit or other monitoring panel. Wiring must be sized so that the voltage drop in the circuit does not exceed 1 volt. Dry contacts close when a monitored event occurs. Consult condenser electrical schematic, supplied with the unit, for details.

Contact closure on VFD Drive monitoring terminals indicates a permanent VFD fault. A factory-programmed VFD must be used as the replacement.

Contact closure on TVSS monitoring terminals may indicate unit trouble ranging from electrical supply issues to TVSS replacement required. A properly trained and qualified electrician is required.

3.7 Electrical Connections

Electrical service is required for all models. Electrical service shall conform to national and local electrical codes. Refer to equipment nameplate regarding wire size and circuit protection requirements. Refer to electrical schematic when making connections. Refer to **Figures 19, 20 and 21** for electrical service entrances into unit.

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



WARNING

Risk of electric shock. Can cause injury or death.

Disconnect all local and remote electric power supplies before working in the unit. Unit contains lethal voltage in some circuits. Use voltmeter to make sure power is turned Off before making any electrical connections.

NOTICE

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.

NOTICE

Use copper wiring only. Make sure that all connections are tight.

3.7.1 VFD Control Condensers (TCDV) only

The installer/startup technician must determine the type of 3-phase supply power being used for the VFD Control Condenser: Wye-connected power or Delta- connected power.

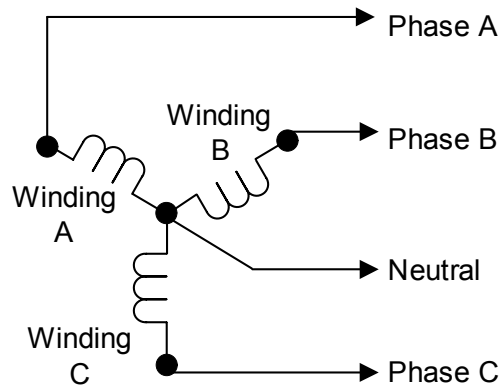
Wye-connected power has two different voltages that can be measured: Phase-to-Phase voltage (this is equal to the nominal input voltage) and Phase-to-Neutral voltage (typically used for small single phase loads (120 VAC or 277 VAC). See **Figure 16**.

Delta-connected power only has one voltage level that can be measured: Phase-to-Phase. See **Figure 17**.

3.7.2 Wye-Connected Power Supply

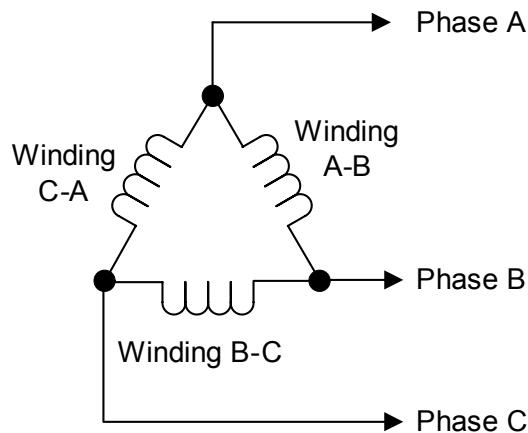
No control changes are required if the Liebert VFD Control Condenser will be operated with Wye-connected power.

Figure 16 Wye-connected power diagram



3.7.3 Delta-Connected Power Supply

Figure 17 Delta-connected power diagram

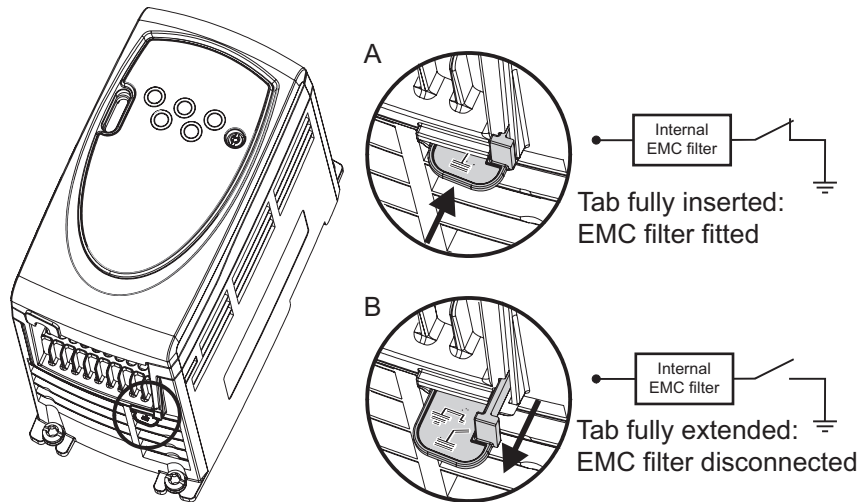


Disconnect EMC Filter for Delta-Connected Power

Installer/startup technician needs to disconnect the EMC filter on the VFD to ensure proper operation if the Liebert VFD Control Condenser will be operated with Delta-connected power.

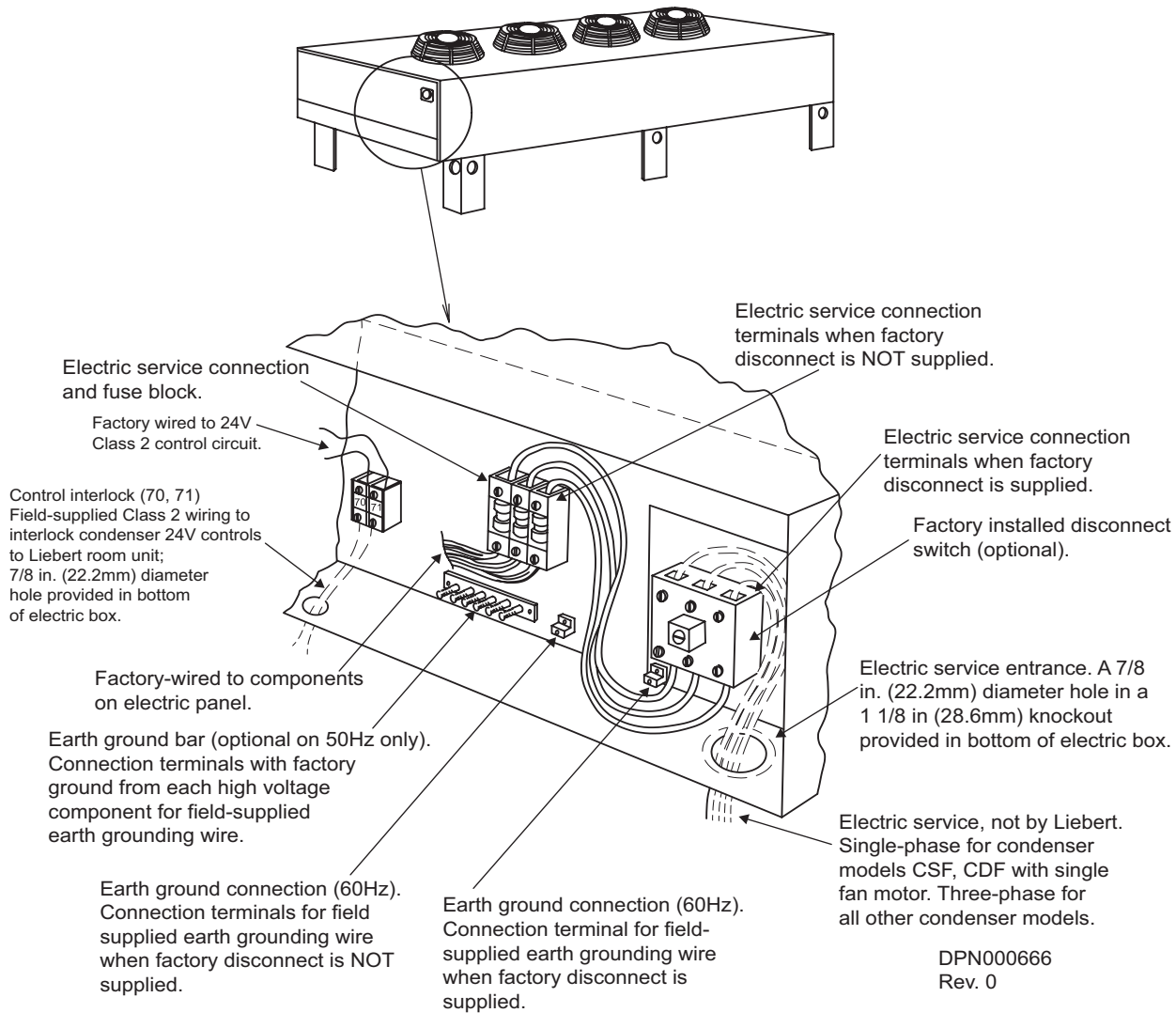
1. Disconnect the power supply before working on the unit.
2. Open the electrical panel cover and locate the VFD (Refer to **Figure 20**).
3. Using **Figure 18**, locate the small black plastic tab immediately to the right of the wiring connection block of the VFD control
4. Pull the tab to fully extend it, disconnecting the EMC filter from the circuit.

Figure 18 Disconnecting EMC filter for operation with Delta-connected power



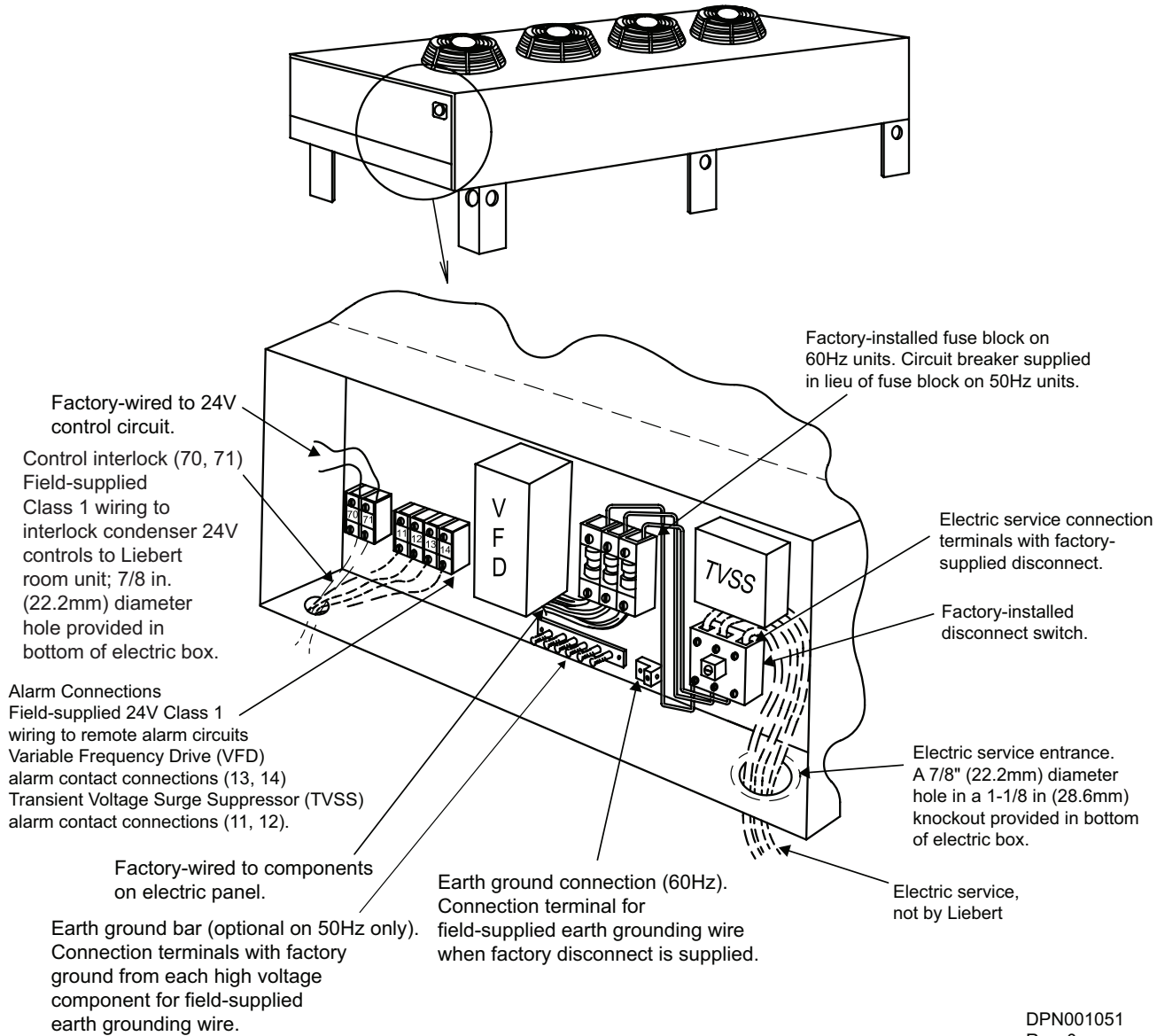
3.8 Electrical Field Connection Descriptions

Figure 19 Electrical field connections for Fan Speed Control Condensers



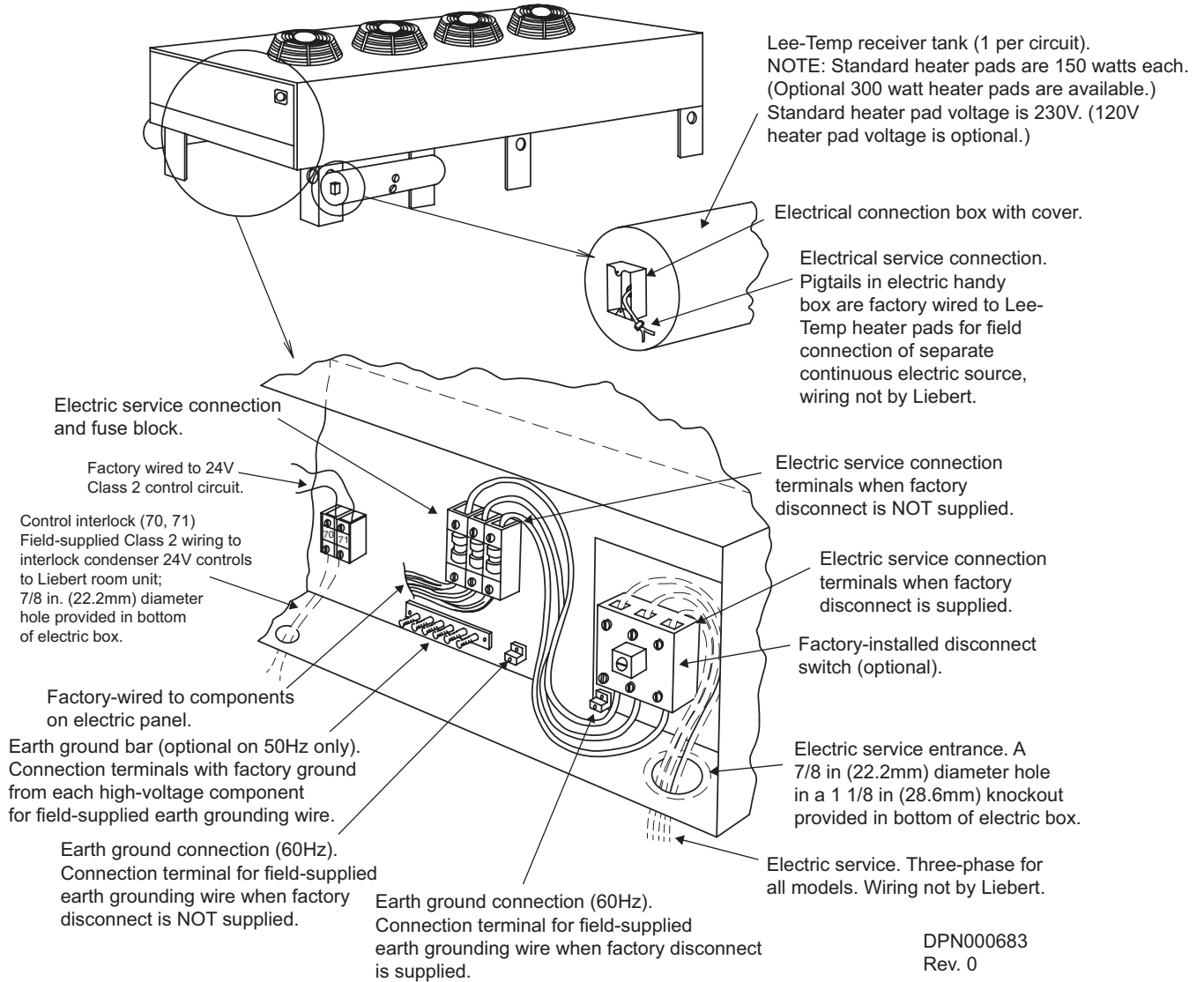
NOTE: Refer to specification sheet for full load amp. and wire size amp. ratings.

Figure 20 Electrical field connections for VFD control condensers



NOTE: Refer to specification sheet for full load amp. and wire size amp. ratings.

Figure 21 Electrical field connections for Liebert Lee-Temp control condensers



NOTE: Refer to specification sheet for full load amp. and wire size amp. ratings.

3.9 Refrigeration Piping Connections



WARNING

Risk of explosive discharge from high-pressure refrigerant. Can cause equipment damage, injury or death. Relieve pressure before working with piping.



WARNING

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

If a pressure relief device is not provided with the condenser unit, the system installer must provide and install a discharge pressure relief valve rated for a maximum of 500 psig (34bar) in the high side refrigerant circuit. Do not install a shutoff valve between the compressor and the field installed relief valve.

One or more additional pressure relief valves are required downstream of any and all field installed isolation valves as shown in **Figures 2** and **24**. Do not isolate any refrigerant circuits from overpressurization protection.



NOTE

POE (polyol ester) oil, required with R407C 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.

3.9.1 Piping Guidelines

Indoor units and condensers both ship with nitrogen holding charges. 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. Use a flow of dry nitrogen through the piping to prevent the formation of copper oxide scale inside the piping. Avoid soft solders such as 50/50 or 95/5.
- Isolate piping from building using vibration isolating supports.
- Refer to indoor unit 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 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 Lee-Temp condenser is located more than 15 ft (4.6m) below the evaporator or if Fan Speed/VFD Control Condenser is located more than 30 ft. (9.2m) below the evaporator.
- Consult factory if piping run exceeds 150 feet (46m) equivalent length.
- Keep piping clean and dry, especially on units with POE oil (R407C 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 Liebert or 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.

A pressure relief valve is provided with Liebert Lee-Temp condensers. A fusible plug is provided on Liebert Fan Speed Control and VFD condensers. The Liebert indoor cooling unit has a factory-installed high-pressure safety switch in the high side refrigerant circuit.

3.9.2 Field Piping Installation

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 22, 23** and **24** below 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 Lee-Temp systems.



NOTE

Keep the evaporator unit and condenser closed with their factory charge of dry nitrogen 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 dry nitrogen charge and connect to the field piping. Finally, vent the evaporator unit's dry nitrogen charge and make its piping connections last.

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

Figure 22 VFD and Fan Speed Control condenser piping

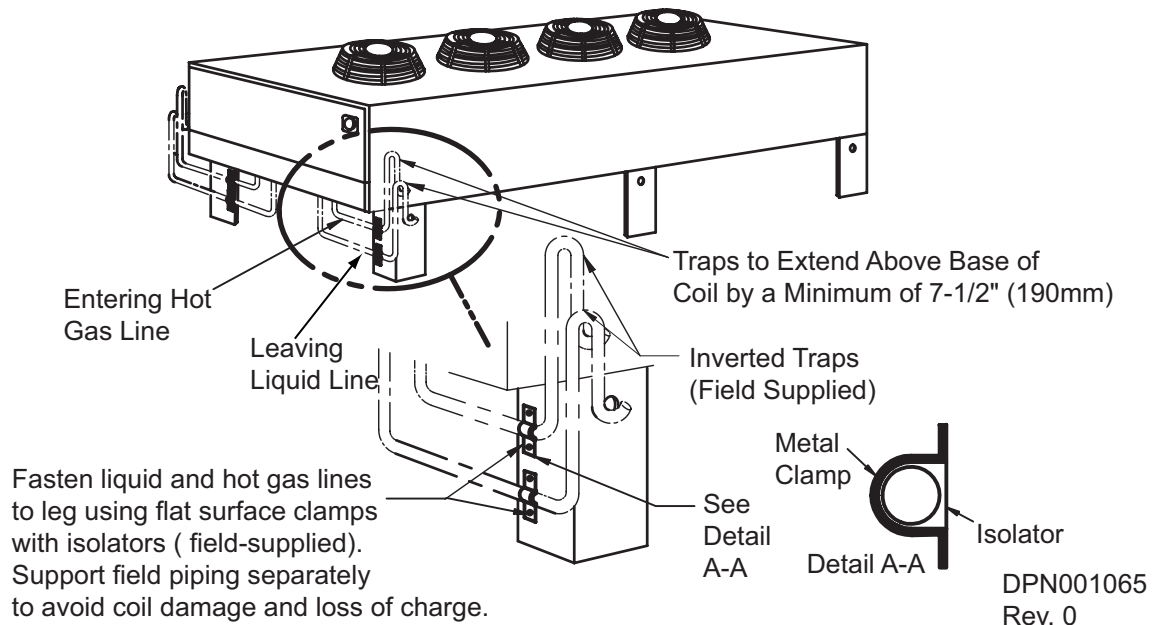
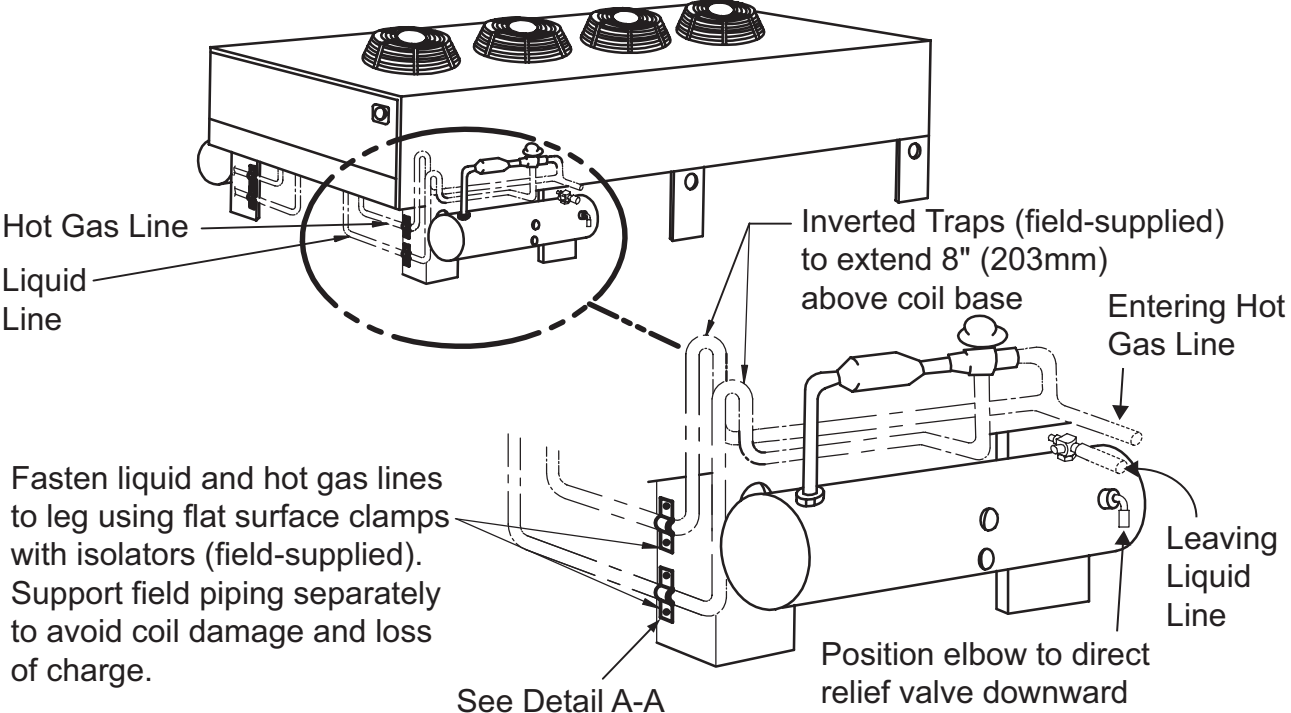
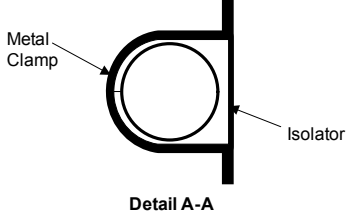


Figure 23 Lee-Temp head pressure control condenser piping

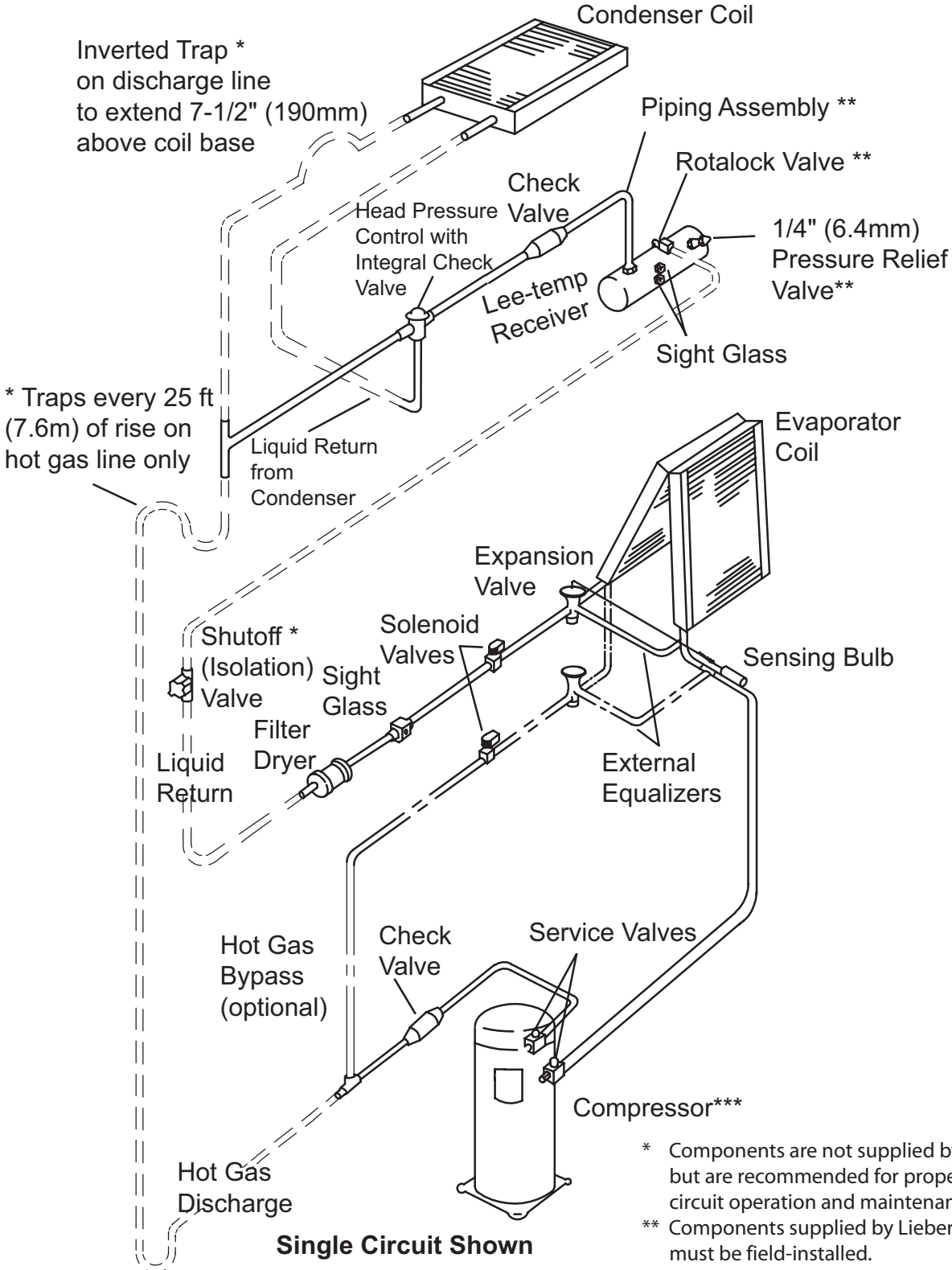


Fasten liquid and hot gas lines to leg using flat surface clamps with isolators (field-supplied). Support field piping separately to avoid coil damage and loss of charge.



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Rev. 2

Figure 24 General arrangement—Air cooled models with Lee-Temp control



* Traps every 25 ft (7.6m) of rise on hot gas line only

Single Circuit Shown

- ===== Factory Piping
- Optional Piping
- Field Piping

* Components are not supplied by Liebert but are recommended for proper circuit operation and maintenance.
 ** Components supplied by Liebert and must be field-installed.
 *** Various compressor types may be available.

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 Rev. 0

3.10 System Dehydration/Leak Test and Charging Procedures

Procedures for leak check and evacuation of the entire refrigeration system are contained in the installation manual of the indoor unit. Use the proper manual section corresponding to the winter control system used on the condenser (VFD/Fan Speed Control or Lee-Temp Control) and the refrigerant to be charged into the system.

4.0 CHECKLIST FOR COMPLETED INSTALLATION

4.1 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

4.2 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 and low voltage wiring connections are tight
- 5. TCDV condensers only—Check for Delta-Connected Power Supply and make any needed adjustments per **3.7.1 - VFD Control Condensers (TCDV) only**
- 6. Monitoring wiring connections completed, when equipped, to indoor cooling unit or external monitoring panel
- 7. Confirm that unit is properly grounded to an earth ground
- 8. Control transformer setting matches incoming power
- 9. Electrical service conforms to national and local codes
- 10. Check fans for proper phase rotation. Blades should rotate clockwise when viewing the unit from the fan guard side.

4.3 Piping

- 1. Piping is completed to corresponding indoor cooling unit refrigeration circuit.
- 2. Piping leak-checked, evacuated and charged.
- 3. Piping is properly sized, sloped and trapped for proper oil return.
- 4. Piping is routed to reduce potential of rub-through or chaffing.

4.4 Other

- 1. Fans rotate freely and in proper direction
- 2. Adjust ambient thermostat setpoints to match setpoints on the electrical schematic supplied with the condenser.
- 3. Foreign material removed from in and around all equipment installed (construction materials, construction debris, etc.).
- 4. Installation materials and tools have been removed from in and around all equipment (literature, shipping materials, tools, etc.).
- 5. Blank start-up sheet located, ready for completion by installer or start-up technician.

5.0 OPERATION



WARNING

Risk of electric shock. Can cause injury or death.

Disconnect all local and remote electric power supplies before working within. Unit contains potentially lethal electrical voltage.

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

The fans may start unexpectedly. Disconnect power supply before working on unit. 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.

5.1 Startup Checklist

Refer to **4.0 - Checklist for Completed Installation** and verify that all installation items have been completed before beginning to start the condenser.

5.2 Startup

- Locate “Liebert Condensers and Drycoolers Warranty Inspection Check Sheet” (Document # SAFM-8542-54).
- Turn the condenser disconnect ON. Indoor units should be turned on and set for cooling to allow operation of condenser.
- Check the fans for proper rotation: Clockwise when viewing the unit from the fan guard (top) side. Check that air is being drawn through the coil and discharged out the fan assembly. Some ambient thermostats may need to be temporarily adjusted to lower temperature settings to observe all fans operate. Readjust thermostat settings to correspond to setpoints shown on the electrical schematic supplied with the unit.
- Complete “Liebert Condensers and Drycoolers Warranty Inspection Check Sheet” (Document # SAFM-8542-54).



NOTE

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

- Contact your local Liebert sales representative or Liebert Air Product Support if you have any questions or problems during unit startup and commissioning.
- Local Liebert sales offices and Liebert air product support contacts can be found at www.liebert.com/servicesupport_pages/ServiceSupport.aspx?x=servicesupport or by calling 1-800-LIEBERT.

6.0 SYSTEM MAINTENANCE



WARNING

Risk of electric shock. Can cause injury or death.

Disconnect all local and remote electric power supplies before working in the unit. Use voltmeter to make sure power is turned Off before making any electrical connections.

Unit contains lethal voltage in some circuits.

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

The fans may start unexpectedly. Disconnect power supply before working on unit. 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.

6.1 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 **6.2.2 - Maintenance Inspection Checklist** for each of these inspections.

If performance or operation problems are detected at anytime, refer to **Table 9 - Troubleshooting** for required action.

6.2 Special Procedures

6.2.1 Condenser Cleaning

Keeping the outdoor condenser coils clean is an important factor in maintaining peak efficiency, reliability and long life of the equipment. It is much easier to keep up on frequent cleanings rather than wait until heavy build up has occurred which may create head pressure problems with the evaporator units.

When to Clean

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, a visual inspection of the coil is recommended to monitor conditions.

What to Use

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, we recommend a non-acidic type cleaner be used. Acid-type cleaners can be aggressive to the coil fins as well as surrounding areas. Many sites do not allow the use of acidic cleaners for environmental reasons.

How to Clean

The absolute best way to clean coils is from the inside out. This requires disconnecting the power supply from the condenser before working on the unit. The fan guards and fan blades must be removed to gain access to the coil surface. The sprayer can then be worked across the coil using the water/cleaning solution, pushing the dirt and debris out the bottom of the coil. Although this does extend the time involved, the results are well worth it. This method should be used at least once a year. 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 pre-scheduled shutdown with the operator may be in order. 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 and secure the fan blades and fan guards after the cleaning is finished. Last, reconnect the power supply to the condenser.

6.2.2 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
<p>Condenser</p> <ul style="list-style-type: none"> ___ 1. Coil surfaces free of debris ___ 2. Fans free of debris ___ 3. Fan motors securely mounted ___ 4. Motor bearings in good condition ___ 5. Check all refrigerant lines and capillaries for vibration isolation. Support as necessary. ___ 6. No refrigerant leaks. <p>Condenser Electrical Panel</p> <ul style="list-style-type: none"> ___ 1. On TCDV models, check TVSS protection status indicator light. 	<p>Condenser</p> <ul style="list-style-type: none"> ___ 1. Complete all monthly items ___ 2. Piping in good condition ___ 3. Inspect refrigerant lines for signs of oil leaks. Repair leaks as found. ___ 4. Check refrigerant charge level in each receiver tank (if equipped), based on procedures in the indoor unit's manual. Continuous system operation required. ___ 5. Wash coil as needed ___ 6. Repair bent or damaged fins. <p>Condenser Electric Panel</p> <ul style="list-style-type: none"> ___ 1. Check all electrical connections ___ 2. Check contactors for pitting ___ 3. Operational sequence/setpoints <p>Fan Motors</p> <ul style="list-style-type: none"> ___ 1. Motor #1 amp draw _____ amps ___ 2. Motor #2 amp draw _____ amps ___ 3. Motor #3 amp draw _____ amps ___ 4. Motor #4 amp draw _____ amps ___ 5. Motor #5 amp draw _____ amps ___ 6. Motor #6 amp draw _____ amps ___ 7. Motor #7 amp draw _____ amps ___ 8. Motor #8 amp draw _____ amps

Notes

Signature: _____

Make photocopies of this form for your records

Table 9 Troubleshooting

Symptom	Possible Cause	Check or Remedy
Condenser will not start	No power to condenser	Check voltage at input terminal block
	Circuit breaker 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 indoor unit suction pressure	Insufficient refrigerant in system	Check for leaks, repair, and add refrigerant
	Fan-cycling ambient thermostats setpoints too low	Check schematic for recommended setpoints and adjust.
Low discharge pressure	Faulty head pressure control valve or condenser FSC/VFD control	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
		Check for correct ambient thermostat setpoints, as applicable.
High refrigerant charge	Check refrigerant charge	
VFD Condenser trips out on overvoltage (OU displayed on VFD controller)	Supply voltage is Delta configuration or is ungrounded/high impedance	Shut off AC voltage, locate the VFD, pull out the EMC tab and reconnect power
TVSS indicator lights are extinguished or red LED is illuminated and monitoring terminals 11/12 are closed	No voltage or improper phasing exists at condenser	Check voltage at input terminal block
	Electrical connections to TVSS are faulty	Locate connection problem and repair
	A surge exceeding the rating of the TVSS has occurred	Replace TVSS and inspect other components for damage and replace them if necessary

NOTES

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