



# Liebert® Air Cooled Fin/Tube Condensers

## **Technical Design Manual**

50 Hz and 60 Hz

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### **Technical Support Site**

If you encounter any installation or operational issues with your product, check the pertinent section of this manual to see if the issue can be resolved by following outlined procedures.

Visit <https://www.vertiv.com/en-us/support/> for additional assistance.

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# 1 Introduction

## 1.1 Product Description and Features

The Vertiv™ Liebert® Air Cooled Fin/Tube Condenser is a 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 and 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 1.1** Liebert® Two Fan Condenser



## 1.2 Agency Listed

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



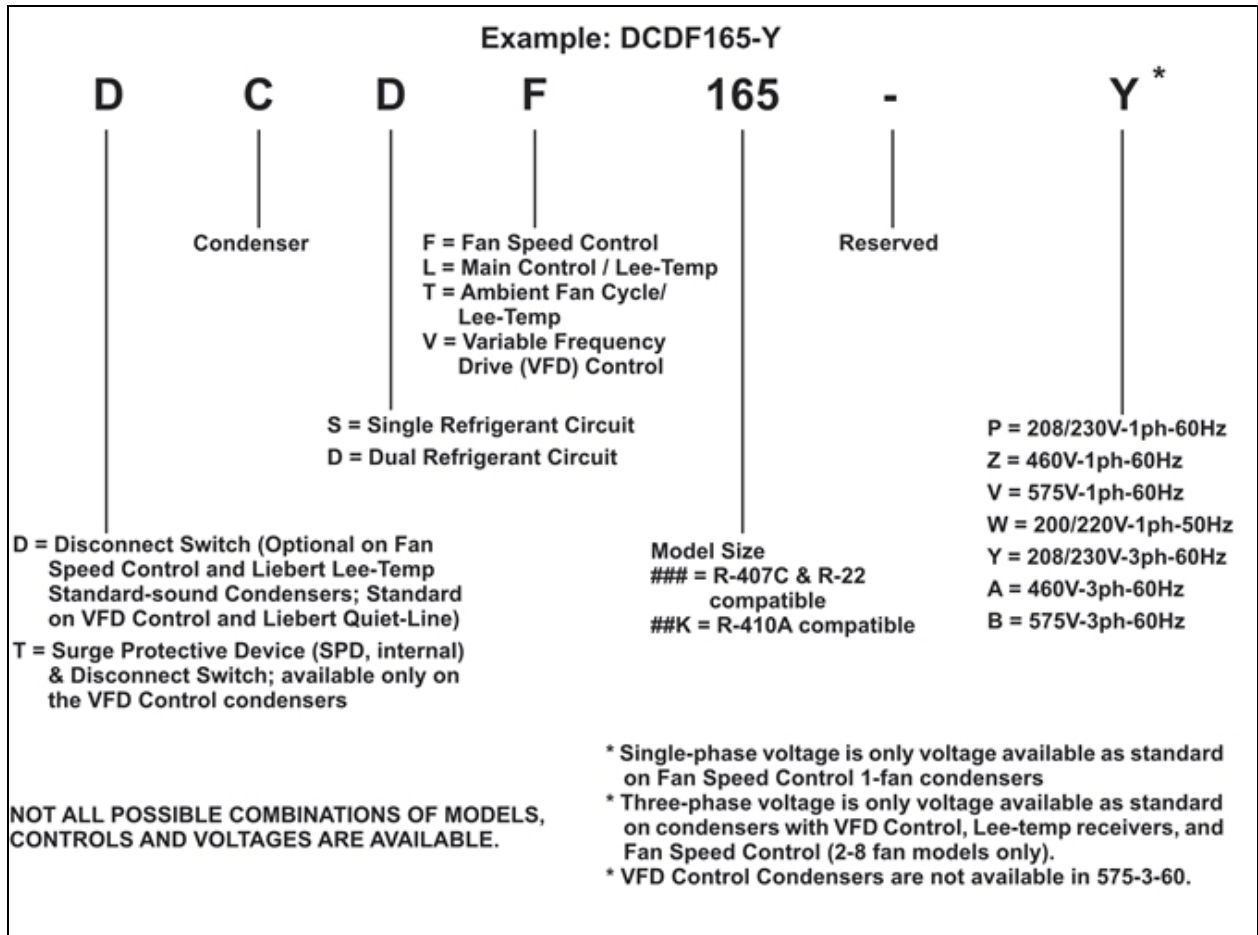
### 1.3 Location

When considering installation locations, consider that these units reject heat into the atmosphere and should be located in a clean air area, away from loose dirt and foreign matter that may clog the coil. In addition, condensers must not be located in the vicinity of steam, hot air or fume exhausts. Condensers should be located no closer than 3 feet from a wall, obstruction or adjacent unit with no obstructions over the unit. Install condensers in a level position to assure proper refrigerant flow and oil return. Condensers must be installed in vertical airflow orientation to ensure NEMA 3R rating of electrical box. For roof installation, mount the condenser on suitable curbs or other supports in accordance with local codes.

Do not mount condensers in areas where normal unit operating sound levels might disturb the working or residential environments of others.

Use caution when installing condensers below the indoor unit. Fan Speed and VFD condensers must not be installed more than 15 ft. (4.6 m) below the indoor unit; Vertiv™ Liebert® Lee-Temp condensers should be installed above or at the same level as the indoor unit. Contact the factory for assistance in specifying sub-cooling coils to each circuit to extend these limits.

## 1.4 Liebert® Condenser Model Number Nomenclature



NOTE: Not all model/options/voltage combinations are available.

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## 2 Standard Features

### 2.1 Standard Features—All Condensers

Liebert® air cooled condensers consist of condenser coil(s), housing, propeller fan(s) direct driven by individual fan motor(s), electrical controls and mounting legs. Liebert® air cooled condensers provide positive refrigerant head pressure control to the Precision Cooling indoor unit by adjusting heat rejection capacity. Various methods are employed to match indoor unit type, minimum outdoor design ambient and maximum sound requirements.

#### 2.1.1 Condenser Coil

Liebert®-manufactured coils are constructed of copper tubes in a staggered tube pattern. Tubes are expanded into continuous, corrugated aluminum fins. The fins have full-depth fin collars completely covering the copper tubes, which are connected to heavy wall Type “L” headers. Inlet coil connector tubes pass through relieved holes in the tube sheet for maximum resistance to piping strain and vibration. Coils are either single circuit or dual circuit, depending on the application. The hot gas and liquid lines are spun shut at the factory and include a factory-installed Schrader valve. Coils are factory leak-tested at a minimum of 300 psig (2068 kPag), dehydrated, then filled and sealed with a low pressure inert gas holding charge for shipment.

#### 2.1.2 Housing

The condenser housing is fabricated from bright aluminum sheet and divided into individual fan sections by full width baffles. Structural support members, including coil support frame, motor and drive support, are galvanized steel for strength and corrosion resistance. Aluminum legs are provided for mounting unit for vertical discharge and have rigging holes for hoisting the unit into position. The unit’s electrical panel is inside an integral NEMA 3R weatherproof section of the housing.

#### 2.1.3 Propeller Fan

Aluminum propeller fan blades are secured to a corrosion-protected steel hub. Fan guards are heavy gauge, close-meshed steel wire with corrosion-resistant polyester paint finish rated to pass a 1000-hour salt spray test. Fans are secured to the fan motor shaft by a keyed hub and dual setscrews. Fan diameter is 26 in. (660 mm) or less. The fans are factory-balanced and run before shipment.

#### 2.1.4 Fan Motor

The condenser’s fan motor is a continuous air-over design equipped with rain shield and permanently sealed bearing. Die-formed, galvanized steel supports are used for rigid mounting of the motor.

#### 2.1.5 Electrical Controls

Electrical controls, overload protection devices and service connection terminals are factory-wired inside the integral electrical panel section of the housing. A locking disconnect switch is factory-mounted and wired to the electrical panel and controlled via an externally mounted locking door handle. An indoor unit interlock circuit enables condenser operation whenever indoor unit compressors are active. Only supply wiring and indoor unit interlock wiring are required at condenser installation.

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## 3 Specific Condenser Types—Features

### 3.1 Head Pressure Control Types

#### 3.1.1 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).

#### 3.1.2 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 0°F (-17.8°C) as standard and, with optional, low-ambient VFD heater kit, will start/operate as low as -20°F (-28.9°C).

#### 3.1.3 Vertiv™ 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. Liebert® Lee-Temp control is required for Vertiv™ Liebert® Quiet-Line condensers.

### 3.2 Sound Level Options

#### 3.2.1 Standard Condenser

All fan speed and VFD condensers are standard condensers with moderate operating sound levels. Liebert® Lee-Temp condensers with standard-size coils matching fan speed and VFD coil sizes are standard sound level condensers.

#### 3.2.2 Vertiv™ Liebert® Quiet-Line Condenser

Liebert® Quiet-Line condensers can help your facility meet the strictest noise codes and do so at less cost than traditional condensers with acoustical shielding. Liebert® 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. Liebert® Lee-Temp control is required for Liebert® Quiet-Line Condensers.

### 3.3 Surge Protective Device—Optional

A surge protective device (SPD) 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 a data center. The SPD is designed to protect sensitive electronic condenser components from high voltage transients, up to 25 kVA/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 SPD may require replacement to restore surge protection to the condenser.

### 3.4 Typical System Configurations

**Figure 6.10** on page 33 shows a single refrigeration circuit diagram, displaying the indoor air conditioning unit, the outdoor condenser (VFD, Fan Speed Control or Vertiv™ Liebert® Lee-Temp) and field-supplied interconnection piping.



## 4 Condenser Performance Data

Table 4.1 Condenser Performance Data, 60Hz, R-407C

Model #	Total Heat Rejection, kBtuh (kW) R-407C				Fans Direct Drive				Sound Power LwA	Sound Pressure dBA*
	30°F (16.7°C) TD	25°F (13.9°C) TD	20°F (11.1°C) TD	15°F (8.3°C) TD	Qty	Diam.	HP	CFM		
Standard	90°F DB	95°F DB	100°F DB	105°F DB						
083	102 (29.9)	82 (24.0)	63 (18.2)	43 (12.5)	1	26	3/4	5900	86.7	72.5
104	128 (37.3)	104 (30.4)	81 (23.5)	57 (16.7)	1	26	3/4	5500	86.6	72.5
165	208 (60.6)	167 (48.7)	127 (37.0)	87 (25.4)	2	26	3/4	11800	90.3	75.5
205	290 (84.7)	238 (69.5)	186 (54.3)	134 (39.1)	2	26	3/4	10300	91.0	75.5
251	301 (87.9)	243 (70.9)	185 (54.1)	129 (37.5)	3	26	3/4	17950	94.0	77.3
308	380 (110.9)	308 (89.9)	238 (69.3)	168 (49.0)	3	26	3/4	16650	93.8	77.3
415	601 (175.3)	491 (143.3)	383 (111.7)	278 (81.0)	4	26	3/4	20650	94.4	78.5
510	640 (186.6)	530 (154.7)	421 (122.9)	315 (91.8)	4	26	3/4	18200	94.4	78.5
616	760 (221.6)	619 (180.4)	475 (138.6)	336 (98.0)	6	26	3/4	33300	96.8	80.3
830	1200 (350.0)	983 (286.6)	765 (223.0)	555 (161.9)	8	26	3/4	41300	97.4	81.5
1010	1280 (373.3)	1061 (309.4)	846 (246.7)	627 (182.8)	8	26	3/4	36400	97.4	81.5
<b>Liebert® Quiet-Line</b>										
063	70 (20.5)	58 (16.9)	46 (13.3)	33 (9.7)	1	26	1/4	2425	68.9	56.5
119	123 (36.0)	100 (29.1)	77 (22.6)	55 (16.2)	2	26	1/4	5250	72.6	59.5
127	141 (41.0)	116 (33.7)	90 (26.4)	66 (19.2)	2	26	1/4	4850	72.6	59.5
143	148 (43.2)	123 (35.8)	98 (28.6)	73 (21.3)	2	26	1/4	4250	72.6	59.5
214	232 (67.5)	193 (56.1)	154 (45.0)	116 (33.9)	3	26	1/4	6400	74.8	61.3
286	312 (90.9)	260 (75.7)	209 (60.9)	157 (45.8)	4	26	1/4	8275	76.2	62.5
409	444 (129.4)	368 (107.2)	291 (84.8)	219 (63.8)	6	26	1/4	13750	78.4	64.3
572	623 (181.8)	519 (151.4)	417 (121.5)	312 (90.9)	8	26	1/4	17050	79.9	65.5
TD = Temperature difference between the Entering Air Temperature and Midpoint Condensing Temperature.										
Capacity shown is the condenser's THR at sea level. If the condenser is a dual-circuit unit, each circuit's capacity is 1/2 of the THR shown.										
*Sound Pressure levels @ 5 ft. (1.5 m)										

**Table 4.2 Condenser Performance Data, 60Hz, R-410A**

Model #	Total Heat Rejection, kW (kBtuh) R-410A				Fans Direct Drive				Sound Power LwA	Sound Pressure dBA*
	30°F (16.7°C) TD	25°F (13.9°C) TD	20°F (11.1°C) TD	15°F (8.3°C) TD	Qty	Diam.	HP	CFM		
Standard	90°F DB	95°F DB	100°F DB	105°F DB						
28K	31.6 (108)	26.4 (90)	20.5 (70)	15.0 (51)	1	26	3/4	5775	86.6	72.5
60K	74.2 (253)	60.4 (206)	46.8 (160)	34.0 (116)	2	26	3/4	11550	91.0	75.5
90K	118.6 (405)	97.2 (332)	76.0 (259)	55.0 (188)	3	26	3/4	17300	93.8	77.3

R-410A condensers are available only in 60 Hz.

TD = Temperature Difference between the Entering Air Temperature and Midpoint Condensing Temperature.

Capacity shown is the condenser's THR at sea level. If the condenser is a dual-circuit unit, each circuit's capacity is 1/2 of the THR shown.

\*Sound Pressure levels @ 5 ft. (1.5 m)

**Table 4.3 Condenser Performance Data, 50Hz, R-407C**

Model #	Total Heat Rejection, kBtuh (kW) R-407C				Fans Direct Drive				Sound Power LwA	Sound Pressure dBA*
	30°F (16.7°C) TD	25°F (13.9°C) TD	20°F (11.1°C) TD	15°F (8.3°C) TD	Qty	Diam.	Hp	CFM		
Standard	90°F DB	95°F DB	100°F DB	105°F DB						
083	91 (26.6)	73 (21.4)	56 (16.3)	39 (11.3)	1	26	3/4	4900	81.7	68.3
104	112 (32.7)	92 (26.7)	71 (20.7)	51 (14.8)	1	26	3/4	4575	82.5	69.1
165	185 (54.0)	149 (43.5)	114 (33.2)	79 (23.0)	2	26	3/4	9800	85.9	71.8
205	251 (73.2)	206 (60.0)	161 (47.1)	118 (34.4)	2	26	3/4	8475	87.2	70.6
251	270 (78.8)	218 (63.6)	167 (48.7)	117 (34.1)	3	26	3/4	14900	89.4	73.5
308	333 (97.1)	271 (79.1)	210 (61.3)	149 (43.5)	3	26	3/4	13700	89.4	73.7
415	516 (150.4)	424 (123.8)	332 (96.9)	242 (70.5)	4	26	3/4	16950	91.0	75.7
510	542 (158.1)	450 (131.2)	360 (104.9)	269 (78.4)	4	26	3/4	14900	91.0	75.7
616	667 (194.5)	543 (158.4)	420 (122.6)	299 (87.2)	6	26	3/4	27450	92.4	76.7
830	1031 (300.8)	849 (247.5)	665 (194.0)	484 (141.3)	8	26	3/4	33900	94.0	78.7
1010	1085 (316.5)	900 (262.4)	721 (210.2)	538 (156.8)	8	26	3/4	29800	94.0	78.7
<b>Liebert® Quiet-Line</b>										
063	60 (17.5)	50 (14.5)	39 (11.4)	29 (8.4)	1	26	1/4	2000	65.6	53.2
119	108 (31.4)	87 (25.5)	68 (19.7)	50 (14.6)	2	26	1/4	4350	69.3	56.2
127	121 (35.2)	99 (28.9)	78 (22.7)	57 (16.5)	2	26	1/4	4000	69.3	56.2
143	124 (36.2)	104 (30.2)	83 (24.1)	61 (17.9)	2	26	1/4	3475	69.3	56.2

**Table 4.3 Condenser Performance Data, 50Hz, R-407C (continued)**

Model #	Total Heat Rejection, kBtuh (kW) R-407C				Fans Direct Drive					
	30°F (16.7°C) TD	25°F (13.9°C) TD	20°F (11.1°C) TD	15°F (8.3°C) TD	Qty	Diam.	Hp	CFM	Sound Power LwA	Sound Pressure dBA*
214	193 (56.2)	161 (47.0)	131 (38.1)	100 (29.1)	3	26	1/4	5225	71.5	58.0
286	258 (75.3)	216 (62.9)	174 (50.8)	132 (38.5)	4	26	1/4	6750	72.9	59.2
409	378 (110.3)	312 (91.1)	249 (72.7)	188 (54.9)	6	26	1/4	11250	75.1	61.0
572	472 (137.8)	392 (114.2)	310 (90.5)	229 (66.8)	8	26	1/4	13900	76.6	62.2

TD = Temperature Difference between the Entering Air Temperature and Midpoint Condensing Temperature.  
Capacity shown is the condenser's THR at sea level. If the condenser is a dual-circuit unit, each circuit's capacity is 1/2 of the THR shown.  
\*Sound Pressure levels at 5 ft. (1.5 m).

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# 5 Dimensions and Weights

## 5.1 Condenser Dimensions and Anchor Plan

Figure 5.1 Condenser Planning Dimensional Data—1-4 Fan Units

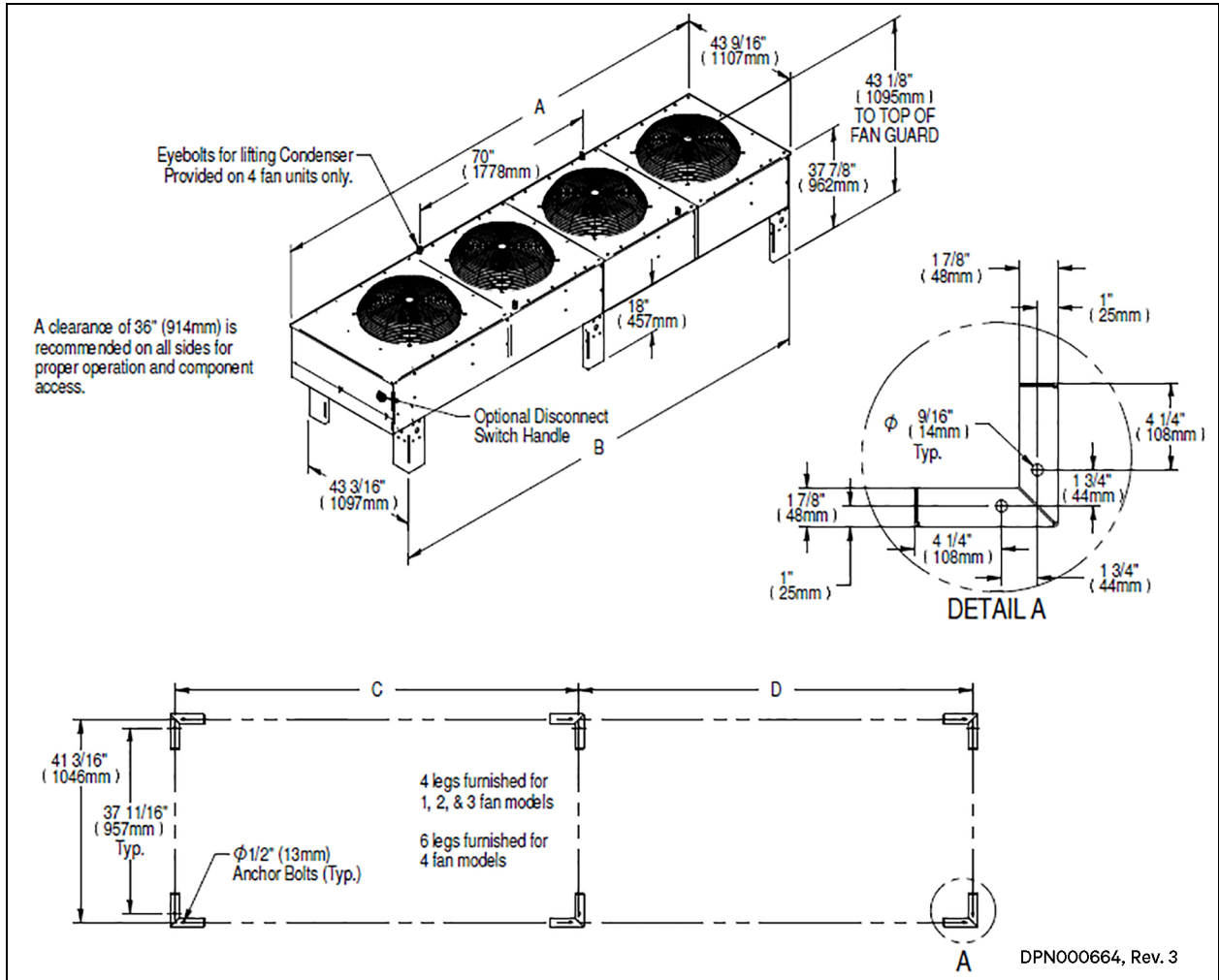


Figure 5.2 Condenser Planning Dimensional Data—1-4 Fan Units

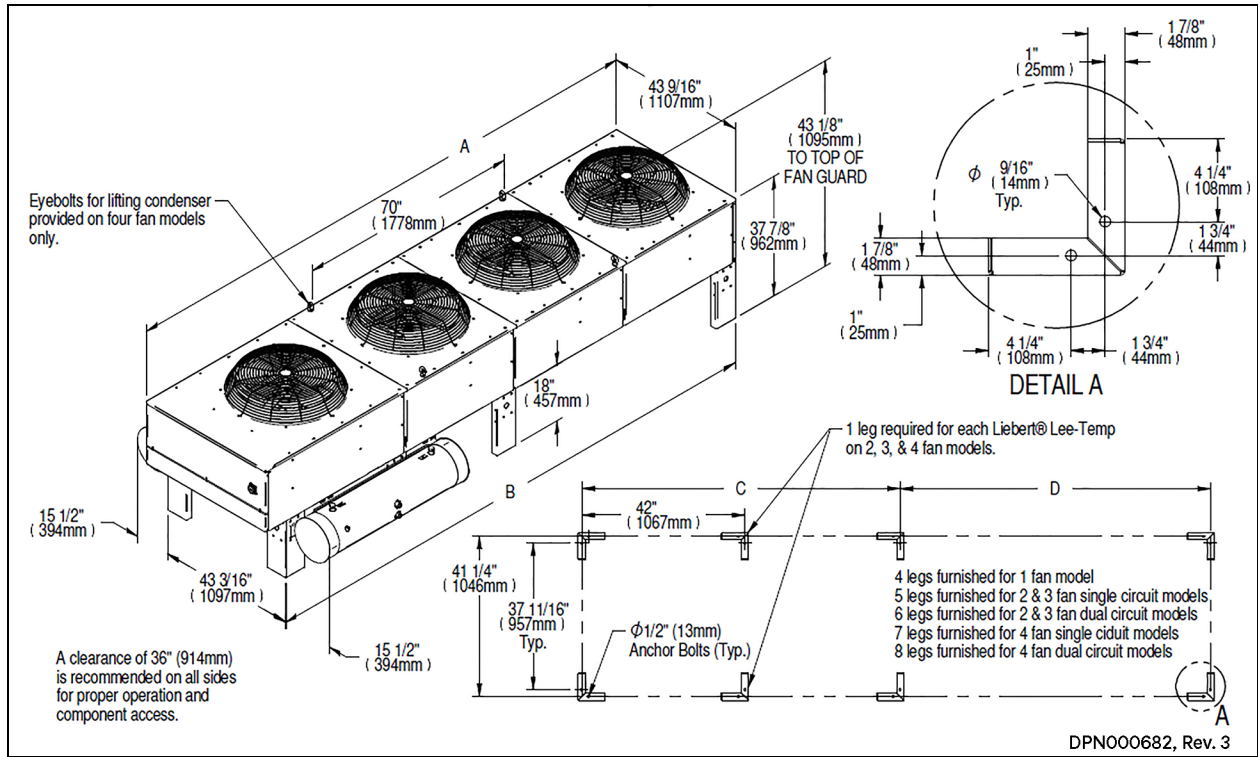


Figure 5.3 Condenser Planning Dimensional Data—6 and 8 Fan Units

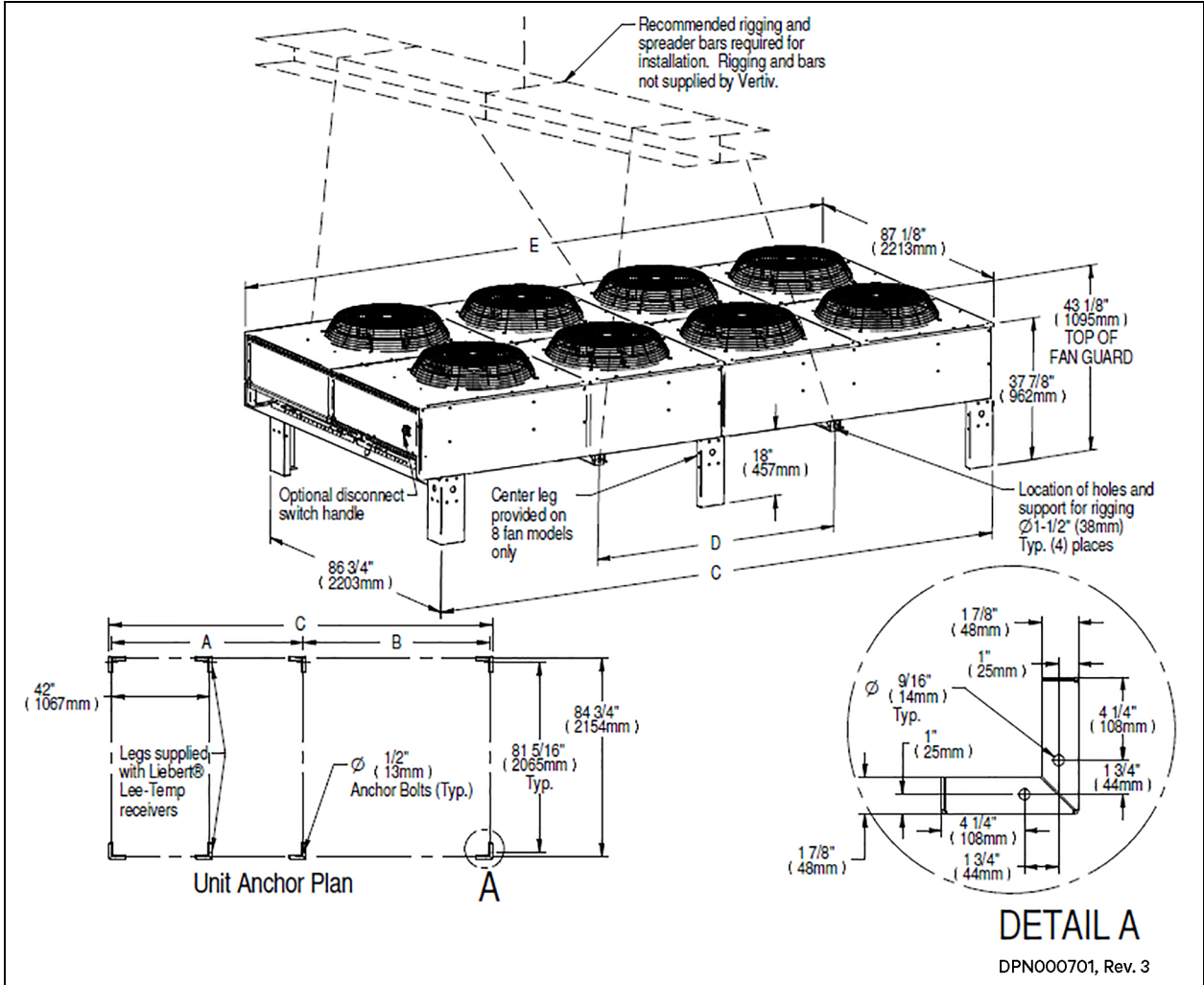
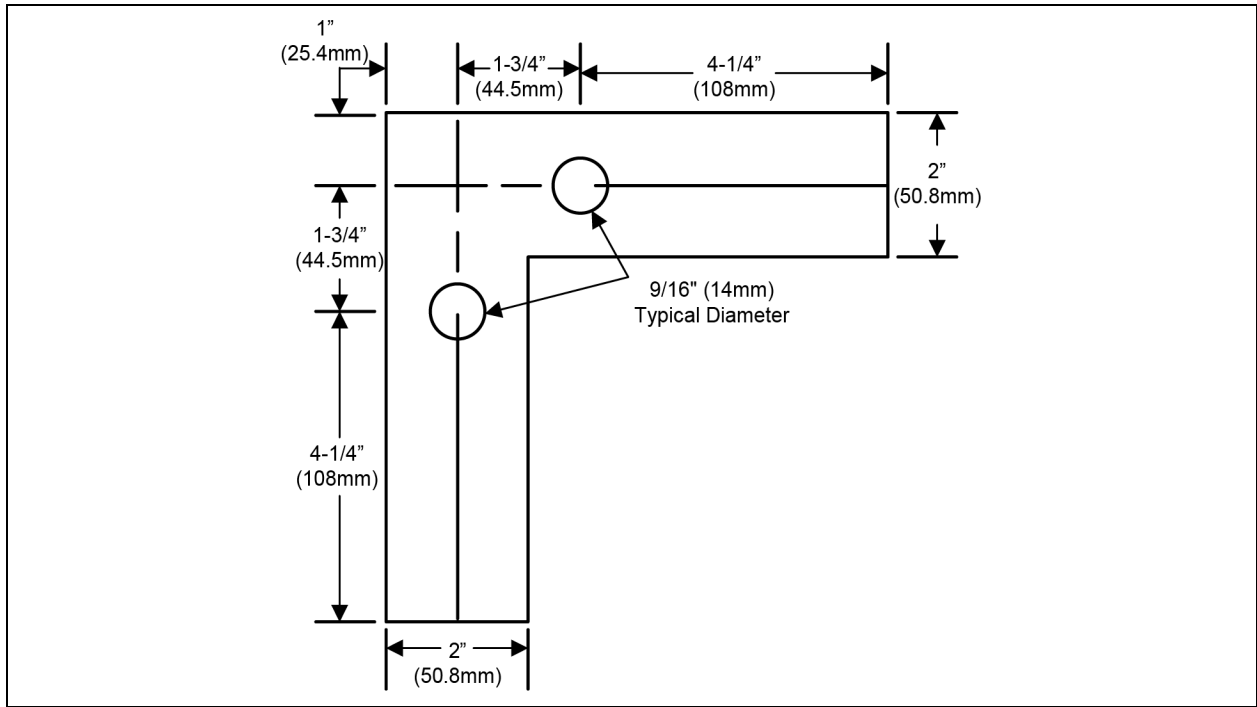


Figure 5.4 Typical Fin/Tube Condenser Footprint—Dimensions



## 5.2 Condenser Weights

Table 5.1 Vertiv™ Liebert® Air Cooled Condenser Dry and Shipping Weights

Model	No. of Fans	Unit dry weight lb. (kg)	Domestic Packaging			Export Packaging		
			Shipping Weight lb. (kg)	Dimensions (LxWxH) in. (mm)	Volume ft <sup>3</sup> (m <sup>3</sup> )	Shipping Weight lb. (kg)	Dimensions (LxWxH) in. (mm)	Volume ft <sup>3</sup> (m <sup>3</sup> )
<b>Standard Models</b>								
083	1	295 (134)	450 (204)	62 x 36 x 63 (157 x 91 x 160)	81 (2.3)	557 (253)	63 x 37 x 64 (160 x 94 x 163)	86 (2.5)
104		315 (143)	470 (213)			577 (262)		
165	2	425 (193)	682 (309)	102 x 36 x 63 (259 x 91 x 160)	134 (3.8)	839 (381)	103 x 37 x 64 (262 x 94 x 163)	141 (4.0)
205		495 (225)	752 (341)			909 (412)		
251	3	500 (227)	859 (390)	142 x 36 x 63 (361 x 91 x 160)	186 (5.3)	1047 (475)	143 x 37 x 64 (363 x 94 x 163)	196 (5.6)
308		670 (304)	1029 (467)			1217 (552)		
415	4	840 (381)	1301 (590)	182 x 36 x 63 (462 x 91 x 160)	239 (6.7)	1558 (707)	183 x 37 x 64 (465 x 94 x 64)	251 (7.0)
510		1190 (540)	1651 (749)			1908 (865)		
616	6	1380 (626)	1823 (827)	142 x 36 x 94 (361 x 91 x 239)	278 (7.9)	2105 (955)	143 x 37 x 95 (363 x 94 x 241)	291 (8.2)



**Table 5.1 Vertiv™ Liebert® Air Cooled Condenser Dry and Shipping Weights (continued)**

Model	No. of Fans	Unit dry weight lb. (kg)	Domestic Packaging			Export Packaging		
			Shipping Weight lb. (kg)	Dimensions (LxWxH) in. (mm)	Volume ft <sup>3</sup> (m <sup>3</sup> )	Shipping Weight lb. (kg)	Dimensions (LxWxH) in. (mm)	Volume ft <sup>3</sup> (m <sup>3</sup> )
830	8	1750 (794)	2315 (1050)	182 x 36 x 94 (462 x 91 x 239)	356 (10.0)	2704 (1227)	183 x 37 x 95 (465 x 94 x 241)	372 (10.5)
1010		2640 (1197)	3205 (1454)			3594 (1630)		
<b>Liebert® Quiet-Line Models</b>								
063	1	315 (143)	470 (213)	62 x 36 x 63 (157 x 91 x 160)	81 (2.3)	577 (262)	63 x 37 x 64 (160 x 94 x 163)	86 (2.5)
119	2	425 (193)	682 (309)	102 x 36 x 63 (259 x 91 x 160)	134 (3.8)	839 (301)	103 x 37 x 64 (262 x 94 x 163)	141 (4.0)
127		495 (225)	752 (341)			909 (412)		
143		515 (234)	772 (350)			929 (421)		
214	3	840 (381)	1199 (544)	142 x 36 x 63 (361 x 91 x 160)	186 (5.3)	1387 (629)	143 x 37 x 64 (363 x 94 x 163)	196 (5.6)
286	4	1105 (501)	1566 (710)	182 x 36 x 63 (462 x 91 x 160)	239 (6.7)	1823 (827)	183 x 37 x 64 (465 x 94 x 64)	251 (7.0)
409	6	1380 (626)	1823 (827)	142 x 36 x 94 (361 x 91 x 239)	278 (7.9)	2105 (955)	143 x 37 x 95 (363 x 94 x 241)	291 (8.2)
572	8	2430 (1102)	2995 (1359)	182 x 36 x 94 (462 x 91 x 239)	356 (10.0)	3384 (1535)	183 x 37 x 95 (465 x 94 x 241)	372 (10.5)
<b>R-410A Models</b>								
28K	1	325 (147)	480 (218)	62 x 36 x 63 (157 x 91 x 160)	81 (2.3)	587 (266)	63 x 37 x 64 (160 x 94 x 163)	86 (2.5)
60K	2	475 (215)	732 (332)	102 x 36 x 63 (259 x 91 x 160)	134 (3.8)	889 (403)	103 x 37 x 64 (262 x 94 x 163)	141 (4.0)
90K	3	675 (306)	1034 (469)	142 x 36 x 63 (361 x 91 x 160)	186 (5.3)	1222 (554)	143 x 37 x 64 (363 x 94 x 163)	196 (5.6)

**Table 5.2 Vertiv™ Liebert® Lee-Temp Receiver Weights**

Condenser Model #	Receiver Part #	Receivers per Condenser	Weight per Receiver lb. (kg)
<b>Standard Models</b>			
DCSL083	1C19982P1	1	100 (45)
DCSL104	1C19982P1		100 (45)
DCSL165	W-0050		125 (57)
DCSL205	W-0050		125 (57)
DCSL251	W-0050		125 (57)
DCSL308	W-0060		145 (66)
DCSL415	185011P1		260 (118)
DCSL616	W-0410 <sup>1</sup>		200 (91)
DCSL616	179701P1 <sup>2</sup>		424 (192)
DCDL104	1C19982P1	2	100 (45)
DCDL165	1C19982P1		100 (45)
DCDL205	W-0050		125 (57)
DCDL251	1C19982P1		100 (45)
DCDL308	W-0050		125 (57)
DCDL415	W-0060		145 (66)
DCDL510	W-0410		200 (91)
DCDL616	W-0060		145 (66)
DCDL830	185011P1		260 (118)
<b>Liebert® Quiet-Line Models</b>			
DCSL063	1C19982P1	1	100 (45)
DCST119	W-0050		125 (57)
DCSL127	W-0050		125 (57)
DCSL143	W-0060		145 (66)
DCST214	W-0410		200 (91)
DCST286	W-0410		200 (91)

**Table 5.2 Vertiv™ Liebert® Lee-Temp Receiver Weights (continued)**

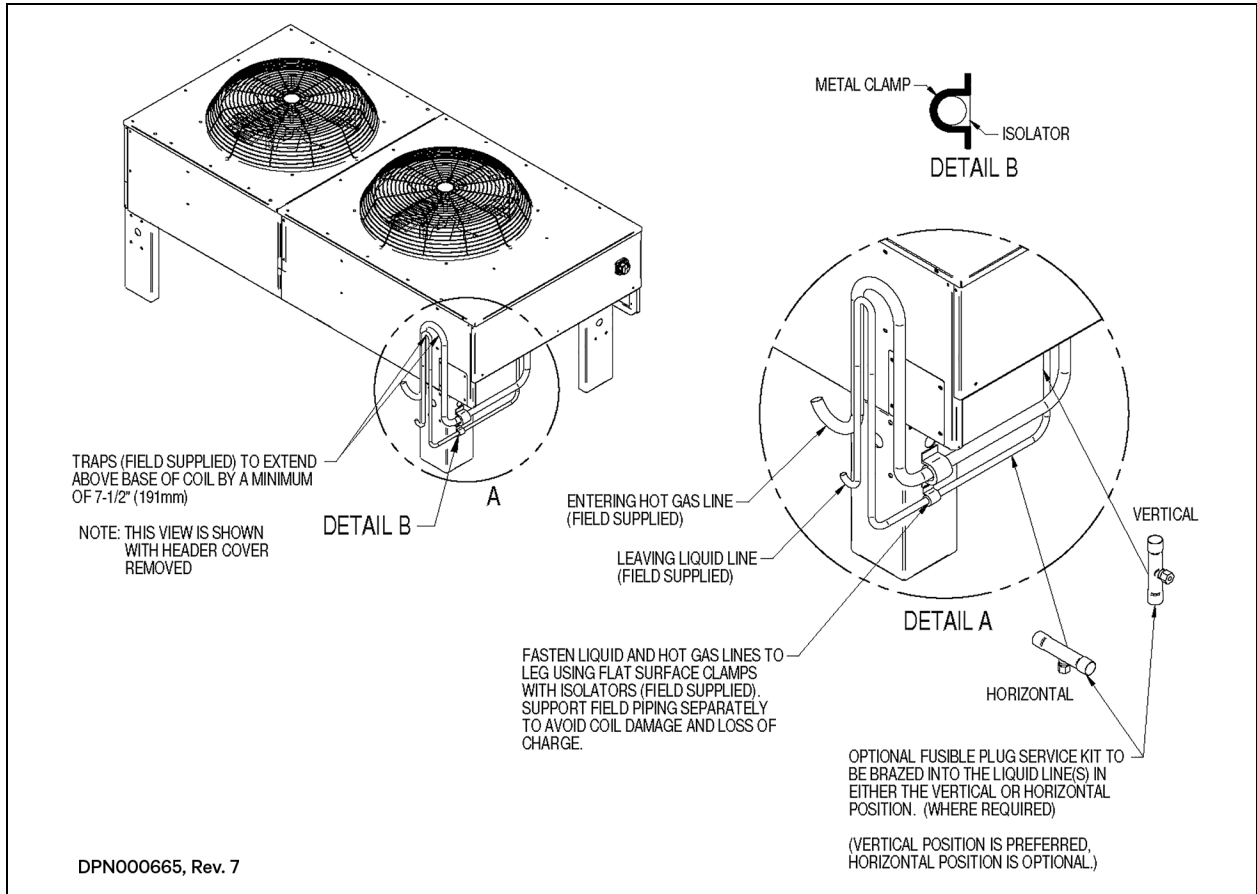
Condenser Model #	Receiver Part #	Receivers per Condenser	Weight per Receiver lb. (kg)
DCDL119	1C19982P1	2	100 (45)
DCDL127	1C19982P1		100 (45)
DCDL143	W-0050		125 (57)
DCDT214	W-0050		125 (57)
DCDL286	W-0060		145 (66)
DCDT409	W-0410		200 (91)
DCDT572	W-0410		200 (91)
<b>R-410A Models</b>			
DCSL28K	195315P1	1	125 (57)
DCSL60K	195316P1		145 (66)
DCSL90K	196702P1		200 (91)
1. Match-up for 35 to 105°F (2 to 41°C) design temperature range.			
2. Match-up for -30 to 105°F (-34 to 41°C) design temperature range.			

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# 6 Refrigerant Piping and Charge Planning

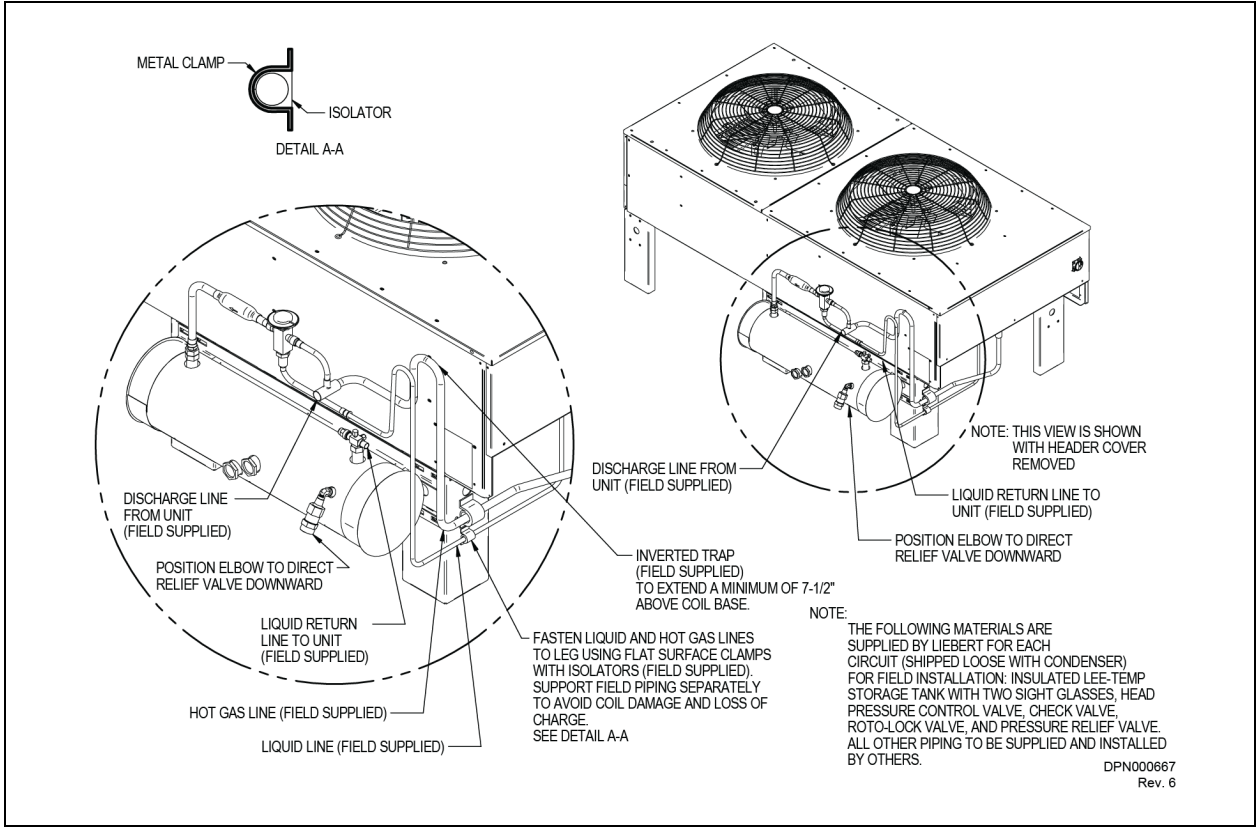
## 6.1 Refrigerant Piping Configurations

Figure 6.1 Single Circuit Piping, VFD and Fan Speed Control, 1-4 Fan Condensers



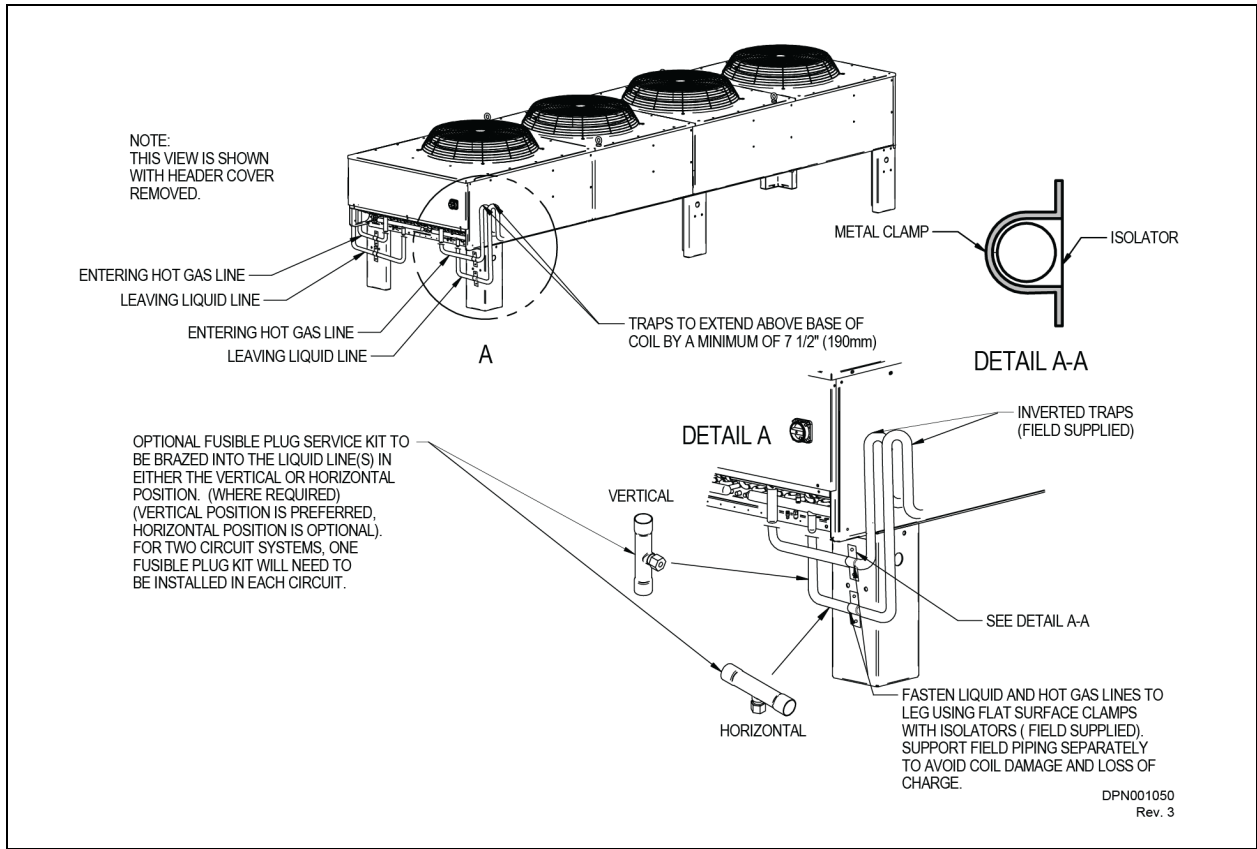
Condenser Piping Connection Sizes, CU. OD.		
Model Number	Entering Hot Gas Line, in.	Returning Liquid Line, in.
DCSF083, TCSV083	7/8	5/8
DSCF104, TCSV104	1-1/8	5/8
DCSF165, TCSV165		7/8
DCSF205, TCSV205		
DCSF251, TCSV251	1-5/8	1-1/8
DCSF308, TCSV308		
DCSF415	1-3/8	1-5/8
DCSF510	2-1/8	

Figure 6.2 Single Circuit Piping, Vertiv™ Liebert® Lee-Temp and Vertiv™ Liebert® Quiet-Line 1-4 Fan Condensers



Condenser Piping Connection Sizes							
Model Number	Condenser Type	Condenser Connections ODS		Liebert® Lee-Temp Receiver	Liebert® Lee-Temp Connections IDS		
		Hot Gas Line, in.	Liquid Line, in.		Hot Gas Tee, in.	Liq to L-T Valve, in.	Receiver Out, in.
DCSL28K	Standard	1-1/8	7/8	195315P1	1-1/8	5/8	7/8
DCSL60K				195316P1			
DCSL083		7/8	5/8	1C19982P1	1-1/8	7/8	5/8
DCSL90K		1-1/8	7/8	196702P1			
DCSL104			5/8	1C19982P1			
DCSL165			7/8	W-0050	1-3/8	1-1/8	7/8
DCSL205							
DCSL251							
DCSL308		1-5/8					
DCSL415		1-3/8	185011P1				
DCSL063	Liebert® Quiet-Line	1-1/8	5/8	1C19982P1	1-1/8	7/8	5/8
DCST119			7/8	W-0050			
DCSL127							
DCSL143		W-0060					
DCST214			1-5/8	1-1/8	W-0410		
DCST286		2-1/8					

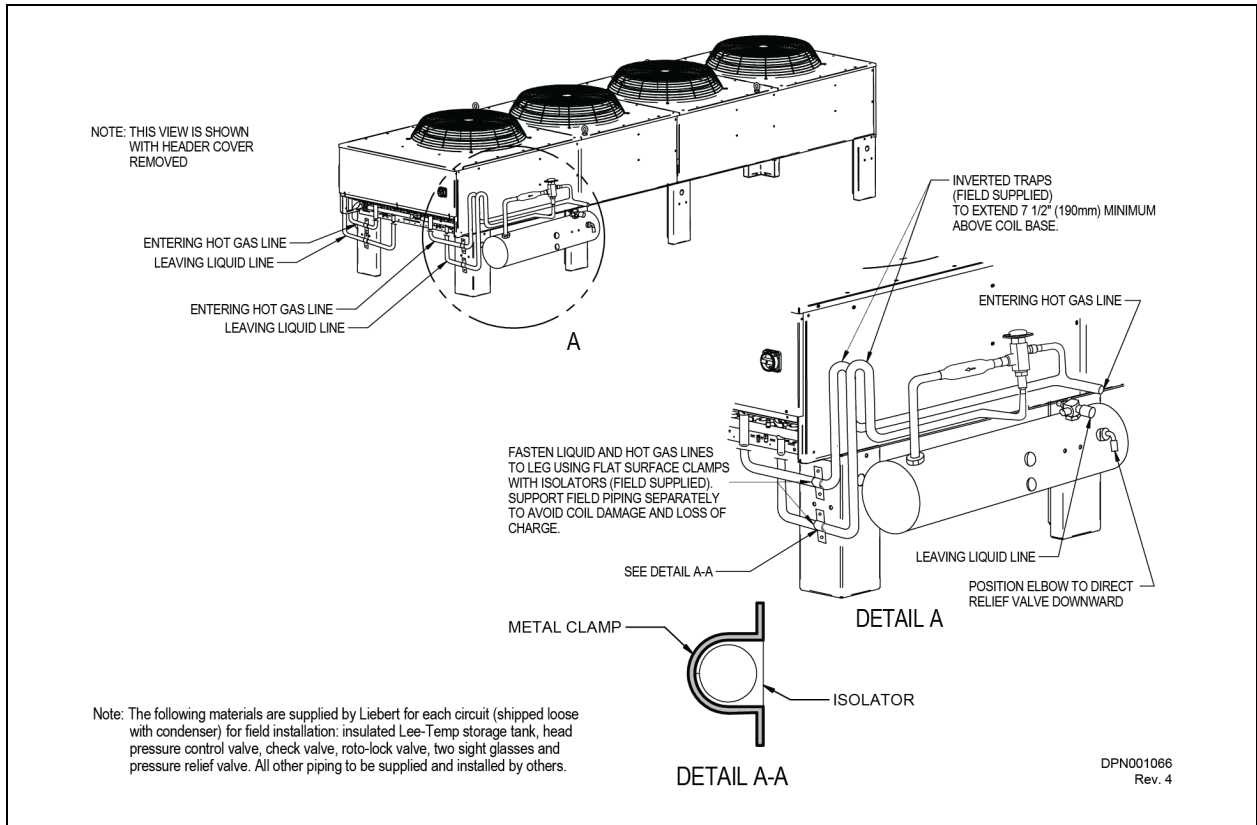
Figure 6.3 Dual Circuit Piping, VFD and Fan Speed Control, 1-4 Fan Condensers



Condenser Piping Connection Sizes, CU. OD. (2 per unit)		
Model Number	Entering Hot Gas Line, in.	Returning Liquid Line, in.
DCDF104	7/8	1/2
DCDF165, TCDV165		5/8
DCDF205, TCDV205	1-1/8	7/8
DCDF251, TCDV251		
DCDF308, TCDV308	1-3/8	1-1/8
DCDF415, TCDV415		
DCDF510, TCDV510	1-5/8	

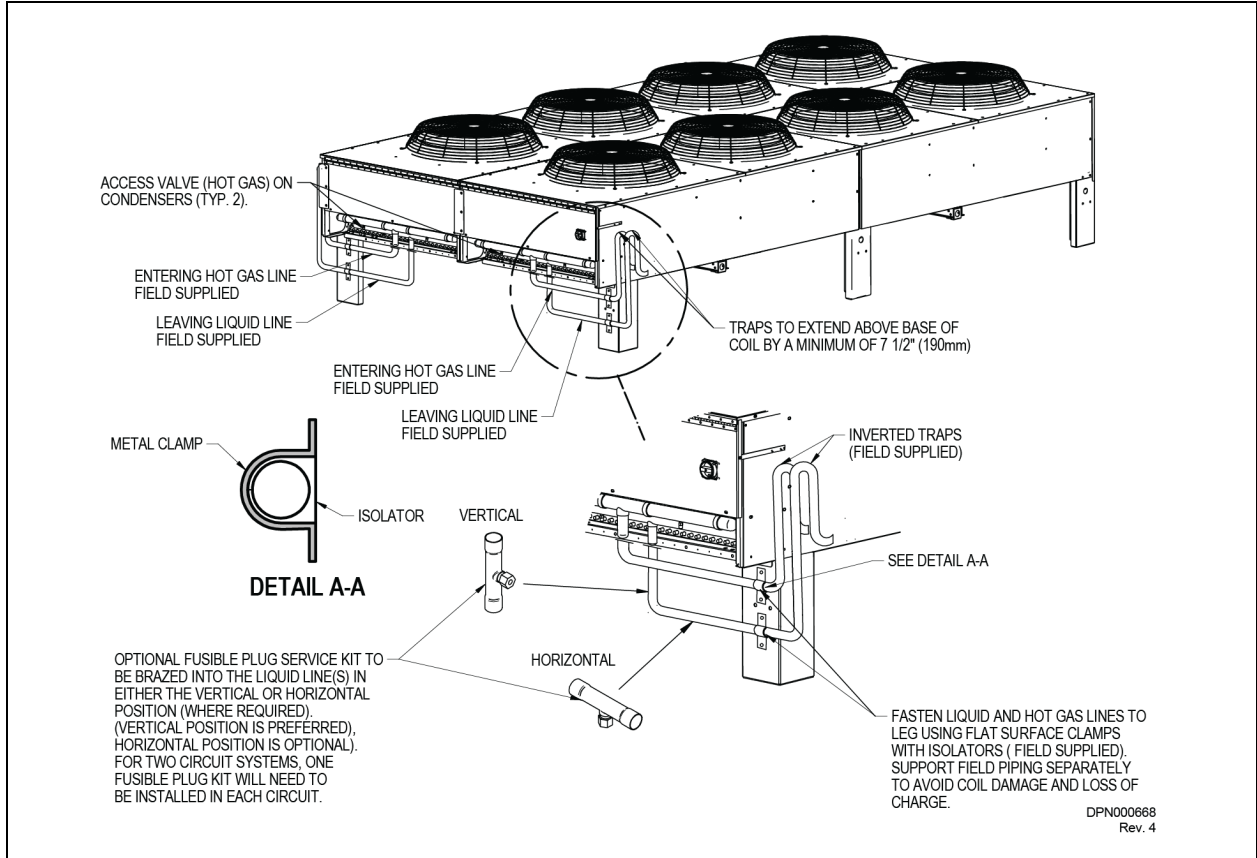


Figure 6.4 Dual Circuit Piping, Vertiv™ Liebert® Lee-Temp and Vertiv™ Liebert® Quiet-Line 1-4 Fan Condensers



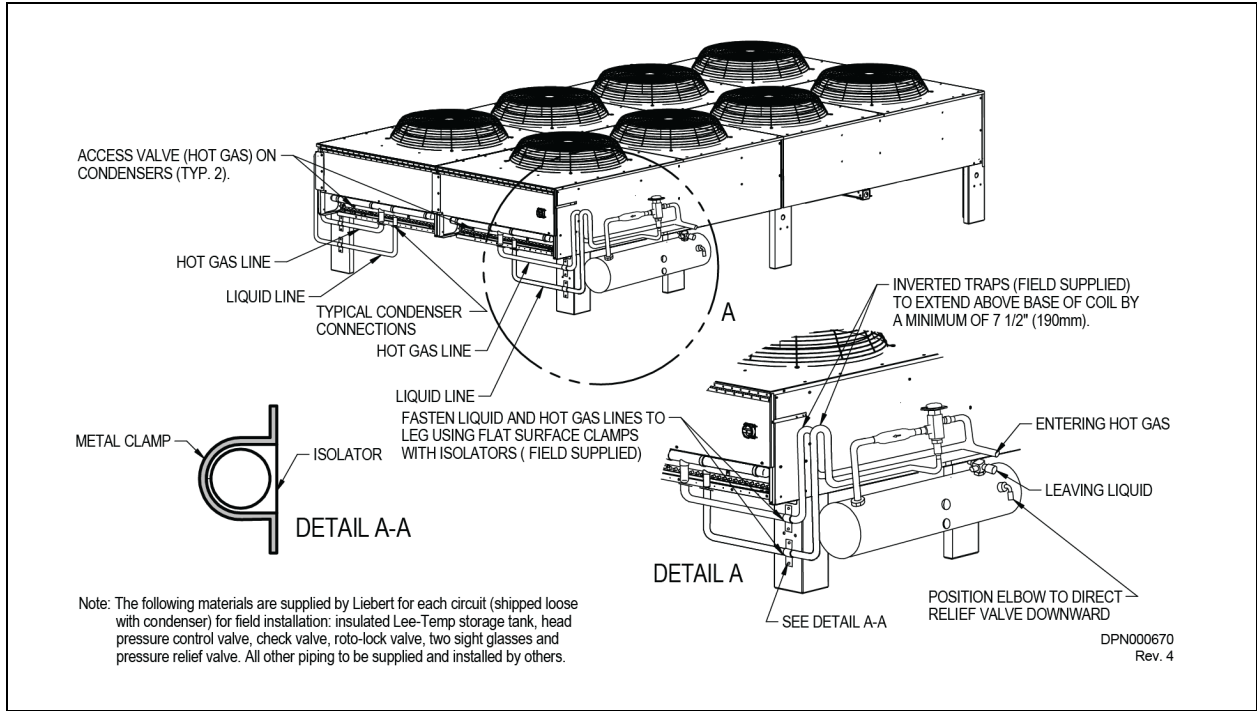
Model Number	Condenser Type	Condenser Connections ODS (2 per unit)		Liebert® Lee-Temp Receiver	Liebert® Lee-Temp Connections IDS (2 per unit)		
		Hot Gas Line, in.	Liquid Line, in.		Hot Gas Tee, in.	Liq to L-T Valve, in.	Receiver Out, in.
DCDL104	Standard	7/8	1/2	(2) 1C19982P1	1-1/8	7/8	5/8
DCDL165			5/8				
DCDL205		1-1/8	7/8	(2) W-0050	1-3/8	1-1/8	7/8
DCDL251				(2) 1C19982P1	1-1/8	7/8	5/8
DCDL308				(2) W-0050	1-3/8	(2) W-0060	1-3/8
DCDL415							
DCDL510		1-5/8	(2) W-0410				
DCDL119	Liebert® Quiet-Line	7/8	5/8	(2) 1C19982P1	1-1/8	7/8	5/8
DCDL127		1-1/8	7/8	(2) W-0050	1-3/8	1-1/8	7/8
DCDL143							
DCDT214							
DCDL286							

Figure 6.5 Dual Circuit Piping, Fan Speed Control, 6- and 8-Fan Condensers



Model Number	Number of Fans	Connection Sizes, ODS (2 per unit)	
		Entering Hot Gas Line, in.	Returning Liquid Line, in.
DCDF616	6	1-5/8	1-1/8
DCDF830	8	1-3/8	
DCDF1010			2-1/8

**Figure 6.6 Dual Circuit Piping, Vertiv™ Liebert® Lee-Temp and Vertiv™ Liebert® Quiet-Line-Line 6- and 8-Fan Condensers**



Model Number	Condenser Type	Fan Qty.	Condenser Connections ODS (2 per unit)		Liebert® Lee-Temp Receiver	Liebert® Lee-Temp Connections IDS (2 per unit)		
			Hot Gas Line, in.	Liquid Line, in.		Hot Gas Tee, in.	Liq to L-T Valve, in.	Receiver Out, in.
DCDL616	Standard	6	1-5/8	1-1/8	(2) W-0060	1-3/8	1-1/8	7/8
DCDL830		8	1-3/8		(2) 185011P1			
DCDT409	Liebert® Quiet-Line	6	1-5/8		(2) W-0410			
DCDT572		8	2-1/8					

## 6.2 Refrigerant Charge Planning Values

Planning for the refrigerant requirements of the completed system is the addition of the charges from Indoor Unit, Condenser (including Vertiv™ Liebert® Lee-Temp receiver, if used) and the interconnecting piping. **Table 6.1** on the next page, **Table 6.3** on page 29, **Table 6.2** on the next page and **Table 6.4** on page 29 and 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 6.1 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	Liebert® Lee-Temp (includes receiver)	FSC or VFD	Liebert® Lee-Temp (includes receiver)	FSC or VFD	Liebert® Lee-Temp (includes receiver)	FSC or VFD	Liebert® Lee-Temp (includes receiver)
083	5 (2.3)	27 (12.3)	3 (1.4)	NA	5 (2.3)	26 (11.8)	3 (1.4)	NA
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)	56 (25.3)	19 (8.6)	72 (32.7)	7 (3.2)	54 (24.4)
251	19 (8.6)	75 (34.0)	10 (4.6)	38 (17.2)	18 (8.2)	71 (32.2)	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)	210 (95.0)	25 (11.3)	107 (48.4)	51 (23.1)	200 (90.8)	24 (10.9)	102 (46.2)
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	N/A	27 (12.3)	113 (51.3)	N/A	See <b>Table 6.2</b> below	26 (11.8)	108 (49.0)
830	N/A	N/A	53 (24)	210 (95.1)	N/A	N/A	51 (23.1)	200 (90.8)
1010	N/A	N/A	60 (27.2)	154 (69.9)	N/A	N/A	57 (25.9)	147 (66.7)
<b>Liebert® Quiet-Line Condenser Models</b>								
063	N/A	39 (17.7)	N/A	NA	N/A	37 (16.8)	N/A	NA
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	152 (68.9)	N/A	N/A	N/A	148 (67.2)
572	N/A	N/A	N/A	196 (88.9)	N/A	N/A	N/A	186 (84.4)

**Table 6.2 R-407C Refrigerant Required for DCSL616 Condensers for Vertiv™ Liebert® XDC, Approximate**

Model #	Liebert® Lee-Temp Receiver	Receiver Tank Length, in. (mm)	Refrigerant Per Circuit (inc. receiver), lb. (kg)
DCSL616	W-0410 <sup>1</sup>	48 (1219)	164 (75)
	179701P1 <sup>2</sup>	96 (2438)	254 (115.2)

1. Match-up for 35 to 105°F (2 to 41°C) design temperature range.  
 2. Match-up for -30 to 105°F (-34 to 41°C) design temperature range.

**Table 6.3 R-410A Refrigerant Required, Approximate**

Single-Circuit Model	VFD, lb (kg)	Liebert® Lee-Temp (inc. receiver), lb (kg)
28K	7 (3.2)	41 (18.6)
60K	16 (7.3)	75 (34.0)
90K	25 (11.3)	109 (49.4)

**Table 6.4 Interconnecting Piping Refrigerant Charge**

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

Per DPN003099, Rev. 1

## 6.3 Condenser Positioning Guidelines

**Table 6.5 Indoor Unit Maximum Distance from the Remote Condenser—Vertiv™ Liebert® Fin/Tube Condenser with or without Vertiv™ Liebert® Lee-Temp**

Parameter	Maximum Distances, ft. (m)	
From R-407C cooling unit to condenser	150 (45.7) equivalent length	
From R-410A cooling unit to condenser	300 (91.4) equivalent length	
VFD/FSC condenser relative to indoor unit	Above: 60 (18.3)	Below: 15 (4.5)
Liebert® Lee-Temp/Liebert® Quiet-Line condenser relative to indoor unit	Above: 60 (18.3)	Below: 0 (0)

Figure 6.7 Condenser Positioning at the Same Level as Indoor Unit

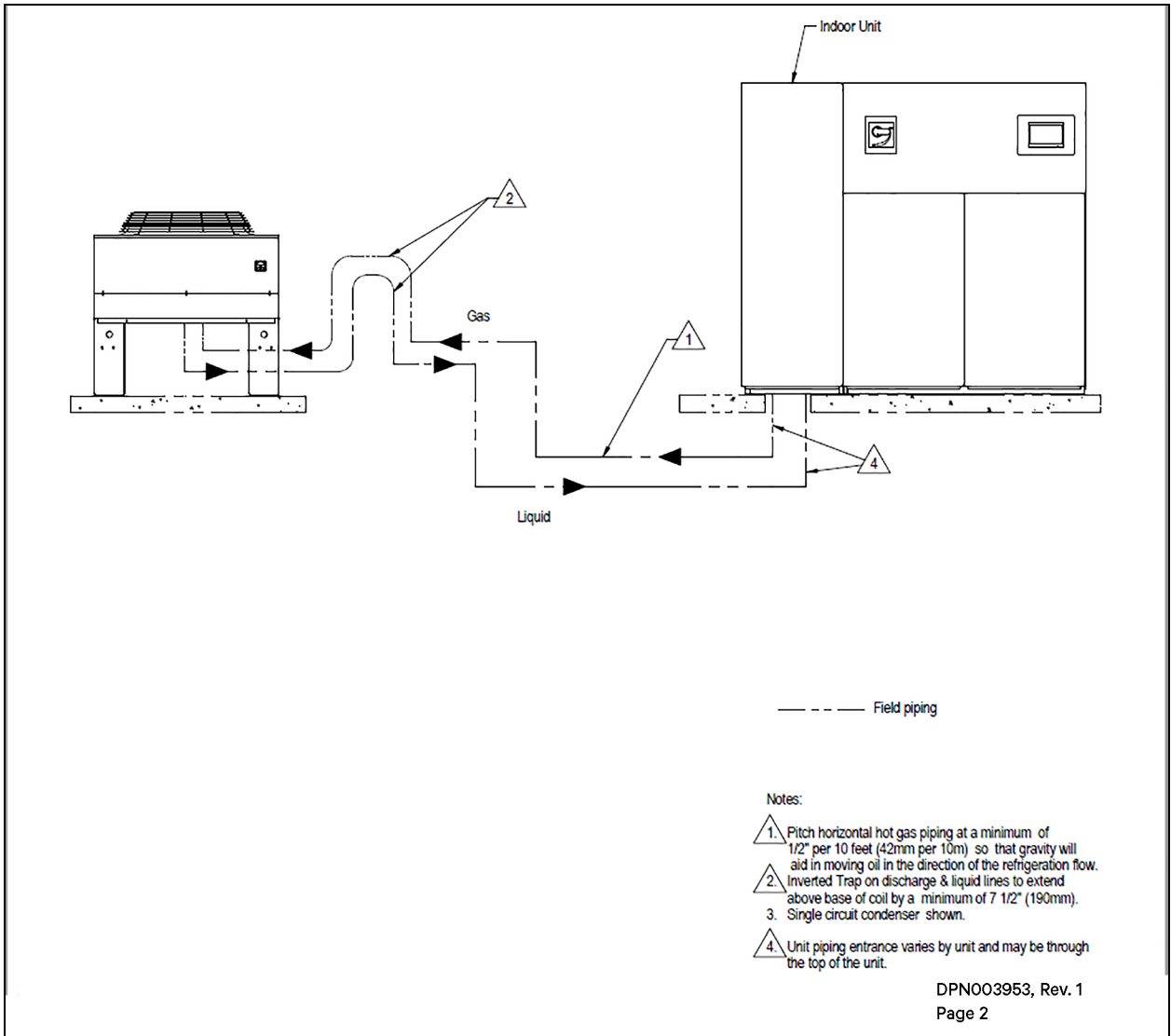
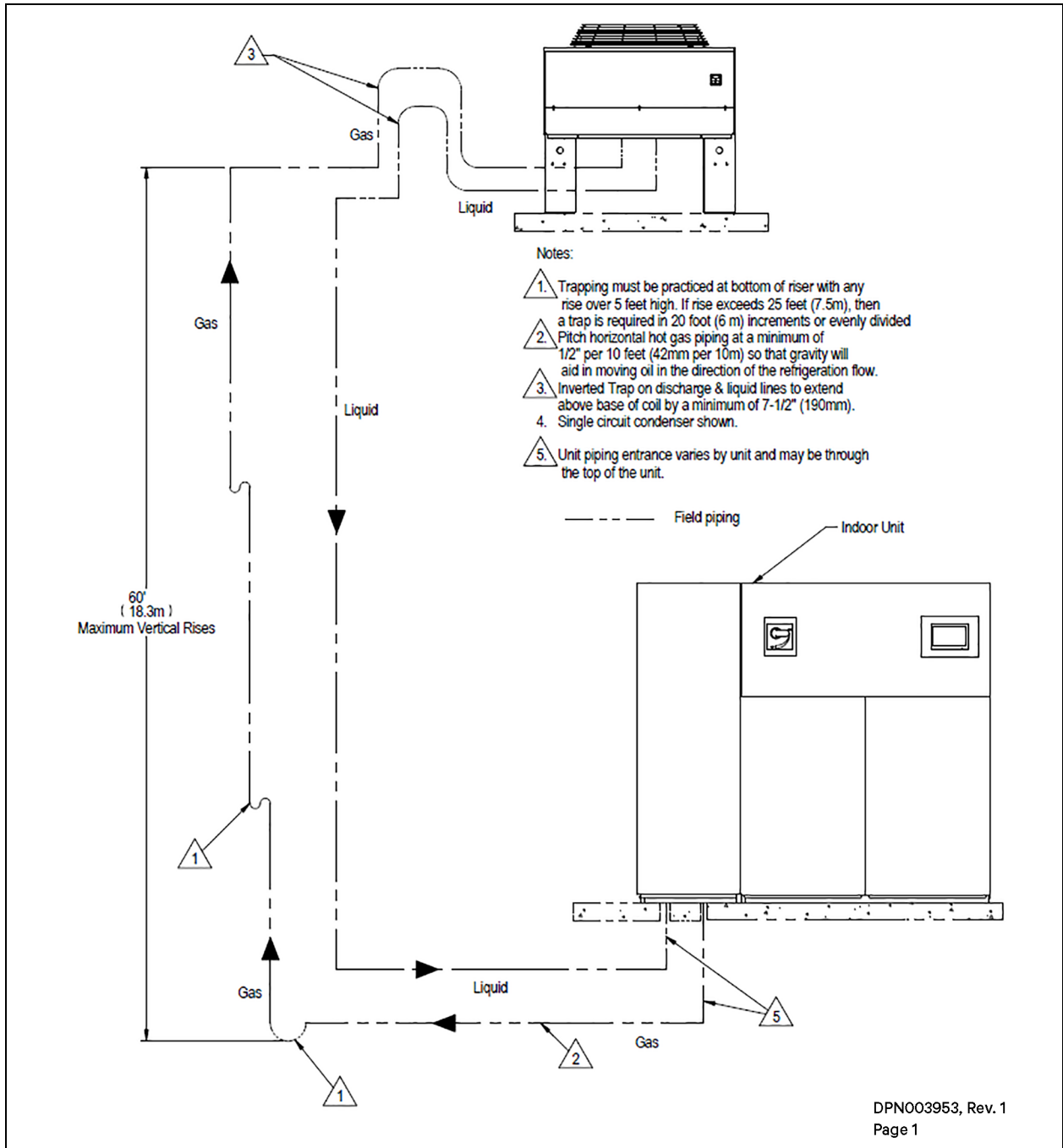
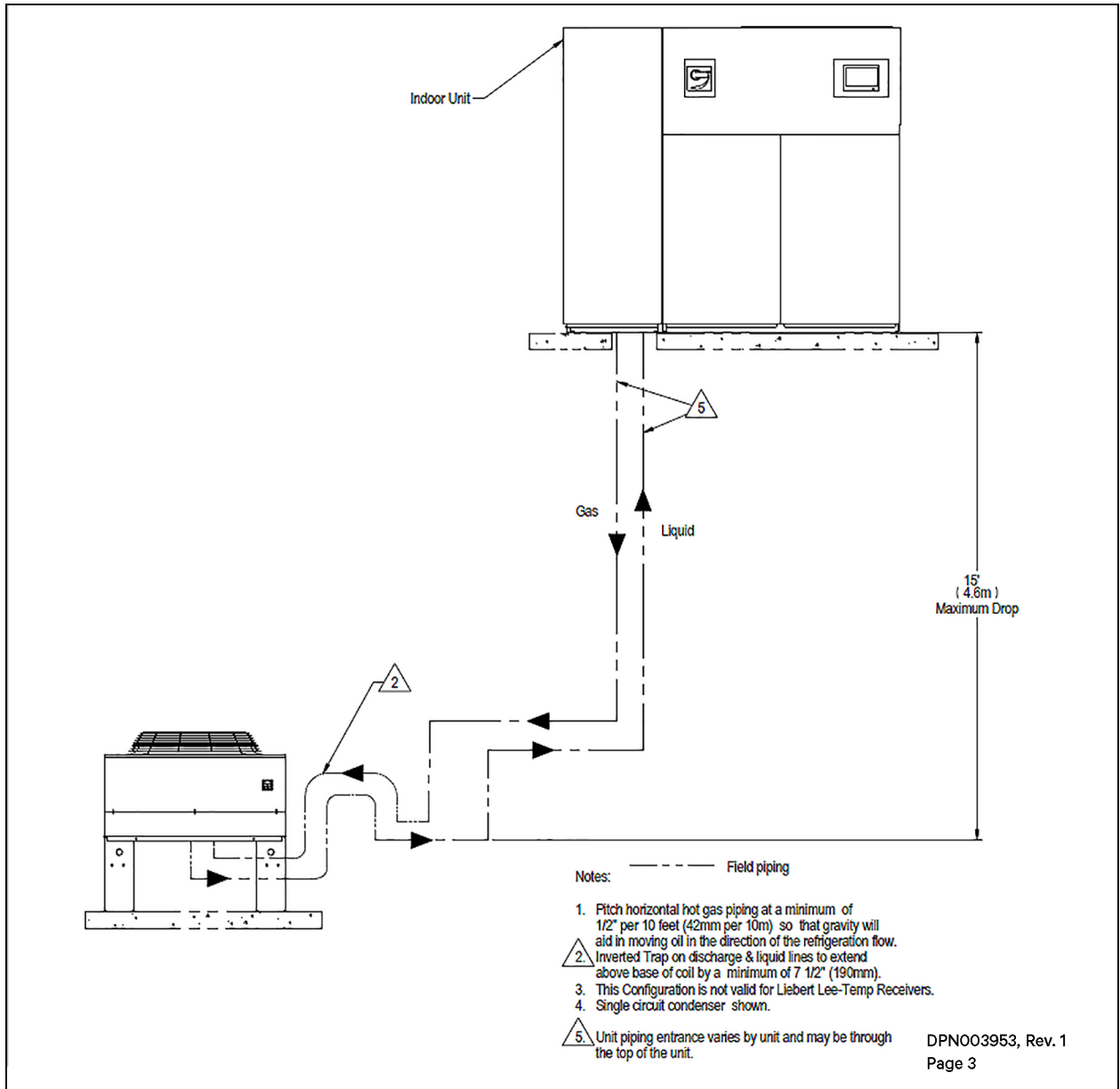


Figure 6.8 Condenser Positioning Above the Indoor Unit



See Table 6.5 on page 29 for maximum distances between, above, and below units.

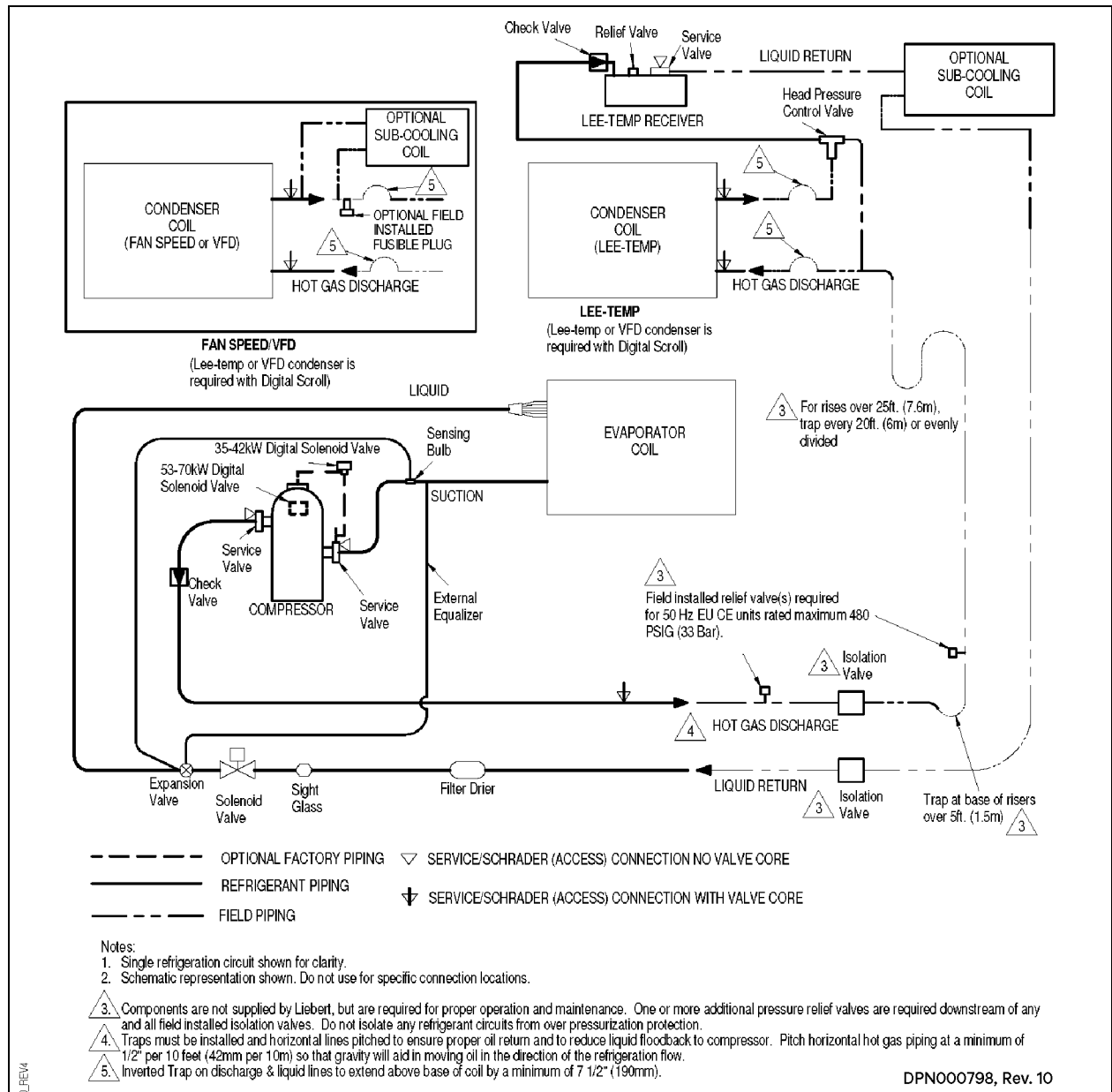
Figure 6.9 Condenser Positioning Below Indoor Unit



See Table 6.5 on page 29 for maximum distances between, above, and below units.



Figure 6.10 General Arrangement—Typical Air Cooled System Piping



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## 7 Electrical Data

The following tables list the electrical data for the condensers.

**Table 7.1 60Hz Condenser Data**

Model #	083, 104, 28K			165, 205, 60K			251, 308, 90K			415, 510			616			830, 1010		
# of Fans	1			2			3			4			6			8		
Input Voltage	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD
<b>Fan Speed Controlled</b>																		
208/230	4.8	6.0	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
460	2.5	3.1	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
575	1.9	2.4	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
208/230	—	—	—	8.3	9.5	15	11.8	13.0	15	15.3	16.5	20	23.6	24.8	30	30.6	31.8	40
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
<b>VFD Controlled<sup>1</sup></b>																		
208/230	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
<b>Liebert® Lee-Temp Controlled/Fan-Cycling</b>																		
208/230	3.5	4.4	15	7.0	7.9	15	10.5	11.4	15	14.0	14.9	20	21.0	21.9	25	28.0	28.9	35
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	20
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

<sup>1</sup>When Low-Ambient VFD Heater Kit is installed, increase condenser WSA by 10 A for 208 V, 1.1 A for 230 V and 0.5 A for 460 V.

**Table 7.2 60Hz Condenser Electrical Data, Liebert® Quiet-Line**

Model #	063			119, 127, 143			214			286			409			572		
# of Fans	1			2			3			4			6			8		
Input Voltage	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD
208/230	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	20
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 7.3 50Hz Condenser Full Load Amp Values**

Condenser Control Type	Fan Speed Controlled		VFD Controlled		Liebert® Lee-Temp Controlled/Fan-Cycling		Liebert® Quiet-Line Quiet-Line Liebert® Lee-Temp Controlled/Fan-Cycling		
	Model #	# of Fans	Input Voltage - Phase	Input Voltage - Phase	Input Voltage - Phase	Input Voltage - Phase	Model #	Input Voltage - Phase	
083, 104	1	4.0	200/220-1	380/415-3	200/230-3	380/415-3	063	200/230-3	380/415-3
			4.0	-	3.7	1.8		3.5	1.7
165, 205	2	-	380/415-3	380/415-3	7.2	3.5	119, 127, 143	3.6	1.8
			3.7	3.7	7.0	3.4		3.6	1.8
251, 308	3	-	380/415-3	380/415-3	10.7	5.2	214	5.4	2.7
			5.4	5.4	10.5	5.1		5.4	2.7
415, 510	4	-	380/415-3	380/415-3	14.2	6.9	286	7.2	3.6
			7.1	7.1	14.0	6.8		7.2	3.6
616	6	-	380/415-3	380/415-3	-	-	409	10.8	5.4
			10.8	10.8	21.0	10.2		10.8	5.4
830, 1010	8	-	380/415-3	380/415-3	-	-	572	14.4	7.2
			14.2	14.2	28.0	13.6		14.4	7.2

**Table 7.4 Vertiv™ Liebert® Lee-Temp Receiver Electrical Data, 50Hz and 60Hz**

Rated Voltage - Single Phase	120			200/208/230		
Watts/Receiver	150	300	450	150	300	450
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
The Liebert® Lee-Temp receiver requires a separate power feed for heaters. The condenser is not designed to supply power to the receiver.						

**Table 7.5 Minimum Recommended Control Circuit Wire Size, AWG, 60Hz Models**

Control Wire Run ft (m)	Control Type														
	VFD & Fan Speed Controlled						Liebert® Lee-Temp Only		Liebert® Lee-Temp Controlled with Fan-Cycling						
	Number of Fans						Number of Fans		Number of Fans						
	1	2	3	4	6	8	1-4	6 & 8	2	3	4	6	8		
0-25 (0-7.6)	16	16	16	16	16	16	16	16	16	16	16	16	16		
26-50 (7.9-15.2)			16	16	14	16				16	16	16			
51-75 (15.5-22.8)			16	16	14	14				16	16	16	16		
76-100 (23.2-30.4)			16	16	12	12				16	16	16	16	16	
101-125 (30.8-38.1)			16	14	10	12				16	16	16	14	16	14
126-150 (38.4-45.7)			14	14	10	10				16	16	16	14	14	14
Table based on 16AWG min. wire size, 0.4A per contactor, 1 to 1.5V maximum drop & 104°F (40°C) average ambient temperature															

**Table 7.6 Minimum Recommended Control Circuit Wire Size, mm<sup>2</sup>, 50 Hz Models**

Control Wire Run, M (ft)	Control Type												
	VFD & Fan Speed Controlled						Liebert® Lee-Temp Only		Liebert® Lee-Temp Controlled with Fan-Cycling				
	Number of Fans						Number of Fans		Number of Fans				
	1	2	3	4	6	8	1-4	6 & 8	2	3	4	6	8
0-7.6 (0-25)	1.0	1.0	1.0	1.0	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
7.9-15.2 (26-50)			1.0	1.0	2.5	2.5		1.0	1.0	1.0	1.0	1.0	1.0
15.5-22.8 (51-75)			1.5	1.5	4.0	4.0		1.0	1.0	1.5	1.5	1.5	1.5
23.2-30.4 (76-100)			1.5	2.5	6.0	4.0		1.0	1.0	1.5	2.5	1.5	2.5
30.8-38.1 (101-125)			2.5	2.5	6.0	6.0		1.5	1.5	2.5	2.5	2.5	2.5
38.4-45.7 (126-150)			2.5	4.0	6.0	6.0		1.5	1.5	2.5	4.0	2.5	4.0

Table based on 1.0mm<sup>2</sup> min. wire size, 0.5A per contactor, 1 to 1.5V maximum drop & 40 °C (104 °F) average ambient temperature

## 7.1 Electrical Connections

Figure 7.1 Electrical Field Connections for Fan Speed Control Condensers

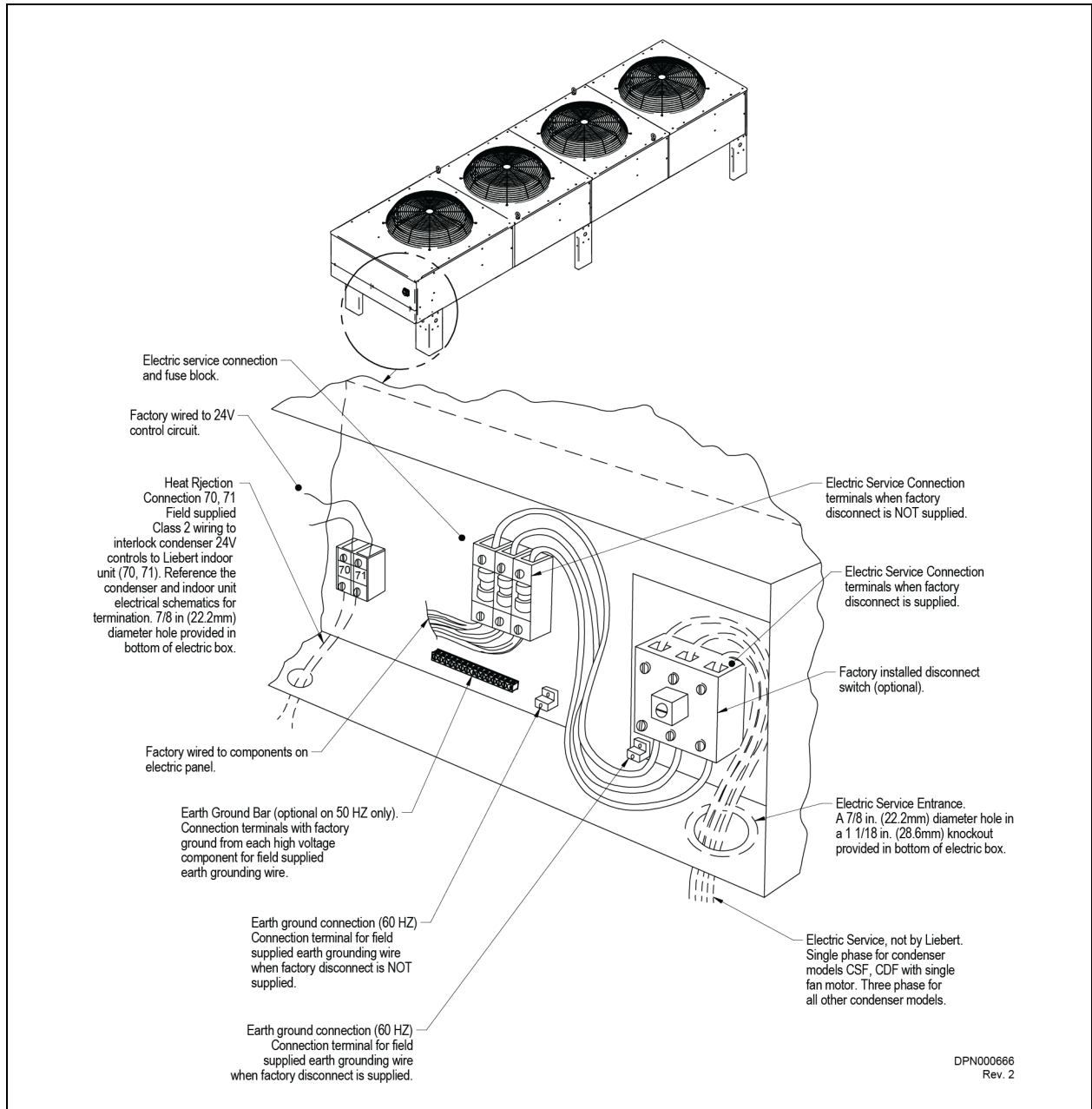
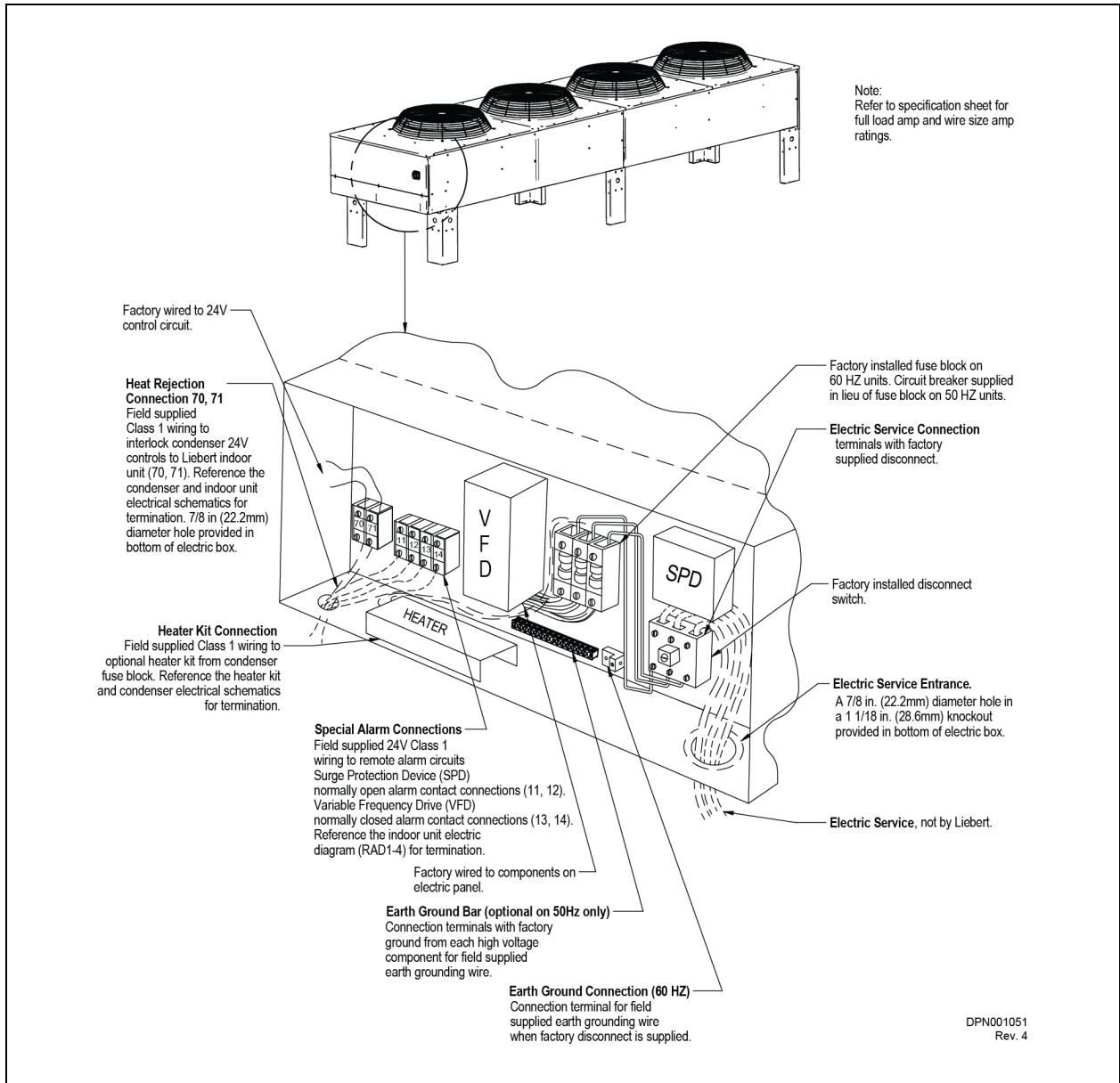
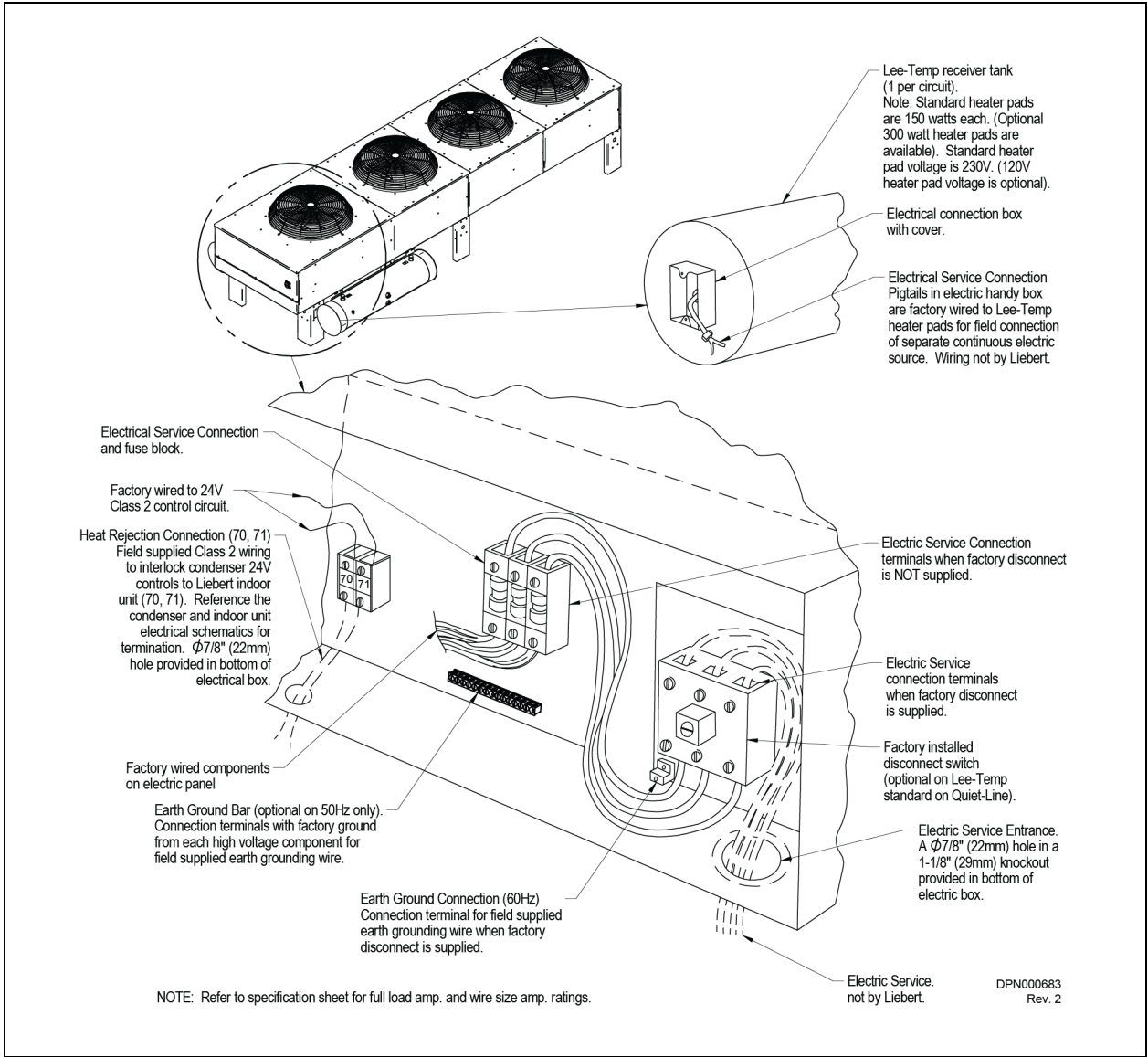




Figure 7.2 Electrical Field Connections for VFD-control Condensers



**Figure 7.3 Electrical Field Connections for Vertiv™ Liebert® Lee-Temp and Vertiv™ Liebert® Quiet-Line Control Condensers**



## 7.2 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 is required for connection between like-numbered terminals 70 & 71 on both units. Wiring must be sized and selected for insulation case per NEC and other local codes. See [Electrical Data](#) on page 35 and [Electrical Data](#) on page 35 for recommended wire sizing for control wiring runs up to 150 ft (45.7 m). Contact the factory for assistance with longer wiring runs. See **Figure 7.1** on page 40, **Figure 7.2** on page 41 and **Figure 7.3** on the previous page and indoor unit manual for location of terminals on condensers and indoor units.

## 7.3 Low Voltage Monitoring Wiring—VFD Condensers 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 healthy VFD drive. Contact open indicates no power to condenser or a permanent VFD fault. A factory-programmed VFD must be used as the replacement.

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

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# Appendices

## **Appendix A: Guide Specifications for Liebert® Air Cooled Condensers with Direct Drive Propeller Fan**

The following are the guide specifications for the Vertiv™ Liebert® Air Cooled Fin/Tube Condenser.

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# Vertiv™ Liebert® Air-Cooled Fin/Tube Condensers with Direct-drive Propeller Fan Guide Specifications

## 1.0 GENERAL

### 1.1 Summary

These specifications describe requirements for a Liebert® Air-cooled fin/tube condenser for a Liebert Thermal Management system. The condenser shall be designed to reject waste heat to outdoor air and to control refrigerant head pressure as outdoor ambient conditions change.

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

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

The condenser model number shall be: \_\_\_\_\_

### 1.2 Design Requirements

The condenser shall be a factory-assembled unit, complete with integral electrical panel, designed for outdoor installation. (The condenser shall be a draw-through design.)

The condenser shall have a total heat rejection capacity of \_\_\_\_\_ kW (kBtuh) rated at an outdoor ambient of \_\_\_\_\_ °F (°C) and a midpoint condensing temperature of \_\_\_\_\_ °F (°C) and a refrigerant flow to produce a subcooling of 5°F (2.8°C)

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

### 1.3 Submittals

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

### 1.4 Quality Assurance

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

## 2.0 PRODUCT

### 2.1 Standard Features—All Condensers

Condenser shall consist of condenser coil(s), housing, propeller fan(s) direct driven by individual fan motor(s), electrical controls and mounting legs. The Vertiv™ Liebert® Air-cooled condenser shall provide positive refrigerant head pressure control to the indoor cooling unit by adjusting heat rejection capacity. Various methods shall be available to match indoor unit type, minimum outdoor design ambient and maximum sound requirements.

#### 2.1.1 Condenser Coil

Liebert manufactured coil shall be constructed of copper tubes in a staggered tube pattern. Tubes are expanded into continuous, corrugated aluminum fins. The fins have full-depth fin collars completely covering the copper tubes, which are connected to heavy wall Type “L” headers. Inlet coil connector tubes pass through relieved holes in the tube sheet for maximum resistance to piping strain and vibration. Coil shall be [(single circuit) (dual circuit)]. The hot-gas and liquid lines shall be spun shut and shall include a factory-installed Schrader valve. Coils shall be factory leak-tested at a minimum of 300 psig (2068kPa), dehydrated, then filled and sealed with a low-pressure inert gas holding charge for shipment. Field relief of the Schrader valve shall indicate a leak-free system.

#### 2.1.2 Housing

The condenser housing shall be constructed of bright aluminum sheet and divided into individual fan sections by full-width baffles. Structural support members, including coil support frame, motor and drive support, are galvanized steel for strength and corrosion resistance. Aluminum legs shall be provided to mount unit for vertical air discharge and have rigging holes for hoisting the unit into position. An electrical panel shall be inside an integral NEMA 3R weatherproof section of the housing.

#### 2.1.3 Propeller Fan

Propeller fan shall have aluminum blades secured to corrosion protected steel hub. Fans shall be secured to the fan motor shaft by means of the keyed hub and dual setscrews. Fan diameter shall be 26" (660mm) or less. Fans shall be factory-balanced and run before shipment. Fan guards shall be heavy gauge, close-meshed steel wire with corrosion resistant polyester paint finish that shall be rated to pass a 1000-hour salt spray test.

#### 2.1.4 Fan Motor

Fan motor shall be continuous air-over design and shall be equipped with rain shield and permanently sealed bearing. Motors shall be rigidly mounted on die-formed galvanized steel supports.

#### 2.1.5 Electrical Controls

Electrical controls, overload protection devices and service connection terminals shall be provided, and factory wired inside the integral electrical panel section of the housing. A locking disconnect switch shall be factory-mounted and wired to the electrical panel and controlled via an externally mounted locking door handle. An indoor unit interlock circuit shall enable condenser operation whenever indoor unit compressors are active. Only supply wiring and indoor unit interlock wiring are required at condenser installation.



## 2.2 Specific Features by Condenser Type

### 2.2.1 Variable Frequency Drive (VFD) Condenser (1-4 Fan)

The VFD condenser shall have a variable frequency drive controlling one inverter duty, variable speed motor and On/Off fan motor(s) (for multiple fan models only) to vary the airflow across the coil. The VFD shall use one or more pressure transducers to sense refrigerant pressure to adjust fan speed to a positive head pressure control range. The inverter duty motor shall have permanently lubricated ceramic ball bearings. The Liebert variable frequency drive control system shall provide overload protection for the variable speed motor. On/Off fan motor(s) shall have individual internal overload protection and shall be controlled by ambient air thermostat(s) increasing/decreasing condenser capacity in stepped increments. Motors shall have a TEAO enclosure and a full speed of 1140RPM @ 60Hz (950RPM @ 50Hz). An internal Surge Protective Device (SPD) shall protect the VFD from power surges. Alarm contacts for the SPD and VFD shall be provided for monitoring of system components.

The VFD Control system shall provide positive startup and operation in ambient temperature as low as - [0°F (-17.8°C)] [-20°F (-28.9°C) with optional, low ambient VFD heater kit]. The air-cooled condenser shall have a \_\_\_ volt, \_\_\_ ph \_\_\_ Hz power supply.

### 2.2.2 Fan Speed Control (FSC) Condenser (1 Fan)

The FSC condenser shall have a fan speed controller sensing refrigerant pressure and varying the speed of a FSC duty motor. Motor shall be single-phase and include built-in overload protection. Motor shall have an ODP enclosure and have a full speed of 1100RPM @ 60Hz (920RPM @ 50Hz).

The fan speed control system shall provide positive startup and operation in ambient temperature as low as -20°F (-28.9°C). The air-cooled condenser shall have a \_\_\_ volt, 1 ph, \_\_\_ Hz power supply.

### 2.2.3 Fan Speed Control (FSC) Condenser (2, 3 or 4 Fans)

The FSC condenser shall have a fan speed controller sensing refrigerant pressure and varying the speed of an FSC duty motor. Additional fan motors shall be fixed speed, cycled On/Off by ambient air thermostats to further vary the airflow across the coil. The FSC motor shall be single-phase and include built-in overload protection. FSC motor shall have an ODP enclosure and a full speed of 1100RPM @ 60Hz (920RPM @ 50Hz). The fixed speed motors shall be three-phase and have individual internal overload protection. Fixed speed motors shall have a TEAO enclosure and a full speed of 1140RPM @ 60Hz (950RPM @ 50Hz).

The Vertiv™ Liebert® Lee-Temp control system shall provide positive startup and operation in ambient temperature as low as -20°F (-28.9°C). The air-cooled condenser shall have a \_\_\_ volt, 3 ph, \_\_\_ Hz power supply.

### 2.2.4 Fan Speed Control (FSC) Condenser (6 & 8 Fans)

The FSC condenser shall have two fan speed controllers, each sensing the refrigerant pressure of its associated refrigerant circuit and independently varying the speed of the FSC duty motor. Additional motors shall be fixed speed, cycled On/Off by ambient air thermostats to further vary the airflow across the coil. The FSC motors shall be single-phase and include built-in overload protection. FSC motors shall have an ODP enclosure and a full speed of 1100RPM @ 60Hz (920RPM @ 50Hz). The fixed speed motors shall be three-phase and have individual internal overload protection. Fixed speed motors shall have a TEAO enclosure and a full speed of 1140RPM @ 60Hz (950RPM @ 50Hz).

The fan speed control system shall provide positive startup and operation in ambient temperature as low as -20°F (-28.9°C). The Vertiv™ Liebert® Air-cooled condenser shall have a \_\_\_ volt, 3 ph, \_\_\_ Hz power supply.

## 2.2.5 Vertiv™ Liebert® Lee-Temp Condensers (All Fan Quantities)

Liebert® Lee-Temp condensers shall consist of fixed speed fan motor(s), controlled by internal contactor(s). Fans shall run full speed whenever compressors are running. The fixed speed motors shall be three-phase and provide individual internal overload protection. Fixed speed motors shall have a TEAO enclosure and a full speed of 1140RPM @ 60Hz (950RPM @ 50Hz).

Each refrigerant circuit shall have an insulated, heated receiver tank with sight glasses, pressure relief valve, rotalock valve for refrigerant charge isolation and piping assembly with head pressure operated 3-way valve and check valve. Components shall be field assembled to the condenser. The 3-way valve shall sense refrigerant head pressure and adjust the flooding charge in the condenser coil to adjust the condenser heat rejection capacity. The Liebert® Lee-Temp heater shall be [(150W) (300W)], include an integral thermostat to maintain refrigerant temperature at a minimum of 85°F (29°C) and requires a separate power supply of [(208/230-1-60) (120-1-60 volt) (200/230-1-50) (110-1-50)].

This system shall allow system startup and positive head pressure control with ambient temperatures as low as -30°F (-34.4°C).

## 2.2.6 Vertiv™ Liebert® Quiet-Line Condensers (All Fan Quantities)

Liebert® Quiet-Line condensers shall consist of fixed speed fan motor(s), controlled by internal contactor(s). One fan per refrigerant circuit shall run at full speed with the compressor(s). Additional fan motors may be full speed or cycled based on ambient temperatures. Motors shall have a TEAO enclosure, provide individual overload protection and have a full speed of 570RPM @ 60Hz (475RPM @ 50Hz).

Each refrigerant circuit shall have an insulated, heated receiver tank with sight glasses, pressure relief valve, rotalock valve for refrigerant charge isolation and piping assembly with head pressure operated 3-way valve and check valve. Components shall be field assembled to the condenser. The 3-way valve shall sense refrigerant head pressure and adjust the flooding charge in the condenser coil to adjust the condenser heat rejection capacity. The Liebert® Lee-Temp heater shall be [(150W) (300W)], include an integral thermostat to maintain refrigerant temperature at a minimum of 85°F (29°C) and requires a separate power supply of [(208/230-1-60) (120-1-60 volt) (200/230-1-50) (110-1-50)].

This system shall allow system startup and positive head pressure control with ambient temperatures as low as -30°F (-34.4°C).

## 3.0 EXECUTION

### 3.1 Installation of Air Conditioning Unit

#### 3.1.1 General

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

#### 3.1.2 Electrical Wiring

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

#### 3.1.3 Piping Connections

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

#### 3.1.4 Field Quality Control

Start cooling units in accordance with manufacturer's startup instructions. Test controls and demonstrate compliance with requirements. These specifications describe requirements for a computer room environmental control system. The system shall be designed to maintain temperature and humidity conditions in the rooms containing electronic equipment.

The manufacturer shall design and furnish all equipment to be fully compatible with heat dissipation requirements.

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