



# Liebert<sup>®</sup> Air-Cooled, Direct-Drive Drycooler

## **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 Nomenclature and Components

This section describes the model number for Vertiv™ Liebert® Drycooler units and components.

## 1.1 Vertiv™ Liebert® Drycooler Model Number Nomenclature

Table 1.2 below, describes each digit of the model number.

**Table 1.1 Liebert® Drycooler Model Number Example**

1	2	3	4	5	6	7	8	9	10
D	D	N	T	3	5	0	A	4	8

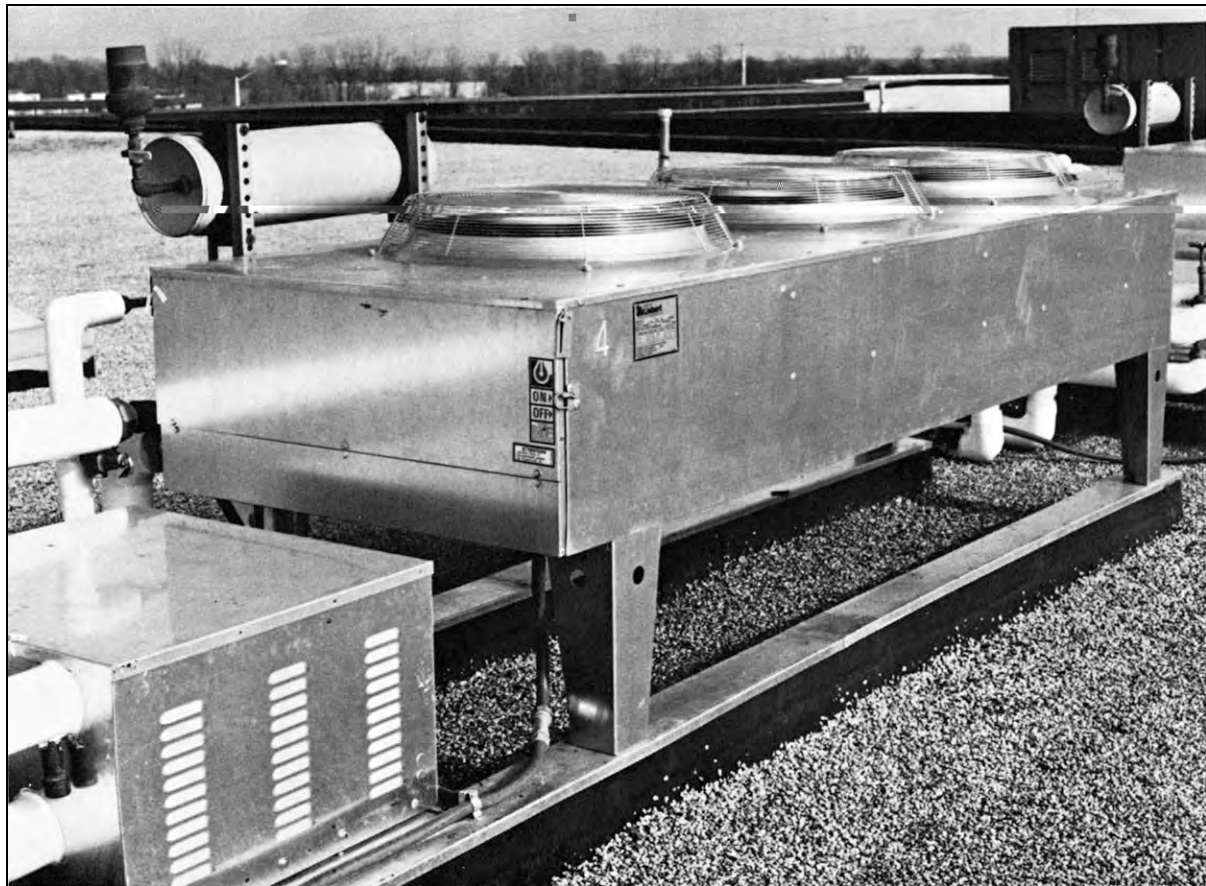
**Table 1.2 Liebert® Drycooler Model Number Digit Definitions**

Digit	Description
Digit 1 - Disconnect Switch	D = Disconnect switch designator on units without pump controls, see Digit 3.
Digit 2 = Unit Family	D = Drycooler
Digit 3 - Pump Control	N = No pump control S = Single pump control D = Dual pump control
Digits 4 - Fan Control	C = No fan control L = Main fan control T = Fan cycling O = Fan cycling and pump control S = Special-order fan/pump control F = Fan speed control
Digits 5, 6, 7 - Model Size	
Digit 8 - Power Supply	P = 208/230V / 1ph / 60Hz W = 200/220V / 1ph / 50Hz Y = 208/230V / 3ph / 60Hz A = 460V / 3ph / 60Hz B = 575V / 3ph / 60Hz M = 380/415V / 3ph / 50Hz
Digits, 9 and 10 - Circuiting	Blank for standard circuiting. See <b>Table 4.2</b> on page 18 and <b>Table 4.3</b> on page 19.

## 1.2 Product Description and Features

The Vertiv™ Liebert® Air-cooled, Direct-drive Drycooler is a low-profile, direct-drive propeller fan-type air-cooled unit. Constructed with an aluminum cabinet and a copper-tube aluminum fin coil, the unit is quiet and corrosion resistant. All electrical connections and controls are enclosed in an integral NEMA 3R rated electrical panel section of the Liebert® Drycooler.

Figure 1.1 Liebert® Three Fan Drycooler



### Agency Listed

Standard 60-Hz 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.



## 1.2.1 Standard Features—All Vertiv™ Liebert® Drycooler

Liebert® Drycoolers consist of drycooler coil(s), housing, propeller fan(s) direct-driven by individual fan motor(s), electrical controls and mounting legs. Liebert® air-cooled drycoolers provide for heat-rejection needs of glycol-cooled Thermal Management units by using outdoor air to remove heat from circulating water/glycol mixtures and to maintain water/glycol temperatures within designed and controlled ranges. Various control methods are employed to match indoor unit type, indoor unit to drycooler/pump combinations and maximum sound requirements.

### Liebert® Drycooler 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. Coil circuit options can be selected and factory built to provide the right combination of heat transfer and pressure drop for the glycol system. The glycol supply and return pipes are either spun shut (1-4 fan) or capped (6-fan and 8-fan) at the factory and include a factory-installed Schrader valve. Coils are factory leak-tested at a minimum of 300 psig (2068kPag), dehydrated, then filled and sealed with an inert gas holding charge for shipment.

### 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 the 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.

### 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" (660mm) or less. The fans are factory-balanced and run before shipment.

## 1.2.2 Fan Motor

The Liebert® Drycooler'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.

## 1.2.3 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 drycooler operation whenever the indoor unit's compressors are active. Supply wiring and indoor unit interlock wiring are required at drycooler installation, along with any pumps controlled by the Liebert® Drycooler's electrical panel. The electrical panel provides at least 5000A Short Circuit Current Rating (SCCR) and is marked with this value.

## 1.2.4 Control Types and Control Options

### Fan Speed—DSF, DDF

Available only on single-fan standard drycoolers with integral pump controls. Fan speed control provides an infinite number of speed variations on specially designed, single-phase, permanent split capacitor motor, by monitoring leaving fluid temperature.

Fan speed control provides air delivery in direct proportion to heat rejection requirements of the system. The control is adjustable to maintain the temperature of the fluid leaving the drycooler. Either of two temperature ranges can be field-selected: 30 to 60°F (-1 to 16°C) for Vertiv™ Liebert® GLYCOOL applications or 70 to 100°F (21 to 38°C) for glycol applications.

### Fan Cycling Control—DDNT, DSO, DDO

Available on all sizes of standard sound and Vertiv™ Liebert® Quiet-Line drycoolers. A thermostatic control cycles the fan on a single-fan drycooler in response to leaving fluid temperatures. Two or more thermostats are employed on drycoolers with two or more fans to cycle fans or groups of fans in response to leaving fluid temperatures. The thermostat setpoints are listed on the factory-supplied schematic. They typically range from 35 to 45°F (2 to 7°C) for GLYCOOL applications and 65 to 75°F (18 to 24°C) for glycol applications.

### Main Fan Control—DDNL

Available on all sizes of standard-sound and Liebert® Quiet-Line drycoolers without pump controls. All fans run when an external contact closure completes internal 24VAC circuit.

### No Controls - DDNC

Available on all sizes of standard-sound and Liebert® Quiet-Line drycoolers without pump controls. All fans are activated at full speed when power is applied to the Liebert® Drycooler.

### Pump Controls

Available on all Fan Speed and Fan Cycling Control drycoolers. Controls for pump(s) up to 7.5hp are built into the same integral electric panel as the Liebert® Drycooler fan controls. Pump fuses, overload heaters and flow switch (dual pump control models) are included with the Liebert® pump packages or must be field-supplied for field-supplied pumps.

Dual pump option—Provides controls for primary and standby pump. The flow switch senses loss of flow and switches to the standby pump for continuous system operation in the event of a pump failure. An internal switch allows manual selection of the lead/lag pump.

## 1.2.5 Sound Level Options

### Standard Liebert® Drycoolers

All Fan Speed, Fan Cycling, Main Fan and No Control drycoolers are standard Liebert® Drycoolers with moderate operating sound levels.



## Vertiv™ Liebert® Quiet-Line Drycoolers

Liebert® Quiet-Line drycoolers can help meet the strictest noise codes and do so at less cost than traditional Liebert® Drycooler with acoustic shielding. Liebert® Quiet-Line drycoolers utilize the same reliable construction features of the standard drycoolers and have oversized coils and slower speed fan motors that yield the required heat rejection needed at significantly lower sound levels.

Vertiv™ Liebert® Quiet-Line Drycoolers are available on Fan Cycling (with and without Pump Controls), Main Control and No Control Vertiv™ Liebert® Drycoolers.

### 1.2.6 Typical System Configurations

The standard glycol-cooled precision air conditioning system includes these major components:

- Indoor air conditioning unit with heat exchangers (refrigerant/glycol)
- Glycol regulating valve
- Outdoor air-cooled drycooler
- Glycol pump(s)
- Expansion/compression tank
- Pump controls
- Interconnection piping
- Unit interlock control wiring

The piping general-arrangement drawings, listed in **Table 1.3** below, show single unit to drycooler loop arrangement, multiple indoor units and multiple outdoor drycoolers using a dual pump package and on a common piping loop. The drawings are included in the [Submittal Drawings](#) on page 41.

Additional field-supplied components, such as valves, expansion tank, strainers and flow or pressure switches are also shown in the piping general-arrangement drawings. These components are necessary and should be included when designing a system with one indoor and one outdoor unit on a piping loop or a system using multiple indoor and outdoor units on a common piping loop. Larger systems may also benefit from an air separator (not shown).

**Table 1.3 Piping General Arrangement Drawings**

Document Number	Title
DPN000895	Piping Schematic Water/Glycol 77kW—105kW Semi-Hermetic Compressor Models
DPN000896	Piping Schematic Water/Glycol Scroll Compressor Models
DPN001430	Piping Schematic Water/Glycol Digital Scroll Compressor Models
DPN001432	Piping Schematic Liebert® GLYCOOL Digital Scroll Compressor Models
DPN000897	Piping Schematic Liebert® GLYCOOL 77kW—105kW Semi-Hermetic Compressor Models
DPN000898	Piping Schematic Liebert® GLYCOOL Scroll Compressor Models
DPN002931	Piping Schematic Water/Glycol Models
DPN002932	Piping Schematic Liebert® GLYCOOL Models
DPN003822	Piping Schematic Multiple Liebert® Drycoolers and Cooling Units on Common Glycol Loop

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## 2 System Data

### 2.1 Performance Data and Selection

Table 2.1 Vertiv™ Liebert® Drycooler Performance Data, 60Hz—Standard Models

Standard Circuits Data					Fans Direct Drive					
Model Number *D**	Total Heat Rejection, kBtuh (kW) @25F ITD	Glycol Flow Rate, GPM (lpm)	Pressure Drop, Ft. H <sub>2</sub> O (kPa)	No. of Internal Circuits(Std.)	No. of Fans	Blade Diameter, in (cm)	Rated Motor hp	Air Flow (CFM)	Sound Power, LwA	Sound Pressure, dBA**
033	38 (11.1)	10 (38)	9.1 (27)	4	1	26 (66)	3/4	7200	86.5	72.5
069	67 (19.6)	20 (76)	8.9 (27)	8				6870	86.5	72.5
092	92 (27.1)	30 (114)	8.6 (26)	12				6600	86.5	72.5
109	109 (31.9)	40 (152)	8.1 (24)	16				6300	86.5	72.5
112	118 (34.6)	40 (152)	10.1 (30)	16				6090	86.5	72.5
139	134 (39.3)	40 (152)	7.1 (21)	16	2			13700	91.0	75.5
174	173 (50.8)	40 (152)	10.5 (31)	16				13300	91.0	75.5
197	197 (57.7)	40 (152)	13.9 (42)	16				12645	91.0	75.5
225	231 (67.7)	65 (246)	10.9 (33)	26				12200	91.1	75.5
260	260 (76.3)	60 (227)	10.1 (30)	24	3			19900	94.0	77.3
310	311 (91.0)	80 (303)	9.8 (29)	32				19000	94.0	77.3
350	353 (103)	80 (303)	14.6 (44)	32				17400	94.0	77.3
352	328 (96.2)	60 (227)	12.9 (39)	24	4			24800	94.4	78.5
419	394 (115)	80 (303)	12.7 (38)	32				23650	94.4	78.5
466	441 (129)	100 (379)	12.7 (38)	40				22800	94.4	78.5
491	469 (137)	120 (455)	12.8 (38)	48				21700	94.4	78.5
620	621 (182)	160 (606)	9.8 (29)	64	6			37900	96.8	80.3
650	652 (191)	130 (493)	15.2 (45)	52				36500	96.8	80.3
700	706 (207)	160 (606)	14.6 (44)	64				34800	96.8	80.3
790	787 (231)	160 (606)	12.7 (38)	64	8			47300	97.4	81.5
880	882 (258)	200 (758)	12.7 (38)	80		45500	97.4	81.5		
940	938 (275)	240 (910)	12.5 (37)	96		43400	97.4	81.5		

Standard data based on 95 °F (35 °C) EAT, 120 °F (48.9 °C) EFT, 40% E.G.  
 Capacity shown is Drycooler THR at sea level.  
 Sound pressure is dBA at 5ft (1.5m)

**Table 2.2 Vertiv™ Liebert® Drycooler Performance Data, 60Hz—Vertiv™ Liebert® Quiet-Line Models**

Standard Circuits Data					Fans Direct Drive					
Model Number *D**	Total Heat Rejection, kBtuh (kW) @25F ITD	Glycol Flow Rate, GPM (lpm)	Pressure Drop, Ft. H <sub>2</sub> O (kPa)	No. of Internal Circuits(Std.)	No. of Fans	Blade Diameter, in (cm)	Rated Motor hp	Air Flow (CFM)	Sound Power, LwA	Sound Pressure, dBA**
040	44 (13.0)	20 (76)	8.8 (26)	8	1	26 (66)	1/4	3110	68.9	56.5
057	57 (16.7)	30 (114)	8.6 (26)	12				2990	68.9	56.5
060	63 (18.4)	40 (152)	8.1 (24)	16				2840	68.9	56.5
080	89 (26.0)	40 (152)	7.0 (21)	16	2			6220	72.6	59.5
111	111 (32.5)	40 (152)	10.4 (31)	16				5980	72.6	59.5
121	121 (35.4)	40 (152)	13.7 (41)	16				5680	72.6	59.5
158	166 (48.7)	60 (227)	10.0 (30)	24	3			8970	74.8	61.3
173	185 (54.2)	80 (303)	9.7 (29)	32				8520	74.8	61.3
178	186 (54.5)	80 (303)	14.5 (43)	32				7440	74.8	61.3
205	219 (64.2)	60 (227)	12.9 (39)	24	4			11680	76.2	62.5
248	248 (72.8)	80 (303)	12.5 (37)	32				11360	76.2	62.5
347	369 (108)	160 (606)	9.8 (29)	64	6			17040	78.4	64.3
356	372 (109)	160 (606)	14.6 (44)	64				14880	78.4	64.3
453	496 (145)	160 (606)	12.6 (38)	64	8			22720	79.9	65.5
498	505 (148)	240 (910)	12.4 (37)	96				19840	79.9	65.5

Standard data based on 95 °F (35 °C) EAT, 120 °F (48.9 °C) EFT, 40% E.G.  
 Capacity shown is drycooler THR at sea level.  
 Sound Pressure is dBA at 5ft (1.5m)

**Table 2.3 Vertiv™ Liebert® Drycooler Performance Data, 50Hz—Standard Models**

Standard Circuits Data						Fans Direct Drive				
Model Number *D**	Total Heat Rejection, kBtuh (kW) @ 25F ITD	Glycol Flow Rate, GPM (lpm)	Pressure Drop, Ft. H <sub>2</sub> O (kPa)	No. of Internal Circuits (Std.)	No. of Fans	Blade Diameter, in (cm)	Rated Motor hp	Air Flow (CFM)	Sound Power, LwA	Sound Pressure, dBA**
033	35 (10.3)	10 (38)	9.1 (27)	4	1	26 (66)	3/4	6000	825	69.1
069	60 (17.4)	20 (76)	8.9 (27)	8				5700	825	69.1
092	82 (23.9)	30 (114)	8.6 (26)	12				5500	81.7	68.3
109	95 (27.7)	40 (152)	8.1 (24)	16				5300	81.7	68.3
112	104 (30.3)	40 (152)	10.1 (30)	16				5100	81.7	68.3
139	119 (34.8)	40 (152)	7.1 (21)	16	2			11400	85.9	71.8
174	153 (44.5)	40 (152)	10.5 (31)	16				11100	85.9	71.8
197	175 (51.0)	40 (152)	13.9 (42)	16				10500	85.9	71.8
225	204 (59.4)	65 (246)	10.9 (33)	26				10100	85.9	71.8
260	230 (67.1)	60 (227)	10.1 (30)	24	3			16600	89.4	73.7
310	274 (80.0)	80 (303)	9.8 (29)	32				15800	89.4	73.7
350	312 (91.0)	80 (303)	14.6 (44)	32				14500	89.4	73.7
352	290 (84.5)	60 (227)	12.9 (39)	24	4			20700	91.0	75.7
419	347 (101)	80 (303)	12.7 (38)	32				19700	91.0	75.7
466	389 (114)	100 (379)	12.7 (38)	40				19000	91.0	75.7
491	416 (121)	120 (455)	12.8 (38)	48				18100	91.0	75.7
620	549 (160)	160 (606)	9.8 (29)	64	6			31600	92.4	76.7
650	577 (168)	130 (493)	15.2 (45)	52				30400	92.4	76.7
700	624 (182)	160 (606)	14.6 (44)	64				2900	92.4	76.7
790	697 (203)	160 (606)	12.7 (38)	64	8			39400	94.0	78.7
880	781 (228)	200 (758)	12.7 (38)	80		37900	94.0	78.7		
940	830 (242)	240 (910)	12.5 (37)	96		36200	94.0	78.7		

Standard data based on 95 °F (35 °C) EAT, 120 °F (48.9 °C) EFT, 40% E.G.  
 Capacity shown is drycooler THR at sea level.  
 Sound Pressure is dBA at 5ft (1.5m)

**Table 2.4 Vertiv™ Liebert® Drycooler Performance Data, 50Hz—Vertiv™ Liebert® Quiet-Line-Line Models**

Model Number *D**	Standard Circuits Data				Fans Direct Drive					
	Total Heat Rejection, kBtuh (kW) @ 25F ITD	Glycol Flow Rate, GPM (lpm)	Pressure Drop, Ft. H <sub>2</sub> O (kPa)	No. of Internal Circuits (Std.)	No. of Fans	Blade Diameter, in (cm)	Rated Motor hp	Air Flow (CFM)	Sound Power, LwA	Sound Pressure, dBA**
040	19 (5.6)	20 (76)	8.8 (26)	8	1	26 (66)	1/4	2600	65.6	53.2
057	45 (13.2)	30 (114)	8.6 (26)	12				2500	65.6	53.2
060	52 (15.3)	40 (152)	8.1 (24)	16				2400	65.6	53.2
080	65 (19.2)	40 (152)	7.0 (21)	16	2			5200	69.3	56.2
111	84 (24.7)	40 (152)	10.4 (31)	16				5000	69.3	56.2
121	96 (28.2)	40 (152)	13.7 (41)	16				4700	69.3	56.2
158	127 (37.1)	60 (227)	10.0 (30)	24	3			7500	71.5	58.0
173	151 (44.2)	80 (303)	9.7 (29)	32				7100	71.5	58.0
178	172 (50.3)	80 (303)	14.5 (43)	32				6200	71.5	58.0
205	160 (46.7)	60 (227)	12.9 (39)	24	4			9700	72.9	59.2
248	191 (55.9)	80 (303)	12.5 (37)	32				9500	72.9	59.2
347	302 (88)	160 (606)	9.8 (29)	64	6			14200	75.1	61.0
356	343 (101)	160 (606)	14.6 (44)	64				12400	75.1	61.0
453	383 (112)	160 (606)	12.6 (38)	64	8			18900	76.6	62.2
498	457 (134)	240 (910)	12.4 (37)	96				16500	76.6	62.2

Standard data based on 95 °F (35 °C) EAT, 120 °F (48.9 °C) EFT, 40% E.G.  
 Capacity shown is drycooler THR at sea level.  
 Sound Pressure is dBA at 5ft (1.5m)

## 3 Planning Guidelines

### 3.1 Site Considerations

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. The Vertiv™ Liebert® Drycoolers and pumps should be installed in a location offering maximum security and access for maintenance. Avoid ground level sites with public access and areas that are subject to heavy snow or ice accumulations and sites in the vicinity of steam, hot air or fume exhausts. Liebert® Drycoolers should be located no closer than 3 feet from a wall, obstruction or adjacent unit. There should be no obstructions over the unit. Liebert® Drycoolers must not be installed in a pit, where discharge air is likely to be recirculated through the drycooler or installed where objects restrict the air inlet free area.

The Liebert® Drycooler must be installed on a level surface to ensure proper glycol flow, venting and drainage. For roof installation, mount the Liebert® Drycooler on suitable curbs or other supports in accordance with local codes. To minimize sound and vibration transmission, mount steel supports across load-bearing walls.

Allow adequate space for pump packages, expansion/compression tanks, piping and additional field supplied devices. When mounting pump packages, mount on level surface or suitable curbs that will allow cooling ventilation air to enter from underneath the pump package frame and exit through the louvers.

### 3.2 Shipping Dimensions and Weights

**Table 3.1 Standard Vertiv™ Liebert® Drycooler Net Weights, Shipping Weights, Dimensions and Volume, Approximate**

Model	No. of Fans	Dry Weight lb (kg)	Domestic Packed				Export Packed			
			Weight	Dimension (LxWxH)		Volume	Weight	Dimension (LxWxH)		Volume
			lb. (kg)	in.	cm)	ft <sup>3</sup> (m <sup>3</sup> )	lb. (kg.)	in.	cm)	ft <sup>3</sup> (m <sup>3</sup> )
*D**033	1	355 (161)	510 (231)	62x36x63	(157x91x160)	81 (2.3)	617 (280)	63x37x64	(160x94x163)	86 (2.5)
*D**069		375 (170)	530 (240)				637 (289)			
*D**092		395 (179)	550 (249)				657 (298)			
*D**109		415 (188)	570 (259)				677 (307)			
*D**112		435 (197)	590 (268)				697 (316)			
*D**139	2	500 (227)	757 (343)	102x36x63	(259x91x160)	134 (3.8)	914 (415)	103x37x64	(262x94x163)	141 (4.0)
*D**174		540 (245)	797 (362)				954 (433)			
*D**197		580 (263)	837 (380)				994 (451)			
*D**225		620 (281)	877 (398)				1034 (469)			
*D**260	3	735 (333)	1104 (501)	142x36x63	(361x91x160)	186 (5.3)	1282 (582)	143x37x64	(363x94x163)	196 (5.6)
*D**310		795 (361)	1164 (528)				1342 (609)			
*D**350		855 (388)	1224 (555)				1402 (636)			
*D**352	4	940 (426)	1401 (635)	182x36x63	(462x91x160)	239 (6.7)	1658 (752)	183x37x64	(465x94x163)	251 (7.0)
*D**419		1020 (463)	1481 (672)				1738 (788)			
*D**466		1050 (476)	1511 (685)				1768 (802)			
*D**491		1100 (499)	1561 (708)				1818 (825)			

**Table 3.1 Standard Vertiv™ Liebert® Drycooler Net Weights, Shipping Weights, Dimensions and Volume, Approximate (continued)**

Model	No. of Fans	Dry Weight lb (kg)	Domestic Packed				Export Packed			
			Weight	Dimension (LxWxH)		Volume	Weight	Dimension (LxWxH)		Volume
			lb. (kg)	in.	cm)	ft <sup>3</sup> (m <sup>3</sup> )	lb. (kg.)	in.	cm)	ft <sup>3</sup> (m <sup>3</sup> )
*D**620	6	1780 (808)	2223 (1008)	142x36x94	(361x91x239)	278 (7.9)	2948 (1337)	143x37x95	(363x94x241)	291 (8.2)
*D**650		1830 (831)	2273 (1031)				2998 (1360)			
*D**700		1880 (854)	2323 (1054)				3048 (1383)			
*D**790	8	2250 (1022)	2815 (1277)	182x36x94	(462x91x239)	356 (10.0)	3769 (1710)	183x37x95	(465x94x241)	372 (10.5)
*D**880		2330 (1058)	2895 (1313)				3849 (1746)			
*D**940		2430 (1103)	2995 (1359)				3949 (1791)			

**Table 3.2 Vertiv™ Liebert® Quiet-Line Drycooler Net Weights, Shipping Weights, Dimensions and Volume, Approximate**

Model	No. of Fans	Dry Weight lb (kg)	Domestic Packed				Export Packed			
			Weight	Dimension (LxWxH)		Volume	Weight	Dimension (LxWxH)		Volume
			lb. (kg)	in.	cm)	ft <sup>3</sup> (m <sup>3</sup> )	lb. (kg.)	in.	cm)	ft <sup>3</sup> (m <sup>3</sup> )
*D**040	1	375 (170)	530 (240)	62x36x63	(157x91x160)	81 (2.3)	637 (289)	63x37x64	(160x94x163)	86 (2.5)
*D**057		395 (179)	550 (249)				657 (298)			
*D**060		415 (188)	570 (259)				677 (307)			
*D**080	2	500 (227)	757 (343)	102x36x63	(259x91x160)	134 (3.8)	914 (415)	103x37x64	(262x94x163)	141 (4.0)
*D**111		540 (245)	797 (362)				954 (433)			
*D**121		580 (263)	837 (380)				994 (451)			
*D**158	3	735 (333)	1104 (501)	142x36x63	(361x91x160)	186 (5.3)	1282 (582)	143x37x64	(363x94x163)	196 (5.6)
*D**173		795 (361)	1164 (528)				1342 (609)			
*D**178		855 (388)	1224 (555)				1402 (636)			
*D**205	4	940 (426)	1401 (635)	182x36x63	(462x91x160)	239 (6.7)	1658 (752)	183x37x64	(465x94x163)	251 (7.0)
*D**248		1020 (463)	1481 (672)				1738 (788)			
*D**347	6	1780 (808)	2223 (1008)	142x36x94	(361x91x239)	278 (7.9)	2948 (1337)	143x37x95	(363x94x241)	291 (8.2)
*D**356		1880 (854)	2323 (1054)				3048 (1383)			
*D**453	8	2250 (1022)	2815 (1277)	182x36x94	(462x91x239)	356 (10.0)	3769 (1710)	183x37x95	(465x94x241)	372 (10.5)
*D**498		2430 (1103)	2995 (1359)				3949 (1791)			



### 3.3 Planning Dimensions and Anchor Plans

The unit dimensions are described in the submittal documents included in the [Submittal Drawings](#) on page 41.

The following table lists the relevant documents by number and title.

**Table 3.3 Dimension Planning Drawings**

Document Number	Title
DPN000274	Cabinet Anchor Dimensional and General Data 1-4 Fan Models
DPN000280	Cabinet Anchor Dimensional and General Data 1-4 Fan Quiet-Line Models
DPN000721	Cabinet and Anchor Dimensional Data 6 and 8 Fan Heat Rejection Quiet-Line Models

### 3.4 Pump Packages

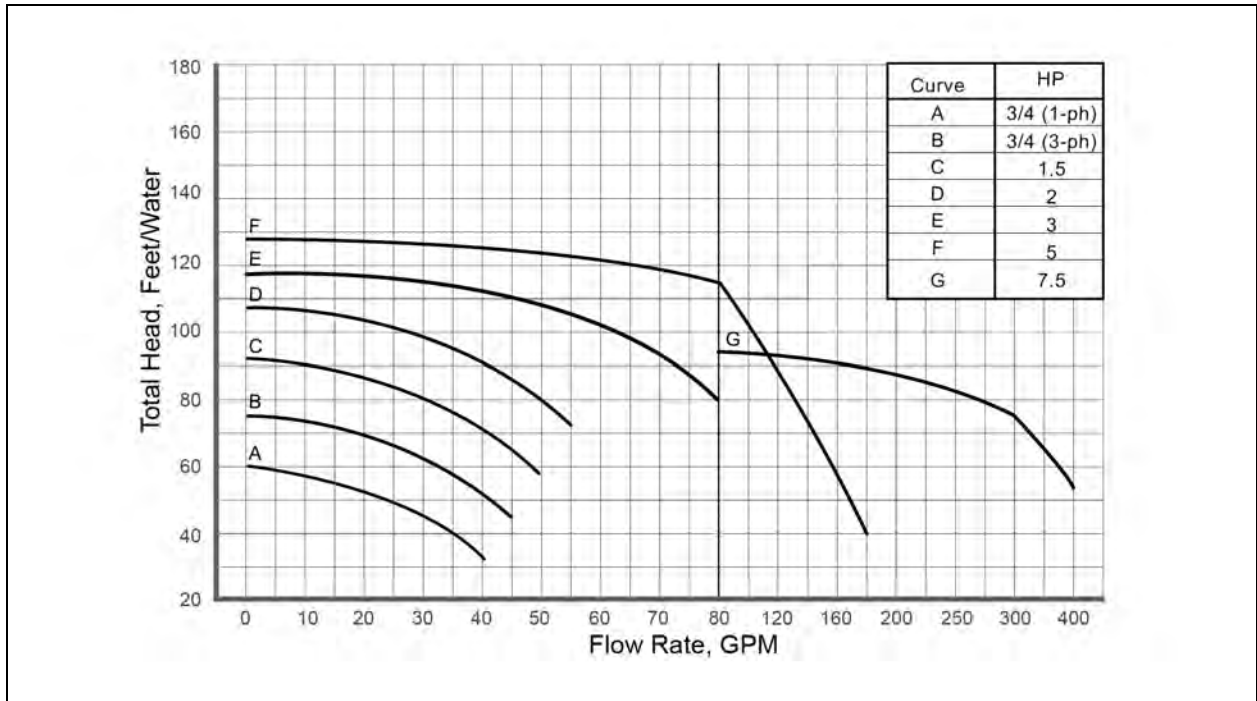
The planning dimensions, electrical power-supply requirements, piping connections, and electrical connections are described in the submittal documents included in the [Submittal Drawings](#) on page 41.

The following table lists the relevant documents by number and title.

**Table 3.4 Vertiv™ Liebert® Drycooler Pump Drawings**

Document Number	Title
DPN000278	Piping Locations and Dimension Data Single Pump Package.
DPN000328	Liebert® Drycooler Piping Connections and Dimensional Data Dual Pump Package
DPN000329	Liebert® Drycooler Electrical and Piping Connection Data Pump Package

Figure 3.1 Pump Curve, 60 Hz



**NOTE:** Higher-capacity pumps are available. Please contact your local sales rep for more information.

### 3.4.1 Expansion Tank

The expansion tank, included in a standard pump package, has an internal volume of 8.8 gal. (33 l) and a maximum pressure of 100 psi (690 kPa).

The tank is sized for a typical “open” system with a fluid volume of less than 75 gal. (280 l). When used in a “closed” system, volumes of up to 140 gal. (530 l) can be accommodated. We recommend use of a field-supplied safety-relief valve for systems “closed” to atmospheric venting. Other piping accessories for filling, venting, or adjusting the fluid in the system, are recommended, but not included.

The planning dimensions and general arrangement are described in the submittal documents included in the [Submittal Drawings](#) on page 41.

The following table lists the relevant documents by number and title.

**Table 3.5 Vertiv™ Liebert® Drycooler Pump and Tank Drawings**

Document Number	Title
DPN004183	Liebert® Drycooler General Arrangement Diagram and Dimensional Data Expansion Tank for Glycol/Liebert® GLYCOOL Systems

### 3.4.2 Compression Tank

The compression tank for glycol/Vertiv™ Liebert® GLYCOOL systems includes:

- Tank
- Airtrol fitting
- Sight glass with shut-off valves
- 50-psi relief valve
- Drain valve

Mounting brackets are not included. Maximum design pressure 125 psig.

The planning dimensions and general arrangement are described in the submittal documents included in the [Submittal Drawings](#) on page 41.

The following table lists the relevant documents by number and title.

**Table 3.6 Liebert® Drycooler Pump and Tank Drawings**

Document Number	Title
DPN003898	General Arrangement Diagram and Dimensional Data ASME Compression Tank Kits Glycol/Liebert® GLYCOOL Systems

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## 4 Piping

### 4.1 Piping Guidelines

Field-installed piping must be installed in accordance with local codes.

The pipe connection locations are described in the submittal documents included in the [Submittal Drawings](#) on page 41.

The following table lists the relevant documents by number and title.

**Table 4.1 Piping Connection Drawings**

Document Number	Title
DPN000275	Liebert® Drycooler Piping Connections
DPN000281	Liebert® Drycooler Piping Connections Liebert® Quiet-Line Model
DPN002429	Liebert® Drycooler Piping Connections 6 and 8 Fan Models
DPN002430	Liebert® Drycooler Piping Connections 6 and 8 Fan Liebert® Quiet-Line Models

### 4.2 Glycol/Inhibitor Solution

The percentage of glycol to water will be determined by the outdoor ambient in which the system is operating. Just as critical is the inhibitor used with the glycol.

Commercial ethylene glycol (Union Carbide Ucartherm, Dow Chemical Dowtherm SR-1, and Texaco E.G. Heat Transfer Fluid 100), when pure, is generally less corrosive to the metals than water. It will, however, assume the corrosivity of the water from which it is prepared and may become increasingly corrosive with use if not properly inhibited. Proper inhibitor maintenance must be performed to prevent corrosion of the glycol system. Consult glycol manufacturer for testing and maintenance of inhibitors.

**Automotive antifreeze is unacceptable and must not be used in any glycol fluid system.**

There are two basic concepts of corrosion inhibition: They are classified as corrosion inhibitors or environmental stabilizers. The corrosion inhibitors function by forming a surface barrier that protects the metals. Environmental stabilizers decrease corrosion by stabilizing or favorably altering the overall environment. An alkaline buffer, such as borax, is a simple example, since its prime purpose is to maintain an alkaline condition (pH above 7).

The quality of the water of dilution must be considered because water may contain corrosive elements which reduce the effectiveness of the inhibited formulation. Surface waters that are classified as soft and are low in chloride and sulfate ion content (less than 100 ppm each) should be employed.

## 4.3 Piping Connections

**Table 4.2 Vertiv™ Liebert® Drycooler Piping Connection Sizes (O.D. Cu), 1-4 Fan Standard Sound**

Liebert® Drycooler Model No.	Number of Coil Circuits	Inlet and Outlet Pipe Diameter (Inches)	Liebert® Drycooler Internal Volume (gal./liters)
-033	4*	1-3/8	1.2 (4.6)
-069	4, 8*	1-3/8	2.4 (9.2)
-092	6, 12*, 16	1-5/8	3.7 (13.9)
-109	8	1-3/8	4.9 (18.6)
-109	16*	2-1/8	4.9 (18.6)
-112	8	1-3/8	5.8 (22)
-112	16*, 26	2-1/8	5.8 (22)
-139	8, 16*	2-1/8	4.8 (18.2)
-174	8, 16*, 24	2-1/8	6.9 (26.2)
-197	8	1-3/8	9 (34)
-197	16*, 32	2-1/8	9 (34)
-225	15, 26*	2-1/8	11.1 (42.1)
-260	16, 24*	2-1/8	10 (37.8)
-310	16*, 32	2-1/8	13.1 (49.6)
-350	16, 32*	2-1/8	19.4 (73.3)
-350	48	2-5/8	19.4 (73.3)
-352	16, 24*	2-1/8	13.1 (49.6)
-419	16, 32*	2-1/8	17.4 (65.9)
-466	26	2-1/8	22 (65.9)
-466	40*	2-5/8	22 (65.9)
-491	16, 32	2-1/8	26.3 (99.6)
-491	48*	2-5/8	26.3 (99.6)

\*Standard circuiting

**Table 4.3 Vertiv™ Liebert® Drycooler Quiet-Line Models Piping Connection Sizes (O.D. Cu), 1 - 4 Fan**

Liebert® Drycooler Model No.	Number of Coil Circuits	Inlet and Outlet Pipe Diameter (Inches)	Liebert® Drycooler Internal Volume (gal./liters)
-040	4, 8*	1-1/8	2.4 (9.1)
-057	12*	1-5/8	3.7 (14)
-057	16	2-1/8	3.7 (14)
-060	8	1-3/8	4.9 (18.5)
-060	16*	2-1/8	4.9 (18.5)

**Table 4.3 Vertiv™ Liebert® Drycooler Quiet-Line Models Piping Connection Sizes (O.D. Cu), 1 - 4 Fan  
(continued)**

Liebert® Drycooler Model No.	Number of Coil Circuits	Inlet and Outlet Pipe Diameter (Inches)	Liebert® Drycooler Internal Volume (gal./liters)
-080	8, 16*	2-1/8	4.8 (18.2)
-111	16*, 24	2-1/8	6.9 (26.1)
-121	16*, 32	2-1/8	9 (34.1)
-158	16, 24*	2-1/8	10 (37.9)
-173	16, 32*	2-1/8	13.1 (49.6)
-178	16, 32*	2-1/8	19.4 (73.4)
-178	48	2-5/8	19.4 (73.4)
-205	16, 24*	2-1/8	13.1 (49.6)
-248	16, 32*	2-1/8	17.4 (65.9)
*Standard circuiting			

**Table 4.4 Liebert® Drycooler Piping Connections, 6 and 8 Fan Standard Sound**

Liebert® Drycooler Model No.	No. of Fans	No. of Internal Coils	No. of Inlets and Outlets	Inlet and Outlet Connection Sizes (IDS, Cu)
-620	6	32	2	2-1/8*
-620	6	65*	2	2-1/8*
-620	6	40	2	2-1/8*
-650	6	52*	2	2-1/8*
-650	6	80	4	2-1/8*
-700	6	32	2	2-1/8*
-700	6	64*	2	2-1/8*
-700	6	96	4	2-1/8*
-790	8	32	2	2-1/8*
-790	8	64*	2	2-1/8*
-880	8	52	2	2-1/8*
-880	8	80*	4	2-1/8*
-940	8	32	2	2-1/8*
-940	8	64	2	2-1/8*
-940	8	96*	4	2-1/8*
* Standard circuiting				

**Table 4.5 Vertiv™ Liebert® Drycooler Piping Connections, 6 and 8 Fan Vertiv™ Liebert® Quiet-Line Models**

Liebert® Drycooler Model No.	No. of Fans	No. of Internal Coils	No. of Inlets and Outlets	Inlet and Outlet Connection Sizes (IDS, Cu)
-347	6	32	2	2-1/8"
-347	6	64*	2	2-1/8"
-356	6	32	2	2-1/8"
-356	6	64*	2	2-1/8"
-356	6	96	2	2-1/8"
-453	8	32	2	2-1/8"
-453	8	64	2	2-1/8"
-498	8	32	2	2-1/8"
-498	8	64	2	2-1/8"
-498	8	96*	4	2-1/8"
*Standard circuiting				



## 5 Electrical Power Requirements

### 5.1 Low Voltage Electrical Data

Table 5.1 60Hz Electrical Values—Vertiv™ Liebert® Drycooler without Pump Controls Standard Models

No. of Fans	Model No.	Voltage	Phase	FLA	WSA	OPD
1	33, 69, 092, 109, 112	208/230	1	4.8	6	15
			3	3.5	4.4	15
		460	3	1.7	2.1	15
		575	3	1.4	1.8	15
2	139, 174, 197, 225	208/230	3	7.0	7.9	15
		460	3	3.4	3.8	15
		575	3	2.8	3.2	15
3	260, 310, 350	208/230	3	10.5	11.4	15
		460	3	5.1	5.5	15
		575	3	4.2	4.6	15
4	352, 419, 466, 491	208/230	3	14.0	14.9	20
		460	3	6.8	7.2	15
		575	3	5.6	6.0	15
6	620, 650, 700	208/230	3	21.0	21.9	25
		460	3	10.2	10.6	15
		575	3	8.4	8.8	15
8	790, 880, 940	208/230	3	28.0	28.9	35
		460	3	13.6	14.0	20
		575	3	11.2	11.6	15
Values are calculated per UL 1995. OPD values may be adjusted higher than calculations to compensate for maximum anticipated application temperatures.						

**Table 5.2 60Hz Electrical Values—Vertiv™ Liebert® Drycooler without Pump Controls Vertiv™ Liebert® Quiet-Line Models**

No. of Fans	Model No.	Voltage	Phase	FLA	WSA	OPD
1	40, 57, 60	208/230	3	1.8	2.3	15
		460	3	0.9	1.1	15
		575	3	0.7	0.9	15
2	80, 111, 121	208/230	3	3.6	4.1	15
		460	3	1.8	2.0	15
		575	3	1.4	1.6	15
3	158, 173, 178	208/230	3	5.4	5.9	15
		460	3	2.7	2.9	15
		575	3	2.1	2.3	15
4	205, 248	208/230	3	7.2	7.7	15
		460	3	3.6	3.8	15
		575	3	2.8	3.0	15
6	347, 356	208/230	3	10.8	11.3	15
		460	3	5.4	5.6	15
		575	3	4.2	4.4	15
8	453, 498	208/230	3	14.4	14.9	20
		460	3	7.2	7.4	15
		575	3	5.6	5.8	15
Values are calculated per UL 1995. OPD values may be adjusted higher than calculations to compensate for maximum anticipated application temperatures.						

**Table 5.3 50Hz Electrical Values—Vertiv™ Liebert® Drycoolers without Pump Controls**

# of Fans	Model #	Voltage	Phase	FLA
<b>Standard Models</b>				
1	33, 69, 92, 109, 112	200/230	1	4.0
		380/415	3	1.7
2	139, 174, 197, 225	380/415	3	3.4
3	260, 310, 350	380/415	3	5.1
4	352, 419, 466, 491	380/415	3	6.8
6	620, 650, 700	380/415	3	10.2
8	790, 880, 940	380/415	3	13.6
<b>Liebert® Quiet-Line Models</b>				
1	40, 57, 60	380/415	3	0.9
2	80, 111, 121	380/415	3	1.8
3	158, 173, 178	380/415	3	2.7
4	205, 248	380/415	3	3.6
6	347, 356	380/415	3	5.4
8	453, 498	380/415	3	7.2

**Table 5.4 60Hz Electrical Values—Standard Vertiv™ Liebert® Drycoolers with Integral Pump Controls, 1 to 4 Fans**

# of Fans:		1			2			3			4		
Model #:		33, 69, 092, 109, 112			139, 174, 197, 225			260, 310, 350			352, 419, 466, 491		
Pump hp	Ph	F	W	O	F	W	O	F	W	O	F	W	O
		L	S	P	L	S	P	L	S	P	L	S	P
		A	A	D	A	A	D	A	A	D	A	A	D
<b>208/230/60</b>													
0.75	1	12.4	14.3	20	—	—	—	—	—	—	—	—	—
0.75	3	7	7.9	15	10.5	11.4	15	14.0	14.9	20	17.5	18.4	25
1.5	3	10.1	11.8	15	13.6	15.3	20	17.1	18.8	25	20.6	22.3	25
2.0	3	11.0	12.9	20	14.5	16.4	20	18.0	19.9	25	21.5	23.4	30
3.0	3	14.1	16.8	25	17.6	20.3	30	21.1	23.8	30	24.6	27.3	35
5.0	3	20.2	24.4	40	23.7	27.9	40	27.2	31.4	45	30.7	34.9	50
7.5 *	3	27.7	33.8	50	31.2	37.3	60	34.7	40.8	60	38.2	44.3	60
<b>460/60</b>													
0.75	3	3.3	3.7	15	5.0	5.4	15	6.7	7.1	15	8.4	8.8	15
1.5	3	4.7	5.5	15	6.4	7.2	15	8.1	8.9	15	9.8	10.6	15
2.0	3	5.1	6.0	15	6.8	7.7	15	8.5	9.4	15	10.2	11.1	15
3.0	3	6.5	7.7	15	8.2	9.4	15	9.9	11.1	15	11.6	12.8	15
5.0	3	9.3	11.2	15	11.0	12.9	20	12.7	14.6	20	14.4	16.3	20
7.5	3	12.7	15.5	25	14.4	17.2	25	16.1	18.9	25	17.8	20.6	30
<b>575/60</b>													
0.75	3	2.7	3.1	15	4.1	4.5	15	5.5	5.9	15	6.9	7.3	15
1.5	3	3.8	4.4	15	5.2	5.8	15	6.6	7.2	15	8.0	8.6	15
2.0	3	4.1	4.8	15	5.5	6.2	15	6.9	7.6	15	8.3	9.0	15
3.0	3	5.3	6.3	15	6.7	7.7	15	8.1	9.1	15	9.5	10.5	15
5.0	3	7.5	9.0	15	8.9	10.4	15	10.3	11.8	15	11.7	13.2	15
7.5	3	10.4	12.7	20	11.8	14.1	20	13.2	15.5	20	14.6	16.9	25
Values are calculated per UL 1995. Pump FLA values used are based on NEC tables for motor horsepower. OPD values may be adjusted higher than calculations to compensate for maximum anticipated application temperatures.													
* May require electrical component(s) with higher capacity in the drycooler. Consult factory representatives for assistance before ordering.													

**Table 5.5 60Hz Electrical Values—Standard Vertiv™ Liebert® Drycoolers with Integral Pump Controls, 6 – 8 fans**

# of Fans:		6			8		
Model #:		620, 650, 700			790, 880, 940		
Pump hp	Ph	F L A	W S A	O P D	F L A	W S A	O P D
<b>208/230/60</b>							
0.75	1	—	—	—	—	—	—
0.75	3	24.5	25.4	30	31.5	32.4	40
1.5	3	27.6	29.3	35	34.6	36.3	40
2.0	3	28.5	30.4	35	35.5	37.4	45
3.0	3	31.6	34.3	40	38.6	41.3	50
5.0	3	37.7	41.9	50	44.7	48.9	60
7.5 *	3	45.2	51.3	70	52.2	58.3	80
<b>460/60</b>							
0.75	3	11.8	12.2	15	15.2	15.6	20
1.5	3	13.2	14.0	20	16.6	17.4	20
2.0	3	13.6	14.5	20	17.0	17.9	20
3.0	3	15.0	16.2	20	18.4	19.6	25
5.0	3	17.8	19.7	25	21.2	23.1	30
7.5	3	21.2	24.0	30	24.6	27.4	35
<b>575/60</b>							
0.75	3	9.7	10.1	15	12.5	12.9	15
1.5	3	10.8	11.4	15	13.6	14.2	20
2.0	3	11.1	11.8	15	13.9	14.6	20
3.0	3	12.3	13.3	15	15.1	16.1	20
5.0	3	14.5	16.0	20	17.3	18.8	20
7.5	3	17.4	19.7	25	20.2	22.5	30
Values are calculated per UL 1995. Pump FLA values used are based on NEC tables for motor horsepower. OPD values may be adjusted higher than calculations to compensate for maximum anticipated application temperatures.							
* May require electrical component(s) with higher capacity in the drycooler. Consult factory representatives for assistance before ordering.							

**Table 5.6 60 Hz Electrical Values—Vertiv™ Liebert® Quiet-Line Drycoolers with Integral Pump Controls**

# of Fans:		1			3			4			6			8		
Model #:		40, 57, 60			158, 173, 178			205, 248			356			453, 498		
Pump hp	Ph	F L A	W S A	O P D	F L A	W S A	O P D	F L A	W S A	O P D	F L A	W S A	O P D	F L A	W S A	O P D
<b>208/230/3/60</b>																
0.75	3	5.3	6.2	15	8.9	9.8	15	10.7	11.6	15	14.3	15.2	20	17.9	18.8	25
1.5	3	8.4	10.1	15	12.0	13.7	20	13.8	15.5	20	17.4	19.1	25	21.0	22.7	25
2.0	3	9.3	11.2	15	12.9	14.8	20	14.7	16.6	20	18.3	20.2	25	21.9	23.8	30
3.0	3	12.4	15.1	25	16.0	18.7	25	17.8	20.5	30	21.4	24.1	30	25.0	27.7	35
5.0	3	18.5	22.7	35	22.1	26.3	40	23.9	28.1	40	27.5	31.7	45	31.1	35.3	50
7.5 *	3	26.0	32.1	50	29.6	35.7	50	31.4	37.5	60	35.0	41.1	60	38.6	44.7	60
<b>460/3/60</b>																
0.75	3	2.5	2.9	15	4.3	4.7	15	5.2	5.6	15	7.0	7.4	15	8.8	9.2	15
1.5	3	3.9	4.7	15	5.7	6.5	15	6.6	7.4	15	8.4	9.2	15	10.2	11.0	15
2.0	3	4.3	5.2	15	6.1	7.0	15	7.0	7.9	15	8.8	9.7	15	10.6	11.5	15
3.0	3	5.7	6.9	15	7.5	8.7	15	8.4	9.6	15	10.2	11.4	15	12.0	13.2	15
5.0	3	8.5	10.4	15	10.3	12.2	15	11.2	13.1	20	13.0	14.9	20	14.8	16.7	20
7.5	3	11.9	14.7	25	13.7	16.5	25	14.6	17.4	25	16.4	19.2	30	18.2	21.0	30
<b>575/3/60</b>																
0.75	3	2.0	2.3	15	3.4	3.7	15	4.1	4.4	15	5.5	5.8	15	6.9	7.2	15
1.5	3	3.1	3.7	15	4.5	5.1	15	5.2	5.8	15	6.6	7.2	15	8.0	8.6	15
2.0	3	3.4	4.1	15	4.8	5.5	15	5.5	6.2	15	6.9	7.6	15	8.3	9.0	15
3.0	3	4.6	5.6	15	6.0	7.0	15	6.7	7.7	15	8.1	9.1	15	9.5	10.5	15
5.0	3	6.8	8.3	15	8.2	9.7	15	8.9	10.4	15	10.3	11.8	15	11.7	13.2	15
7.5	3	9.7	12.0	20	11.1	13.4	20	11.8	14.1	20	13.2	15.5	20	14.6	16.9	25
Values are calculated per UL 1995. Pump FLA values used are based on NEC tables for motor horsepower. OPD values may be adjusted higher than calculations to compensate for maximum anticipated application temperatures. * May require electrical component(s) with higher capacity in the drycooler. Consult factory representatives for assistance before ordering.																

**Table 5.7 60-Hz Pump FLA Values**

Pump hp	Phase	Input Power, Volts		
		208/230	460	575
3/4	3	3.5	1.6	1.3
1.5	3	6.6	3.0	2.4
2	3	7.5	3.4	2.7
3	3	10.6	4.8	3.9
5	3	16.7	7.6	6.1
7.5	3	24.2	11.0	9.0
10	3	30.8	14.0	11.0
15	3	46.2	21.0	17.0

Values based on NEC handbook values for three-phase motors.  
For larger pump horsepower, please consult your local sales representative.

## 5.2 Low Voltage Control Wiring

A control interlock between the Vertiv™ Liebert® Drycooler and the indoor cooling units is required. Field-supplied copper wire is required for connection between like-numbered terminals 70 and 71 on both units for remote On/Off control of the Liebert® Drycooler, synchronized with the indoor unit. Wiring must be sized and selected for insulation class per NEC and other local codes. See **Table 5.8** below, **Table 5.10** on the next page, **Table 5.10** on the next page, and **Table 5.11** on page 29 for recommended wire sizing for control wiring (24 VAC), runs up to 150 ft. (45.7m).

Contact the factory for assistance with longer wiring runs.

Refer to the electrical schematics supplied with the Liebert® Drycooler and indoor units for proper wiring of terminals 70 and 71.

**Table 5.8 Minimum Recommended Control Circuit Wire Size, AWG, 60 Hz Models/Liebert® Drycooler Types with Pump Controls**

Control Wire Run, ft (m)	Liebert® Drycooler Types with Pump Controls													
	DSF	DDF	DSO						DDO					
	No. of Fans												No. of Fans	
	1	1	1	2	3	4	6	8	1	2	3	4	6	8
0-25 (0-7.6)	16	16	16	16	16	16	16	16	16	16	16	16	16	16
25-50 (7.9-15.2)	16	16	16	16	16	16	16	14	16	14	14	14	14	14
51-75 (15.5-22.8)	16	16	16	16	16	16	14	14	14	14	14	12	12	12
76-100 (23.2-30.4)	16	16	16	16	16	12	12	12	12	12	12	12	12	12
101-125 (30.8-38.1)	16	14	16	16	14	14	12	12	12	10	10	10	10	10
126-150 (38.4-45.7)	16	14	16	14	14	14	10	12	10	10	10	10	10	10

Data is based on 16AWG minimum wire size, 0.4 amp per contactor, 1 to 1.5 volt maximum drop and 104°F (40°C) average ambient temperature.

**Table 5.9 Minimum Recommended Control Circuit Wire Size, AWG, 60 Hz Models/Vertiv™ Liebert® Drycooler Types without Pump Controls**

Control Wire Run, ft (m)	Liebert® Drycooler Types without Pump Controls							
	(D)DNL		(D)DNT					
	No. of Fans							
	1-4	6 & 8	1	2	3	4	6	8
0-25 (0-7.6)	16	16	16	16	16	16	16	16
25-50 (7.9-15.2)	16	16	16	16	16	16	16	14
51-75 (15.5-22.8)	16	16	16	16	16	16	16	14
76-100 (23.2-30.4)	16	16	16	16	16	16	16	12
101-125 (30.8-38.1)	16	14	16	16	16	16	14	12
126-150 (38.4-45.7)	16	16	16	16	16	14	14	12

Data is based on 16AWG minimum wire size, 0.4 amp per contactor, 1 to 1.5 volt maximum drop and 104°F (40°C) average ambient temperature.

**Table 5.10 Minimum Recommended Control Circuit Wire Size, mm2, 50 Hz Models/Liebert® Drycooler Types with Pump Controls**

Control Wire Run, ft (m)	Liebert® Drycooler Types with Pump Controls													
	DSF	DDF	DSO						DDO					
	No. of Fans													
	1	1	1	2	3	4	6	8	1	2	3	4	6	8
0-25 (0-7.6)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.5	1.0	1.5	1.5	1.5	1.5	1.5
25-50 (7.9-15.2)	1.0	1.0	1.0	1.0	1.0	1.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
51-75 (15.5-22.8)	1.0	1.5	1.0	1.5	2.5	2.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
76-100 (23.2-30.4)	1.0	2.5	1.0	1.5	2.5	2.5	4.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0
101-125 (30.8-38.1)	1.5	2.5	1.5	2.5	2.5	2.5	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
126-150 (38.4-45.7)	1.5	4.0	1.5	2.5	4.0	4.0	6.0	6.0	6.0	6.0	6.0	10.0	6.0	6.0

Data is based on 16AWG minimum wire size, 0.4 amp per contactor, 1 to 1.5 volt maximum drop and 104°F (40°C) average ambient temperature.



**Table 5.11 Minimum Recommended Control Circuit Wire Size, mm2, 50 Hz Models/Vertiv™ Liebert® Drycooler Types without Pump Controls**

Control Wire Run, ft (m)	Liebert® Drycooler Types without Pump Controls							
	(D)DNL		(D)DNT					
	No. of Fans							
	1-4	6 & 8	1	2	3	4	6	8
0-25 (0-7.6)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
25-50 (7.9-15.2)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.5
51-75 (15.5-22.8)	1.0	1.0	1.0	1.0	1.0	1.5	1.5	4.0
76-100 (23.2-30.4)	1.0	1.0	1.0	1.0	1.0	1.5	2.5	4.0
101-125 (30.8-38.1)	1.0	1.5	1.0	1.5	1.5	2.5	2.5	6.0
126-150 (38.4-45.7)	1.0	1.5	1.0	1.5	1.5	2.5	4.0	6.0

Data is based on minimum wire size, 0.4 amp per contactor, 1 to 1.5 volt maximum drop and 104°F (40°C) average ambient temperature.

## 5.3 Electrical Field Connections

Electrical service is required for all drycoolers at the location of the outdoor system. The power supply does not necessarily have to be the same voltage supply that is required by the indoor unit. The only electrical connection between the indoor unit and the drycooler is a two-wire control interlock, which is field-provided and field-connected.

Electrical service must conform to national and local electrical codes.

The electrical connections are described in the submittal documents included in the [Submittal Drawings](#).

The following tables list the relevant documents by number and title.

**Table 5.12 Electrical Field Connection Drawings**

Document Number	Title
DPN000277	Liebert® Drycooler Electrical Field Connections Fan Speed Control
DPN000276	Liebert® Drycooler Electrical Field Connections Fluid Temperature Control
DPN000282	Liebert® Drycooler Electrical Field Connections Fluid Temperature Control Liebert® Quiet-Line Models
DPN000703	Liebert® Drycooler Electrical Field Connections 6 and 8 Fan Models with DSO/DDO Pump Control
DPN000704	Electrical Field Connections 6 and 8 Fan Models with DDNL and DDNT Fan Control
DPN000702	Electrical Field Connections 6 and 8 Fan Heat Rejection Models with No Control
DPN000723	Electrical Field Connections 6 and 8 Fan Liebert® Quiet-Line Models with DSO/DDO Pump Control
DPN000724	Liebert® Drycooler Electrical Field Connections 6 and 8 Fan Liebert® Quiet-Line with DDNL and DDNT Control
DPN000722	Liebert® Drycooler Electrical Field Connections 6 and 8 Fan Liebert® Quiet-Line Heat Rejection Models with No Control

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## 6 Engineering Data, Calculations and Selection Procedure

An alternate, detailed procedure is available to calculate values and select the correct the Vertiv™ Liebert® Drycooler(s) for the application. This can be used to assist in selecting Liebert® Drycooler for applications for ambient conditions that are not standard. Use the following steps for 60Hz Liebert® Drycooler. Contact a sales representative for assistance with 50Hz Liebert® Drycooler.

- Determine the following items to begin this procedure:
  - Design outdoor ambient air temperature,  $T_{oa}$  (F or C)
  - Fluid Flow Rate,  $V_T$  (gpm or lpm)
  - % ethylene glycol concentration
  - Fluid temperatures at drycooler: Entering,  $T_{ef}$  and leaving  $T_{lf}$  (F or C), or
  - Total Required Heat Rejection,  $QR_T$  (kBtu/h or kW) and one of the fluid temperatures above
- Find the following values using these equations and known values above:
  - Initial Temperature Difference (ITD) of entering fluid to outdoor design air,  
 $ITD = T_{ef} - T_{oa}$
  - Total Required Heat Rejection,  $QR_T = V_T * c_v * (T_{ef} - T_{lf})$ , where  $c_v$  is found in **Table 6.1** below , or
  - Leaving fluid temperature,  $T_{lf} = T_{ef} - QR_T / (V_T * c_v)$  where  $c_v$  is found in Table 1.1 on page 1.
- Find the Average Fluid Temperature,  $T_{f,avg} = (T_{ef} + T_{lf}) / 2$
- Find Required Heat Rejection per ITD,  $QR_{ITD} = QR_T / (ITD * f)$ , where  $f$  is the capacity correction factor found in **Figure 6.1** on the next page .
- Using the columns titled Flow Rate Range and THR rate in **Table 6.3** on page 36 , choose the Liebert® Drycooler Model matching application fluid flow rate and meeting/exceeding the required Heat Rejection per ITD,  $QR_{ITD}$  from Step 4 .
- Find the Flow Rate per Circuit,  $V_C = V_T / \text{circuits}$  for the Liebert® Drycooler selected in **Table 6.3** on page 36 . This should be in the range of 1.5 to 3.0 gpm/circuit (5.7 to 11.4 lpm/circuit) for proper long-term performance.
- In **Table 6.3** on page 36 , for the selected Model Number, find the Actual Heat Rejection per ITD using the gpm/circuit from Step 6 . You may interpolate between columns as required. The Actual Heat Rejection per ITD should be equal to or greater than the Required Heat Rejection per ITD,  $QR_{ITD}$  (higher altitude application sites should use **Table 6.2** on the next page correction factors to reduce Actual Heat Rejection results). If it is less, repeat process from Step 5 using a larger model. If the Liebert® Drycooler solution is oversized, lower capacity Liebert® Drycooler are available and may be considered as an alternative solution.
- Calculate the Total Actual Heat Rejection, QA, for the Liebert® Drycooler, using the Actual Heat Rejection per ITD (Step 7 ) and actual ITD and correcting for % glycol and AFT (see **Figure 6.1** on the next page ).  
 $QA = QA_{ITD} * ITD * f$
- After selecting a model, look up the unit's Pressure Drop in **Table 6.2** on the next page . Multiply this pressure drop by the correction factor found in **Figure 6.2** on page 33 . If the resulting pressure drop is higher than your system design, go back to Step 5 and select a model with more circuits or consider multiple units. Contact your sales representative for additional design assistance.

**Table 6.1 Specific Heats for Aqueous Ethylene Glycol Solutions ( $c_v$ )**

% Ethylene Glycol	0%	10%	20%	30%	40%	50%
Btu/h/gpm°F	500	490	480	470	450	433
kW/lpm°C	251	245	241	236	226	217

**Table 6.2 Altitude Correction**

Altitude, ft. (m)	0 (0)	1000 (305)	2000 (610)	5000 (1525)	8000 (2440)	12000 (3660)	15000 (4575)
Correction Factor	1.000	0.979	0.960	0.900	0.841	0.762	0.703

**Figure 6.1 Capacity Correction Factor**

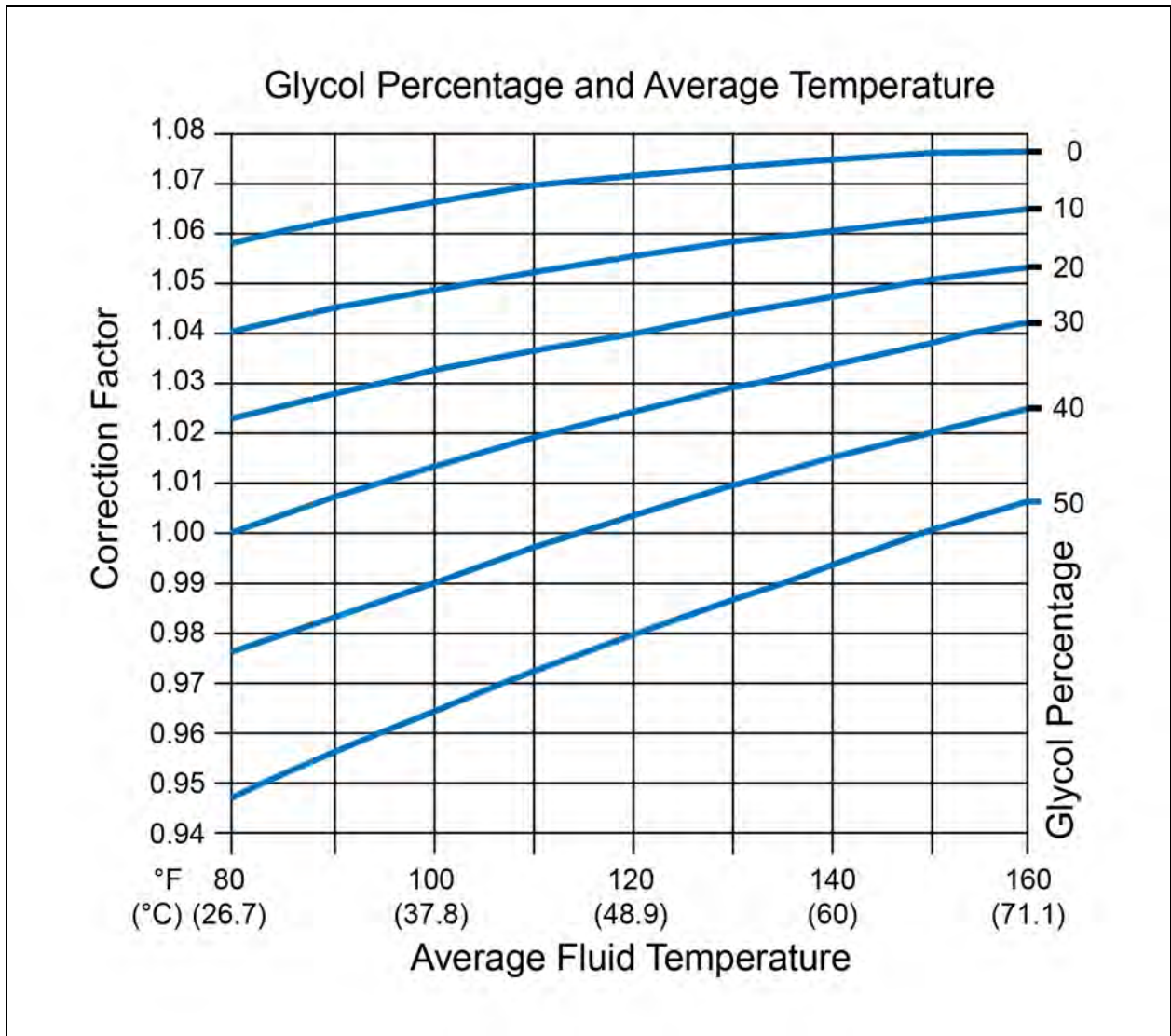


Figure 6.2 Pressure Drop Correction Factor

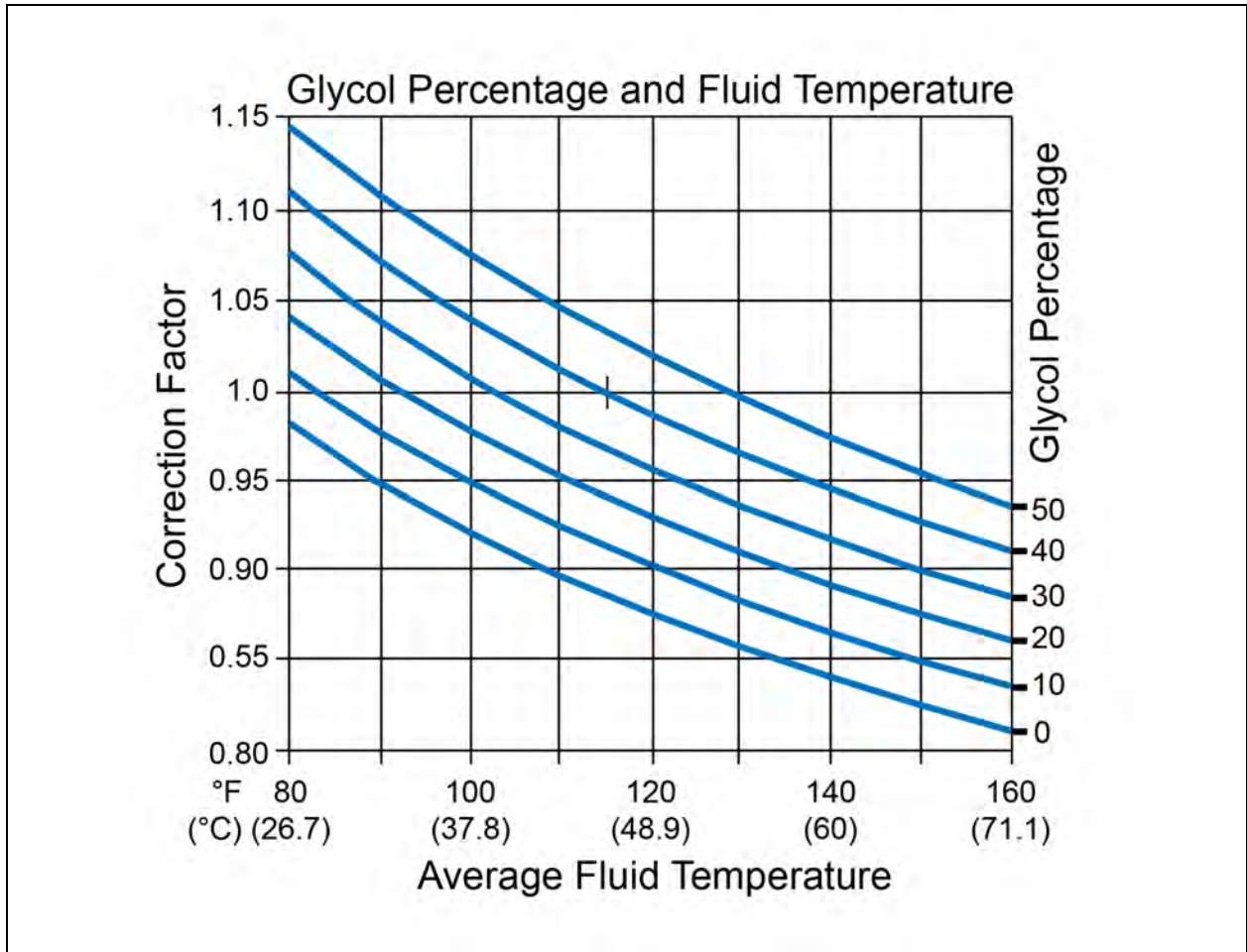


Table 6.3 Vertiv™ Liebert® Drycooler Data for Engineering Calculations/Selection, 60Hz

Model #	Flow Rate Range GPM	No. of Circuits	1.5 GPM/CIR (5.7 LPM/CIR)		2.0 GPM/CIR (7.6 LPM/CIR)		2.5 GPM/CIR (9.5 LPM/CIR)		3.0GPM/CIR (11.4 LPM/CIR)	
			THR Rate kBtuh/°F (kW/°C)	Pressure Drop Ft. of H2O (kPa)	THR Rate kBtuh/°F (kW/°C)	Pressure Drop Ft. of H2O (kPa)	THR Rate kBtuh/°F (kW/°C)	Pressure Drop Ft. of H2O (kPa)	THR Rate kBtuh/°F (kW/°C)	Pressure Drop Ft. of H2O (kPa)
<b>Standard Models</b>										
33	6-12	4*	1.3 (0.69)	4.2 (13)	1.5 (0.79)	6.2 (18)	1.6 (0.84)	9.2 (27)	1.7 (0.89)	12.8 (38)
69	6-12	4	1.8 (0.95)	7.3 (22)	2.1 (1.1)	11.4 (34)	2.3 (1.21)	17 (51)	2.4 (1.26)	23.6 (70)
	12-24	8*	2.3 (1.21)	3.9 (12)	2.5 (1.31)	6 (18)	2.7 (1.42)	8.9 (27)	2.8 (1.47)	12.4 (37)
92	9-18	6	2.7 (1.42)	7 (21)	3 (1.58)	11.7 (35)	3.3 (1.73)	16.7 (50)	3.5 (1.84)	23 (69)
	18-36	12*	3.2 (1.69)	3.7 (11)	3.5 (1.84)	6.2 (18)	3.7 (1.94)	8.7 (26)	3.8 (2)	12.1 (36)
	24-48	16	3.4 (1.79)	3 (9)	3.6 (1.89)	4.6 (14)	3.8 (2)	6.3 (19)	3.9 (2.05)	8.7 (26)
109	12-24	8	3.3 (1.74)	7.1 (21)	3.7 (1.94)	11.3 (34)	3.9 (2.05)	16.8 (50)	4.1 (2.15)	23.3 (69)
	24-48	16*	3.9 (2.06)	3.8 (11)	4.1 (2.15)	6 (18)	4.3 (2.26)	8.2 (24)	4.5 (2.36)	11.4 (34)

**Table 6.3 Vertiv™ Liebert® Drycooler Data for Engineering Calculations/Selection, 60Hz (continued)**

Model #	Flow Rate Range GPM	No. of Circuits	1.5 GPM/CIR (5.7 LPM/CIR)		2.0 GPM/CIR (7.6 LPM/CIR)		2.5 GPM/CIR (9.5 LPM/CIR)		3.0GPM/CIR (11.4 LPM/CIR)	
			THR Rate kBtuh/°F (kW/°C)	Pressure Drop Ft. of H2O (kPa)	THR Rate kBtuh/°F (kW/°C)	Pressure Drop Ft. of H2O (kPa)	THR Rate kBtuh/°F (kW/°C)	Pressure Drop Ft. of H2O (kPa)	THR Rate kBtuh/°F (kW/°C)	Pressure Drop Ft. of H2O (kPa)
112	12-24	8	3.6 (1.89)	12.2 (36)	4 (2.11)	19.5 (58)	4.3 (2.26)	29.2 (87)	4.51 (2.37)	40.6 (121)
	24-48	16*	4.2 (2.22)	4.6 (14)	4.5 (2.36)	7.3 (22)	4.7 (2.47)	10.2 (30)	4.8 (2.52)	14.1 (42)
	39-78	26	4.5 (2.37)	2.6 (8)	4.7 (2.47)	4.4 (13)	4.9 (2.57)	6.6 (20)	5 (2.63)	9.2 (27)
139	12-24	8	3.6 (1.9)	6.2 (18)	4.1 (2.15)	9.8 (29)	4.6 (2.42)	14.6 (44)	4.9 (2.57)	20.2 (60)
	24-48	16*	4.5 (2.37)	3.3 (10)	5 (2.63)	5.2 (15)	5.4 (2.84)	7.1 (21)	5.6 (2.94)	9.8 (29)
174	12-24	8	4.4 (2.31)	12.5 (37)	5.19 (2.72)	20.2 (60)	5.8 (3.04)	30.1 (90)	6.26 (3.29)	41.9 (125)
	24-48	16*	5.8 (3.06)	4.7 (14)	6.5 (3.41)	7.5 (22)	6.9 (3.62)	10.5 (31)	7.3 (3.83)	14.5 (43)
	36-72	24	6.4 (3.38)	3.2 (10)	7 (3.68)	4.9 (15)	7.4 (3.89)	7.3 (22)	7.6 (3.99)	10.1 (30)
197	12-24	8	4.7 (2.49)	16.5 (49)	5.7 (2.99)	26.8 (80)	6.43 (3.38)	40 (119)	—	—
	24-48	16*	6.5 (3.43)	6.2 (18)	7.3 (3.83)	9.9 (30)	7.9 (4.15)	14.1 (42)	8.2 (4.31)	19.4 (58)
	48-96	32	7.7 (4.06)	3 (9)	8.3 (4.36)	5 (15)	8.7 (4.57)	7 (21)	8.9 (4.67)	9.8 (29)
225	24-48	16	7.1 (3.75)	7.4 (22)	8 (4.2)	12 (36)	8.6 (4.52)	17.2 (51)	9 (4.73)	23.9 (71)
	39-78	26*	8.1 (4.27)	4.4 (13)	8.8 (4.62)	7.4 (22)	9.2 (4.83)	11 (33)	9.5 (4.99)	15.2 (45)
260	24-48	16	7.5 (3.96)	6.4 (19)	8.7 (4.57)	10.2 (30)	9.5 (4.99)	14.7 (44)	10.1 (5.3)	20.3 (60)
	36-72	24*	9.7 (5.12)	4.4 (13)	9.7 (5.09)	6.8 (20)	10.4 (5.46)	10.4 (31)	10.9 (5.72)	14 (42)
310	24-48	16	8.3 (4.38)	8.4 (25)	9.7 (5.09)	13.5 (40)	10.7 (5.62)	19.5 (58)	11.4 (5.99)	26.9 (80)
	48-96	32*	10.7 (5.64)	4.1 (12)	11.7 (6.14)	6.9 (21)	12.4 (6.51)	9.8 (29)	12.9 (6.77)	13.6 (41)
350	24-48	16	9.2 (4.85)	12.2 (36)	10.9 (5.72)	20.9 (62)	12.1 (6.35)	29.1 (87)	12.9 (6.77)	40.2 (120)
	48-96	32*	12.3 (6.49)	6 (18)	13.4 (7.04)	10.1 (30)	14.1 (7.4)	14.6 (44)	14.6 (7.67)	20.2 (60)
	72-144	48	13.4 (7.07)	4.2 (13)	14.2 (7.46)	6.7 (20)	14.8 (7.77)	10 (30)	15.1 (7.93)	13.5 (40)
352	24-48	16	8.8 (4.64)	8.1 (24)	10.4 (5.46)	13.1 (39)	11.6 (6.09)	18.9 (56)	12.5 (6.56)	26.2 (78)
	36-72	24*	10.6 (5.59)	5.5 (16)	12.1 (6.35)	8.7 (26)	13.1 (6.88)	12.9 (38)	13.9 (7.3)	17.9 (53)
419	24-48	16	9.5 (5.01)	10.6 (32)	11.4 (5.99)	17.3 (52)	12.9 (6.77)	25.1 (75)	14 (7.35)	36.7 (109)
	48-96	32*	13.2 (6.96)	5.2 (15)	14.7 (7.72)	8.8 (26)	15.7 (8.24)	12.7 (38)	16.5 (8.66)	17.5 (52)
466	39-78	26	13.1 (6.91)	7.9 (24)	15 (7.88)	13.2 (39)	16.2 (8.51)	19.6 (58)	17.1 (8.98)	27.1 (81)
	60-120	40*	15.2 (8.02)	5.3 (16)	16.7 (8.77)	8.6 (26)	17.6 (9.24)	12.7 (38)	18.3 (9.61)	17.6 (52)
491	24-48	16	10.1 (5.33)	15.6 (46)	12.5 (6.56)	25.6 (76)	—	—	—	—
	48-96	32	14.9 (7.86)	7.7 (23)	16.6 (8.72)	12.9 (38)	17.7 (9.29)	18.9 (56)	18.4 (9.66)	26.1 (78)
	72-144	48*	16.7 (8.81)	5.3 (16)	18 (9.45)	8.6 (26)	18.8 (9.87)	12.8 (38)	19.3 (10.13)	17.4 (52)
620	48-96	32	16.7 (8.81)	8 (24)	19.4 (10.19)	13.3 (40)	21.4 (11.24)	19.4 (58)	22.8 (11.97)	26.9 (80)
	96-192	64*	21.4 (11.29)	4.1 (12)	23.5 (12.34)	6.8 (20)	24.8 (13.02)	9.8 (29)	25.8 (13.55)	13.6 (41)
650	60-120	40	19.9 (10.5)	8 (24)	22.7 (11.92)	13.1 (39)	24.6 (12.92)	19.5 (58)	26 (13.65)	27 (80)
	78-156	52*	22 (11.61)	6.3 (19)	24.4 (12.81)	10.2 (30)	26.1 (13.7)	15.2 (45)	27.2 (14.28)	20.6 (61)
	120-240	80	24.6 (12.98)	4.1 (12)	26.5 (13.91)	6.7 (20)	27.8 (14.6)	9.9 (30)	28.7 (15.07)	13.4 (40)

**Table 6.3 Vertiv™ Liebert® Drycooler Data for Engineering Calculations/Selection, 60Hz (continued)**

Model #	Flow Rate Range GPM	No. of Circuits	1.5 GPM/CIR (5.7 LPM/CIR)		2.0 GPM/CIR (7.6 LPM/CIR)		2.5 GPM/CIR (9.5 LPM/CIR)		3.0GPM/CIR (11.4 LPM/CIR)	
			THR Rate kBtuh/°F (kW/°C)	Pressure Drop Ft. of H2O (kPa)	THR Rate kBtuh/°F (kW/°C)	Pressure Drop Ft. of H2O (kPa)	THR Rate kBtuh/°F (kW/°C)	Pressure Drop Ft. of H2O (kPa)	THR Rate kBtuh/°F (kW/°C)	Pressure Drop Ft. of H2O (kPa)
700	48-96	32	18.5 (9.76)	11.8 (35)	21.8 (11.45)	19.8 (59)	24.1 (12.65)	29 (86)	—	—
	96-192	64*	24.6 (12.98)	6 (18)	26.8 (14.07)	10 (30)	28.2 (14.81)	14.6 (44)	29.2 (15.33)	20.2 (60)
	144-288	96	26.7 (14.08)	4 (12)	28.5 (14.96)	6.7 (20)	29.5 (15.49)	9.8 (29)	30.2 (15.86)	13.5 (40)
790	48-96	32	18.9 (9.97)	10.2 (30)	22.8 (11.97)	17.1 (51)	25.7 (13.49)	25 (75)	—	—
	96-192	64*	26.4 (13.93)	5.2 (15)	29.4 (15.44)	8.7 (26)	31.5 (16.54)	12.6 (38)	33 (17.33)	17.5 (52)
880	78-156	52	26.2 (13.82)	8.1 (24)	29.9 (15.7)	13.1 (39)	32.4 (17.01)	19.5 (58)	34.2 (17.96)	26.6 (79)
	120-240	80*	30.4 (16.04)	5.2 (15)	33.4 (17.54)	8.5 (25)	35.3 (18.53)	12.7 (38)	36.6 (19.22)	17.3 (52)
940	48-96	32	20.2 (10.66)	15.3 (46)	25 (13.13)	25.4 (76)	—	—	—	—
	96-192	64	29.8 (15.72)	7.7 (23)	33.2 (17.43)	12.9 (38)	35.4 (18.59)	18.8 (56)	36.8 (19.32)	26 (77)
	144-288	96*	33.4 (17.62)	5.1 (15)	35.9 (18.85)	8.6 (26)	37.5 (19.69)	12.6 (38)	38.6 (20.27)	17.4 (52)
<b>Liebert® Quiet-Line Models</b>										
40	6-12	4	1.4 (0.74)	7.4 (22)	1.5 (0.79)	11.4 (34)	1.6 (0.84)	17 (51)	1.7 (0.89)	23.5 (70)
	12-24	8*	1.6 (0.84)	3.9 (12)	1.7 (0.89)	5.9 (18)	1.8 (0.95)	8.9 (27)	1.8 (0.95)	12.3 (37)
57	18-36	12*	2.1 (1.11)	3.6 (11)	2.2 (1.16)	6.1 (18)	2.3 (1.21)	8.6 (26)	2.3 (1.21)	11.9 (35)
	24-48	16	2.2 (1.16)	3 (9)	2.3 (1.21)	4.6 (14)	2.3 (1.21)	6.2 (18)	2.4 (1.26)	8.6 (26)
60	12-24	8	2.2 (1.16)	7.1 (21)	2.3 (1.21)	11.3 (34)	2.4 (1.26)	16.6 (49)	2.5 (1.31)	23 (69)
	24-48	16*	2.4 (1.27)	3.8 (11)	2.5 (1.31)	5.9 (18)	2.5 (1.31)	8.1 (24)	2.5 (1.31)	11.3 (34)
80	12-24	8	2.7 (1.42)	6.2 (18)	3 (1.58)	9.8 (29)	3.2 (1.68)	14.5 (43)	3.3 (1.73)	20.1 (60)
	24-48	16*	3.2 (1.69)	3.3 (10)	3.4 (1.79)	5.1 (15)	3.6 (1.89)	7 (21)	3.7 (1.94)	9.7 (29)
111	24-48	16*	4.4 (2.32)	4.7 (14)	4.3 (2.26)	7.4 (22)	4.4 (2.31)	10.4 (31)	4.5 (2.36)	14.3 (43)
	36-72	24	4.2 (2.22)	3.2 (10)	4.4 (2.31)	4.8 (14)	4.6 (2.42)	7.2 (21)	4.6 (2.42)	10 (30)
121	24-48	16*	4.4 (2.32)	6.1 (18)	4.7 (2.47)	9.7 (29)	4.8 (2.52)	13.7 (41)	4.9 (2.57)	18.9 (56)
	48-96	32	4.8 (2.53)	2.9 (9)	4.9 (2.57)	4.9 (15)	5 (2.63)	7 (21)	5.1 (2.68)	9.6 (29)
158	24-48	16	5.6 (2.95)	6.4 (19)	6 (3.15)	10.3 (31)	6.3 (3.31)	14.7 (44)	6.6 (3.47)	20.3 (60)
	36-72	24*	6 (3.17)	4.3 (13)	6.4 (3.36)	6.7 (20)	6.6 (3.47)	10 (30)	6.8 (3.57)	13.8 (41)
173	24-48	16	6.1 (3.22)	8.4 (25)	6.6 (3.47)	13.5 (40)	6.9 (3.62)	19.5 (58)	7.1 (3.73)	26.9 (80)
	48-96	32*	6.9 (3.64)	4.1 (12)	7.2 (3.78)	6.8 (20)	7.4 (3.89)	9.7 (29)	7.5 (3.94)	13.5 (40)
178	24-48	16	6.5 (3.43)	12.3 (37)	6.9 (3.62)	20 (60)	7.1 (3.73)	29.1 (87)	7.3 (3.83)	40.1 (119)
	48-96	32*	7.1 (3.75)	6 (18)	7.3 (3.83)	10 (30)	7.4 (3.89)	14.5 (43)	7.5 (3.94)	20 (60)
	72-144	48	7.3 (3.85)	4.1 (12)	7.4 (3.89)	6.6 (20)	7.5 (3.94)	9.9 (30)	7.6 (3.99)	13.3 (40)
205	24-48	16	6.9 (3.64)	8.2 (24)	7.7 (4.04)	13.2 (39)	8.2 (4.31)	18.9 (56)	8.6 (4.52)	26.2 (78)
	36-72	24*	7.8 (4.11)	5.5 (16)	8.4 (4.41)	8.7 (26)	8.8 (4.62)	12.9 (38)	9 (4.73)	17.6 (52)
248	24-48	16	7.6 (4.01)	10.7 (32)	8.5 (4.46)	17.4 (52)	9.1 (4.78)	25.2 (75)	9.4 (4.94)	34.8 (104)
	48-96	32*	9.1 (4.8)	5.2 (15)	9.6 (5.04)	8.7 (26)	9.9 (5.2)	12.5 (37)	10.1 (5.3)	17.3 (52)

**Table 6.3 Vertiv™ Liebert® Drycooler Data for Engineering Calculations/Selection, 60Hz (continued)**

Model #	Flow Rate Range GPM	No. of Circuits	1.5 GPM/CIR (5.7 LPM/CIR)		2.0 GPM/CIR (7.6 LPM/CIR)		2.5 GPM/CIR (9.5 LPM/CIR)		3.0GPM/CIR (11.4 LPM/CIR)	
			THR Rate kBtuh/°F (kW/°C)	Pressure Drop Ft. of H2O (kPa)	THR Rate kBtuh/°F (kW/°C)	Pressure Drop Ft. of H2O (kPa)	THR Rate kBtuh/°F (kW/°C)	Pressure Drop Ft. of H2O (kPa)	THR Rate kBtuh/°F (kW/°C)	Pressure Drop Ft. of H2O (kPa)
347	48-96	32	12.2 (6.44)	8 (24)	13.2 (6.93)	13.3 (40)	13.9 (7.3)	19.4 (58)	14.3 (7.51)	26.8 (80)
	96-192	64*	13.8 (7.28)	4.1 (12)	14.4 (7.56)	6.7 (20)	14.8 (7.77)	9.7 (29)	15 (7.88)	13.4 (40)
356	48-96	32	12.9 (6.81)	11.9 (35)	13.8 (7.25)	19.8 (59)	14.3 (7.51)	29 (86)	14.5 (7.61)	40 (119)
	96-192	64*	14.2 (7.49)	6 (18)	14.7 (7.72)	9.9 (30)	14.9 (7.82)	14.4 (43)	15 (7.88)	20 (60)
	144-288	96	14.6 (7.7)	4 (12)	14.9 (7.82)	6.6 (20)	15 (7.88)	9.6 (29)	15.2 (7.98)	13.3 (40)
453	48-96	32	15.2 (8.02)	10.3 (31)	17 (8.93)	17.2 (51)	18.1 (9.5)	25.1 (75)	18.9 (9.92)	34.7 (103)
	96-192	64*	18.2 (9.6)	5.2 (15)	19.2 (10.08)	8.7 (26)	19.9 (10.45)	12.5 (37)	20.3 (10.66)	17.3 (52)
498	48-96	32	16.1 (8.49)	15.4 (46)	17.8 (9.35)	25.6 (76)	18.8 (9.87)	37.6 (112)	19.2 (10.08)	51.8 (154)
	96-192	64	18.8 (9.92)	7.7 (23)	19.5 (10.24)	12.8 (38)	19.9 (10.45)	18.6 (55)	20.1 (10.55)	25.7 (77)
	144-288	96*	19.5 (10.29)	5.1 (15)	20 (10.5)	8.5 (25)	20.2 (10.61)	12.4 (37)	20.4 (10.71)	17.2 (51)

\* Denotes standard circuiting

THR Rate data is expressed in kBtuh/°F ITD (kW/°C ITD) and is based on 40% EG solution at 115°F (46.1°C) average solution temperature.



# Appendices

## Appendix A: Technical Support and Contacts

### A.1 Technical Support/Service in the United States

Vertiv Group Corporation

24x7 dispatch of technicians for all products.

1-800-543-2378

Liebert® Thermal Management Products

1-800-543-2378

Liebert® Channel Products

1-800-222-5877

Liebert® AC and DC Power Products

1-800-543-2378

### A.2 Locations

#### United States

Vertiv Headquarters

505 N. Cleveland Ave.

Westerville, OH, 43082, USA

#### Europe

Via Leonardo Da Vinci 8 Zona Industriale Tognana

35028 Piove Di Sacco (PD) Italy

#### Asia

7/F, Dah Sing Financial Centre

3108 Gloucester Road

Wanchai, Hong Kong

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## **Appendix B: Guide Specifications**

The following are the guide specifications for the Vertiv™ Liebert® Drycooler.

# Vertiv™ Liebert® Air-cooled, Direct-drive Drycooler 50 Hz and 60 Hz Guide Specifications

## 1.0 GENERAL

### 1.1 Summary

These specifications describe requirements for a Liebert® Air-cooled drycooler for a Liebert Thermal Management system. The drycooler shall be designed to reject waste heat to outdoor air and to control glycol temperature as pumped glycol rates and 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 drycooler model number shall be: \_\_\_\_\_.

### 1.2 Design Requirements

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

The drycooler shall have a total heat rejection capacity of \_\_\_\_ kBtuh (kW) rated at an outdoor ambient of \_\_\_\_ °F (°C), an entering glycol temperature of \_\_\_\_ °F (°C) and a glycol flow rate of \_\_\_\_ GPM (LPM).

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; and 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 Drycoolers

The drycooler shall consist of drycooler coil(s), housing, propeller fan(s) direct driven by individual fan motor(s), electrical controls and mounting legs. The Vertiv™ Liebert® Air-cooled drycooler shall provide glycol temperature 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.

### 2.2 Drycooler Coil

The Liebert manufactured coil shall be constructed of copper tubes in a staggered tube pattern. Tubes shall be expanded into continuous, corrugated aluminum fins. The fins shall 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 split flow into multiple coil circuits, combined to yield a drycooler with \_\_\_\_\_ internal circuits. The supply and return lines shall be (spun shut [1-4 fan models]), (brazed with a cap [6 or 8-fan models]) and shall include a factory-installed Schrader valve. Coils shall be factory leak-tested at a minimum of 300 psig (2068kPag), dehydrated, then filled and sealed with an inert gas holding charge for shipment. Field relief of the Schrader valve shall indicate a leak-free coil.

#### 2.2.1 Housing

The drycooler 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, shall be galvanized steel for strength and corrosion resistance. Aluminum legs shall be provided to mount unit for vertical air discharge and shall have rigging holes for hoisting the unit into position. An electrical panel shall be inside an integral NEMA 3R weatherproof section of the housing. The electrical panel shall provide at least 5,000A SCCR.

#### 2.2.2 Propeller Fan

The propeller fan shall have aluminum blades secured to a corrosion protected steel hub. Fans shall be se-cured to the fan motor shaft by means of a 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-mesh steel wire with corrosion-resistant polyester paint finish that shall be rated to pass a 1000-hour salt spray test.

#### 2.2.3 Fan Motor

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

#### 2.2.4 Electrical Control

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 drycooler operation whenever indoor unit compressors are active. Only supply wiring, indoor unit interlock wiring and high voltage wiring to pumps when controlled by the drycooler shall be required at drycooler installation.

## 2.3 Specific Features by Drycooler Type

### 2.3.1 Fan Speed Control (DSF/DDF) Drycooler (1 Fan) with Integral Pump Control

The DSF/DDF drycooler shall have a fan speed controller that senses the leaving glycol temperature and varying the speed of an FSC duty motor in direct proportion to the heat rejection needs of the system. Fan speed controller shall be factory set to range of 70 to 100°F (21 to 38°C) for glycol-cooled applications. The fan speed control shall be field adjustable to a range of 30 to 60°F (-1 to 16°C) for free cooling applications. The motor shall be single-phase and include built-in overload protection. The motor shall have an ODP enclosure and a full speed of 1100rpm @ 60Hz (920rpm @ 50Hz). The DSF/DDF drycooler shall control operation of glycol pump(s) powered from the electrical panel. The Vertiv™ Liebert® Air cooled drycooler shall have a \_\_\_\_ volt, 1 ph, \_\_\_\_ Hz power supply.

### 2.3.2 Fan Cycling Control (DSO/DDO) Drycooler with Integral Pump Control (All Fan Quantities)

The DSO/DDO drycooler shall sense the leaving glycol temperature and cycle fixed speed fans to maintain glycol temperatures. Aquastats shall have field adjustable set-points. 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 DSO/DDO drycooler shall control operation of glycol pump(s) powered from the electrical panel. The Liebert® Air cooled drycooler shall have a \_\_\_\_ volt, 3 ph, \_\_\_\_ Hz power supply

### 2.3.3 Fan Cycling Control DDNT Drycooler (All Fan Quantities)

The DDNT drycooler shall sense the leaving glycol temperature and cycle fixed-speed fans to maintain glycol temperatures. Aquastats shall have field adjustable setpoints. 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 1140 rpm @ 60Hz (950 rpm @ 50Hz). The Liebert® Air-cooled drycooler shall have a \_\_\_\_ volt, 3 ph, \_\_\_\_ Hz power supply.

### 2.3.4 Main Fan Control DDNL Drycooler (All Fan Quantities)

The DDNL drycooler shall control fixed-speed fans when an external contact closure completes the internal 24VAC circuit. 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 1140 rpm @ 60Hz (950 rpm @ 50Hz). The Liebert® Air-cooled drycooler shall have a \_\_\_\_ volt, 3 ph, \_\_\_\_ Hz power supply.

### 2.3.5 No Fan Control DDNC Drycooler (All Fan Quantities)

The DDNC drycooler shall activate all fixed-speed fans when supply power is applied to the drycooler. 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 1140 rpm @ 60Hz (950 rpm @ 50Hz). The Liebert® Air-cooled drycooler shall have a \_\_\_\_ volt, 3 ph, \_\_\_\_ Hz power supply.

### 2.3.6 Vertiv™ Liebert® Quiet-Line Drycooler (All Fan Quantities)

Liebert® Quiet-Line drycoolers shall be available for DSO, DDO, DDNT, DDNL, and DDNC control types. The fixed-speed fan motor(s) shall have a TEAO enclosure, provide individual overload protection and have a full speed of 570rpm @ 60Hz (475rpm @ 50Hz) for quiet operation.

### 2.3.7 Pump Controls

The control for pump(s) up to 7.5hp shall be incorporated into the drycooler electrical panel and shall be available on all Fan Speed and Fan Cycling Control drycoolers. The pump fuses, overload heaters and flow switch (dual pump control models) for the drycooler electrical panel shall be included with the Liebert pump packages or shall be field-supplied for field-supplied pumps.

The dual pump control option shall provide controls for primary and standby pump operation. A flow switch shall be field installed into glycol piping and wired into the drycooler electrical panel. A loss of glycol flow shall be sensed by the flow switch and the pump controls shall energize the standby pump and de-energize the primary pump. An internal switch shall allow manual selection of the lead/lag pump for the balance of run time.

## **2.4 Ancillary Items**

An expansion tank shall be provided for expansion and contraction of the glycol fluid due to temperature change in the closed system. The tank and air vents shall be field installed at the system's highest elevation to allow venting of trapped air. A fluid pressure relief valve shall be provided for system safety. The system shall include (tank-steel [expansion, compression, diaphragm, bladder], air separator, air vent, fluid pressure relief valve, pressure gauges, flow switches, tempering valves, [primary, primary, and standby] pumps, supply and return piping).

## 3.0 EXECUTION

### 3.1 Installation of Air Conditioning Unit

#### 3.1.1 General

The air conditioning unit shall be installed in accordance with the 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 a copy of the manufacturer's electrical connection diagram submittal to the 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 a copy of manufacturer's piping connection diagram submittal to the 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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## Appendix C: Submittal Drawings

**Table C.1 Submittal Drawing Contents**

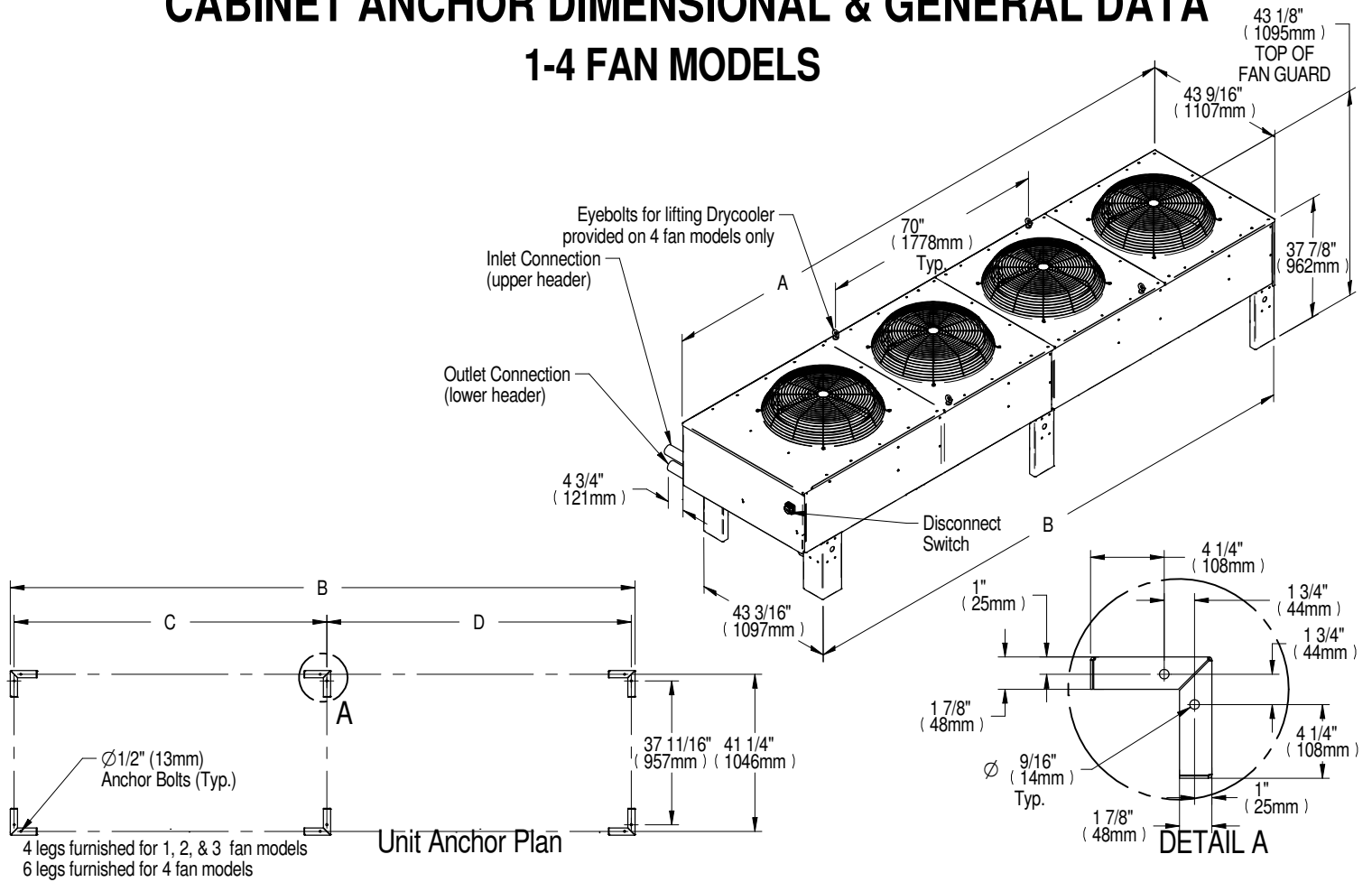
Document Number	Title
<b>Liebert® Drycooler Dimensions</b>	
DPN000274	Cabinet Anchor Dimensional and General Data 1-4 Fan Models
DPN000280	Cabinet Anchor Dimensional and General Data 1-4 Fan Quiet-Line Models
DPN000721	Cabinet and Anchor Data Dimension Data 6 and 8 Fan Heat Rejection Quiet-Line Models
<b>Liebert® Drycooler Piping Schematics (General Arrangement)</b>	
DPN000895	Piping Schematic Water/Glycol 77kW—105kW Semi-Hermetic Compressor Models
DPN000896	Piping Schematic Water/Glycol Scroll Compressor Models
DPN001430	Piping Schematic Water/Glycol Digital Scroll Compressor Models
DPN001432	Piping Schematic Liebert® GLYCOOL Digital Scroll Compressor Models
DPN000897	Piping Schematic Liebert® GLYCOOL 77kW—105kW Semi-Hermetic Compressor Models
DPN000898	Piping Schematic Liebert® GLYCOOL Scroll Compressor Models
DPN002931	Piping Schematic Water/Glycol Models
DPN002932	Piping Schematic Liebert® GLYCOOL Models
DPN003822	Piping Schematic Multiple Liebert® Drycoolers and Cooling Units on Common Glycol Loop
<b>Liebert® Drycooler Piping Connections</b>	
DPN000275	Liebert® Drycooler Piping Connections
DPN000281	Liebert® Drycooler Piping Connections Liebert® Quiet-Line Models
DPN002429	Liebert® Drycooler Piping Connections 6 and 8 Fan Models
DPN002430	Liebert® Drycooler Piping Connections 6 and 8 Fan Liebert® Quiet-Line Models
<b>Liebert® Drycooler Electrical Connections</b>	
DPN000277	Liebert® Drycooler Electrical Field Connections Fan Speed Control
DPN000276	Liebert® Drycooler Electrical Field Connections Fluid Temperature Control
DPN000282	Liebert® Drycooler Electrical Field Connections Fluid Temperature Control Liebert® Quiet-Line Models
DPN000703	Liebert® Drycooler Electrical Field Connections 6 and 8 Fan Models with DSO/DDO Pump Control
DPN000704	Electrical Field Connections 6 and 8 Fan Models with DDNL and DDNT Fan Control
DPN000702	Electrical Field Connections 6 and 8 Fan Heat Rejection Models with No Control
DPN000723	Electrical Field Connections 6 and 8 Fan Quiet-Line Models with DSO/DDO Pump Control
DPN000724	Liebert® Drycooler Electrical Field Connections 6 and 8 Fan Liebert® Quiet-Line with DDNL and DDNT Control
DPN000722	Liebert® Drycooler Electrical Field Connections 6 and 8 Fan Liebert® Quiet-Line Heat Rejection Models with No Control
<b>Liebert® Drycooler Pump Packages</b>	
DPN000278	Piping Locations and Dimensional Data Single Pump Package
DPN000328	Liebert® Drycooler Piping Connections and Dimensional Data Dual Pump Package
DPN000329	Liebert® Drycooler Electrical and Piping Connection Data Pump Package

**Table C.1 Submittal Drawing Contents (continued)**

Document Number	Title
<b>Liebert® Drycooler Expansion Tank</b>	
DPN004183	Liebert® Drycooler General Arrangement Diagram and Dimensional Data Expansion Tank for Glycol/Liebert® GLYCOOL Systems
<b>Liebert® Drycooler Compression Tank</b>	
DPN003898	General Arrangement Diagram and Dimensional Data ASME Compression Tank Kits Glycol/Liebert® GLYCOOL Systems

## CABINET ANCHOR DIMENSIONAL & GENERAL DATA

### 1-4 FAN MODELS



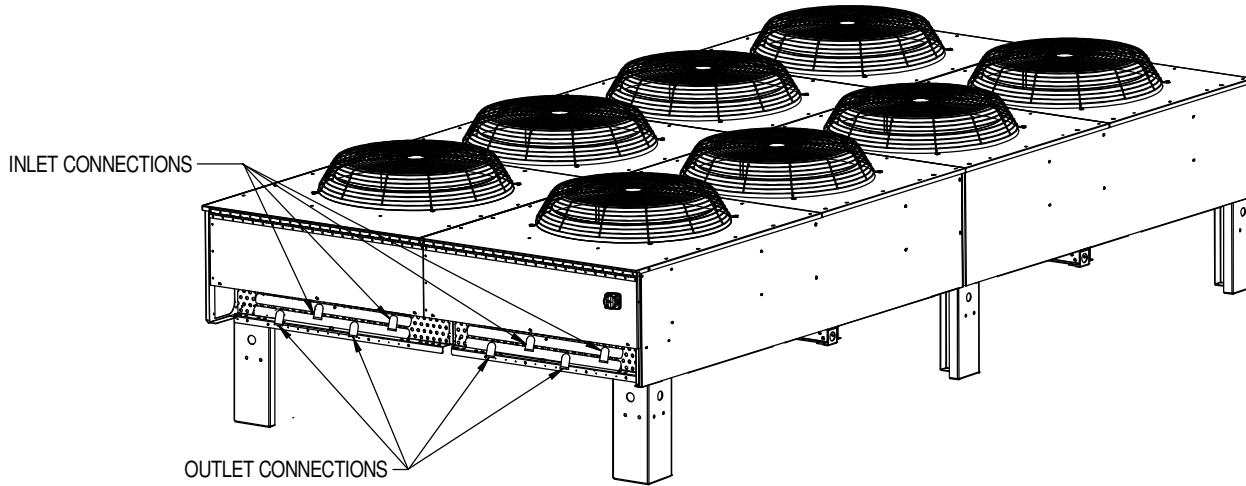
Liebert® Model	No. of fans	A in. (mm)	B in. (mm)	C in. (mm)	D in. (mm)	CFM (l/s)		Internal Volume Gal. (Liters)	Dry Wt. Lbs. (kg)
						60Hz (See note 1)	50Hz (See note 1)		
*D**033	1	51-1/2 (1308)	44 (1118)	42 (1067)	N/A	7200 (3398)	6000 (2932)	1.2 (4.6)	355 (161)
*D**069						6866 (3240)	5722 (2700)	2.4 (9.2)	375 (170)
*D**092						6633 (3130)	5527 (2609)	3.7 (13.9)	395 (179)
*D**109						6322 (2984)	5268 (2486)	4.9 (18.6)	415 (188)
*D**112						6088 (2873)	5074 (2394)	5.8 (22)	435 (197)
*D**139	2	91-1/2 (2324)	84 (2134)	82 (2083)	N/A	13732 (6481)	11443 (5401)	4.8 (18.2)	500 (227)
*D**174						13265 (6261)	11054 (5217)	6.9 (26.2)	540 (245)
*D**197						12645 (5968)	10535 (4973)	9 (34)	580 (263)
*D**225						12177 (5748)	10147 (4789)	11.1 (42.1)	620 (281)
*D**260	3	131-1/2 (3340)	124 (3150)	122 (3099)	N/A	19898 (9392)	16582 (7827)	10 (37.8)	735 (333)
*D**310						18965 (8951)	15804 (7459)	13.1 (49.6)	795 (361)
*D**350						17398 (8212)	14499 (6843)	19.4 (73.3)	855 (388)
*D**352	4	171-1/2 (4356)	164 (4166)	82 (2083)	80 (2032)	24800 (11705)	20667 (9755)	13.1 (49.6)	940 (426)
*D**419						23650 (11163)	19708 (9302)	17.4 (65.9)	1020 (463)
*D**466						22770 (10747)	18975 (8956)	22 (83.3)	1050 (476)
*D**491						21700 (10242)	18083 (8535)	26.3 (99.6)	1100 (499)

**Notes:**

- All Liebert® Drycooler motors are 3/4H.P.
- A minimum clearance of 36" (914mm) is recommended on all sides for proper operation and component access.

# LIEBERT® DRYCOOLER

## PIPING CONNECTIONS 6 & 8 FAN MODELS



4 INLET, 4 OUTLET  
CONNECTIONS SHOWN  
SEE TABLE FOR ACTUAL  
NUMBER PROVIDED.

Model No.	No. of Fans	No. of Internal Circuits	No. of Inlets & Outlets	Inlet & Outlet Connection sizes (IDS, Cu)
-620	6	32	2	2-1/8"
		64*		
-650		40	4	
		52*		
-700		80	2	
		32		
		96	4	
-790		8	32	
64*				
-880	52		4	
80*				
-940	32	2		
	64			
	96*	4		

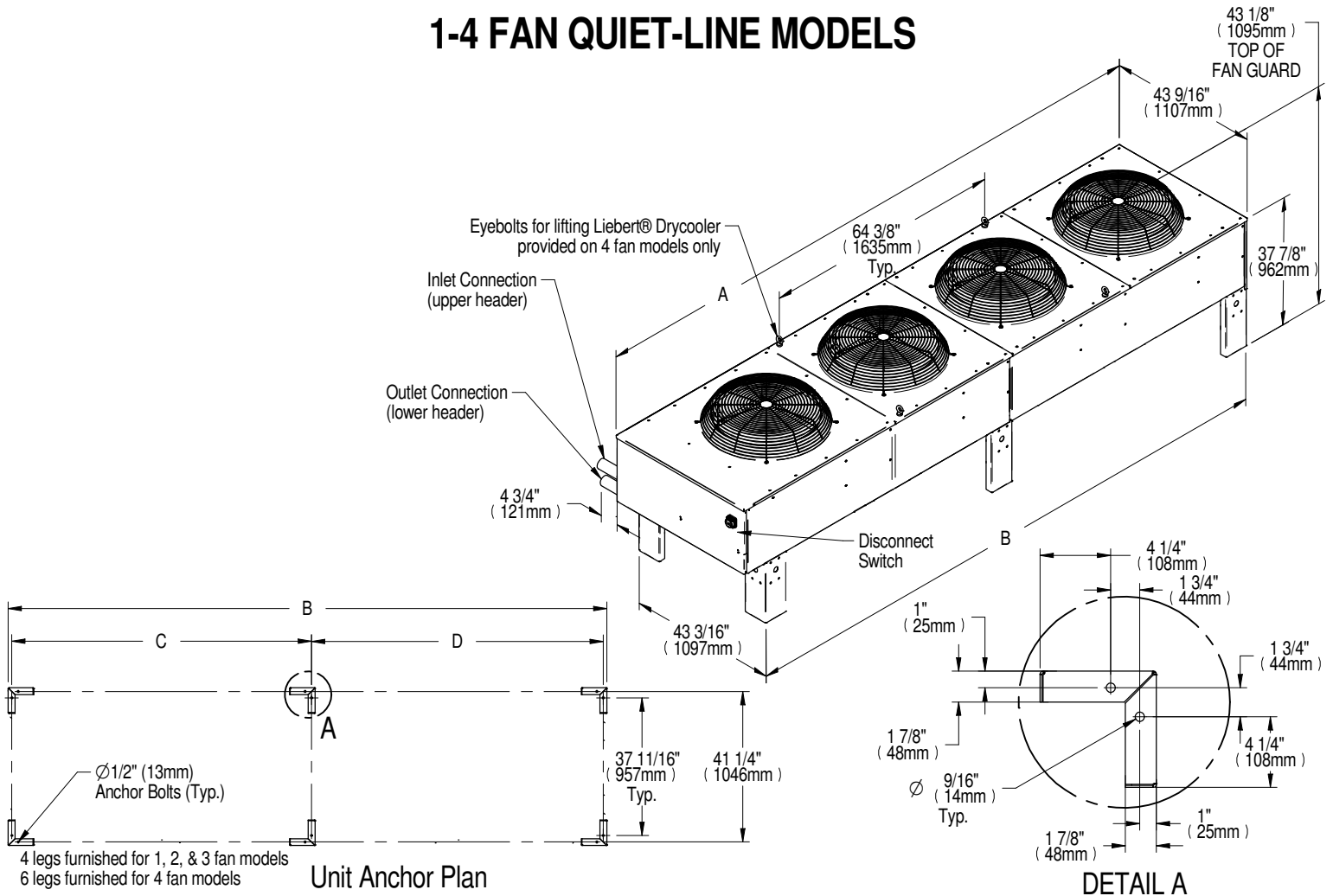
\* STANDARD CIRCUITING



# LIEBERT® DRYCOOLER

## CABINET ANCHOR DIMENSIONAL & GENERAL DATA

### 1-4 FAN QUIET-LINE MODELS

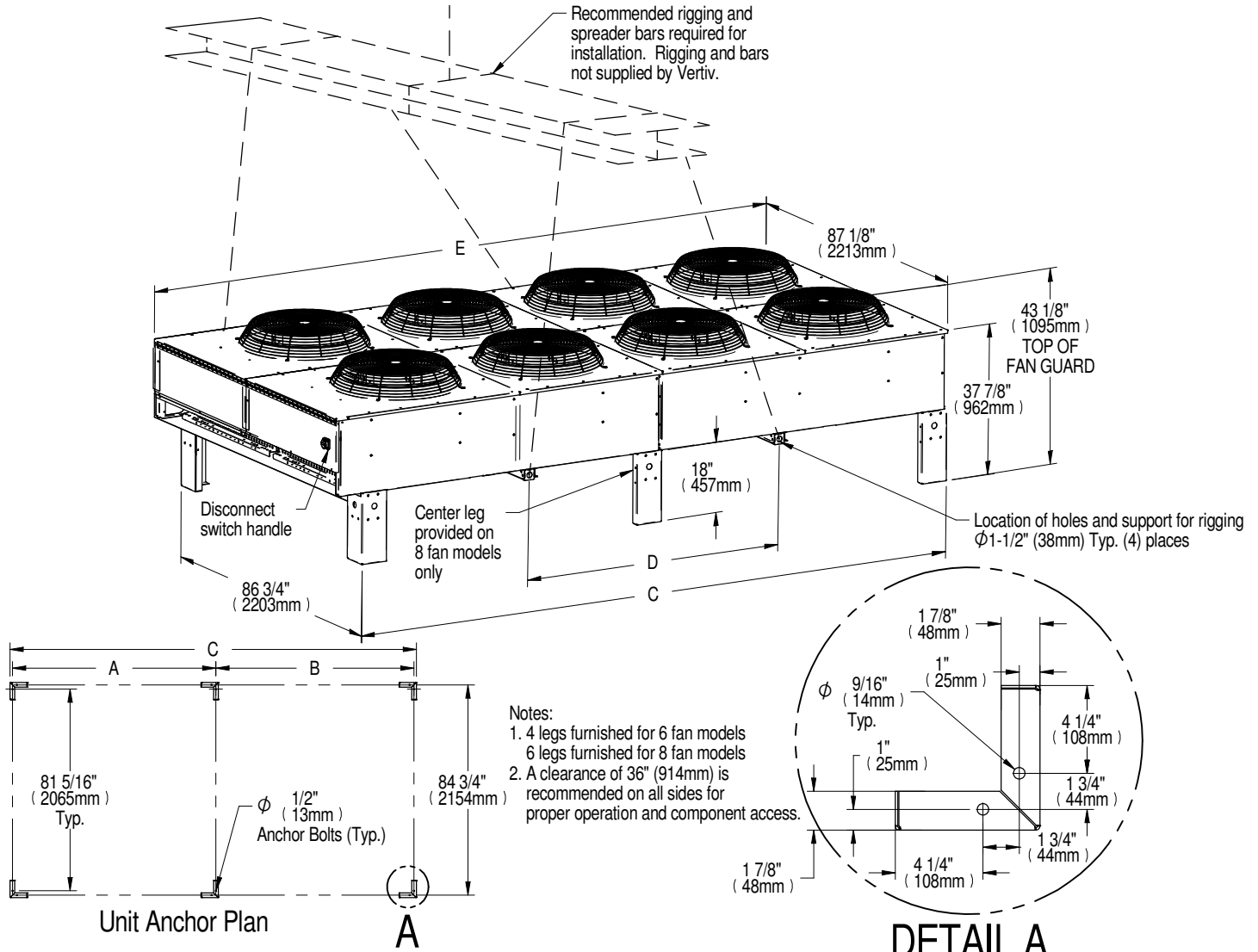


Quiet-Line Model	No. of fans	A in. (mm)	B in. (mm)	C in. (mm)	D in. (mm)	CFM (l/s)		Internal Volume Gal. (Liters)	Dry Wt. Lbs. (kg)
						60Hz (See note 1)	50Hz (See note 1)		
*D**040	1	51-1/2 (1308)	44 (1118)	42 (1067)	N/A	3110 (5285)	2592 (4404)	2.4 (9.1)	375 (170)
*D**057						2990 (5081)	2492 (4234)	3.7 (14)	395 (179)
*D**060						2840 (4826)	2367 (4021)	4.9 (18.5)	415 (188)
*D**080	2	91-1/2 (2324)	84 (2134)	82 (2083)		6220 (10569)	5183 (8808)	4.8 (18.2)	500 (227)
*D**111						5980 (10161)	4983 (8468)	6.9 (26.1)	540 (245)
*D**121						5680 (9651)	4733 (8043)	9 (34.1)	580 (263)
*D**158	3	131-1/2 (3340)	124 (3150)	122 (3099)		8970 (15242)	7475 (12702)	10 (37.9)	735 (333)
*D**173						8520 (14477)	7100 (12064)	13.1 (49.6)	795 (361)
*D**178						7440 (12462)	6200 (10535)	19.4 (73.4)	855 (388)
*D**205	4	171-1/2 (4356)	164 (4166)	82 (2083)	80 (2032)	11680 (19847)	9733 (16539)	13.1 (49.6)	940 (426)
*D**248						11360 (19303)	9467 (16086)	17.4 (65.9)	1020 (463)

- Notes:
1. All Liebert® Drycooler fan motors are 1/4H.P.
  2. A minimum clearance of 36" (914mm) is recommended on all sides for proper operation and component access.

Form No.: DPN001040\_REV14

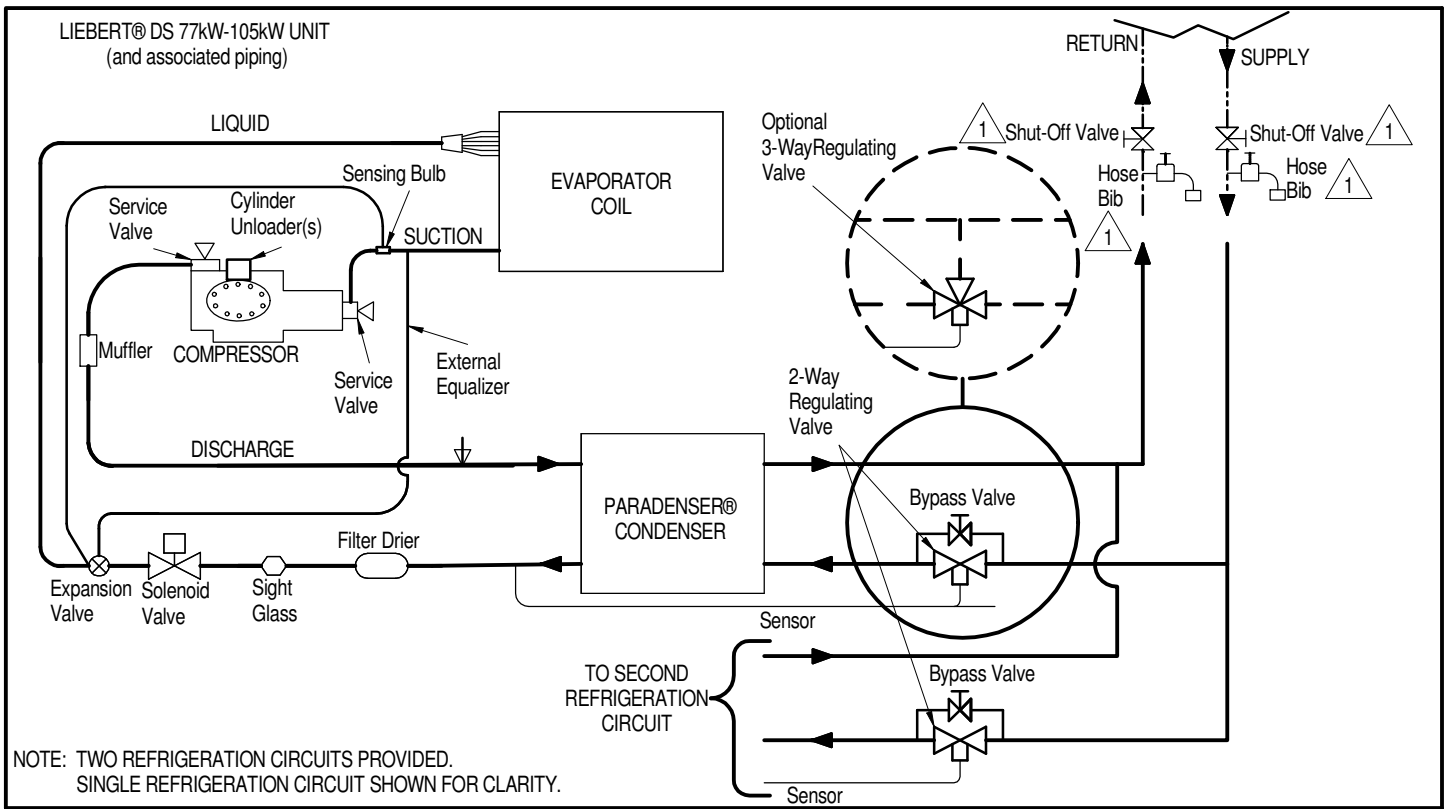
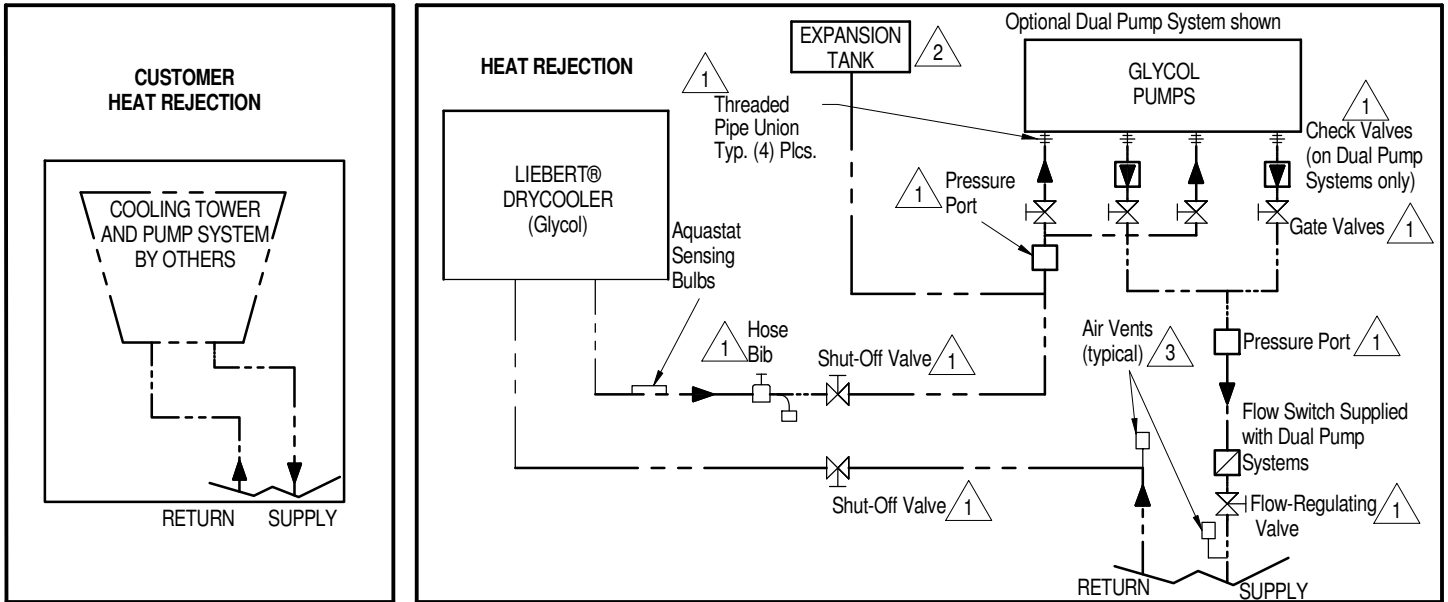
## CABINET & ANCHOR DIMENSIONAL DATA 6 & 8 FAN HEAT REJECTION QUIET-LINE MODELS



Drycooler Physical Data									
Model No.	Drycooler Type	Qty. of Fans	A in. (mm)	B in. (mm)	C in. (mm)	D in. (mm)	E in. (mm)	Coil Internal Vol. Gal (L)	Dry Wt. lbs. (kg)
-620	Standard	6	122 (3099)	N/A	124 (3150)	59 (1499)	131-1/2 (3340)	27 (102.2)	1780 (808)
-650								33 (124.9)	1830 (831)
-700								40 (151.4)	1880 (854)
-347	Quiet-Line	6	122 (3099)	N/A	124 (3150)	59 (1499)	131-1/2 (3340)	27 (102)	1780 (808)
-356								39.3 (149)	1880 (854)
-790	Standard	8	82 (2083)	80 (2032)	164 (4166)	70 (1778)	171-1/2 (4356)	35 (132.5)	2250 (1022)
-880								44 (166.5)	2330 (1058)
-940								52 (196.8)	2430 (1103)
-453	Quiet-Line	8	82 (2083)	80 (2032)	164 (4166)	70 (1778)	171-1/2 (4356)	35 (132)	2250 (1022)
-498								52.6 (199)	2430 (1103)

## PIPING SCHEMATIC

### WATER/GLYCOL 77kW - 105kW SEMI-HERMETIC COMPRESSOR MODELS



NOTE: TWO REFRIGERATION CIRCUITS PROVIDED. SINGLE REFRIGERATION CIRCUIT SHOWN FOR CLARITY.

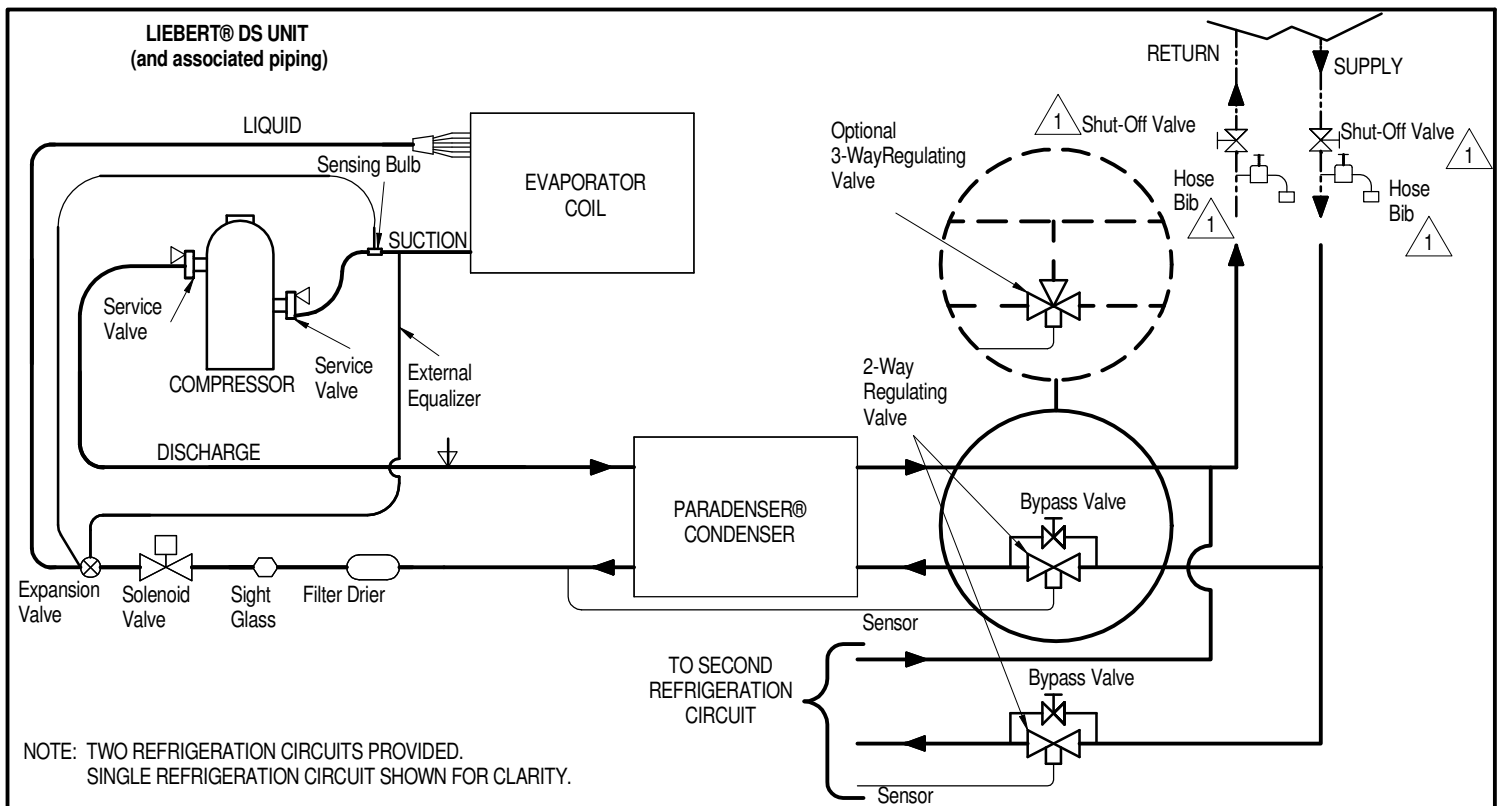
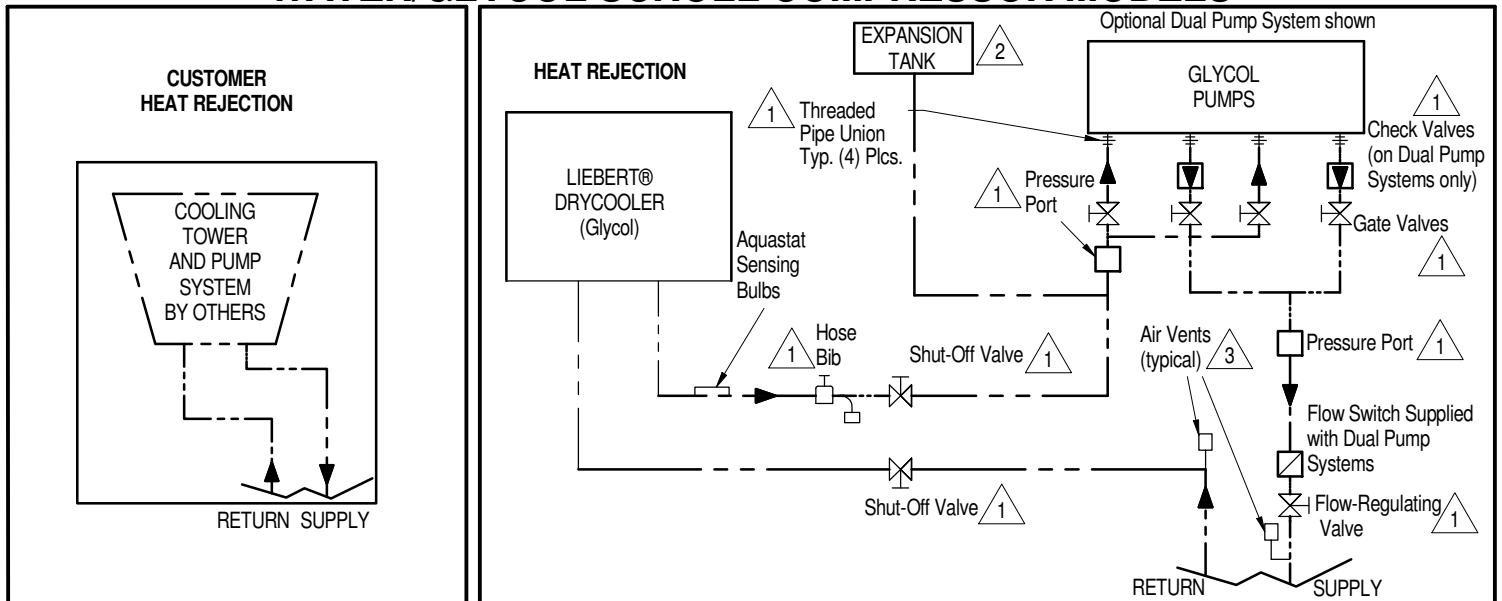
- FACTORY PIPING
- - - - - FIELD PIPING
- · - · - · OPTIONAL FACTORY PIPING
- ▽ SERVICE / SCHRADER (ACCESS) CONNECTION NO VALVE CORE
- ▽ SERVICE / SCHRADER (ACCESS) CONNECTION WITH VALVE CORE

NOTE: SCHEMATIC REPRESENTATION SHOWN. THIS SCHEMATIC DOES NOT IMPLY OR DEFINE ELEVATIONS AND COMPONENT LOCATION, UNLESS SPECIFICALLY NOTED.

- 1. Components are not supplied by Vertiv but are required for proper operation and maintenance
- 2. Field installed at highest point in system on return line to pumps
- 3. Locate at tops of all risers and any intermediate system high points



## PIPING SCHEMATIC WATER/GLYCOL SCROLL COMPRESSOR MODELS

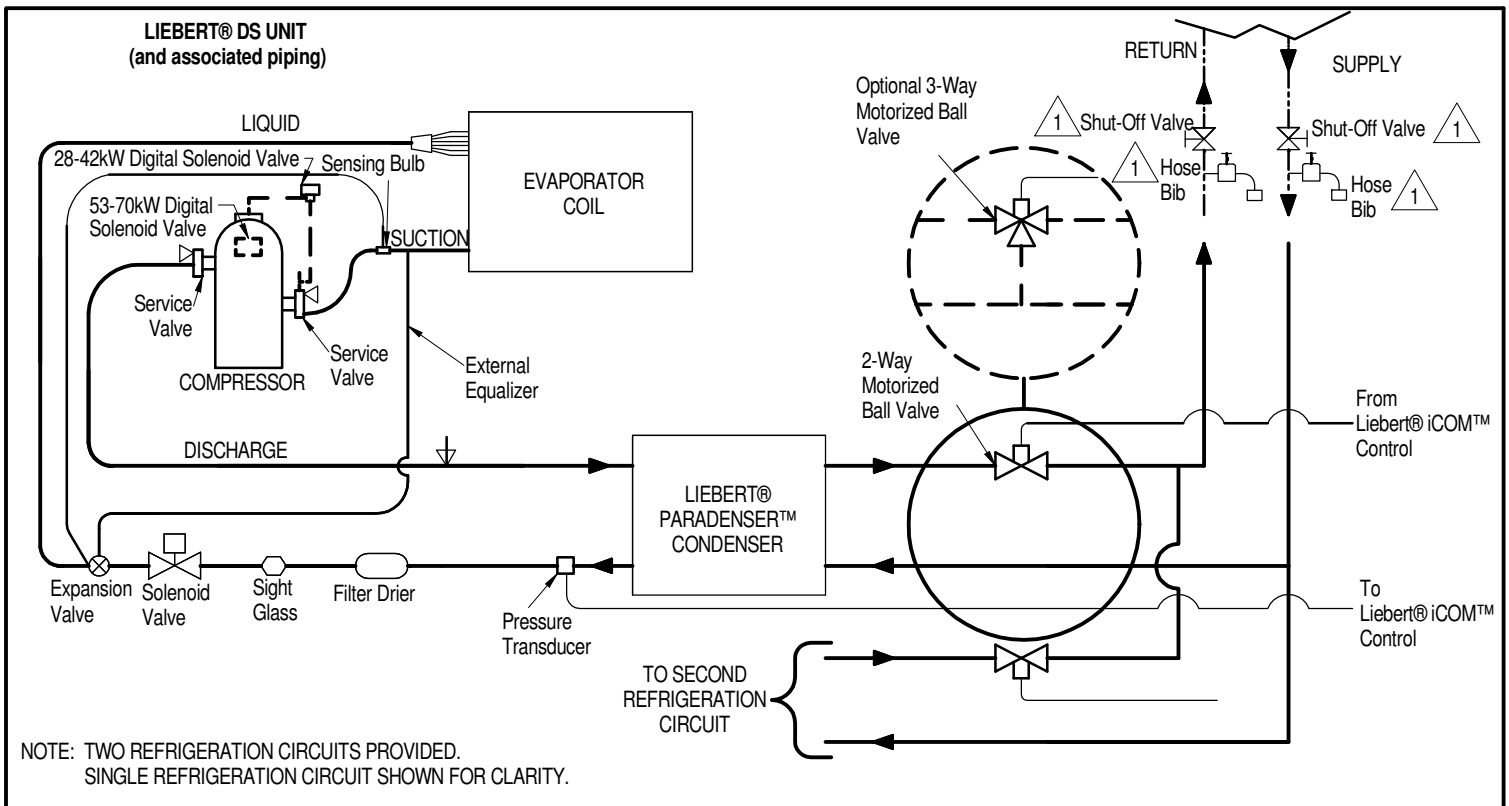
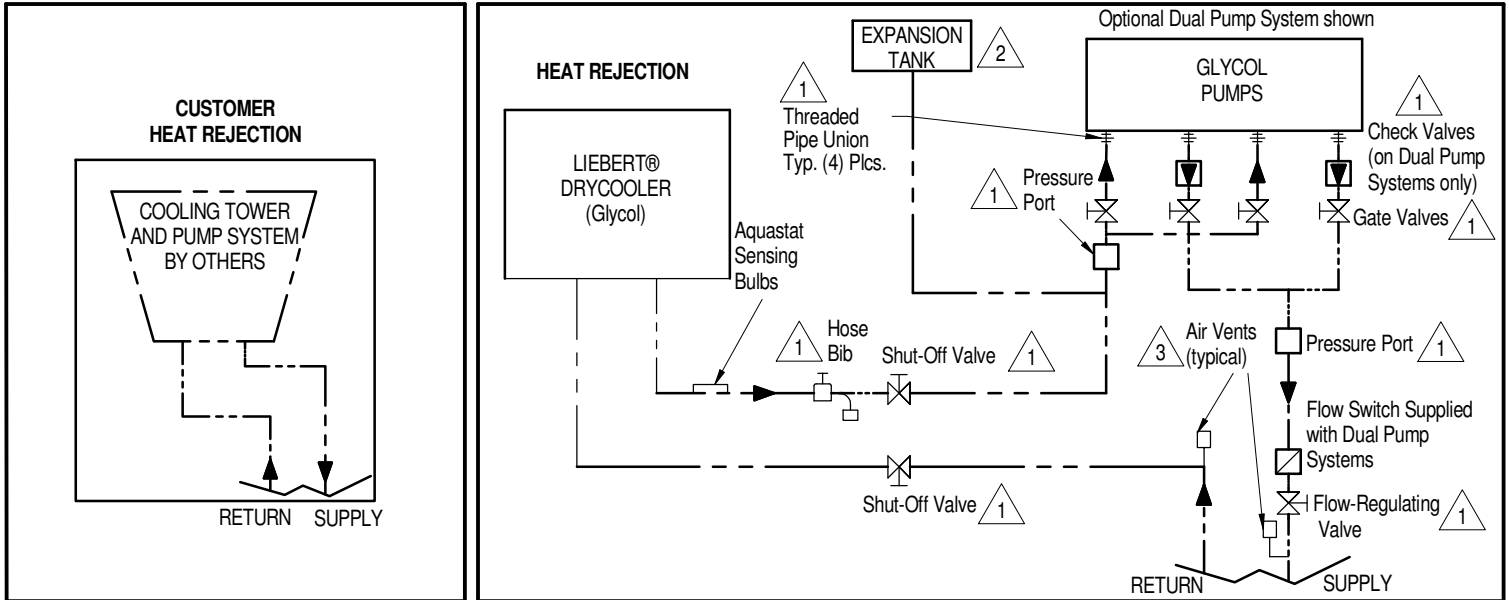


- FACTORY PIPING
- - - FIELD PIPING
- - - - - OPTIONAL FACTORY PIPING
- ▽ SERVICE / SCHRADER (ACCESS) CONNECTION NO VALVE CORE
- ▽ SERVICE / SCHRADER (ACCESS) CONNECTION WITH VALVE CORE

NOTE: SCHEMATIC REPRESENTATION SHOWN. THIS SCHEMATIC DOES NOT IMPLY OR DEFINE ELEVATIONS AND COMPONENT LOCATION, UNLESS SPECIFICALLY NOTED.

- 1 Components are not supplied by Vertiv but are required for proper operation and maintenance
- 2 Field installed at highest point in system on return line to pumps
- 3 Locate at tops of all risers and any intermediate system high points

## PIPING SCHEMATIC WATER/GLYCOL DIGITAL SCROLL COMPRESSOR MODELS

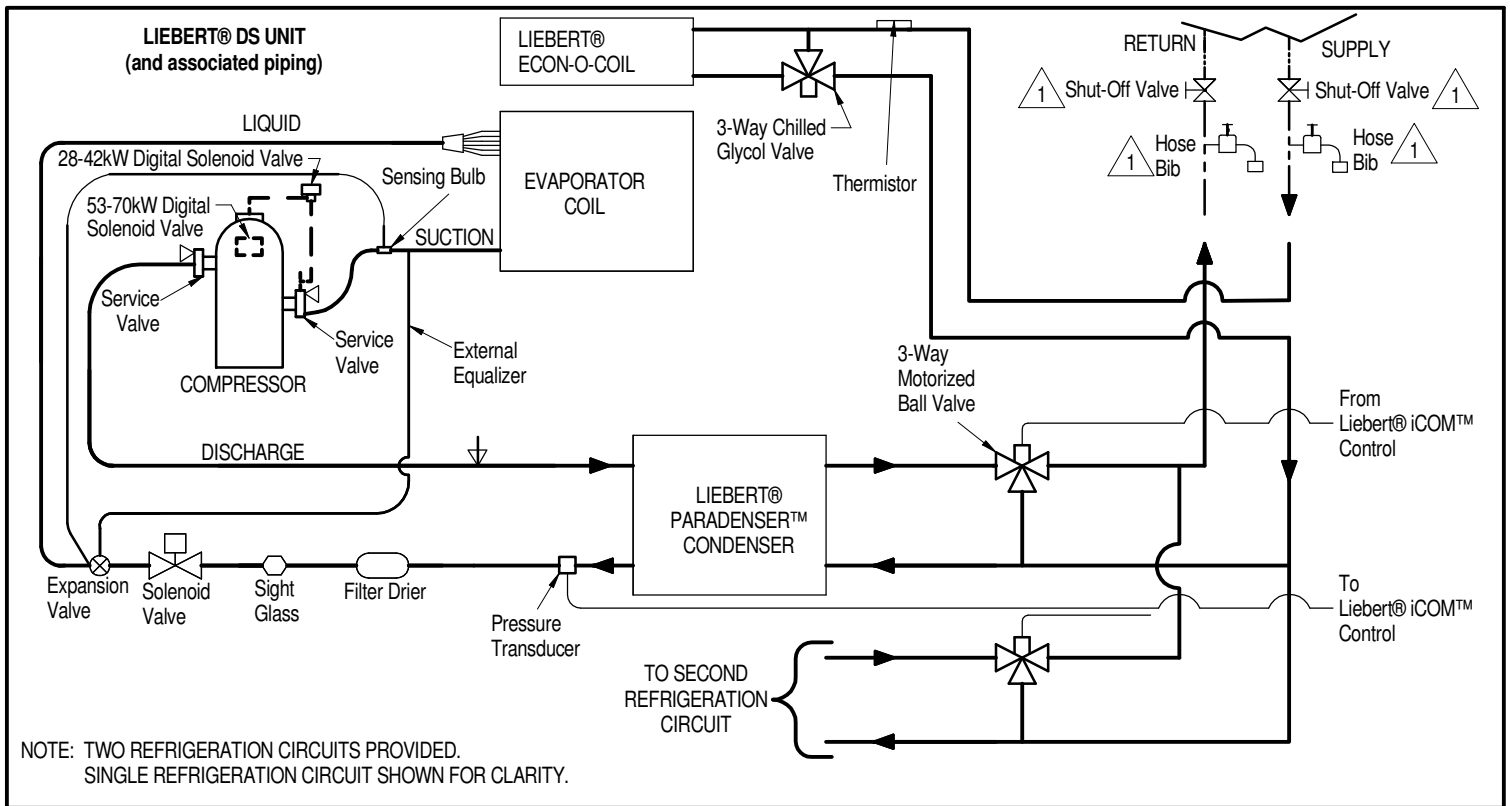
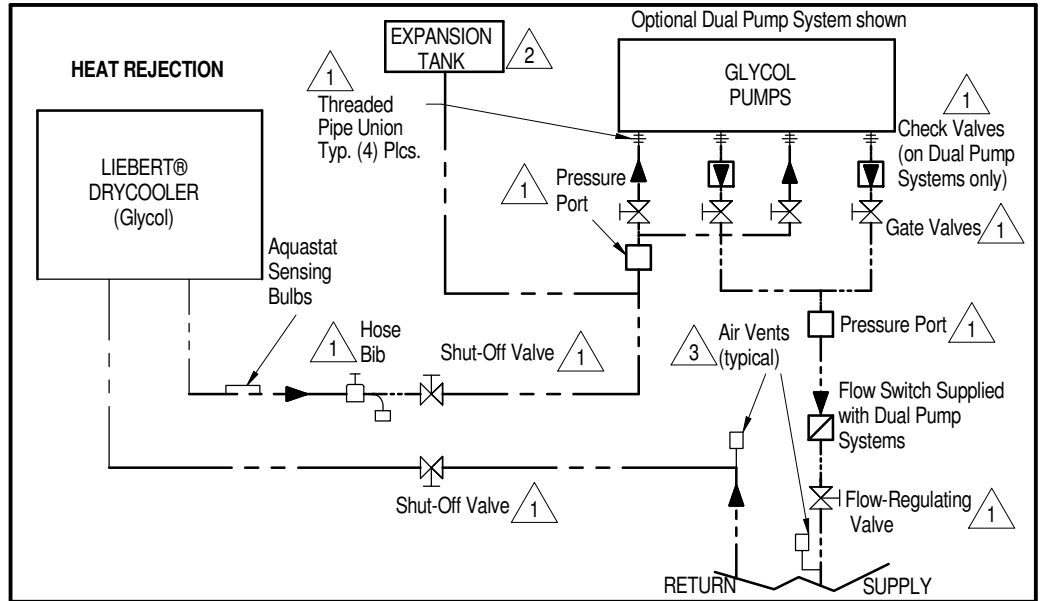


- FACTORY PIPING
- - - - - FIELD PIPING
- - - - - OPTIONAL FACTORY PIPING
- ▽ SERVICE / SCHRADER (ACCESS) CONNECTION NO VALVE CORE
- ▽ SERVICE / SCHRADER (ACCESS) CONNECTION WITH VALVE CORE

NOTE: SCHEMATIC REPRESENTATION SHOWN. THIS SCHEMATIC DOES NOT IMPLY OR DEFINE ELEVATIONS AND COMPONENT LOCATION, UNLESS SPECIFICALLY NOTED.

- 1 Components are not supplied by Vertiv but are required for proper operation and maintenance
- 2 Field installed at highest point in system on return line to pumps
- 3 Locate at tops of all risers and any intermediate system high points

## PIPING SCHEMATIC GLYCOL DIGITAL SCROLL COMPRESSOR MODELS



NOTE: TWO REFRIGERATION CIRCUITS PROVIDED.  
SINGLE REFRIGERATION CIRCUIT SHOWN FOR CLARITY.

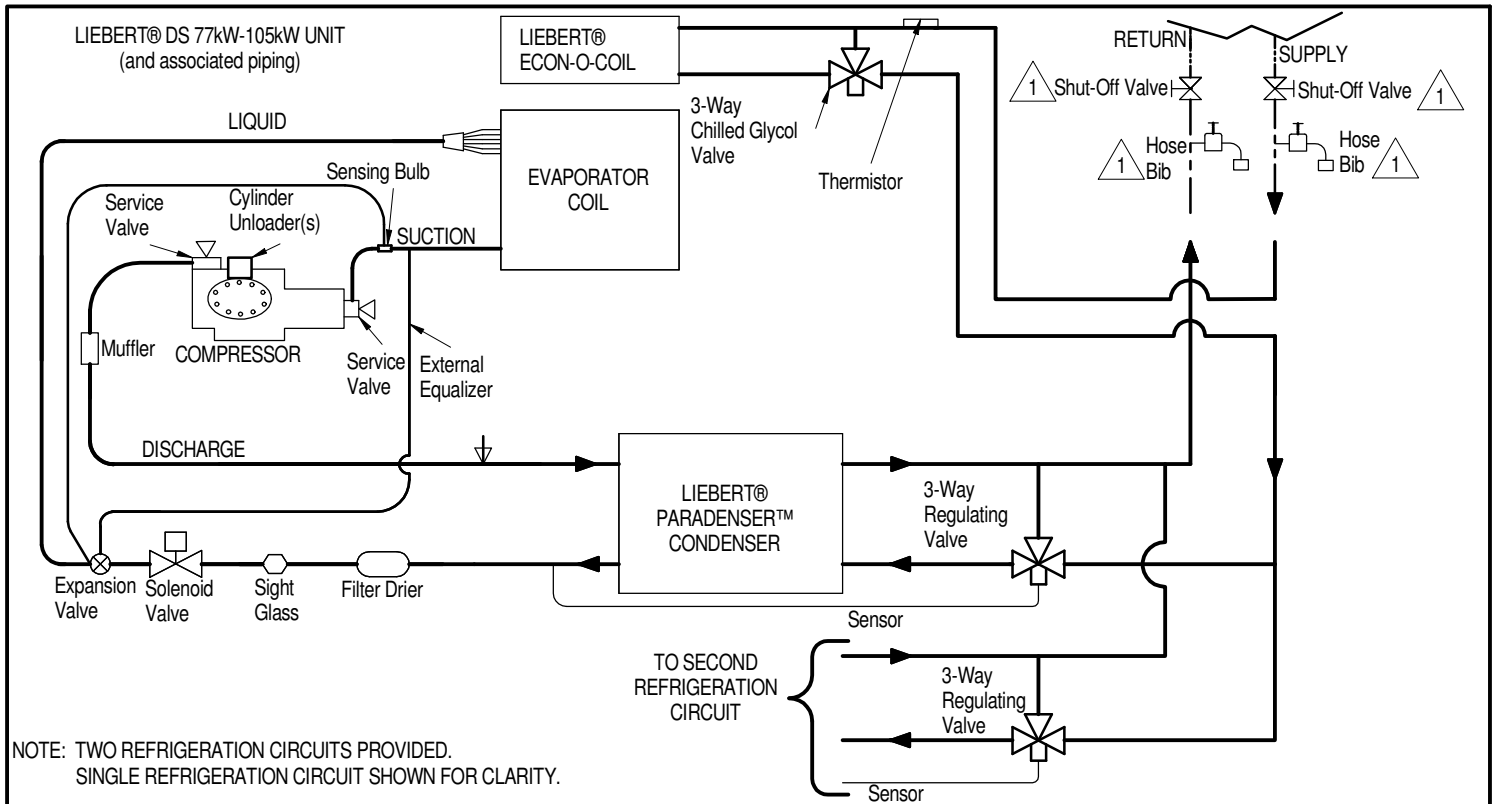
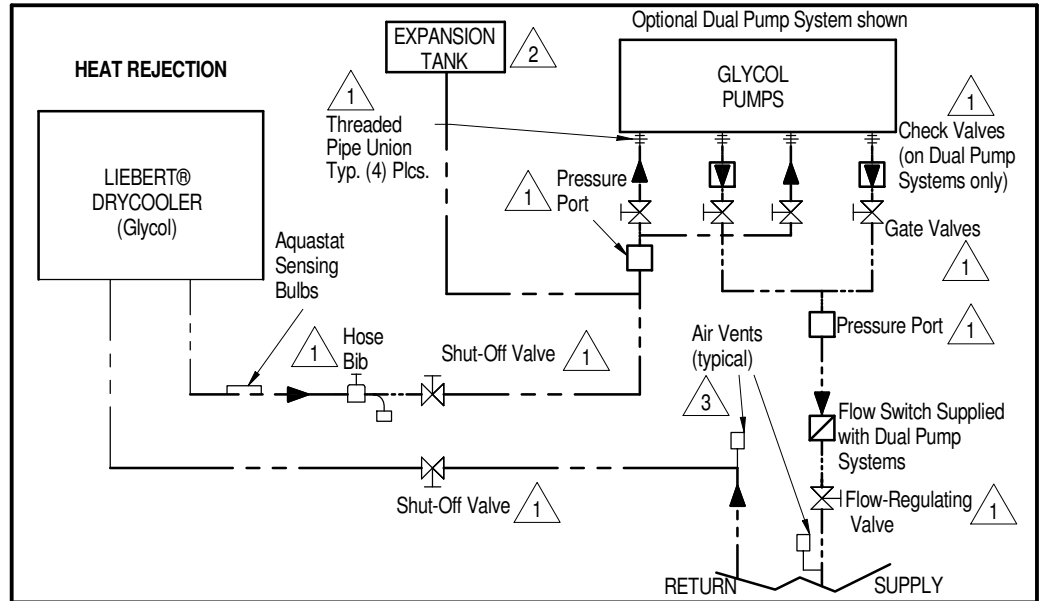
- OPTIONAL FACTORY PIPING
- ==== FACTORY PIPING
- - - - FIELD PIPING
- ▽ SERVICE / SCHRADER (ACCESS) CONNECTION NO VALVE CORE
- ▽ SERVICE / SCHRADER (ACCESS) CONNECTION WITH VALVE CORE


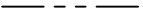


NOTE: SCHEMATIC REPRESENTATION SHOWN. THIS SCHEMATIC DOES NOT IMPLY OR DEFINE ELEVATIONS AND COMPONENT LOCATION, UNLESS SPECIFICALLY NOTED.

- 1 Components are not supplied by Vertiv but are required for proper operation and maintenance
- 2 Field installed at highest point in system on return line to pumps
- 3 Locate at tops of all risers and any intermediate system high points

## PIPING SCHEMATIC

### GLYCOOL 77kW - 105kW SEMI-HERMETIC COMPRESSOR MODELS

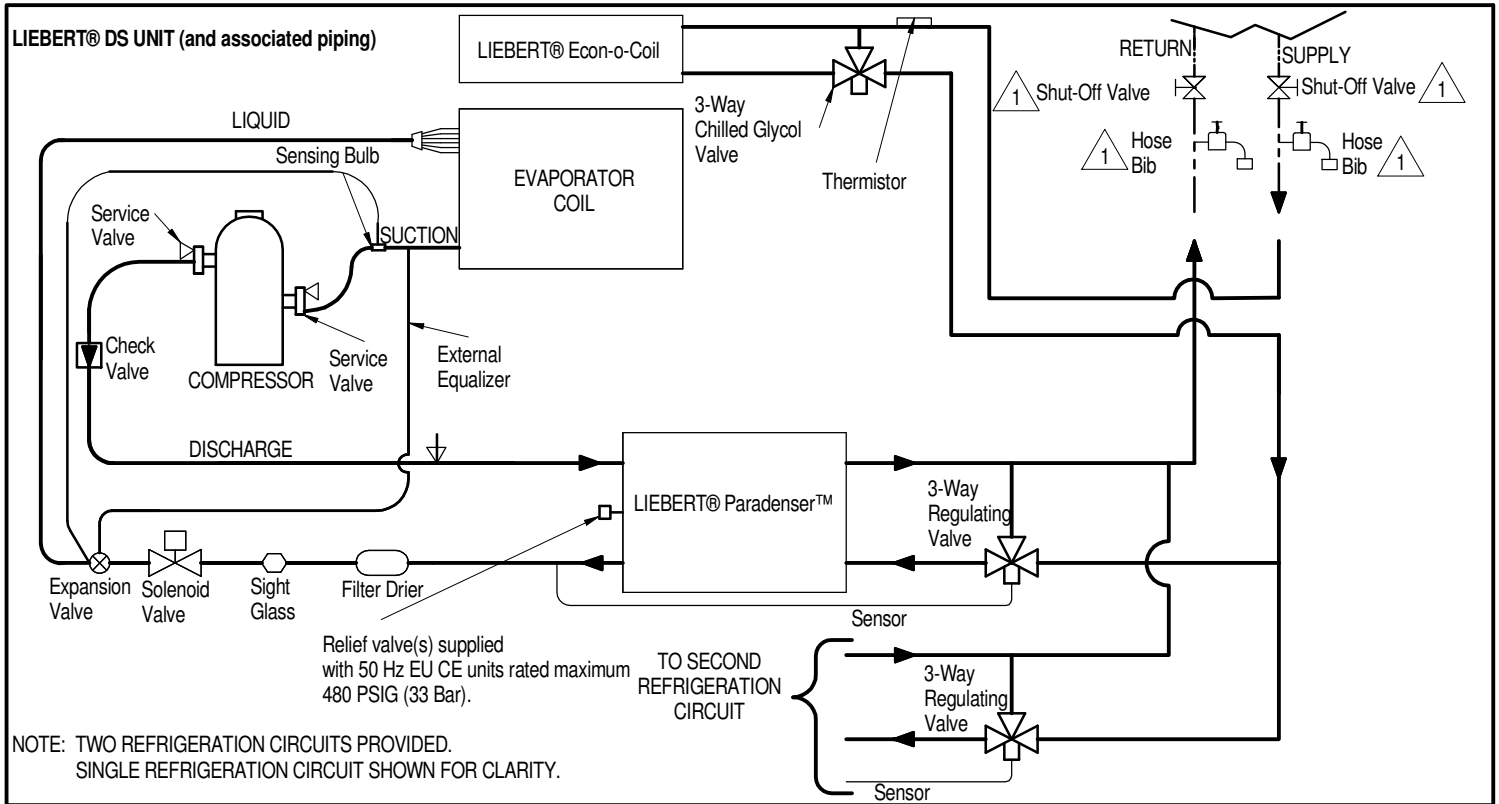
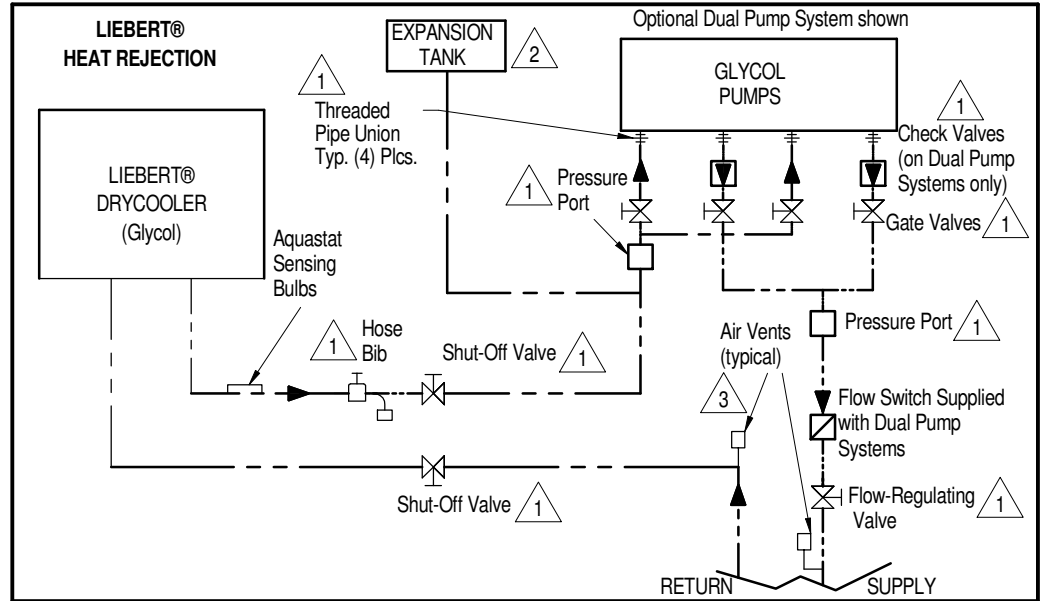


 FACTORY PIPING  
 FIELD PIPING  
 SERVICE / SCHRADER (ACCESS) CONNECTION NO VALVE CORE  
 SERVICE / SCHRADER (ACCESS) CONNECTION WITH VALVE CORE

NOTE: SCHEMATIC REPRESENTATION SHOWN. THIS SCHEMATIC DOES NOT IMPLY OR DEFINE ELEVATIONS AND COMPONENT LOCATION, UNLESS SPECIFICALLY NOTED.

1. Components are not supplied by Vertiv but are required for proper operation and maintenance
2. Field installed at highest point in system on return line to pumps
3. Locate at tops of all risers and any intermediate system high points.

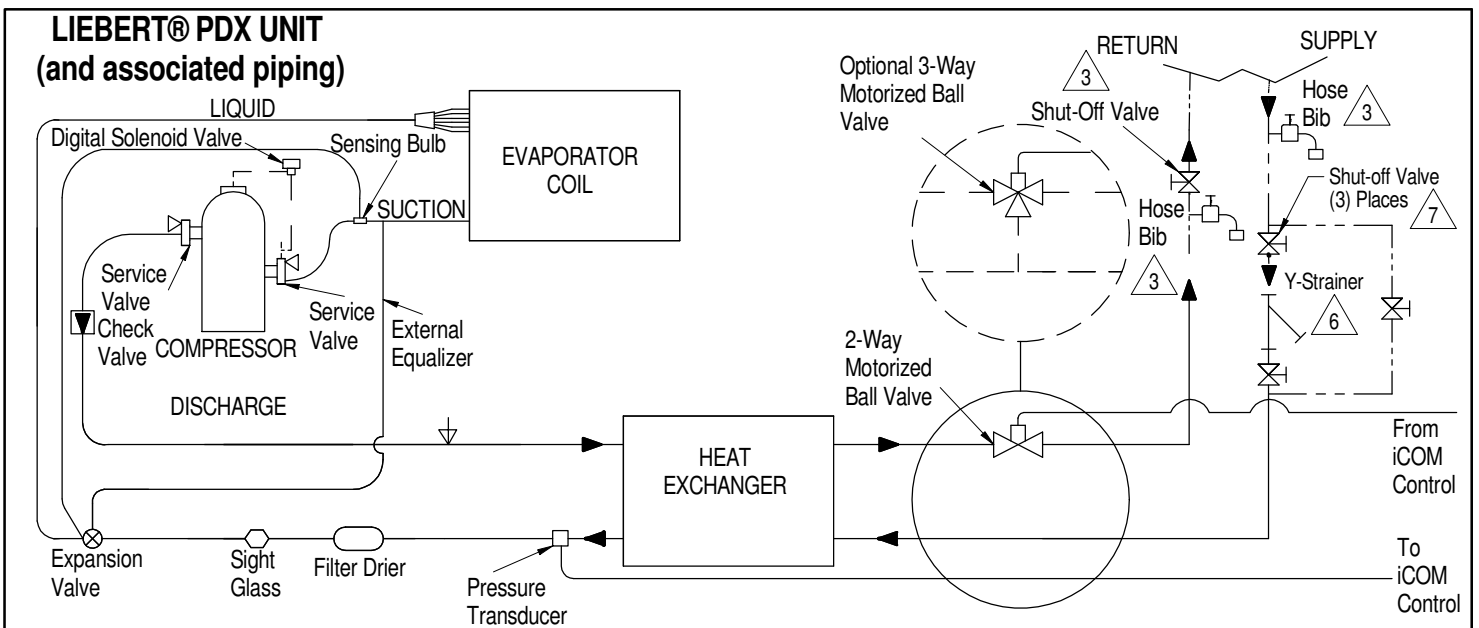
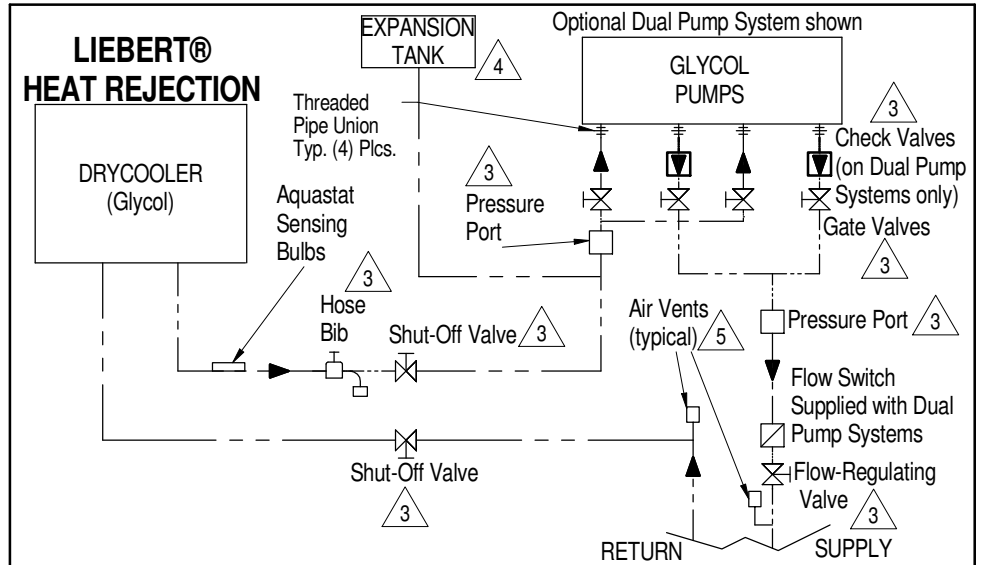
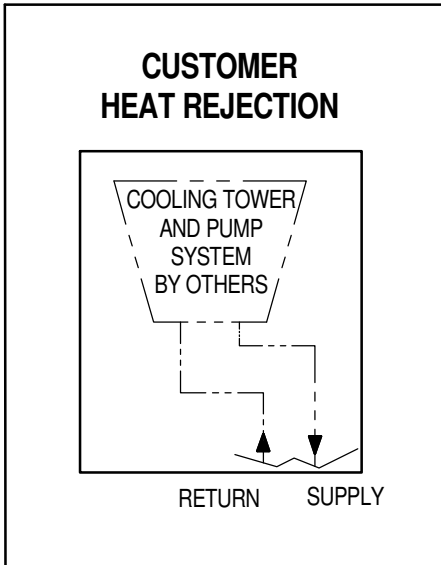
## PIPING SCHEMATIC GLYCOOL SCROLL COMPRESSOR MODELS



———— FACTORY PIPING  
 - - - - - FIELD PIPING  
 ▽ SERVICE / SCHRADER (ACCESS) CONNECTION NO VALVE CORE  
 ▽ SERVICE / SCHRADER (ACCESS) CONNECTION WITH VALVE CORE  
 NOTE: SCHEMATIC REPRESENTATION SHOWN. THIS SCHEMATIC DOES NOT IMPLY OR DEFINE ELEVATIONS AND COMPONENT LOCATION, UNLESS SPECIFICALLY NOTED.

- 1 Components are not supplied by Vertiv but are required for proper operation and maintenance
- 2 Field installed at highest point in system on return line to pumps
- 3 Locate at tops of all risers and any intermediate system high points

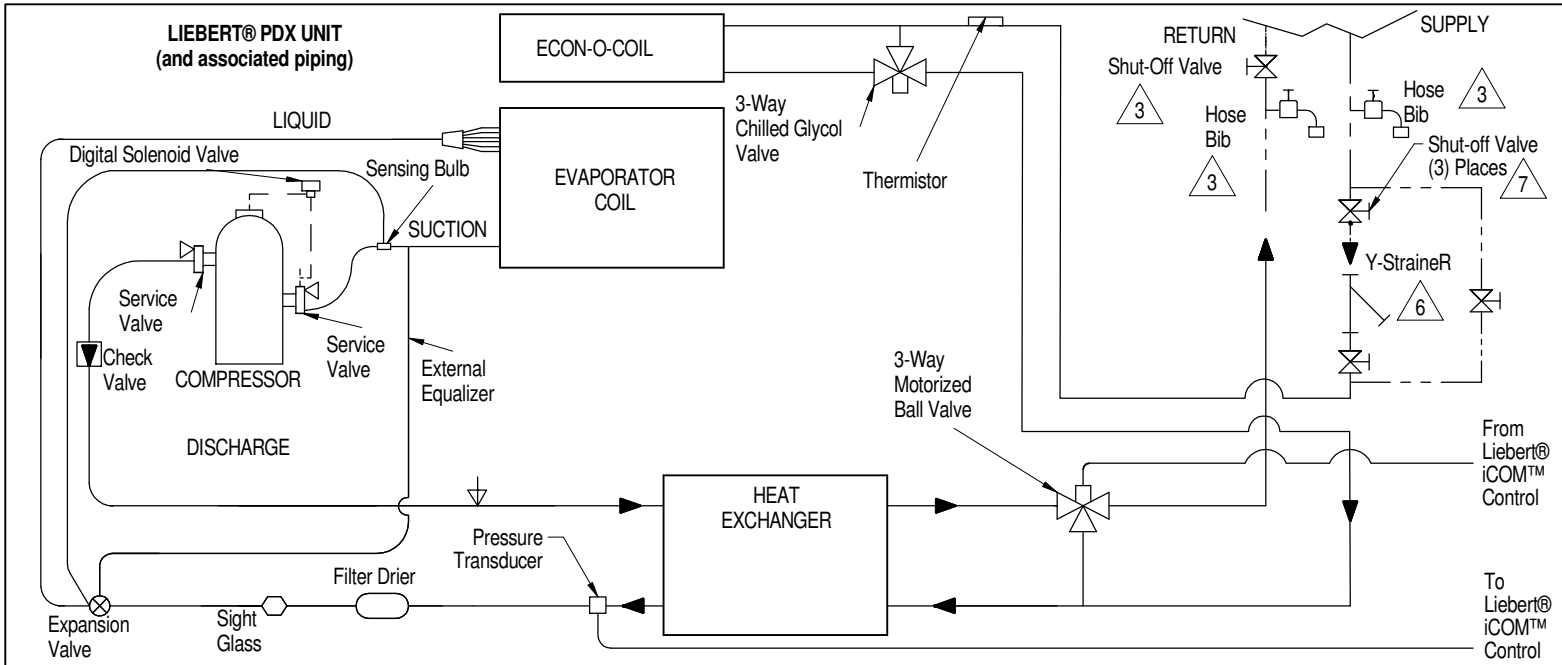
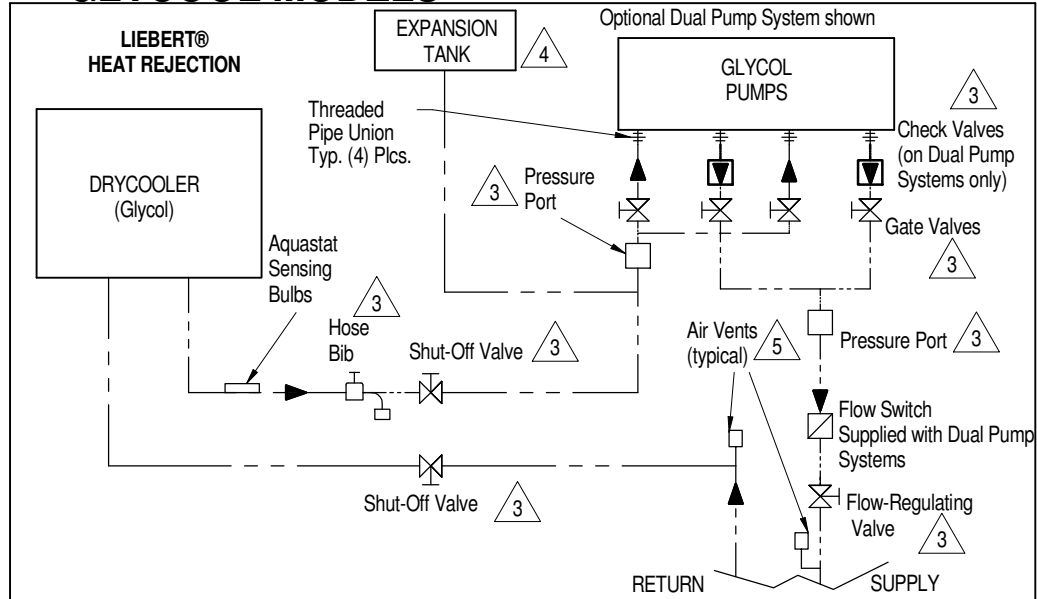
## PIPING SCHEMATIC WATER/GLYCOL MODELS



- FACTORY PIPING
- - - - - FIELD PIPING
- - - - - OPTIONAL FACTORY PIPING
- ▽ SERVICE / SCHRADER (ACCESS) CONNECTION NO VALVE CORE
- ▽ SERVICE / SCHRADER (ACCESS) CONNECTION WITH VALVE CORE

- Notes:
1. Schematic representation shown. Do not use for specific connection locations.
  2. Install a 20 mesh strainer, in an easily accessible location, on the water/glycol supply to prevent particles from entering the heat exchanger. Strainer bypass valves are recommended to allow the strainer to be cleaned while maintaining flow to the cooling unit.
  3. Components are not supplied by Liebert®.
  4. Field installed at highest point in system on return line to pumps.
  5. Locate at tops of all risers and any intermediate system high points.
  6. Components are Liebert® supplied and field installed, and are required for proper circuit operation and maintenance.
  7. Component are not supplied by Liebert® but are recommended for proper circuit operation and maintenance.

## PIPING SCHEMATIC GLYCOOL MODELS



— FACTORY PIPING  
- - - FIELD PIPING

▽ SERVICE / SCHRADER (ACCESS) CONNECTION NO VALVE CORE  
▽ SERVICE / SCHRADER (ACCESS) CONNECTION WITH VALVE CORE

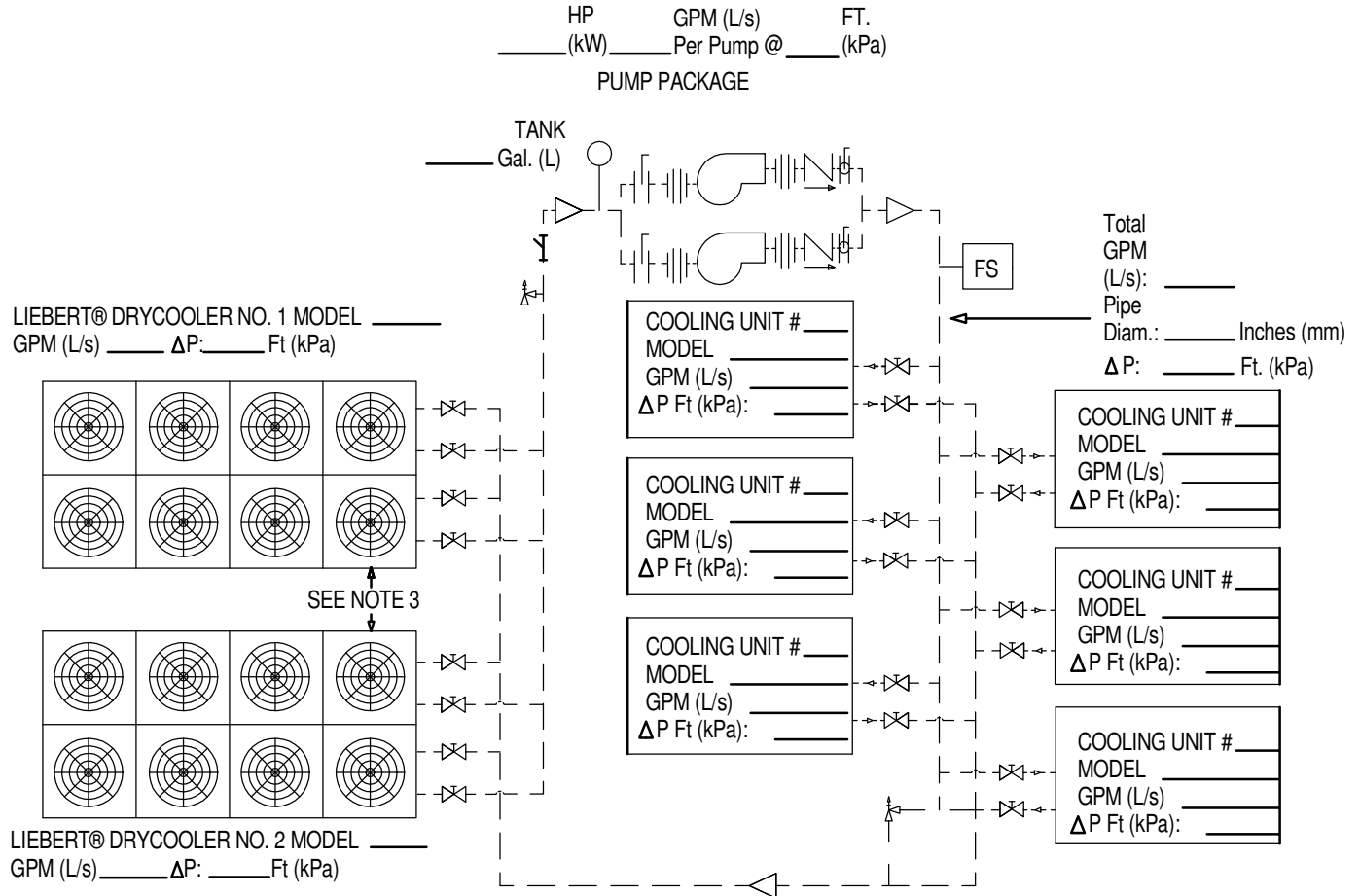
Notes:

1. Schematic representation shown. Do not use for specific connection locations.
2. Install a 20 mesh strainer, in an easily accessible location, on the water/glycol supply to prevent particles from entering the heat exchanger. Strainer bypass valves are recommended to allow the strainer to be cleaned while maintaining flow to the cooling unit.
3. Components are not supplied by Liebert®.
4. Field installed at highest point in system on return line to pumps.
5. Locate at tops of all risers and any intermediate system high points.
6. Components are Liebert® supplied and field installed, and are required for proper circuit operation and maintenance.
7. Component are not supplied by Liebert® but are recommended for proper circuit operation and maintenance.



# LIEBERT® DRYCOOLER

## PIPING SCHEMATIC MULTIPLE DRYCOOLERS & COOLING UNITS ON COMMON GLYCOL LOOP



### LEGEND

- GATE VALVE
- CHECK VALVE
- BUTTERFLY VALVE
- RELIEF VALVE
- UNION
- BALL OR FLOW CONTROL VALVE
- FLOW SWITCH
- $\Delta P$ : PRESSURE DROP
- STRAINER/FILTER

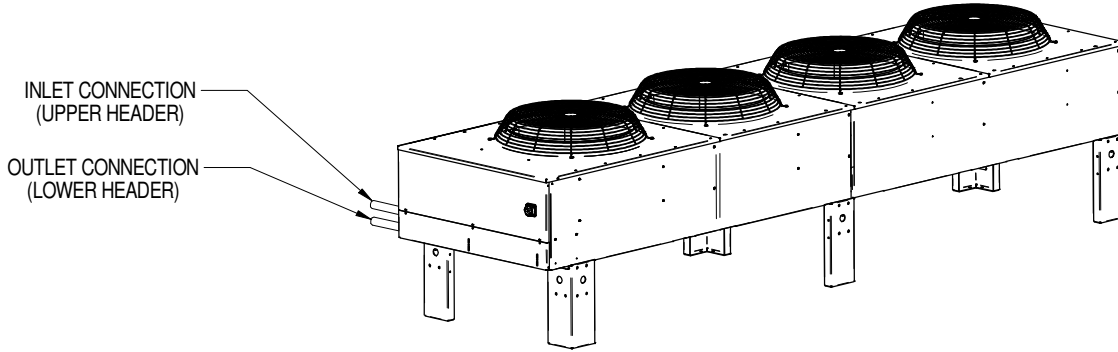
### NOTES:

1. PRESSURE AND TEMPERATURE GAUGES (OR PORTS FOR SAME) ARE RECOMMENDED TO MONITOR COMPONENT PRESSURE DROPS AND PERFORMANCE.
2. FLOW MEASURING DEVICES, DRAIN AND BALANCING VALVES TO BE SUPPLIED BY OTHERS AND LOCATED AS REQUIRED.
3. SEE PRODUCT LITERATURE FOR INSTALLATION GUIDELINES AND CLEARANCE DIMENSIONS.
4. DRAWING SHOWS DUAL PUMP PACKAGE. ALTERNATE PUMP PACKAGES WITH MORE PUMPS MAY BE CONSIDERED, CONSULT SUPPLIER.
5. DEPENDING ON THE LIEBERT® DRYCOOLER COIL CIRCUITING IT MAY HAVE 2 IN/OUT OR 4 IN/OUT CONNECTION POINTS.
6. INSTALL EXPANSION OR COMPRESSION TANK AT THE HIGHEST POINT OF THE SYSTEM.



# LIEBERT® DRYCOOLER

## PIPING CONNECTIONS

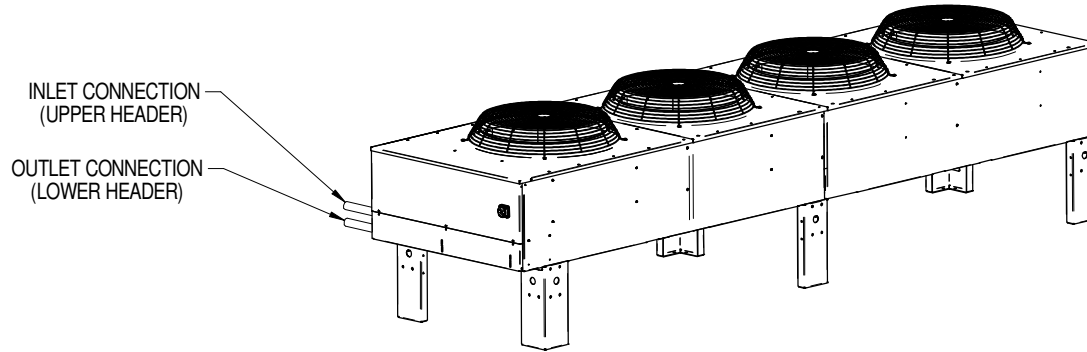


LIEBERT® DRYCOOLER PIPING CONNECTION SIZES (O.D. Cu)		
LIEBERT® DRYCOOLER MODEL NUMBER	NUMBER OF COIL CIRCUITS	INLET & OUTLET PIPE DIAMETER (INCHES)
-033	4*	1 3/8
-069	4, 8*	1 3/8
-092	6, 12*, 16	1 5/8
-109	8	1 3/8
-109	16*	2 1/8
-112	8	1 3/8
-112	16*, 26	2 1/8
-139	8, 16*	2 1/8
-174	8, 16*, 24	2 1/8
-197	8	1 3/8
-197	16*, 32	2 1/8
-225	16, 26*	2 1/8
-260	16, 24*	2 1/8
-310	16, 32*	2 1/8
-350	16, 32*	2 1/8
-350	48	2 5/8
-352	16, 24*	2 1/8
-419	16, 32*	2 1/8
-466	26	2 1/8
-466	40*	2 5/8
-491	16, 32	2 1/8
-491	48*	2 5/8

\* = Standard Circuiting

# LIEBERT® DRYCOOLER

## PIPING CONNECTIONS QUIET-LINE MODELS



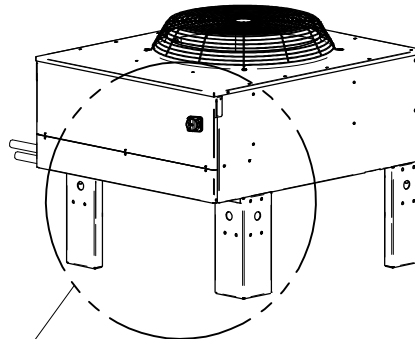
PIPING CONNECTION SIZES (O.D. Cu)		
MODEL NUMBER	NUMBER OF COIL CIRCUITS	INLET & OUTLET PIPE DIAMETER (INCHES)
-040	4, 8*	1 3/8
-057	12*	1 5/8
-057	16	2 1/8
-060	8	1 3/8
-060	16*	2 1/8
-080	8, 16*	2 1/8
-111	16*, 24	2 1/8
-121	16*, 32	2 1/8
-158	16, 24*	2 1/8
-173	16, 32*	2 1/8
-178	16, 32*	2 1/8
-178	48	2 5/8
-205	16, 24*	2 1/8
-248	16, 32*	2 1/8

\* = Standard Circuiting

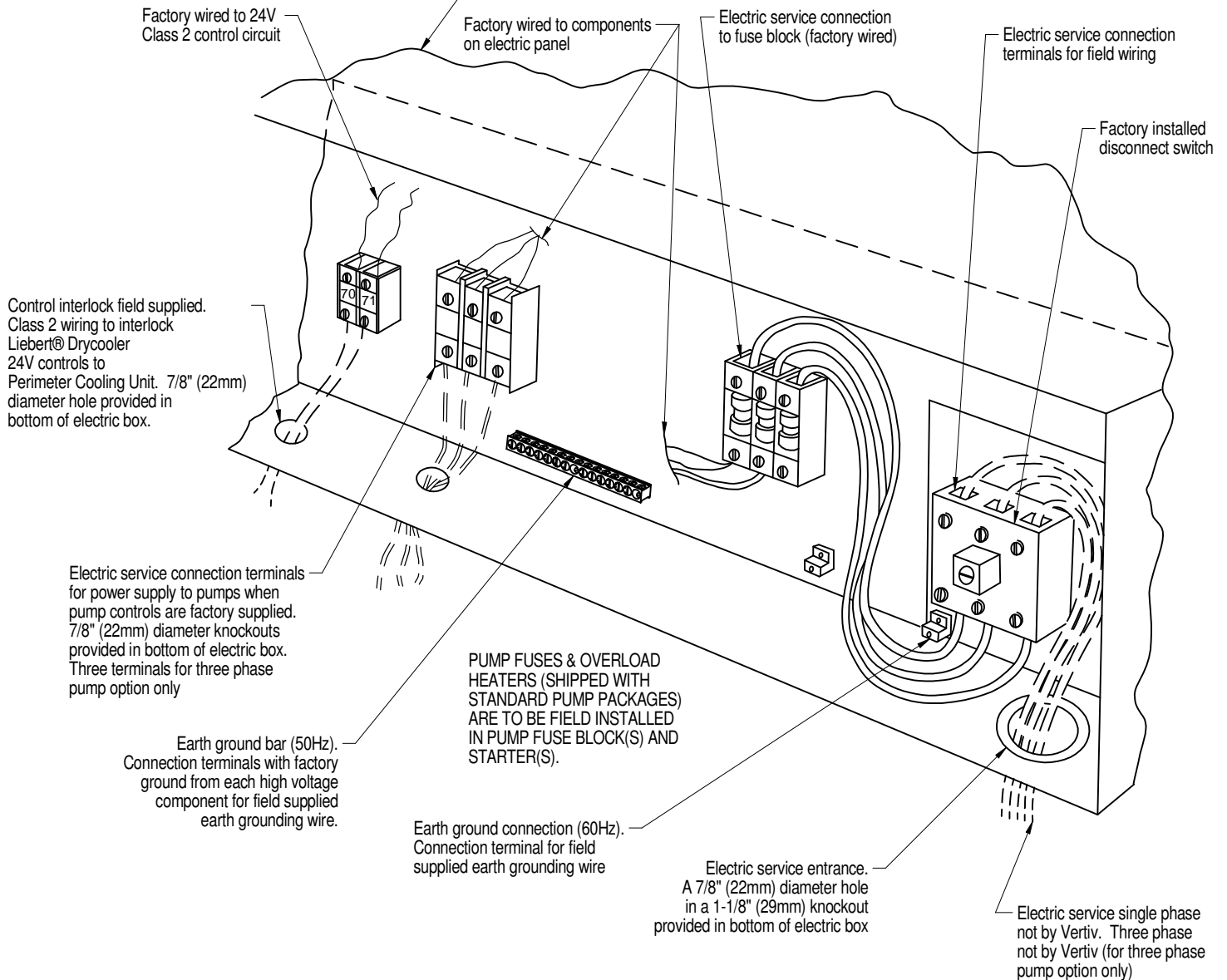


# LIEBERT® DRYCOOLER

## ELECTRICAL FIELD CONNECTIONS FAN SPEED CONTROL

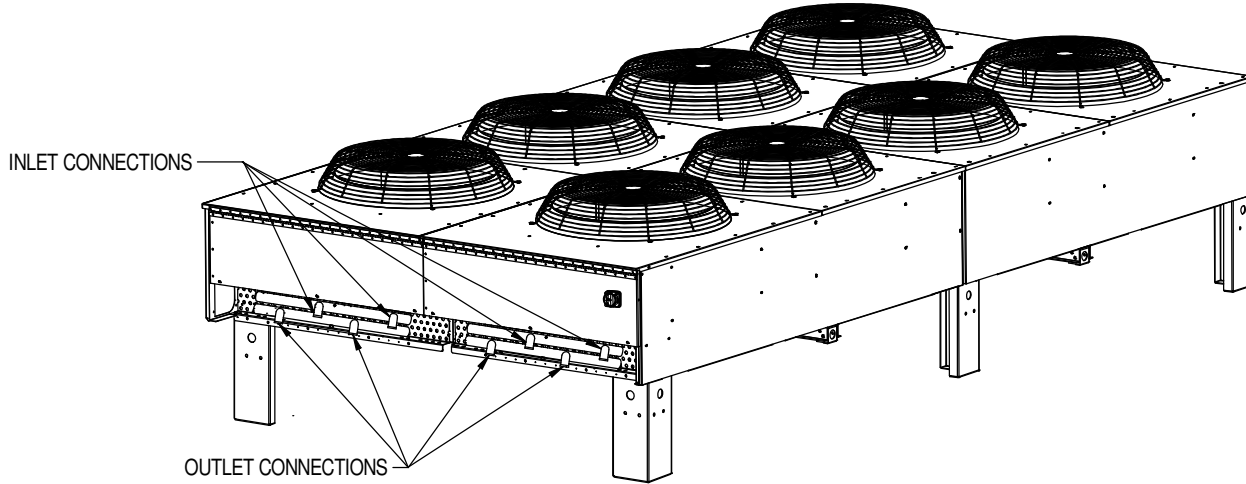


Note:  
Refer to specification sheet for  
full load amp and wire size  
amp ratings



# LIEBERT® DRYCOOLER

## PIPING CONNECTIONS 6 & 8 FAN MODELS



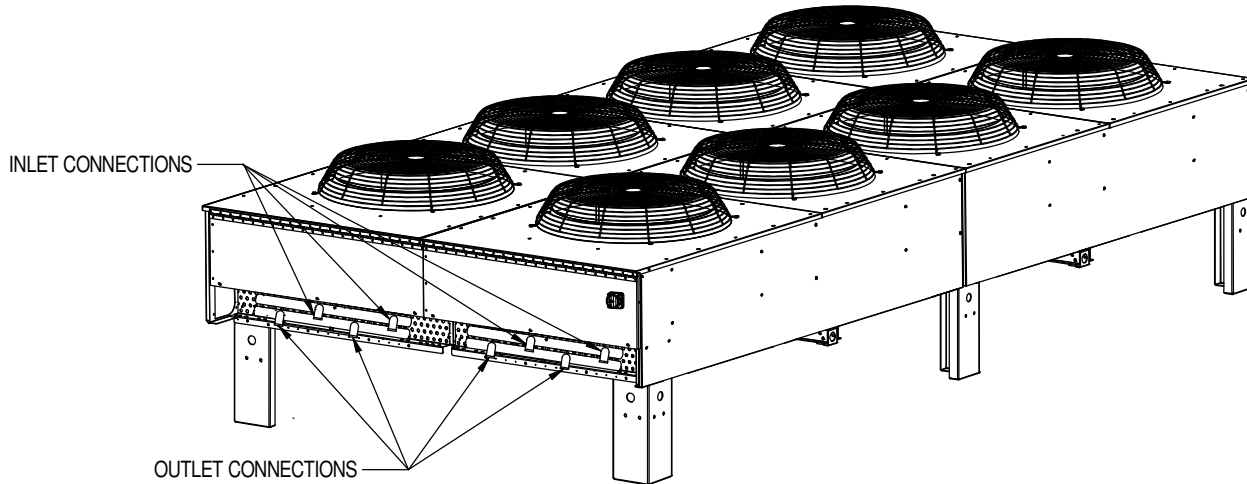
4 INLET, 4 OUTLET  
CONNECTIONS SHOWN  
SEE TABLE FOR ACTUAL  
NUMBER PROVIDED.

Model No.	No. of Fans	No. of Internal Circuits	No. of Inlets & Outlets	Inlet & Outlet Connection sizes (IDS, Cu)
-620	6	32	2	2-1/8"
		64*		
-650		40	4	
		52*		
-700		80	2	
		32		
		64*	4	
-790		8	96	
	32			
-880	64*		4	
	52			
-940	80*		2	
	32			
	64		4	
			96*	

\* STANDARD CIRCUITING

# LIEBERT® DRYCOOLER

## PIPING CONNECTIONS 6 & 8 FAN QUIET-LINE MODELS



4 INLET, 4 OUTLET  
CONNECTIONS SHOWN  
SEE TABLE FOR ACTUAL  
NUMBER PROVIDED.

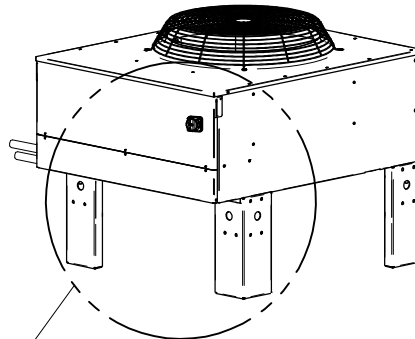
Model No.	Fan Qty.	No. of Internal Circuits	No. of Inlets & Outlets	Inlet & Outlet Connection Size (IDS, Cu)
-347	6	32	2	2-1/8"
		64*		
-356		32	4	
		64*		
-453	8	96	2	
		32		
-498		64	4	
		96*		

\* STANDARD CIRCUITING

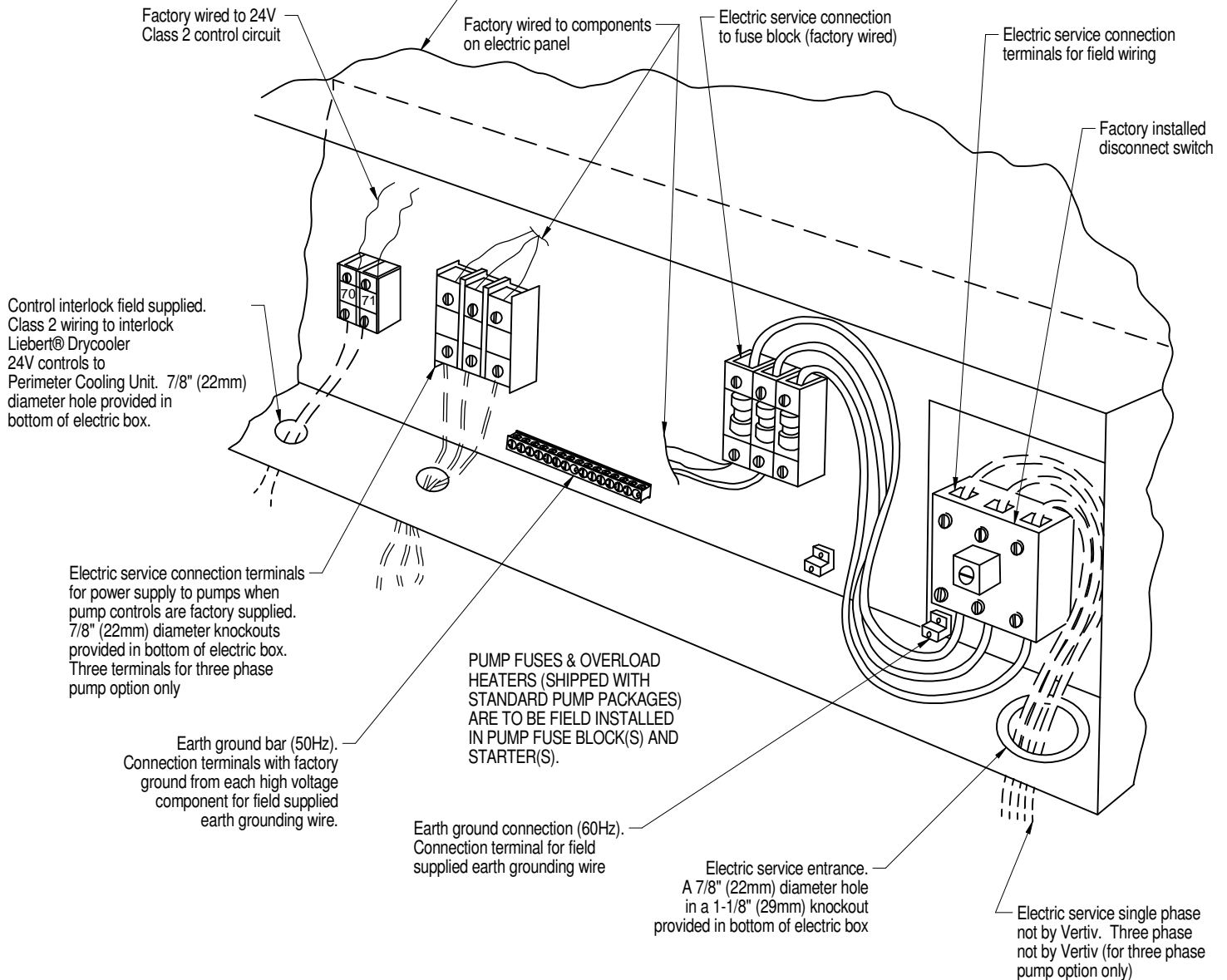


# LIEBERT® DRYCOOLER

## ELECTRICAL FIELD CONNECTIONS FAN SPEED CONTROL



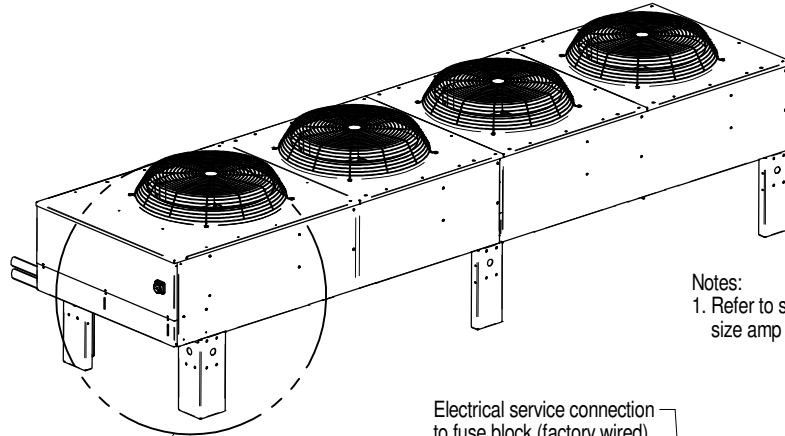
Note:  
Refer to specification sheet for  
full load amp and wire size  
amp ratings



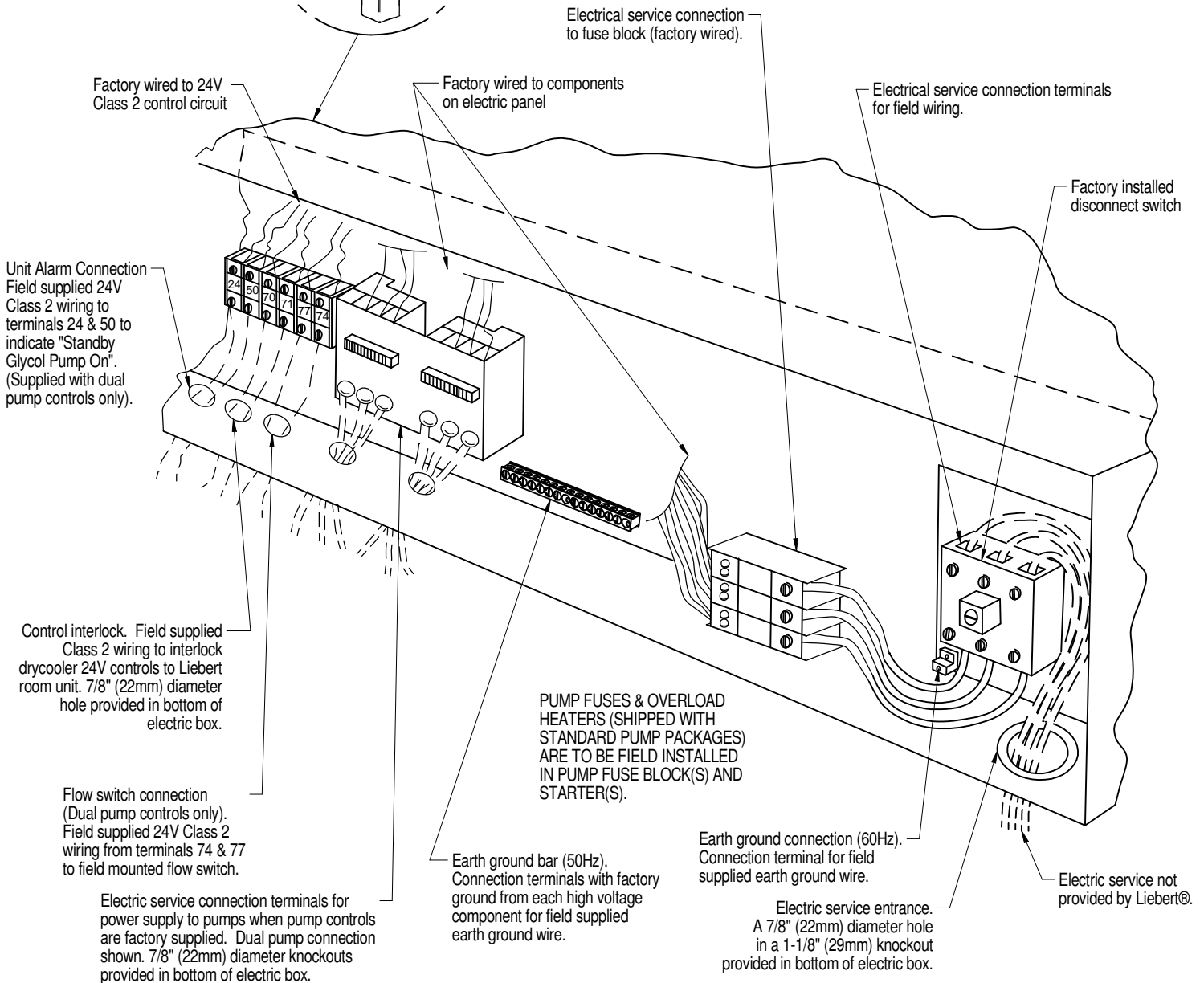


# LIEBERT® DRYCOOLER

## ELECTRICAL FIELD CONNECTIONS FLUID TEMPERATURE CONTROL



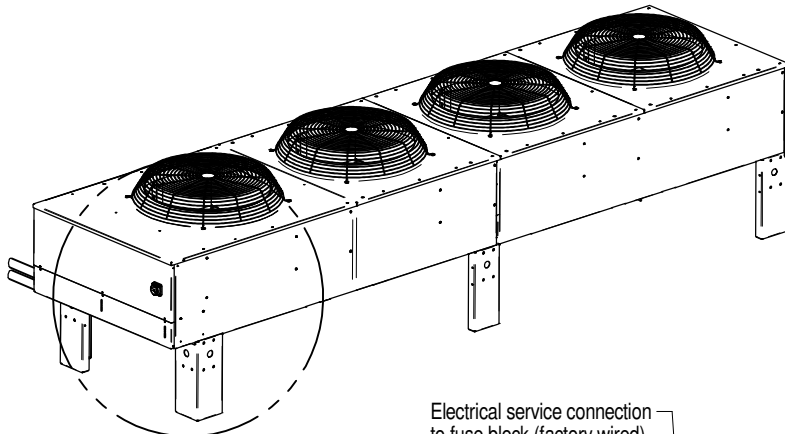
Notes:  
1. Refer to specification sheet for full load amp and wire size amp ratings.



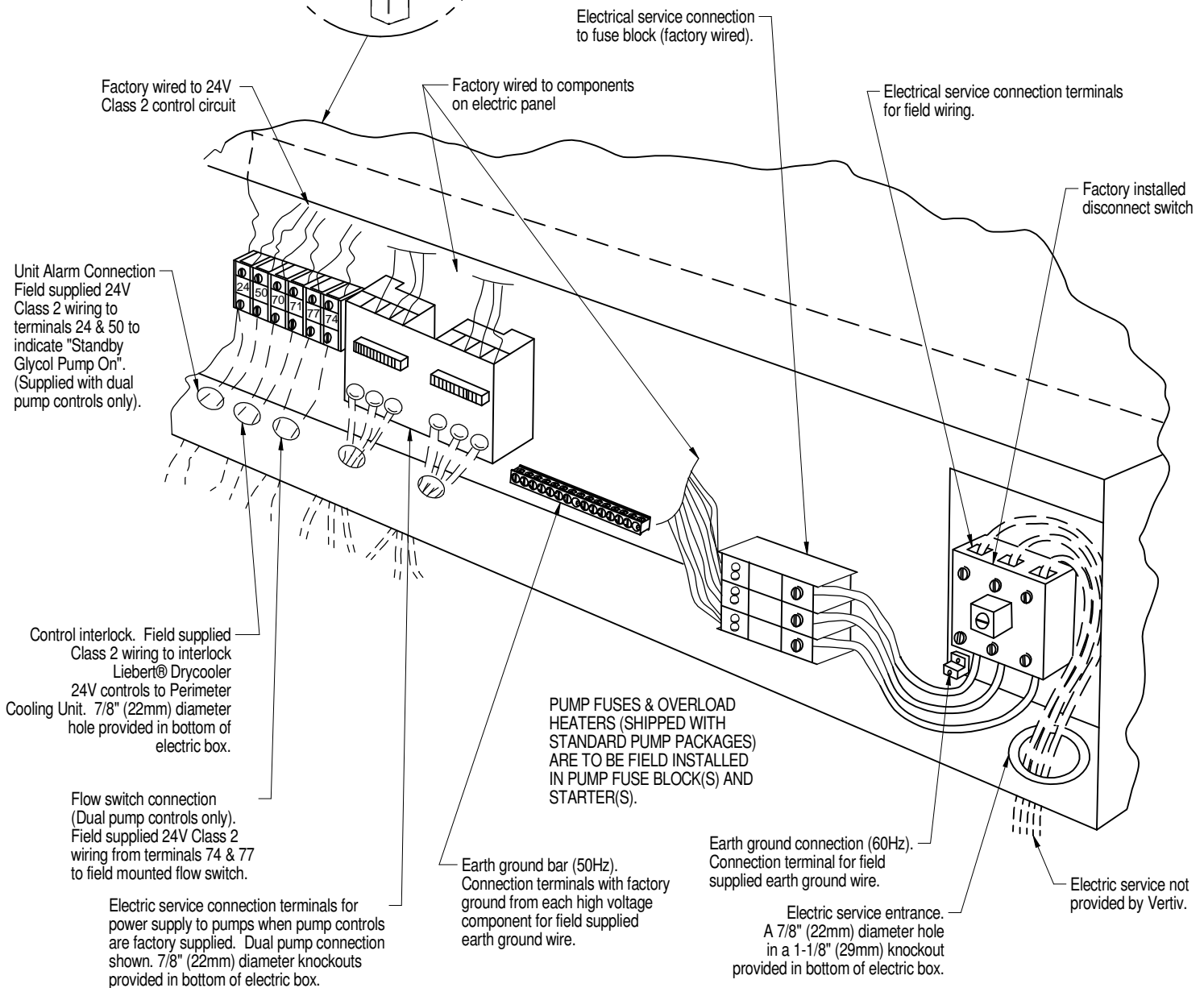


# LIEBERT® DRYCOOLER

## ELECTRICAL FIELD CONNECTIONS FLUID TEMPERATURE CONTROL QUIET-LINE MODELS



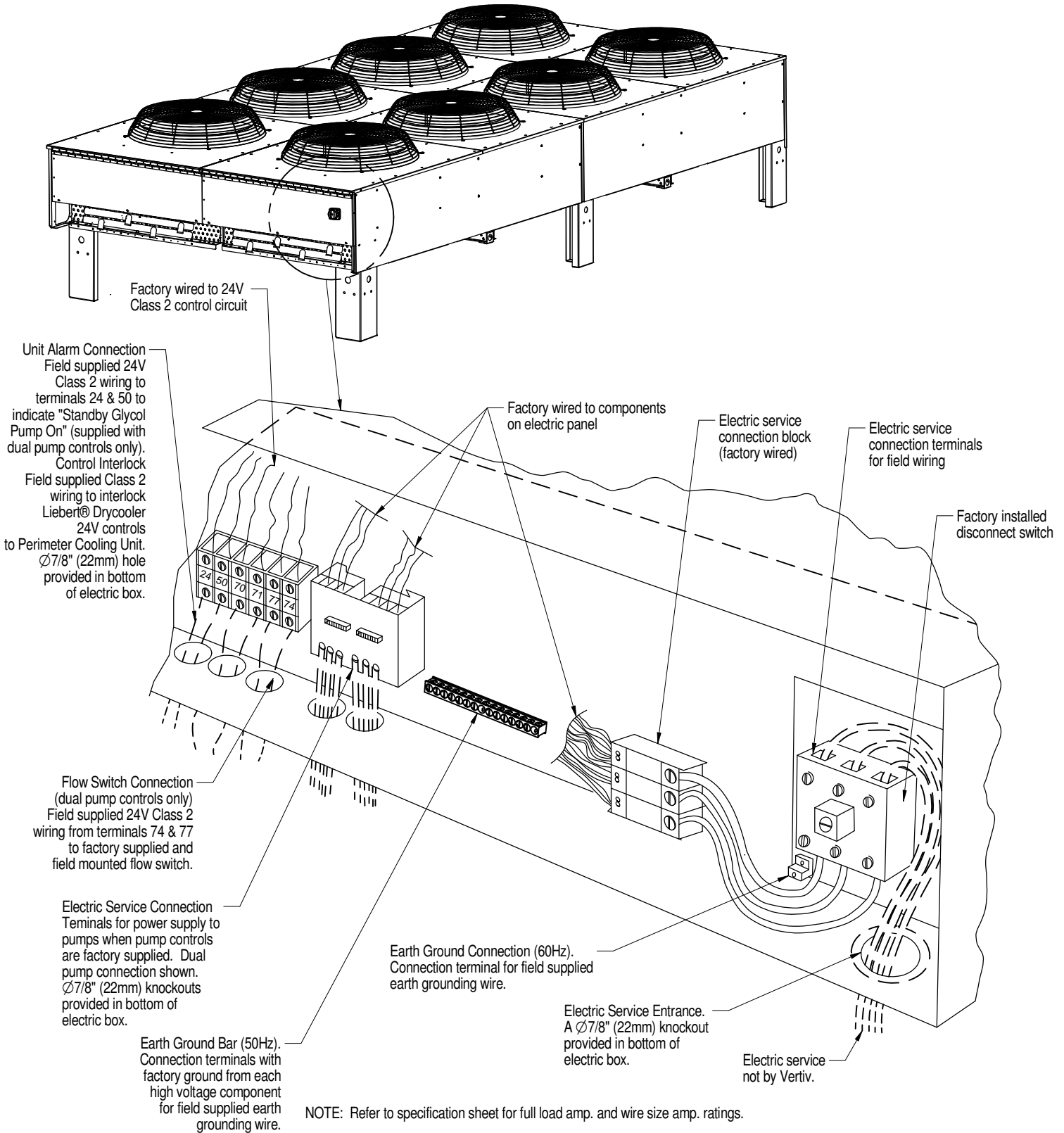
Note:  
Refer to specification sheet  
for full load amp and wire  
size amp ratings.



Form No.: DPN001040\_REV14



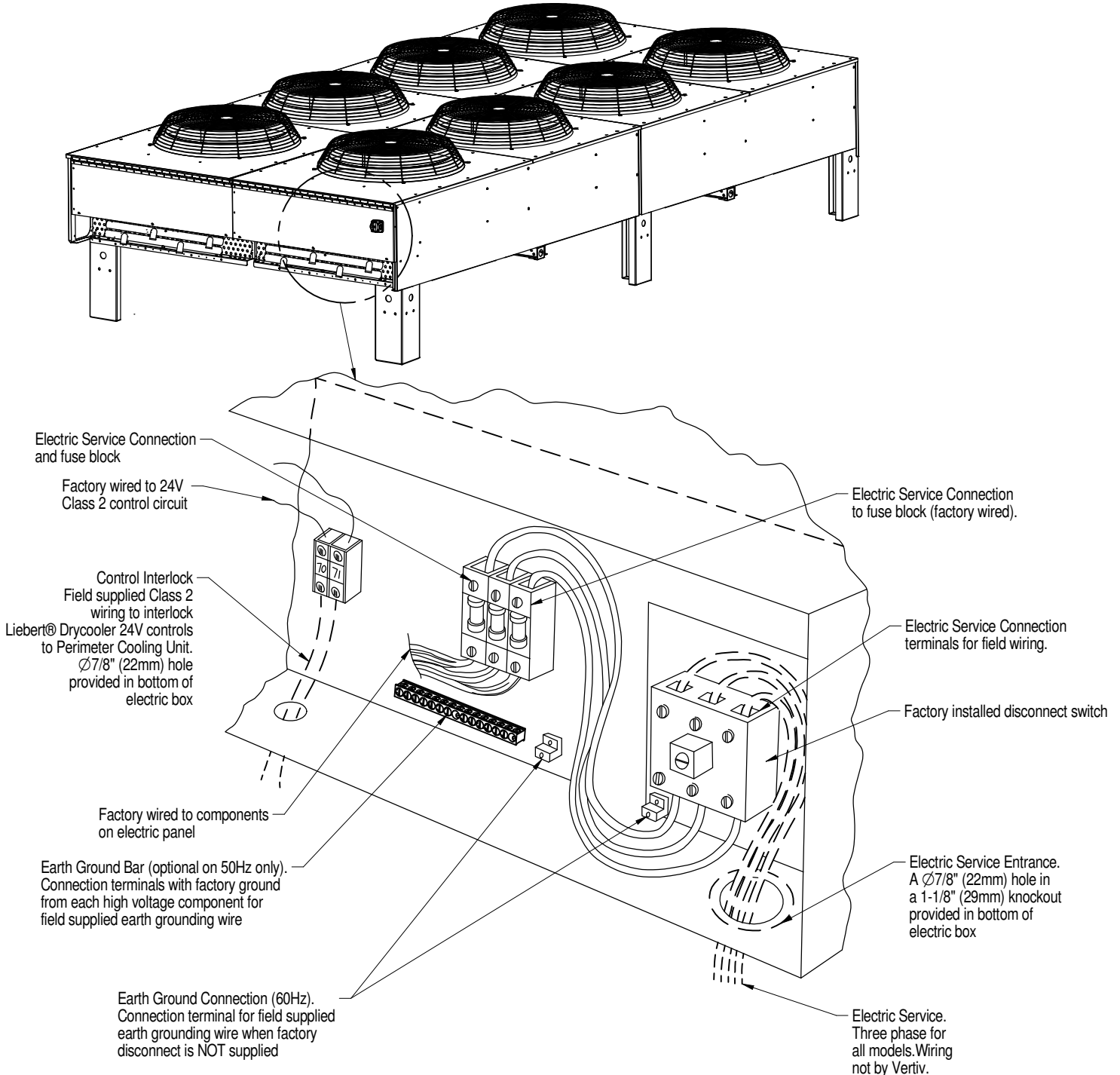
## ELECTRICAL FIELD CONNECTIONS 6 & 8 FAN MODELS W/ DSO/DDO PUMP CONTROL





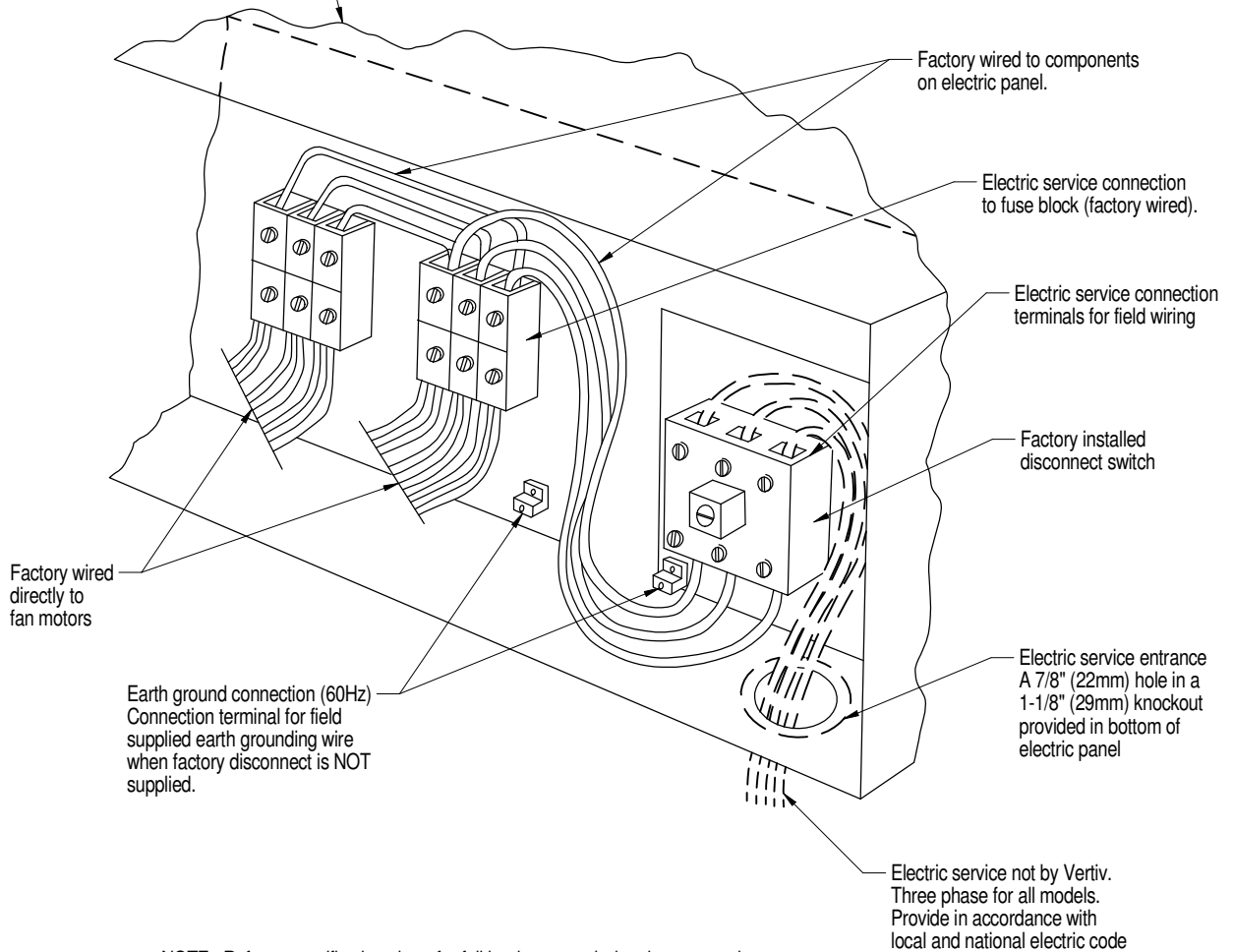
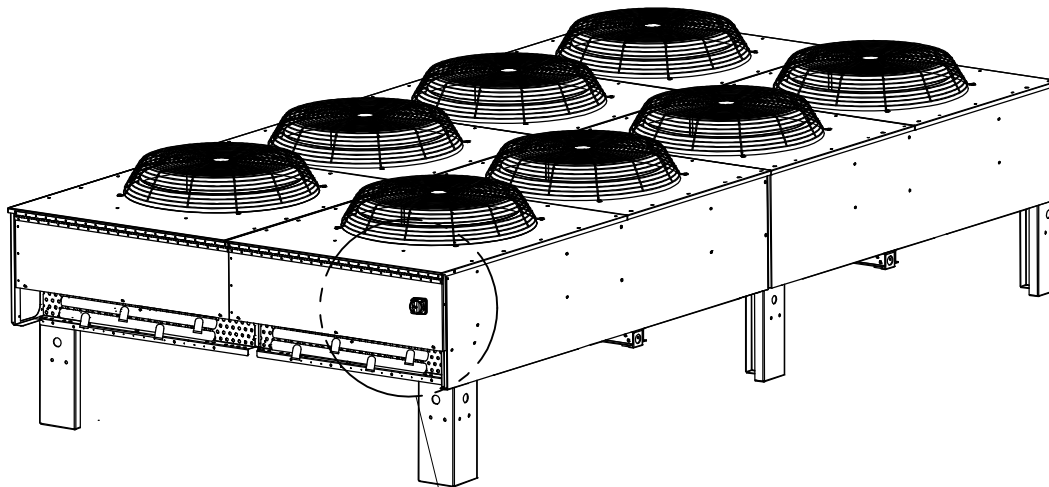
# LIEBERT® DRYCOOLER

## ELECTRICAL FIELD CONNECTIONS 6 & 8 FAN MODELS W/ DDNL & DDNT FAN CONTROL



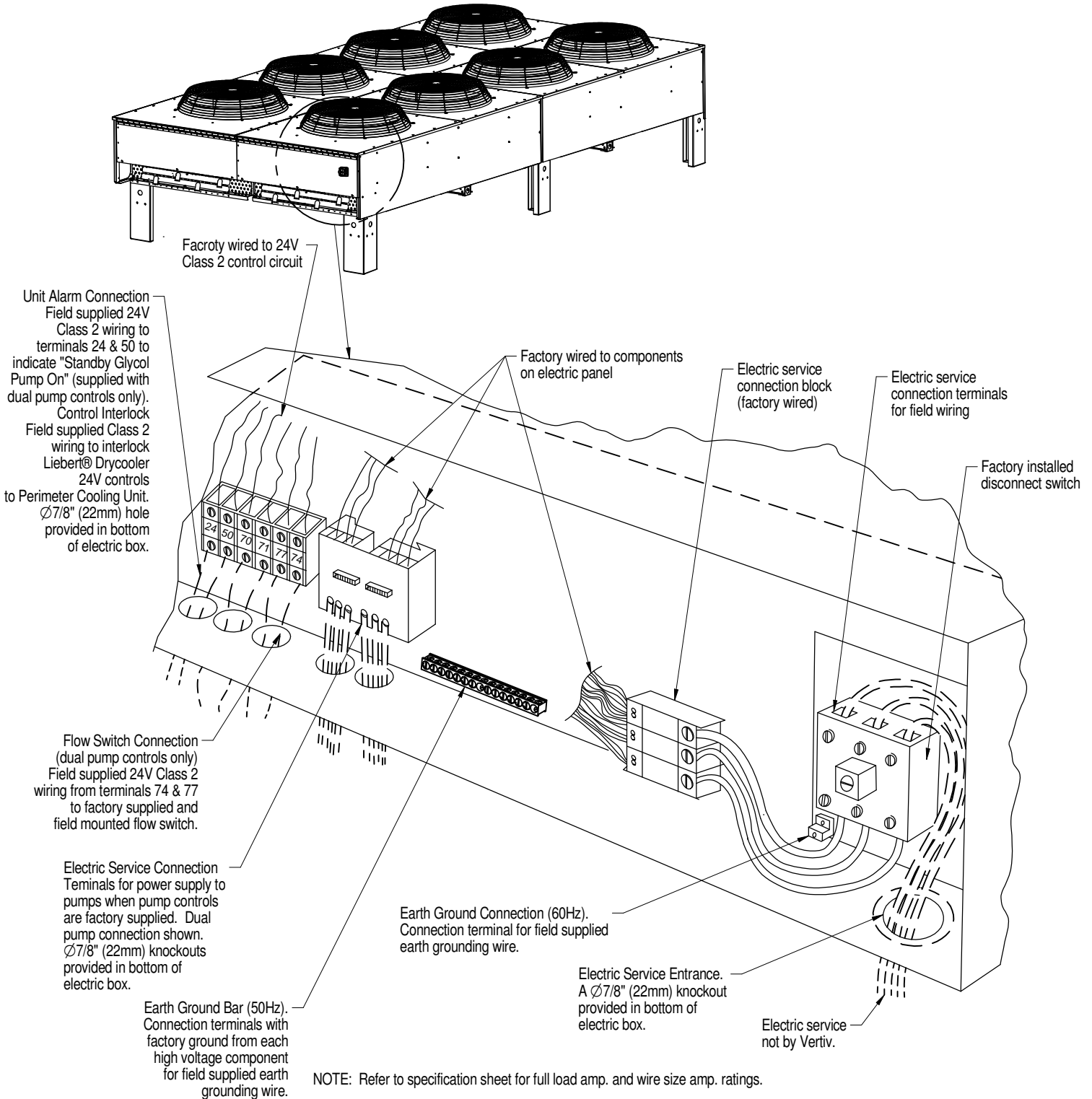
NOTE: Refer to specification sheet for full load amp. and wire size amp. ratings.

## ELECTRICAL FIELD CONNECTIONS 6 & 8 FAN HEAT REJECTION MODELS W/ NO CONTROL



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

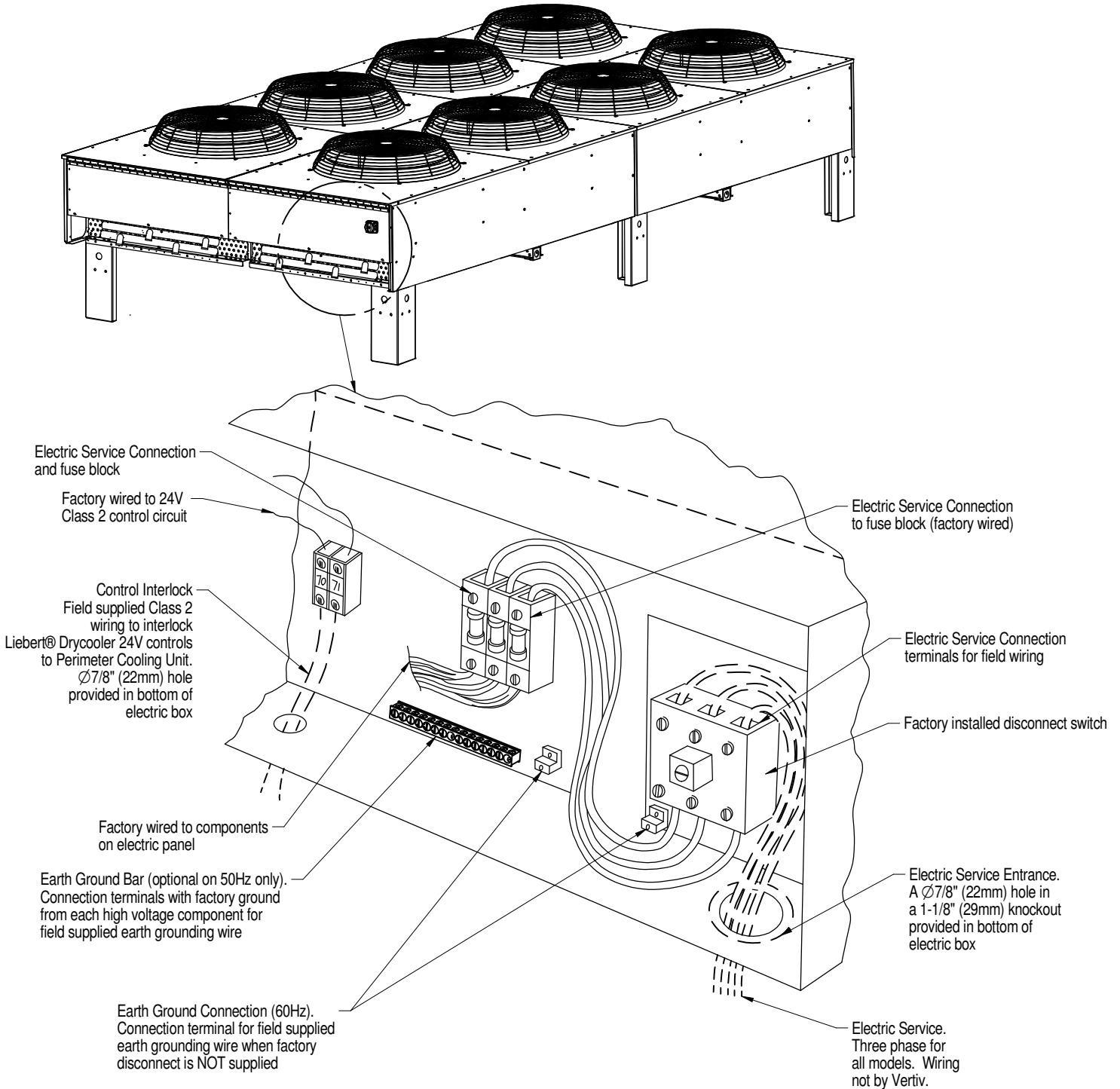
## ELECTRICAL FIELD CONNECTIONS 6 & 8 FAN QUIET-LINE MODELS W/ DSO/DDO PUMP CONTROL





# LIEBERT® DRYCOOLER

## ELECTRICAL FIELD CONNECTIONS 6 & 8 FAN QUIET-LINE W/ DDNL & DDNT CONTROL

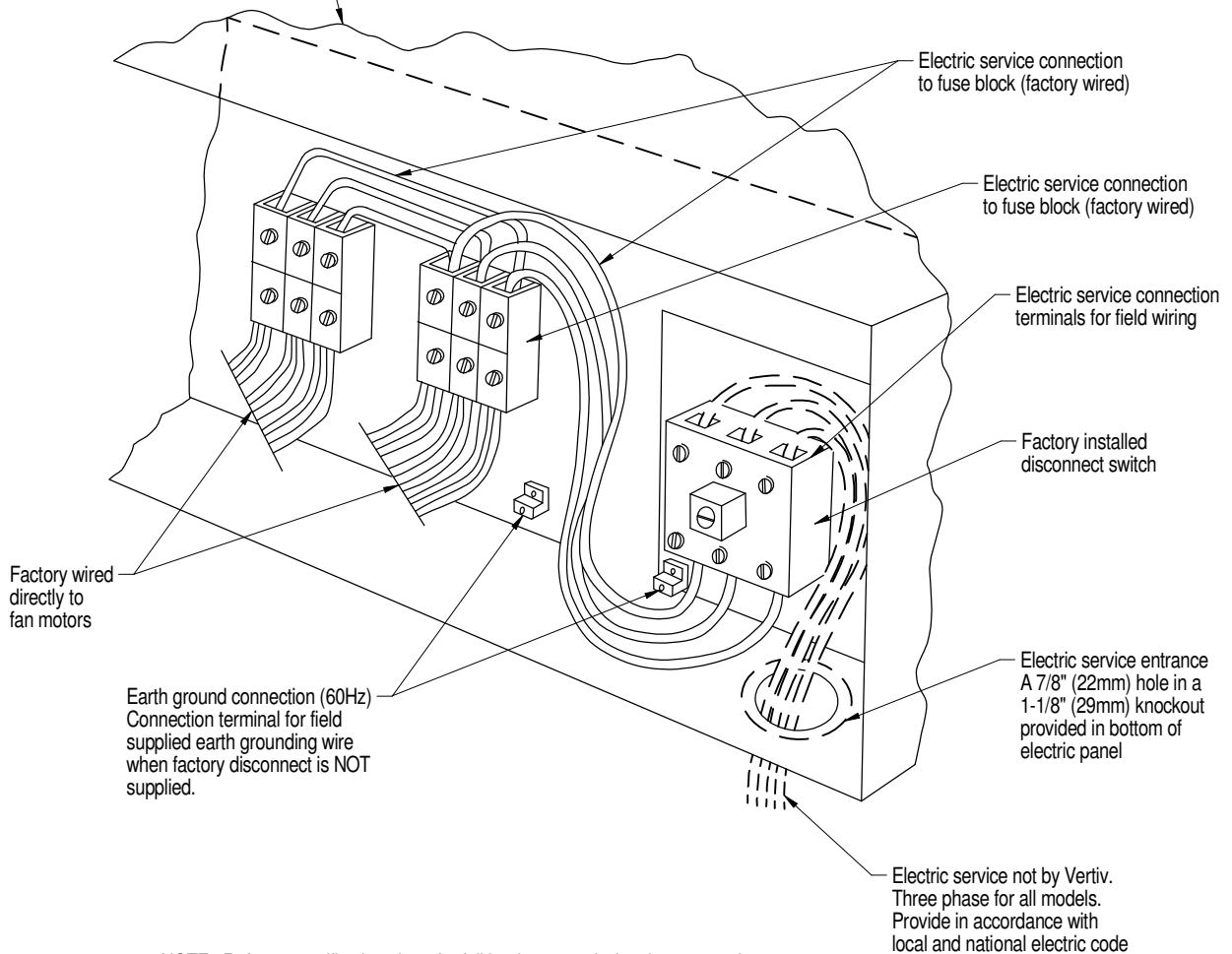
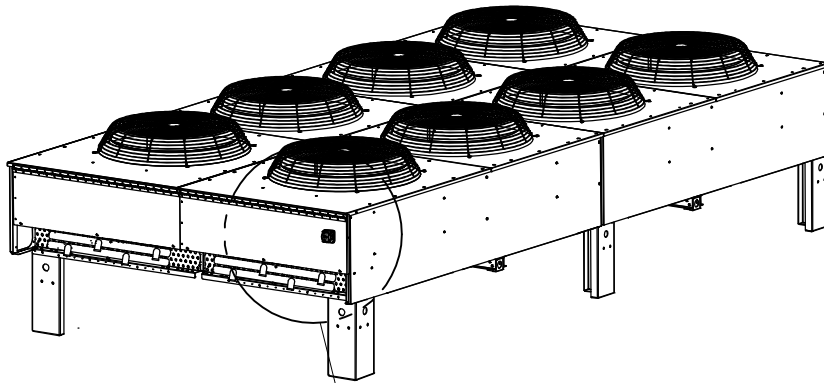


NOTE: Refer to specification sheet for full load amp. and wire size amp. ratings.



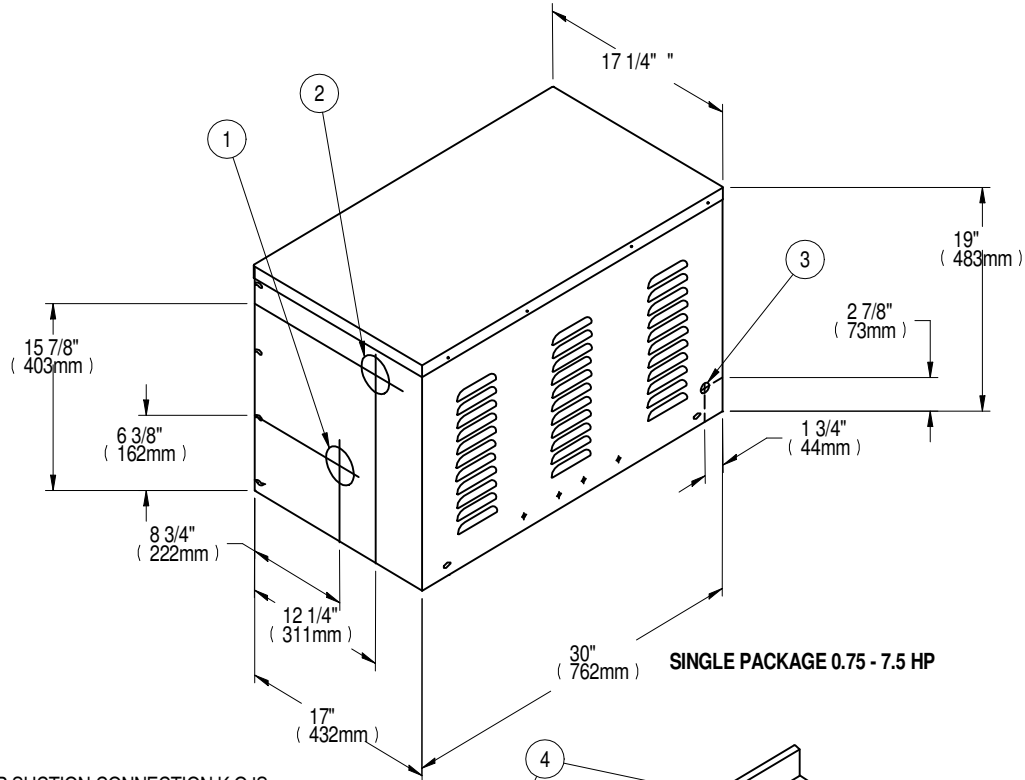
# LIEBERT® DRYCOOLER

## ELECTRICAL FIELD CONNECTIONS 6 & 8 FAN QUIET-LINE HEAT REJECTION MODELS W/ NO CONTROL



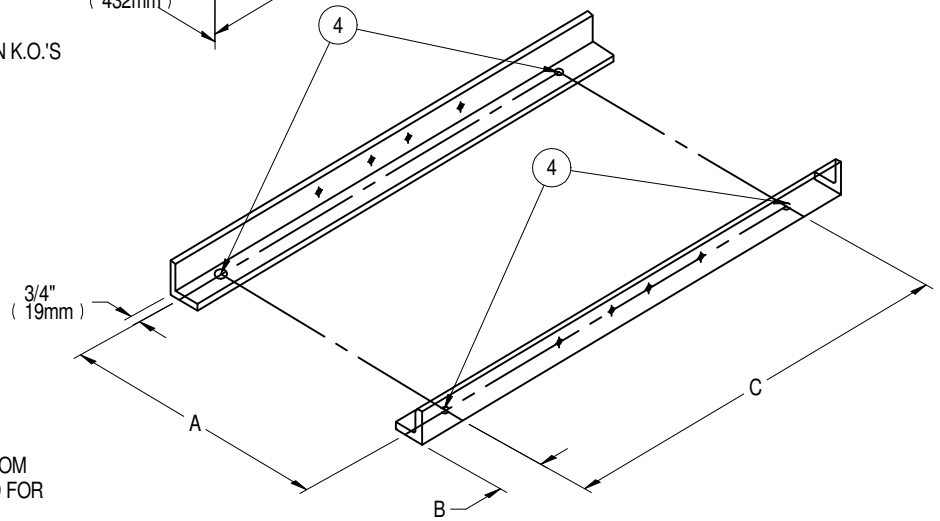
NOTE: Refer to specification sheet for full load amp. and wire size amp. ratings.

## PIPING LOCATIONS & DIMENSIONAL DATA SINGLE PUMP PACKAGE



**SINGLE PACKAGE 0.75 - 7.5 HP**

- ① 3" (76.2mm) DIA. PUMP SUCTION CONNECTION K.O.'S
- ② 3" (76.2mm) DIA. PUMP DISCHARGE CONNECTION K.O.'S
- ③ 7/8" (22.2mm) DIA. ELECTRICAL K.O.'S
- ④ 1/2" (12.7mm) DIA. HOLES FOR MOUNTING



**PUMP PACKAGE MOUNTING ANGLES**

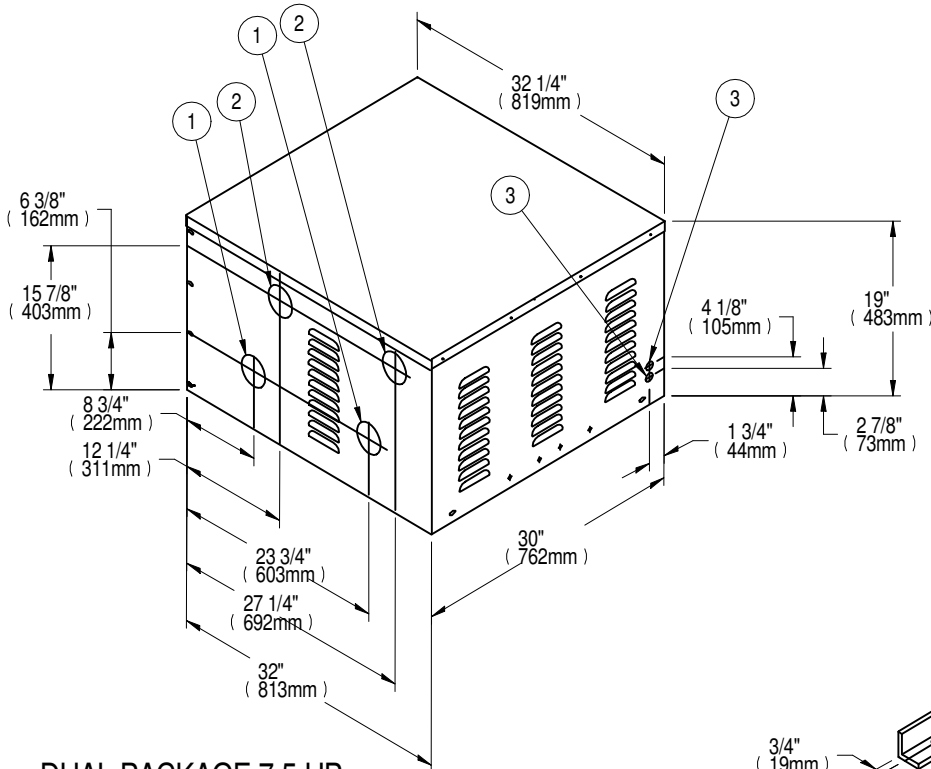
NOTE:  
ANGLES LOCATED INSIDE, BOTTOM  
OF PUMP PACKAGE. VIEW USED FOR  
MOUNTING REFERENCE.

MOUNTING HOLE DIMENSIONAL DATA in. (mm)			
Pump Package	A	B	C
Single (0.75 - 7.5HP)	15-1/4 (387)	2-1/2 (64)	22-1/2 (572)

SINGLE PUMP PACKAGE WEIGHT, lb (kg)	
Model	Weight
S.75	64 (29)
S1.5	66 (30)
S2	
S3	90 (41)
S5	121 (55)
S7.5	152 (69)

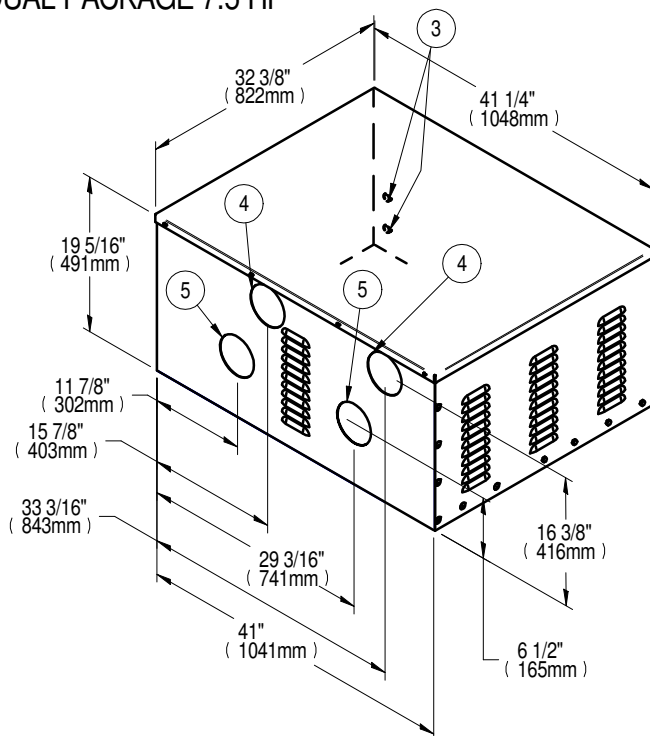
## PIPING CONNECTIONS & DIMENSIONAL DATA DUAL PUMP PACKAGE

### DUAL PACKAGE 0.75 - 5 HP

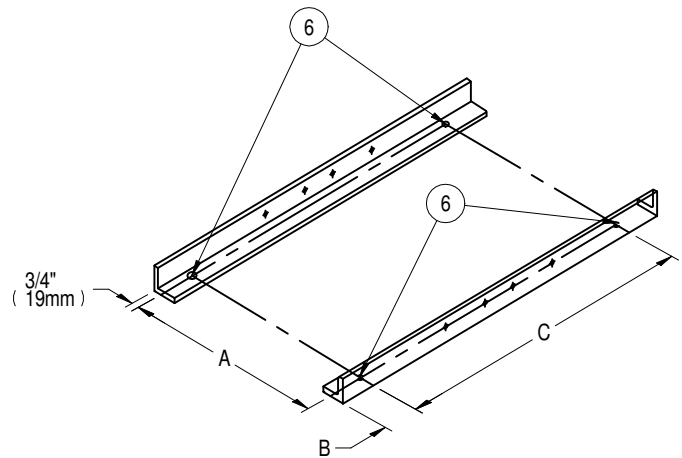


- ① 3" (76.2mm) DIA. PUMP SUCTION CONNECTION K.O.'S
- ② 3" (76.2mm) DIA. PUMP DISCHARGE CONNECTION K.O.'S
- ③ 7/8" (22.2mm) DIA. ELECTRICAL K.O.'S
- ④ 5" (127mm) DIA. PUMP DISCHARGE CONNECTION HOLE
- ⑤ 5" (127mm) DIA. PUMP SUCTION CONNECTION HOLE
- ⑥ 1/2" (12.7mm) DIA. HOLES FOR MOUNTING

### DUAL PACKAGE 7.5 HP



### PUMP PACKAGE MOUNTING ANGLES



NOTE:  
ANGLES LOCATED INSIDE, BOTTOM  
OF PUMP PACKAGE. VIEW USED FOR  
MOUNTING REFERENCE.

Dual Pump Package Weights	
Model	Weight lb (kg)
D.75	138 (63)
D1.5	140 (64)
D2	
D3	164 (74)
D5	220 (100)
D7.5	276 (125)

Mounting Hole Dimensional Data in. (mm)			
Pump Package	A	B	C
Dual (0.75-5HP)	30-1/4 (768)	2-1/2 (64)	22-1/2 (572)
Dual (7.5HP)	39-5/16 (999)	1-3/4 (45)	26-7/8 (683)



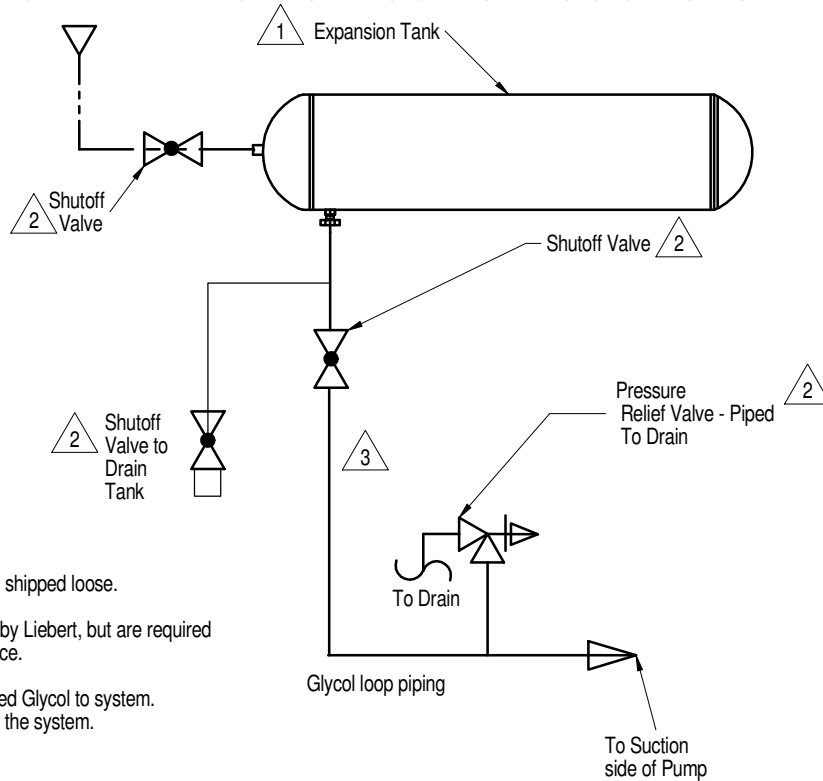


# LIEBERT® DRYCOOLER

## ELECTRICAL & PIPING CONNECTION DATA PUMP PACKAGE

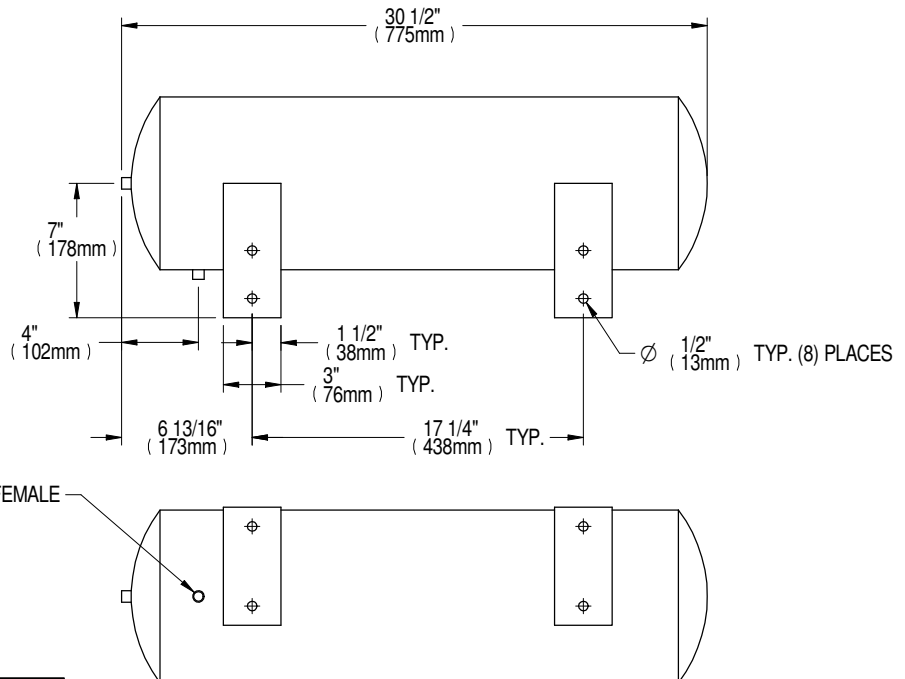
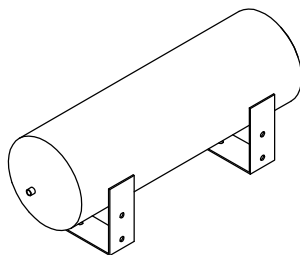
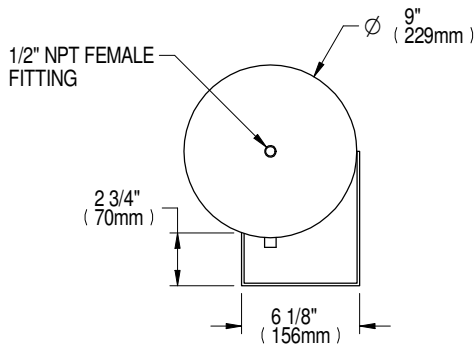
GLYCOL PUMP DATA							
HP	ELECTRICAL DATA 60Hz					PIPING CONNECTIONS NPT FEMALE IN.	
	PHASE	FLA (FULL LOAD AMPS)				SUCTION	DISCHARGE
		208V	230V	460V	575V		
3/4	1	7.6	6.9	N/A	N/A	1-1/4	3/4
1-1/2	3	3.5	3.2	1.6	1.3		
2		6.6	6.0	3.0	2.4		
3		7.5	6.8	3.4	2.7		
5		10.6	9.6	4.8	3.9	1-1/2	1
7.5		16.7	15.2	7.6	6.1		1-1/4
		24.2	22	11	9	3	3
HP	ELECTRICAL DATA 50Hz					PIPING CONNECTIONS NPT FEMALE IN.	
	PHASE	FLA (FULL LOAD AMPS)				SUCTION	DISCHARGE
		380V / 415V					
1	3	1.64 / 1.63				1-1/4	3/4
1-1/2		2.4 / 2.25					
2		3.00 / 2.88					
3		4.7 / 4.38				1-1/2	1-1/4
5		7.9 / 7.47					

## GENERAL ARRANGEMENT DIAGRAM & DIMENSIONAL DATA EXPANSION TANK FOR GLYCOL/GLYCOOL SYSTEMS



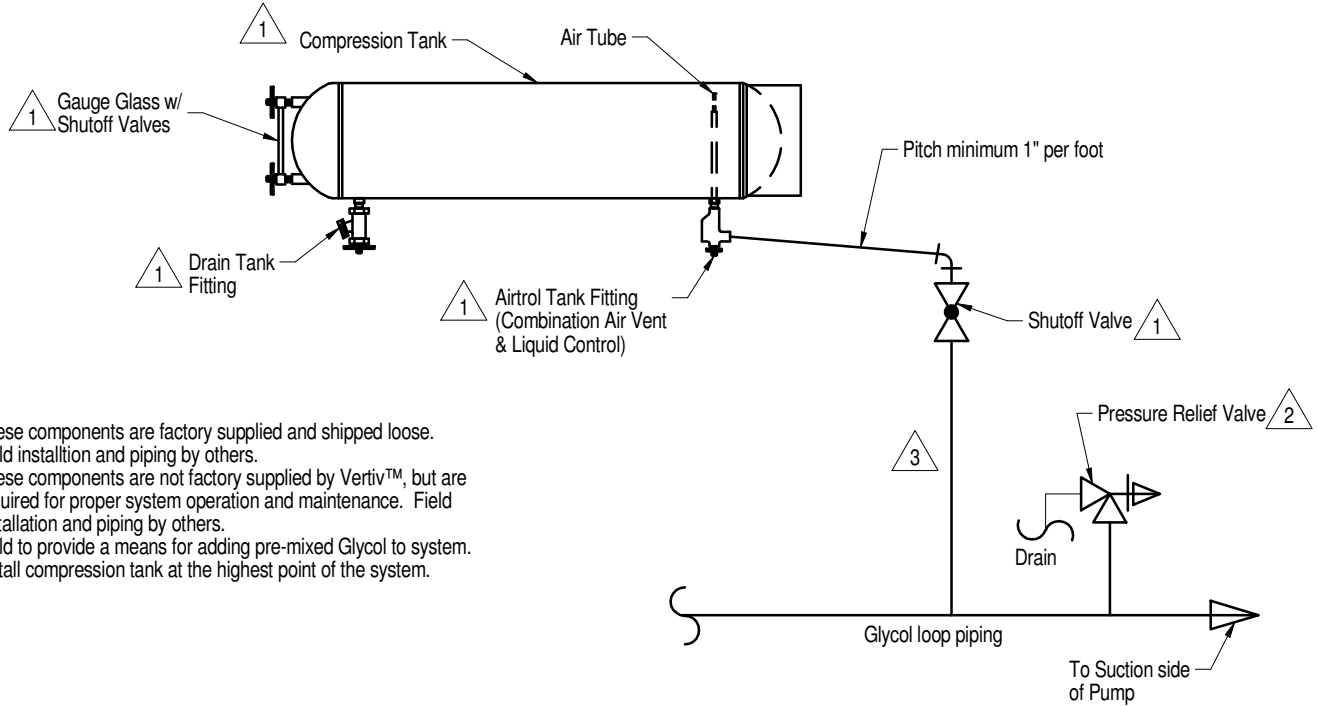
Notes:

- 1. These components are factory supplied and shipped loose. Field installation and piping by others.
- 2. These components are not factory supplied by Liebert, but are required for proper system operation and maintenance. Field installation and piping by others.
- 3. Field to provide a means for adding pre-mixed Glycol to system.
- 4. Install expansion tank at the highest point of the system.



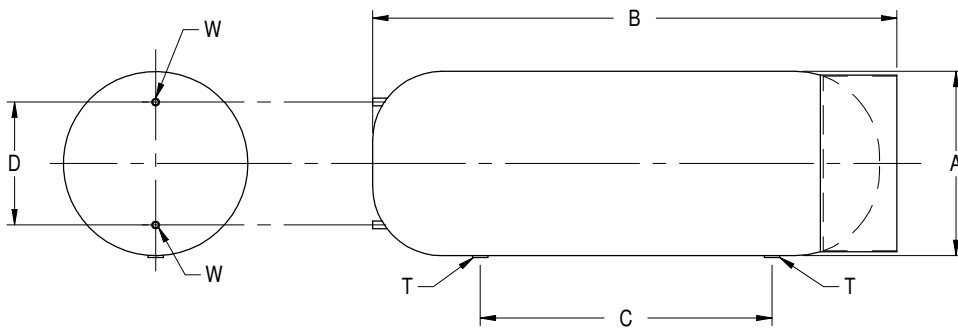
Expansion Tank Volume Gal (L)	Approx. Dry Weight lbs. (kg)	Maximum System Volume Gal (L)	
		Open System	Closed System
Tank Only			
8.8 (33.3)	26 (11.8)	75 (280)	140 (530)

## GENERAL ARRANGEMENT DIAGRAM & DIMENSIONAL DATA ASME COMPRESSION TANK KITS GLYCOL/GLYCOOL SYSTEMS



**Notes:**

- 1. These components are factory supplied and shipped loose. Field installation and piping by others.
- 2. These components are not factory supplied by Vertiv™, but are required for proper system operation and maintenance. Field installation and piping by others.
- 3. Field to provide a means for adding pre-mixed Glycol to system.
- 4. Install compression tank at the highest point of the system.



MAXIMUM SYSTEM (GAL)	TANK CAPACITY (GAL)	DIMENSIONS in. (mm)						APPROX. KIT WT. Lbs. (kg)
		A	B	C	D	T (NPT Female)	W (NPT Female)	
250	15	12 (305)	34-1/8 (867)	19 (483)	8 (203)	1"	1/2"	60 (27.2)
400	24		52-1/8 (1324)	37 (940)				75 (34.0)
500	30	14 (356)	49-3/8 (1254)	31-1/4 (794)	10 (254)	1"	1/2"	82 (37.2)
650	40		64-3/8 (1635)	46-1/4 (1175)				105 (47.6)
1000	60	16 (406)	73 (1854)	53-1/2 (1359)	12 (305)	1"	1/2"	140 (63.5)
1650	100	20 (508)	80-5/16 (2040)	58 (1473)	16 (406)			200 (90.7)

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