



Liebert[®] Air-cooled, Direct-drive Drycooler

Installer/User Guide

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.

TABLE OF CONTENTS

1 Important Safety Instructions	1
2 Nomenclature and Components	7
2.1 Liebert® Drycooler Model Number Nomenclature	7
2.2 Product Description and Features	8
2.2.1 Control Options	8
2.2.2 Typical System Configurations	9
3 Preinstallation and Site Preparation Guidelines	11
3.1 Shipping Dimensions and Weights	11
3.2 Planning Dimensions and Anchor Plans	14
3.3 Pump Packages	14
3.3.1 Expansion Tank	15
3.3.2 Compression Tank	16
4 Equipment Inspection and Handling	17
4.1 Packaging Material	17
4.2 Unit Storage	18
4.3 Handling Unit on the Skid	18
4.4 Unpacking the Unit—All Unit Sizes	19
4.5 Preparing 1 to 4 Fan Liebert® Drycooler for Moving and Installation	21
4.6 Preparing 6 and 8 Fan Vertiv™ Liebert® Drycoolers for Moving and Installation	24
4.7 Mounting the Vertiv™ Liebert® Drycooler	27
5 Piping	29
5.1 Guidelines for Expansion Tanks, Fluid-relief Valves, Air Management and Other Devices	34
5.2 Preparing to Fill the System	34
5.3 Filling the Vertiv™ Liebert® Drycooler System	36
6 Electrical Connections	37
6.1 Line Voltage Wiring	38
6.2 Low Voltage Control Wiring	44
7 Checklist for Completed Installation	47
7.1 Moving and Placing Equipment	47
7.2 Electrical Installation Checks	47
7.3 Piping Installation Checks	47
7.4 Other Installation Checks	47
8 Troubleshooting	49
9 Operation	51
9.1 Start-up Checklist	51
9.2 Vertiv™ Liebert® Drycooler Settings	51
10 Maintenance	53
10.1 General Maintenance	54

10.2 Vertiv™ Liebert® Drycooler Cleaning - Standard Coil 54

 10.2.1 When to Clean the Vertiv™ Liebert® Drycooler Coil 54

 10.2.2 What to Use to Clean the Vertiv™ Liebert® Drycooler Coil 54

 10.2.3 Cleaning the Vertiv™ Liebert® Drycooler Coil 55

 10.2.4 Vertiv™ Liebert® Drycooler Coil Cleaning - Heresite Coated Coil 55

11 Preventive Maintenance Checklist 57

Appendices 61

Appendix A: Technical Support and Contacts 61

Appendix B: Submittal Drawings 63

1 Important Safety Instructions

SAVE THESE INSTRUCTIONS

This manual contains important safety instructions that should be followed during the installation and maintenance of the Vertiv™ Liebert® Air-cooled, Direct-drive Drycooler. Read this manual thoroughly before attempting to install or operate this unit.

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

Adhere to all warnings, cautions, notices and installation, operating and safety instructions on the unit and in this manual. Follow all installation, operation and maintenance instructions and all applicable national and local building, electrical and plumbing codes.



WARNING! Arc flash and electric shock hazard. Open all local and remote electric power-supply disconnect switches, verify with a voltmeter that power is Off and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death. Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable. Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power. The Vertiv™ Liebert® iCOM™ controller does not isolate power from the unit, even in the “Unit Off” mode. Some internal components require and receive power even during the “Unit Off” mode of the Liebert® iCOM™ controller. The factory-supplied disconnect switch is inside the unit. The line side of this switch contains live high-voltage. The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic. Follow all local codes.



WARNING! Risk of electric shock. Can cause equipment damage, injury or death. Open all local and remote electric power supply disconnect switches and verify with a voltmeter that power is off before working within any electric connection enclosures. Service and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers’ specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.



WARNING! Risk of electric shock. Can cause serious injury or death. The Liebert® iCOM™ microprocessor does not isolate power from the unit, even in the "Unit Off" mode. Some internal components require and receive power even during the "unit off" mode of the Liebert® iCOM™ control. Open all local and remote electric power disconnect switches and verify with a voltmeter that power is Off before working on any component of the system.



WARNING! Risk of electrical fire and short circuit. Can cause property damage, injury or death. Select and install the line side electrical supply wire and overcurrent protection device(s) according to the specifications on the unit nameplate(s), per the instructions in this manual and according to the applicable national, state and local code requirements. Use copper conductors only. Verify that all electrical connections are tight. Unit-specific wiring diagrams are provided on each unit.



WARNING! Risk of improper wire sizing/rating and loose electrical connections. Can cause overheated wire and electrical connection terminals resulting in smoke, fire, equipment and building damage, injury or death. Use correctly sized copper wire only and verify that all electrical connections are tight before turning power On. Check all electrical connections periodically and tighten as necessary.



WARNING! Risk of improper wiring, piping, moving, lifting and handling. Can cause equipment damage, serious injury or death. Installation and service of this equipment should be done only by qualified personnel who have been specially-trained in the installation of air-conditioning equipment and who are wearing appropriate, OSHA-approved PPE. See **Table 3.1** on page 11 , and **Table 3.2** on page 13 , for weights.



WARNING! Risk of improper moving, lifting, or handling of the unit. Can cause equipment damage, injury or death. Read all of the following instructions and verify that all lifting and moving equipment is rated for the weight of the unit before attempting to move, lift, remove packaging from or prepare the unit for installation. **Table 3.1** on page 11 , and **Table 3.2** on page 13 , for weights.



WARNING! Risk of contact with high-speed rotating fan blades. Can cause serious injury or death. Open all local and remote electric power-supply disconnect switches, verify with a voltmeter that power is off, and verify that all fan blades have stopped rotating before working in the unit cabinet or on the fan assembly. If control voltage is applied, the fan motor can restart without warning after a power failure. Do not operate the unit with any or all cabinet panels removed.



CAUTION: Risk of unsecured strap ends with sharp edges flying uncontrollably in any direction when cut. Can cause serious injury. Secure both ends of strap when cutting and wear OSHA-approved protective headgear, gloves, and eye protection when working with the securing straps.



CAUTION: Risk of contact with hot surfaces. Can cause injury. Personal burn injury can be the result of touching some electrical components that are extremely hot during unit operation. Allow sufficient time for them to cool to a touch-safe temperature before working within the unit cabinet. Use extreme caution and wear appropriate, OSHA-approved PPE when working on or near hot components.

NOTICE

Risk of improper power-supply connection. Can cause equipment damage and loss of warranty coverage.

Prior to connecting any equipment to a main or alternate power source (for example: back-up generator systems) for start-up, commissioning, testing, or normal operation, ensure that these sources are correctly adjusted to the nameplate voltage and frequency of all equipment to be connected. In general, power-source voltages should be stabilized and regulated to within $\pm 10\%$ of the load nameplate nominal voltage. Also, ensure that no three-phase sources are single-phased at any time.

NOTICE

Risk of piping-system corrosion and freezing fluids. Can cause leaks resulting in equipment and expensive building damage. Cooling coils and piping systems are at high risk of freezing and premature corrosion. Fluids in these systems must contain an inhibitor to prevent premature corrosion.

The system coolant fluid must be analyzed by a competent fluid-treatment specialist before start up to establish the inhibitor level and evaluated at regularly scheduled intervals throughout the life of the system to determine the pattern of inhibitor depletion. The fluid complexity and variations of required treatment programs make it extremely important to obtain the advice of a competent and experienced fluid-treatment specialist and follow a regularly scheduled coolant-fluid system-maintenance program.

Fluid chemistry varies greatly as do the required additives, called inhibitors, that reduce the corrosive effect of the fluids on the piping systems and components.

The chemistry of the coolant fluid used must be considered, because some sources may contain corrosive elements that reduce the effectiveness of the inhibited formulation. Sediment deposits prevent the formation of a protective oxide layer on the inside of the coolant system components and piping. The coolant fluid must be treated and circulating through the system continuously to prevent the buildup of deposits and/or growth of bacteria. Proper inhibitor maintenance must be performed to prevent corrosion of the system.

Consult fluid manufacturer for testing and maintenance of inhibitors.

Commercial-grade coolant fluid is generally less corrosive to the common metals of construction than water itself. It will, however, assume the corrosivity of the coolant fluid from which it is prepared and may become increasingly corrosive with use if not properly inhibited.

Vertiv recommends installing a monitored fluid-detection system that is wired to activate the automatic-closure of field-installed coolant-fluid supply and return shut-off valves to reduce the amount of coolant-fluid leakage and consequential equipment and building damage. The shut-off valves must be sized to close-off against the maximum coolant-fluid system pressure in case of a catastrophic fluid leak.

NOTICE

Risk of frozen pipes and corrosion from improper coolant mixture. Can cause water leaks resulting in equipment and building damage.

When the drycooler, the cooling unit or piping may be exposed to freezing temperatures, charge the system with the proper percentage of glycol and water for the coldest design ambient temperature. Automotive antifreeze is unacceptable and must NOT be used in any glycol fluid system. Use only HVAC glycol solution that meets the requirements of recommended industry practices. Do not use galvanized pipe.

NOTICE

Risk of excessive coolant fluid pressure, improper piping material, and unsupported piping. Can cause piping rupture, coolant fluid leaks and building and/or equipment damage.

To avoid the possibility of burst pipes, the system installer must supply and install a relief valve in the system. Galvanized pipe must not be used in glycol systems. To help prevent piping failures, supply and return lines must be supported such that their weight does not bear on the piping of the unit or pumps.

NOTICE

Risk of overheated pump seals. Can cause piping system damage, coolant fluid leaks, and substantial building damage.

Do not run pumps without fluid in the system. Pump seals require fluid to keep them cool; running them without fluid for any amount of time will damage the seals, which may cause a failure.

NOTICE

Risk of damage from forklift. Can cause unit damage. Keep tines of the forklift level and at a height suitable to fit below the skid and/or unit to prevent exterior and/or underside damage.

NOTICE

Risk of a catastrophic water circuit rupture. Can cause expensive building and equipment damage.

Install shutoff valves in the supply and return water lines that automatically close if water is detected by the leak detection system. The shutoff valves should be spring return and must be rated for a close-off pressure that is the same as or higher than the supply water pressure. A monitored leak detection system should be installed in the base of the unit or under the unit to actuate the shutoff valves immediately on a leak detection signal.

NOTICE

Risk of no-flow condition. Can cause equipment damage.

Do not leave the water/coolant fluid-supply circuit in a no-flow condition. Idle fluid allows the collection of sediment that prevents the formation of a protective oxide layer on the inside of tubes. Keep unit switched On and water/coolant fluid-supply circuit system operating continuously.

NOTICE

Risk of using the wrong type of glycol. Can cause piping damage, coolant fluid leaks, and catastrophic and expensive building and equipment damage.

Do not use automotive antifreeze as it contains chemicals that can damage the piping system.

Typical inhibited formula ethylene glycol and propylene glycol are supplied with corrosion inhibitors and do not contain a silicone anti-leak formula. Commercial ethylene glycol and propylene glycol, when pure, are generally less corrosive to the common metals of construction than water itself. Aqueous solutions of these glycols, however, assume the corrosivity of the water from which they are prepared and may become increasingly corrosive with use when not properly inhibited.

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2 Nomenclature and Components

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

2.1 Liebert® Drycooler Model Number Nomenclature

Table 2.2 below, describes each digit of the model number.

Table 2.1 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

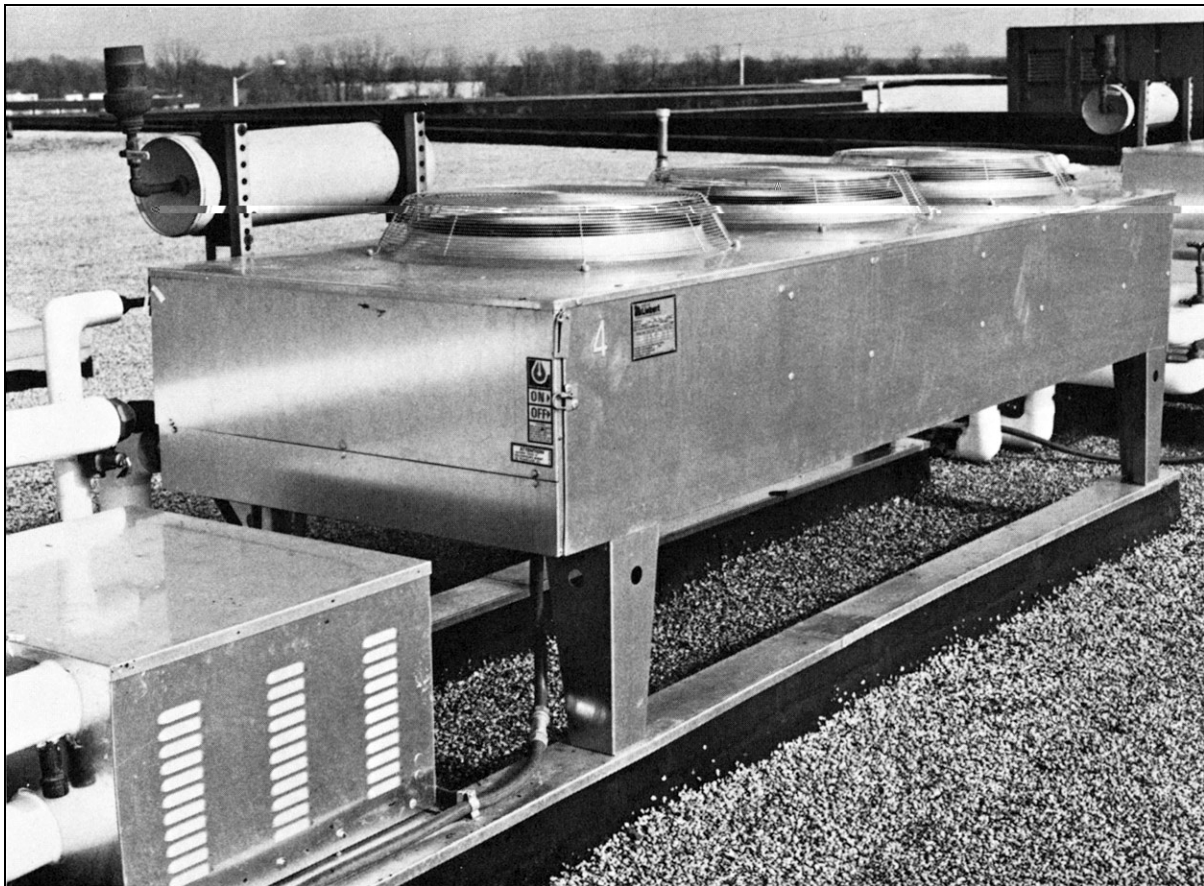
Table 2.2 Liebert® Drycooler Model Number Digit Definitions

Digit	Description
Digit 1 - Disconnect Switch	D = Disconnect switch designator on units without pump controls, see Digit 3, otherwise blank.
Digit 2 = Unit Family	D = Liebert® 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 Table 5.3 on page 32 and Table 5.4 on page 33 for standard and optional circuiting.

2.2 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 2.1 Liebert® Three Fan Drycooler



2.2.1 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 Vertiv™ Liebert® Drycooler. Either of two temperature ranges can be field-selected: 30 to 60°F (-1 to 16°C) for 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.

2.2.2 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 Vertiv™ Liebert® Drycooler
- Glycol pump(s)
- Expansion/compression tank
- Pump controls
- Interconnection piping
- Unit interlock control wiring

The piping general arrangement drawings, listed in **Table 23** on the next page, show single unit to Liebert® 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 Contents](#) on page 63.

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 2.3 Piping General Arrangement Drawings

Document Number	Title
DPN000895	Piping diagram, Liebert® DS, glycol, semi-hermetic compressor models
DPN000896	Piping diagram, Liebert® DS, water/glycol, scroll compressor models
DPN001430	Piping diagram, Liebert® DS, water/glycol, digital-scroll compressor models
DPN001432	Piping diagram, Liebert® DS, GLYCOOL, digital-scroll compressor models
DPN000897	Piping diagram, Liebert® DS, GLYCOOL, semi-hermetic compressor models
DPN000898	Piping diagram, Liebert® DS, GLYCOOL, scroll compressor models
DPN002931	Piping diagram, Liebert® PDX with water/glycol
DPN002932	Piping diagram, Liebert® PDX with GLYCOOL
DPN003822	Typical piping arrangement with multiple drycoolers and multiple indoor units

3 Preinstallation and Site Preparation Guidelines

The unit dimensions, pipe-connection locations, and piping schematics are described in the submittal documents included in the [Submittal Drawings Contents](#) on page 63.

- Install the Vertiv™ Liebert® Drycooler in a location offering maximum security and access for maintenance.
- Avoid ground-level sites with public access and areas prone to heavy snow or ice accumulations.
- Whenever interior building locations must be used, utilize a Liebert® Piggyback Drycooler. Contact your Vertiv sales representative for more information.
- To ensure adequate air supply, we recommend that Liebert® Drycoolers be installed in an area with clean air, away from loose dirt and foreign matter that might clog the coil, and away from steam, hot-air, or fume exhaust.
- Liebert drycoolers must not be installed in a pit because discharge air is likely to be recirculated through the unit.
- Liebert® Drycoolers should be located no closer than 3 ft (1 m) from a wall, obstruction, or adjacent unit and avoid locations where objects restrict the air-inlet free area.
- For roof installation, mount the Liebert® Drycooler on suitable curbs or other supports in accordance with local codes.
- The Liebert® Drycooler must be installed on a level surface to ensure proper glycol flow, venting and drainage.
- 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.
- The Liebert® Drycooler must be installed in a vertical air-flow orientation to maintain NEMA 3R rating of electrical box. The unit is CSA c-us Certified for vertical air flow only and has not been tested for any other orientation.

3.1 Shipping Dimensions and Weights

Table 3.1 Standard 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 ³ (m ³)	lb. (kg.)	in.	(cm)	ft ³ (m ³)		
*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)					

Table 3.1 Standard 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 ³ (m ³)	lb. (kg.)	in.	cm)	ft ³ (m ³)	
*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)				
*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 ³ (m ³)	lb. (kg.)	in.	cm)	ft ³ (m ³)
*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)			

3.2 Planning Dimensions and Anchor Plans

The unit dimensions are described in the submittal documents included in the [Submittal Drawings Contents](#) on page 63.

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

Table 3.3 Dimension Planning Drawings

Document Number	Title
DPN000274	Cabinet and Anchor dimensions for 1 to 4 fan drycoolers
DPN000280	Cabinet and Anchor dimensions for 1 to 4 fan Quiet-Line drycoolers
DPN000721	Cabinet and Anchor dimensions for 6 to 8 fan standard and Quiet-Line drycoolers

3.3 Pump Packages

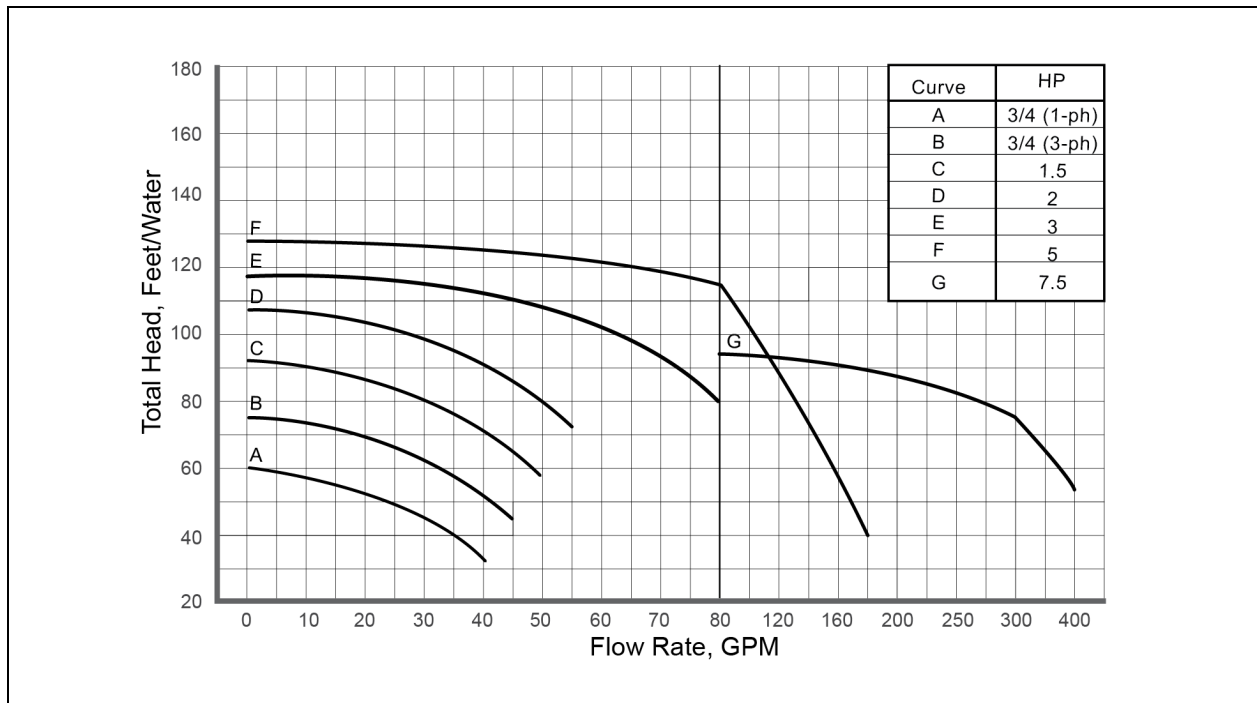
The planning dimensions, electrical power-supply requirements, piping connections, and electrical connections are described in the submittal documents included in the [Submittal Drawings Contents](#) on page 63.

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

Table 3.4 Vertiv™ Liebert® Drycooler Pump Drawings

Document Number	Title
DPN000329	Pump Electrical Power Data and Piping-connection sizes.
DPN000278	Single-pump Piping connection locations and dimensional data
DPN000328	Dual-pump Piping connection locations and dimensional data

Figure 3.1 Pump Curve, 60 Hz



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

3.3.1 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 Contents](#) on page 63.

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	Expansion Tank General Arrangement and Dimensional Data

3.3.2 Compression Tank

The compression tank for glycol/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 Contents](#) on page 63 .

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

Table 3.6 Liebert® Drycooler Pump and Tank Drawings

Document Number	Title
DPN003898	Compression Tank General Arrangement and Dimensional Data

4 Equipment Inspection and Handling



WARNING! Risk of improper moving, lifting, or handling of the unit. Can cause equipment damage, injury or death. Read all of the following instructions and verify that all lifting and moving equipment is rated for the weight of the unit before attempting to move, lift, remove packaging from or prepare the unit for installation. See **Table 3.1** on page 11, and **Table 3.2** on page 13



CAUTION: Risk of contact with sharp edges, splinters, and exposed fasteners. Can cause injury. Only properly trained and qualified personnel wearing appropriate, OSHA-approved PPE should attempt to move, lift, remove packaging from or prepare the unit for installation.

NOTICE

Risk of improper lifting. Can cause equipment damage. Make sure that the spreader bars are wider than the unit. If the spreader bars are too short, the slings may crush the unit.

NOTICE

Risk of damage from forklift. Can cause unit damage. Keep tines of the forklift level and at a height suitable to fit below the skid and/or unit to prevent exterior and/or underside damage.

NOTICE

Risk of improper storage. Keep the unit upright, indoors and protected from dampness, freezing temperatures and contact damage.

Upon arrival of the unit and before unpacking:

- Verify that the labeled equipment matches the bill of lading.
- Carefully inspect all items for visible or concealed damage.
- Report damage immediately to the carrier and file a damage claim with a copy sent to Vertiv or to your sales representative.

Equipment Recommended for Handling the Unit:

- Forklift
- Lift beam
- Slings
- Spreader bars
- Crane

4.1 Packaging Material



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

4.2 Unit Storage

Store the Vertiv™ Liebert® Drycooler in the original packaging in an area protected from excessive dirt, debris and contact damage until final installation

4.3 Handling Unit on the Skid

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

Using a forklift

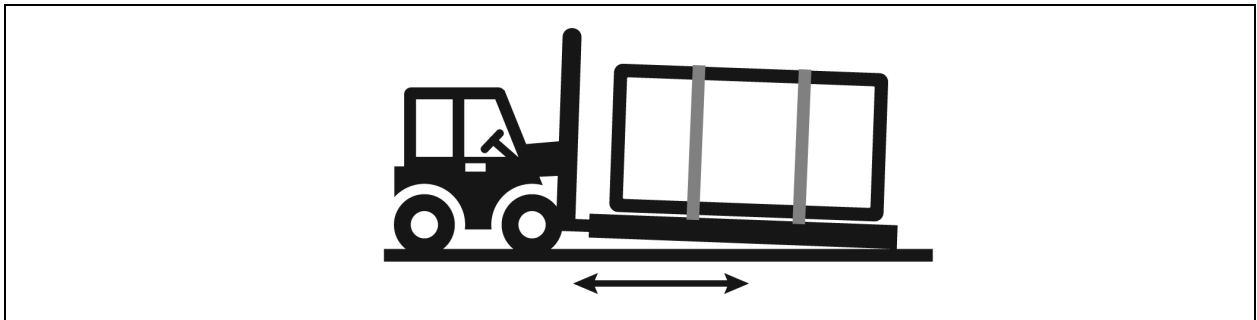
NOTICE

Risk of improper forklift handling. Can cause unit damage.

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

- Make sure the forks (if adjustable) are spread to the widest allowable distance to still fit under the skid.
- Type of forklift used will depend on the terrain the unit is to be moved across during handling.
- Minimum forklift fork length:
 - for 1 fan and two fan units—48 in. (1219 mm)
 - for 3 fan and 4 fan units—72 in. (1829 mm)
 - for 6 fan units—72 in. (1829 mm)
 - for 8 fan units—96 in. (2438 mm)
- When moving the packaged unit, do not lift it any higher than 6 in. (152 mm). If the unit must be lifted higher than 6-in. (152 mm), you must exercise great care, and no one may be closer than 20 ft (6 m) to the lift point.
- We recommend lifting one end off the ground no more than 6 in. (152 mm) and using the forklift to push or pull the unit.

Figure 4.1 Forklift Position with 1 to 8 Fan Units



Using a Crane

- We recommend using slings rated for the unit weight.
- Spreader bars must be used for sling stability and to keep the slings from pressing against the unit. Make sure spreader bars are wider than the unit.
- Place the slings near the ends of the unit, under the top deck boards of the skid.

4.4 Unpacking the Unit—All Unit Sizes

Refer to **Figure 4.2** on the next page, for the following steps:

1. For domestic packaging:
 - Remove the fastener clamps from the top and sides of the unit.
 - Remove all screws and washer from the wooden fencing.
 - Remove the fence

– or –

For export packaging, remove the crate.

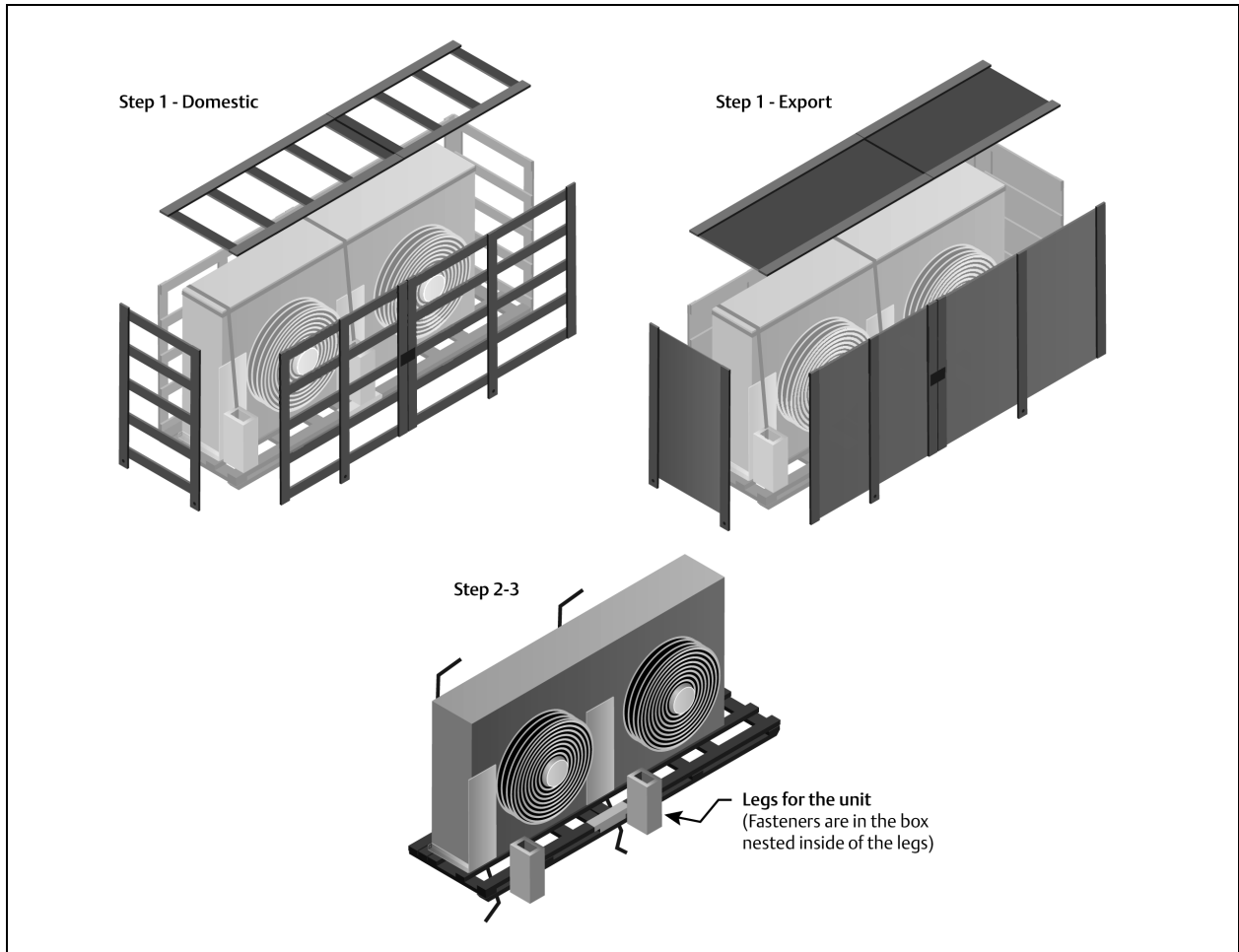
2. Carefully remove the steel straps securing the unit to the skid.



CAUTION: Risk of unsecured strap ends with sharp edges flying uncontrollably in any direction when cut. Can cause serious injury. Secure both ends of each strap when cutting and wear OSHA approved protective headgear, gloves and eye protection when working with the securing straps.

3. Set the legs aside, but keep accessible.
 - Depending on the number of fans, more or less steel straps may be removed at this step.

Figure 4.2 Removing Protective Material

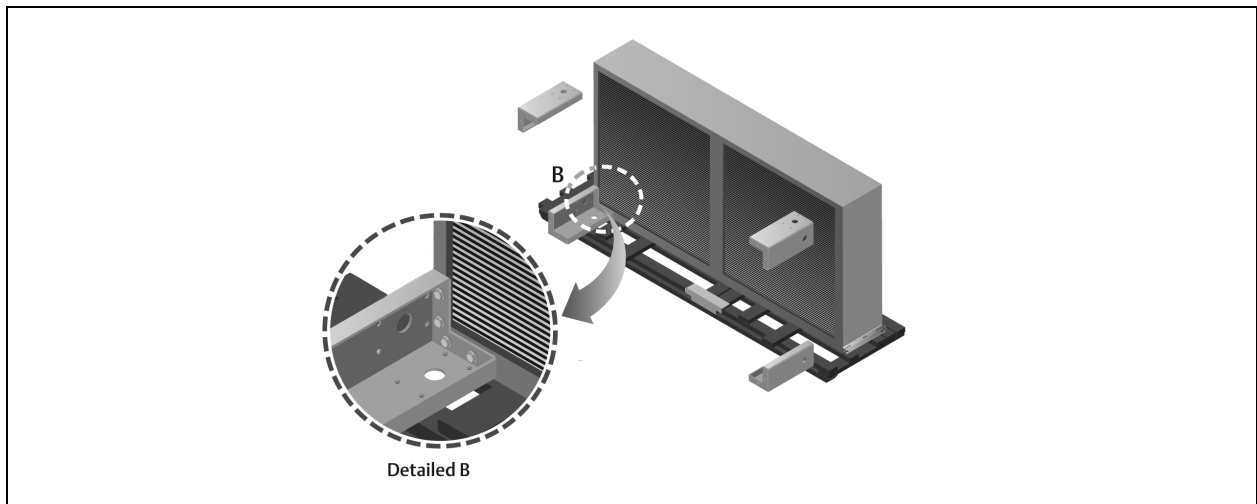


4.5 Preparing 1 to 4 Fan Liebert® Drycooler for Moving and Installation

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

1. Attach legs to the unit at indicated locations, using the fasteners provided with the legs, **Figure 4.3** below .
 - Recommended tools for attachment is a 5/8" socket and ratchet.
 - More legs may be available for installation than are shown. This will depend on the unit type and number of fans. Refer to the appropriate planning-dimensions drawing in [Submittal Drawings Contents](#) on page 63 , for the number of legs on your unit.

Figure 4.3 Attaching Legs to 1 to 4 Fan Liebert® Drycoolers

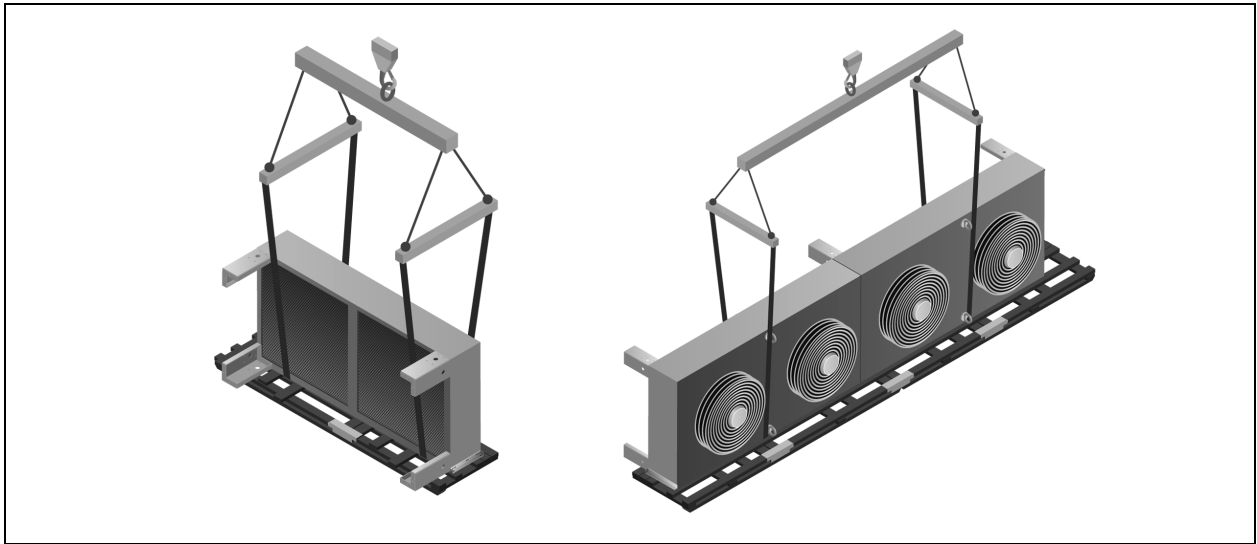


2. Place slings around the unit between the unit and the top deck boards of the skid as shown in **Figure 4.4** below :
 - **1 fan, 2 fan and 3 fan units:** against the inside of the attached legs.
 - **4 fan units:** against the outside of the attached eye bolts.
3. Use spreader bars, a lift beam and a crane to lift the unit off the skid. Make sure spreader bars are wider than the unit to prevent crushing force.

NOTICE

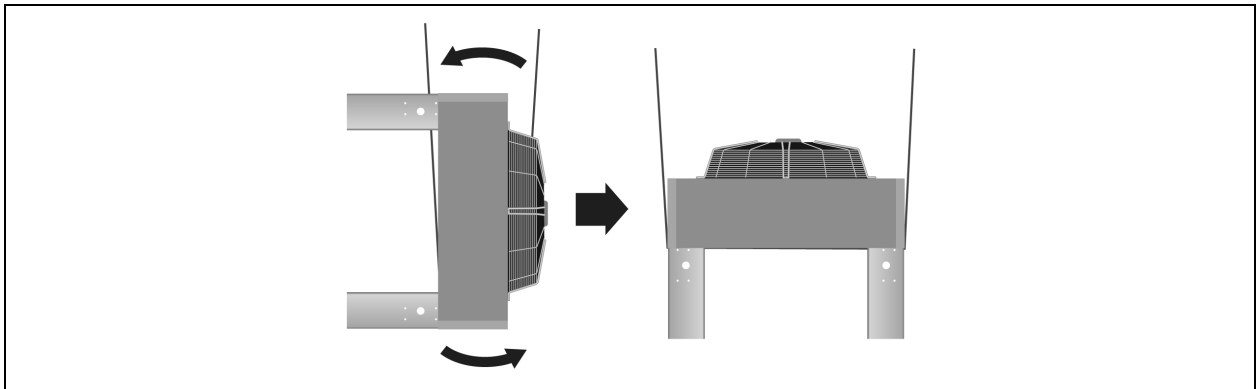
Risk of improper lifting. Can cause equipment damage. Make sure that the spreader bars are wider than the unit. If the spreader bars are too short, the slings may crush the unit.

Figure 4.4 Securing Slings to 1 to 4 Fan Liebert® Drycoolers for Lifting Off Skid



4. Lift the unit 24" (610mm) off the top deck of the skid.
5. Remove the skid from under the unit.
6. To rotate the unit, a mechanized method is recommended, but if one is not available, use a minimum of four properly-protected individuals to rotate the elevated unit 90 degrees so the unit legs are pointing toward the ground, **Figure 4.5** below .
7. Set the upright unit on the ground so the legs support unit weight.
8. Remove the straps from around unit.

Figure 4.5 Rotate and Set Liebert® Drycooler on Ground or Level Surface



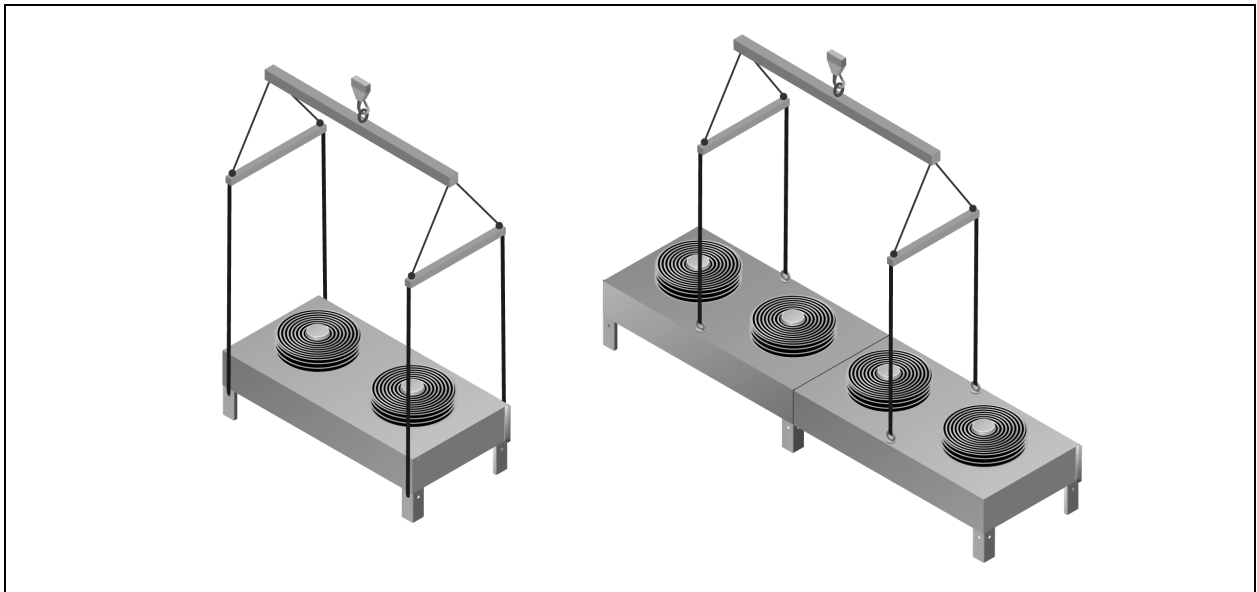
9. Refer to **Figure 4.6** below, to attach rigging for lifting. Spreader bars are still required. Make sure that the spreader bars are wider than the unit.
 - **1 fan, 2 fan and 3 fan units:** Route the straps through the large holes in the side of the legs.
 - **4-fan units:** Secure straps or chains to the eye bolts on top of the unit.

NOTICE

Risk of improper lifting. Can cause equipment damage. Make sure that the spreader bars are wider than the unit. If the spreader bars are too short, the slings may crush the unit.

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

Figure 4.6 Rigging to Lift 1 to 4 Fan Liebert® Drycoolers

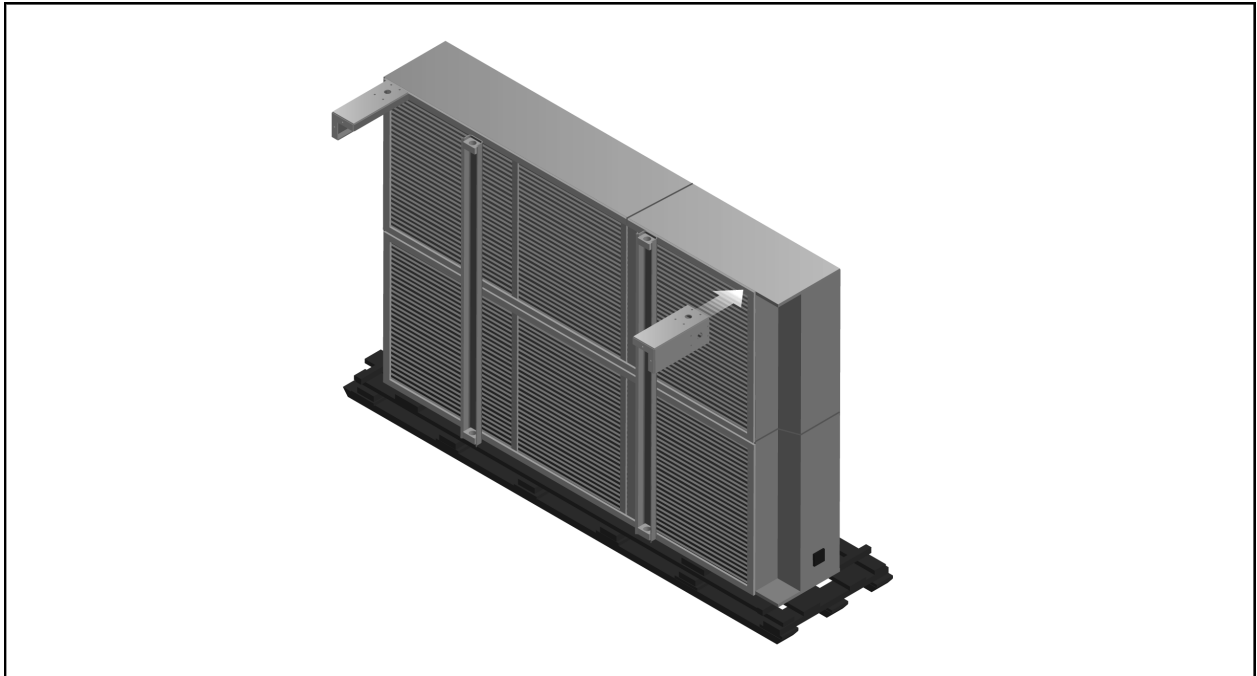


4.6 Preparing 6 and 8 Fan Vertiv™ Liebert® Drycoolers for Moving and Installation

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

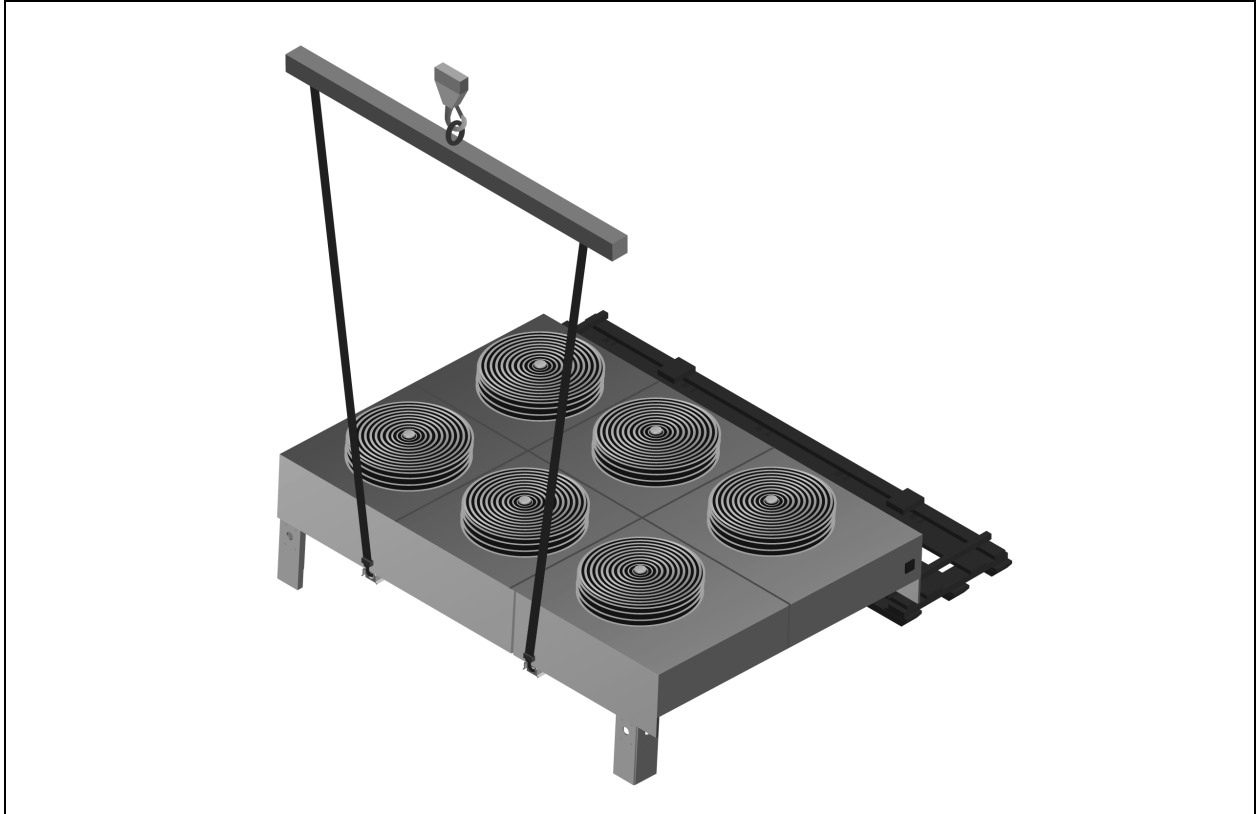
1. Refer to **Figure 4.7** below, to attach the legs to the higher side of the unit:
 - Use four (4) fasteners per leg. Fasteners are provided with the legs.
 - Recommended tools for attachment is a 5/8" socket and ratchet.
 - More legs may be required for installation than are shown. This will depend on the unit type and number of fans. Refer to the appropriate planning-dimensions drawing in [Submittal Drawings Contents](#) on page 63, for the number of legs on your unit.

Figure 4.7 Attach Legs to Higher Side of 6 or 8 Fan Liebert® Drycooler



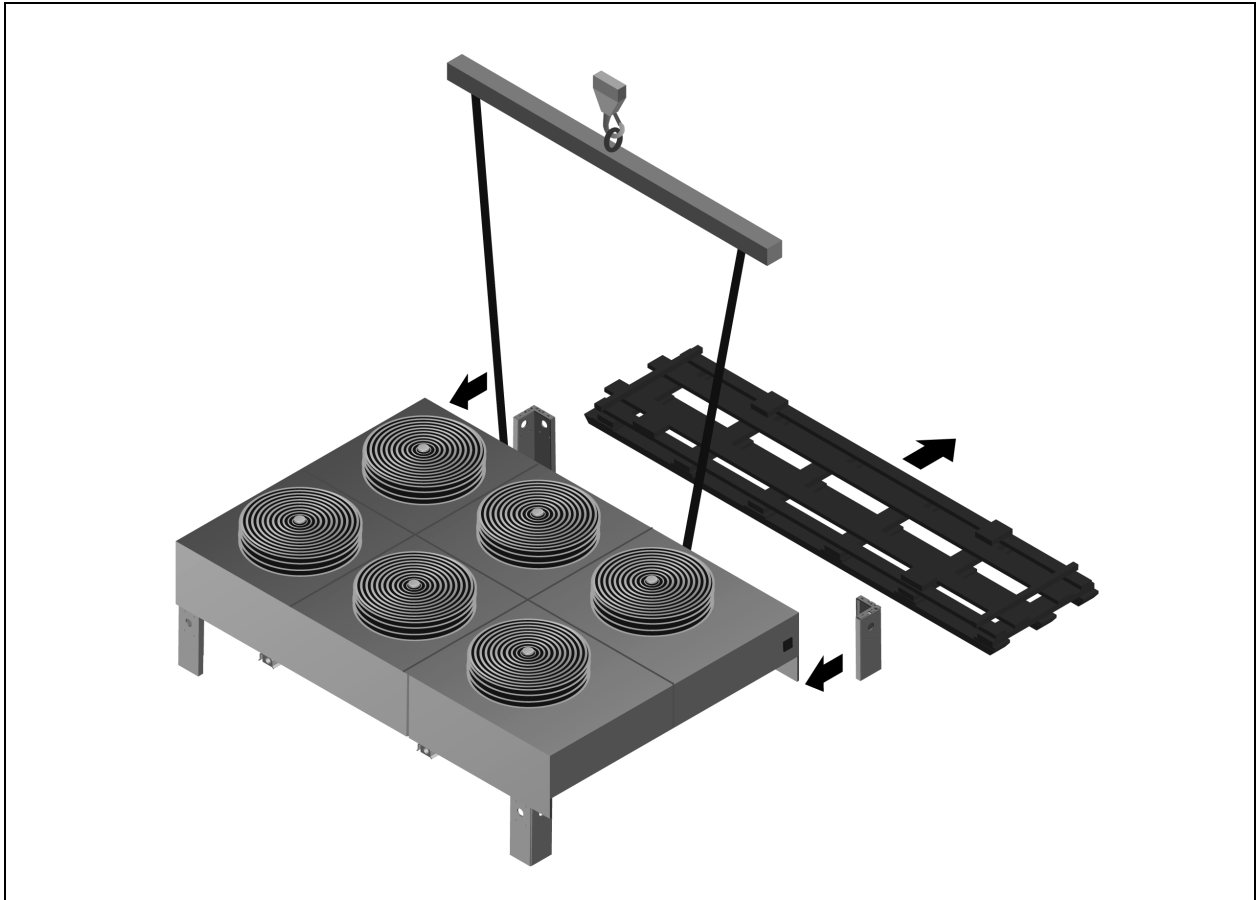
2. Attach slings or chains to the unit lift rails as shown in **Figure 4.8** below
 - Mechanically lower the unit in order to rest on the attached legs.
 - Make sure not to damage the opposite side of the unit.

Figure 4.8 Use Sling to Lower Side with Legs Attached



3. Move the slings or chains to the lift rail side that is resting on the skid, **Figure 4.9** below .
 - Mechanically lift the unit to a point where the side being lifted is just high enough to allow for safe attachment of the remaining unit legs.
 - Move the skid out the way and attach remaining legs.

Figure 4.9 Move Sling to Side Resting on Skid and Lift to Remove Skid and Install Legs



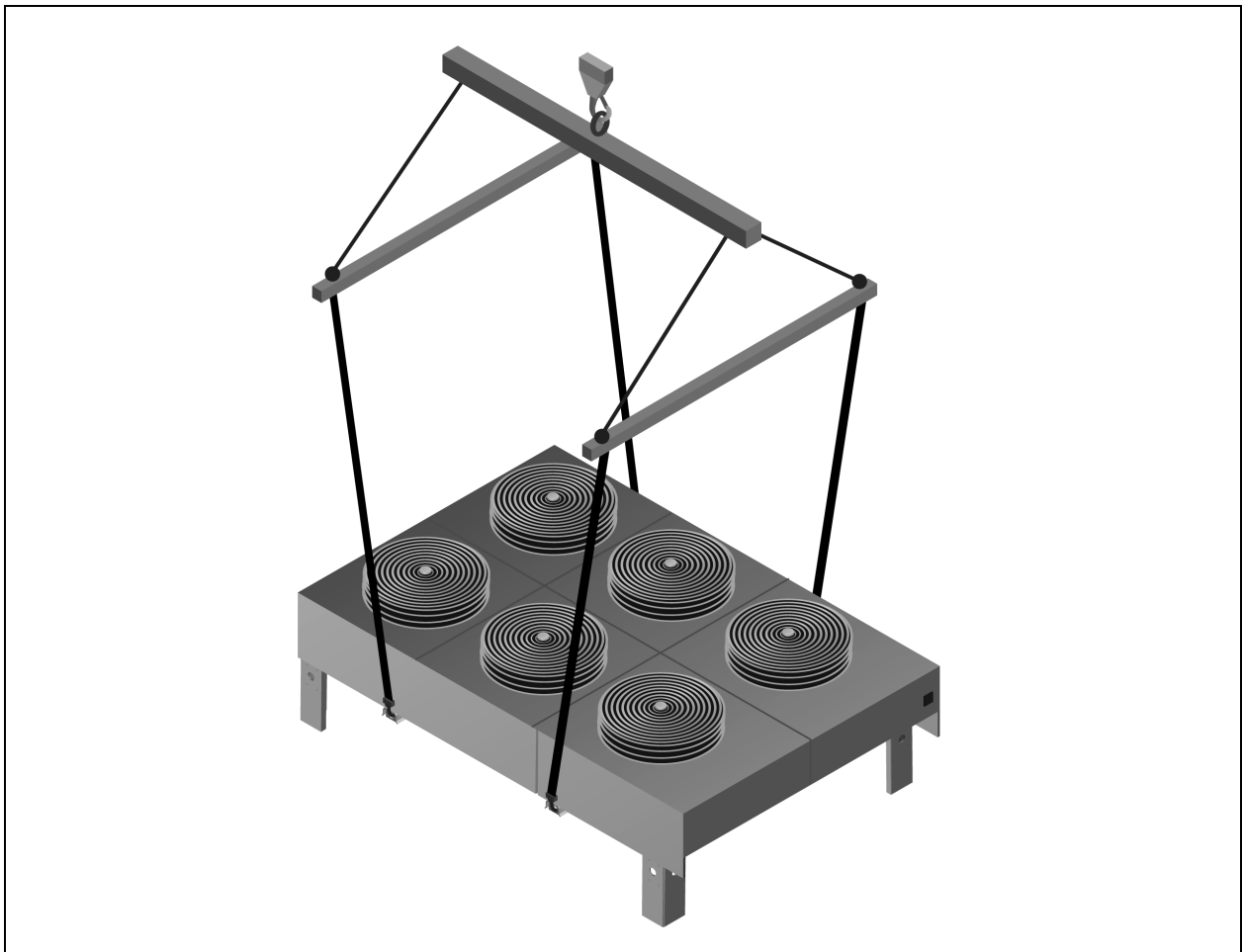
4. Set the upright unit on the ground so that the legs support the unit's weight.
5. Reposition and add straps and spreader bars to prepare the unit for lifting to installation location, **Figure 4.10** below .
 - Use the support channels located under the unit to attach straps or chains.
 - Spreader bars are still required. Make sure spreader bars are wider than the unit to keep the straps from pressing on the sides of the unit.

NOTICE

Risk of improper lifting. Can cause equipment damage. Make sure that the spreader bars are wider than the unit. If the spreader bars are too short, the slings may crush the unit.

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

Figure 4.10 Rigging 6 and 8 Fan Liebert® Drycooler for Lifting



4.7 Mounting the Vertiv™ Liebert® Drycooler

The Liebert® Drycooler must be installed so that it is level within 1/2 in. (13 mm) to ensure proper glycol flow, venting, and drainage. For roof installation, mount the Liebert® Drycooler on suitable curbs or other supports. Follow all local and national codes. Secure the legs to the mounting surface using a field-supplied 1/2-in. (13-mm) diameter bolt in each of the two 9/16-in. (14-mm) holes in each leg. For anchor dimensions, refer to the appropriate drawing for your unit model included in the [Submittal Drawings Contents](#) on page 63 .

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5 Piping

NOTICE

Risk of piping-system corrosion and freezing fluids. Can cause leaks resulting in equipment and expensive building damage. Cooling coils and piping systems are at high risk of freezing and premature corrosion. Fluids in these systems must contain an inhibitor to prevent premature corrosion.

The system coolant fluid must be analyzed by a competent fluid-treatment specialist before start up to establish the inhibitor level and evaluated at regularly scheduled intervals throughout the life of the system to determine the pattern of inhibitor depletion. The fluid complexity and variations of required treatment programs make it extremely important to obtain the advice of a competent and experienced fluid-treatment specialist and follow a regularly scheduled coolant-fluid system-maintenance program.

Fluid chemistry varies greatly as do the required additives, called inhibitors, that reduce the corrosive effect of the fluids on the piping systems and components.

The chemistry of the coolant fluid used must be considered, because some sources may contain corrosive elements that reduce the effectiveness of the inhibited formulation. Sediment deposits prevent the formation of a protective oxide layer on the inside of the coolant system components and piping. The coolant fluid must be treated and circulating through the system continuously to prevent the buildup of deposits and/or growth of bacteria. Proper inhibitor maintenance must be performed to prevent corrosion of the system.

Consult fluid manufacturer for testing and maintenance of inhibitors.

Commercial-grade coolant fluid is generally less corrosive to the common metals of construction than water itself. It will, however, assume the corrosivity of the coolant fluid from which it is prepared and may become increasingly corrosive with use if not properly inhibited.

Vertiv recommends installing a monitored fluid-detection system that is wired to activate the automatic-closure of field-installed coolant-fluid supply and return shut-off valves to reduce the amount of coolant-fluid leakage and consequential equipment and building damage. The shut-off valves must be sized to close-off against the maximum coolant-fluid system pressure in case of a catastrophic fluid leak.

NOTICE

Risk of a catastrophic water circuit rupture. Can cause expensive building and equipment damage.

Install shutoff valves in the supply and return water lines that automatically close if water is detected by the leak detection system. The shutoff valves should be spring return and must be rated for a close-off pressure that is the same as or higher than the supply water pressure. monitored leak detection system should be installed in the base of the unit or under the unit to actuate the shutoff valves immediately on a leak detection signal.

NOTICE

Risk of no-flow condition. Can cause equipment damage.

Do not leave the water/coolant fluid-supply circuit in a no-flow condition. Idle fluid allows the collection of sediment that prevents the formation of a protective oxide layer on the inside of tubes. Keep unit switched On and water/coolant fluid-supply circuit system operating continuously.

Piping between the Vertiv™ Liebert® Drycooler, any external pump and the cooling unit is required to complete the system.

Properly-sized pipes will help reduce pumping power and operating costs. Pipe material choices are typically copper, plastic or steel/black iron. Consult glycol and pipe manufacturing literature for compatibility and sizing assistance. Galvanized piping should not be used. Any copper piping installed should be “L” or “K” refrigerant-grade copper.

Liebert® Drycooler supply and return connections vary in size and number. See **Table 5.3** on page 32, and **Table 5.4** on page 33.

Consider the following guidelines when planning and performing the piping installation:

- Follow local piping codes, safety codes.
- Qualified personnel must install and inspect system piping.
- Do not hang or suspend piping from the drycooler-tube sheets protruding below the finned sections of the coil.
- On multiple-pump packages install a check valve at the discharge of each pump to prevent back-flow through the standby pump(s).
- To extend the service life of the Liebert® Drycooler and pumps, install 16-20 mesh-screen filters/strainers in the supply line to the pumps. The filter/strainer(s) should be easily replaced or cleaned.
- Consider installing hose bibs at the lowest point of the system to facilitate filling.
- Keep piping runs as straight as possible, avoid unnecessary bends, and minimize additional fittings.
- Isolate piping from the building with vibration-isolating supports. Use soft, flexible material to seal between pipes and wall openings to prevent pipe damage.
- Use welded or high-temperature soldered joints where possible. Threaded pipe joints, if needed, can be made with tightly drawn Teflon tape.
- Clean and prepare all pipe connections before joining. Be careful not to allow solder/joining debris to get inside the lines during the connection process.

The piping general arrangement and schematics are described in the submittal documents included in the [Submittal Drawings](#) on page 63 .

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

Table 5.1 Piping General Arrangement Drawings

Document Number	Title
DPN000895	Piping diagram, Liebert® DS, glycol, semi-hermetic compressor models
DPN000896	Piping diagram, Liebert® DS, water/glycol, scroll compressor models
DPN001430	Piping diagram, Liebert® DS, water/glycol, digital-scroll compressor models
DPN001432	Piping diagram, Liebert® DS, GLYCOOL, digital-scroll compressor models
DPN000897	Piping diagram, Liebert® DS, GLYCOOL, semi-hermetic compressor models
DPN000898	Piping diagram, Liebert® DS, GLYCOOL, scroll compressor models
DPN002931	Piping diagram, Liebert® PDX with water/glycol
DPN002932	Piping diagram, Liebert® PDX with GLYCOOL
DPN003822	Typical piping arrangement with multiple drycoolers and multiple indoor units

Table 5.2 Piping Connection Drawings

Document Number	Title
DPN000275	Connection locations for standard 1 fan, 2 fan, 3 fan, and 4 fan units
DPN000281	Connection locations for Quiet-Line 1 fan, 2 fan, 3 fan, and 4 fan units
DPN002429	Connection locations for standard 6 fan and 8 fan units
DPN002430	Connection locations for Quiet-Line 6 fan and 8 fan units

Table 5.3 Standard Vertiv™ Liebert® Drycooler Piping Connection Sizes and Internal Volume

Model #	No. of Internal Coil Circuits	No. of Fans	Internal Volume, gal. (L)	No. of Inlets/Outlets	Inlet & Outlet Connection Size	
					ODS Copper, in.	IDS Copper, in.
033	4*	1	1.2 (4.6)	1/1	1-3/8	—
069	4, 8*		2.4 (9.2)	1/1	1-3/8	—
092	6, 12*, 16		3.7 (13.9)	1/1	1-5/8	—
109	8		4.9 (18.6)	1/1	1-3/8	—
	16*			1/1	2-1/8	—
112	8		5.8 (22.0)	1/1	1-3/8	—
	16*, 26	1/1		2-1/8	—	
139	8, 16*	2	4.8 (18.2)	1/1	2-1/8	—
174	8, 16*, 24		6.9 (26.2)	1/1	2-1/8	—
197	8		9.0 (34.0)	1/1	1-3/8	—
	16*, 32			1/1	2-1/8	—
225	16, 26*		11.1 (42.1)	1/1	2-1/8	—
260	16, 24*		10.0 (37.9)	1/1	2-1/8	—
310	16, 32*	13.1 (49.6)	1/1	2-1/8	—	
			1/1	2-1/8	—	
			1/1	2-5/8	—	
350	48	19.4 (73.3)	1/1	2-1/8	—	
352	16, 24*	4	13.1 (49.6)	1/1	2-1/8	—
419	16, 32*		17.4 (65.9)	1/1	2-1/8	—
466	26		22.0 (83.3)	1/1	2-1/8	—
	40*			1/1	2-5/8	—
491	16, 32		26.3 (99.6)	1/1	2-1/8	—
	48*			1/1	2-5/8	—
620	32, 64*	6	27.0 (102.2)	2/2	—	2-1/8
650	40, 52*		33.0 (124.9)	2/2	—	2-1/8
	80			4/4	—	2-1/8
700	32, 64*		40.0 (151.4)	2/2	—	2-1/8
	96			4/4	—	2-1/8
790	32, 64*		8	35.0 (132.5)	2/2	—
880	52	44.0 (166.5)		2/2	—	2-1/8
	80*			4/4	—	2-1/8
940	32, 64	52.0 (196.8)		2/2	—	2-1/8
	96*			4/4	—	2-1/8

* = Standard Circuiting

Table 5.4 Vertiv™ Liebert® Quiet-Line Drycooler Piping Connection Sizes and Internal Volume

Model #	No. of Internal Coil Circuits	No. of Fans	Internal Volume, gal. (L)	No. of Inlets/Outlets	Inlet & Outlet Connection Size	
					ODS Copper, in.	IDS Copper, in.
040	4, 8*	1	2.4 (9.2)	1/1	1-3/8	—
057	12*		3.7 (13.9)	1/1	1-5/8	—
	16		1/1	2-1/8	—	
060	8		4.9 (18.6)	1/1	1-3/8	—
	16*	1/1	2-1/8	—		
080	8, 16*	2	4.8 (18.2)	1/1	2-1/8	—
111	16*, 24		6.9 (26.2)	1/1	2-1/8	—
121	16*, 32		9.0 (34.0)	1/1	2-1/8	—
158	16, 24*	3	10.0 (37.9)	1/1	2-1/8	—
173	16, 32*		13.1 (49.6)	1/1	2-1/8	—
178	16, 32*		19.4 (73.3)	1/1	2-1/8	—
	48		1/1	2-5/8	—	
205	16, 24*	4	13.1 (49.6)	1/1	2-1/8	—
248	16, 32*		17.4 (65.9)	1/1	2-1/8	—
347	32, 64*	6	27.0 (102.2)	2/2	—	2-1/8
356	32, 64*		39.3 (148.8)	2/2	—	2-1/8
	96		4/4	—	2-1/8	
453	32, 64*	8	35.0 (132.5)	2/2	—	2-1/8
498	32, 64		52.0 (196.8)	2/2	—	2-1/8
	96*		4/4	—	2-1/8	

* = Standard circuiting

5.1 Guidelines for Expansion Tanks, Fluid-relief Valves, Air Management and Other Devices

An expansion tank must be provided for expansion and contraction of the fluid due to temperature change in this closed system. Vents are required at system high points to vent trapped air when filling the system. A fluid pressure relief valve is also a necessary piping component.

All systems must have an air management system to ensure proper component operation and system performance. There are several methods that can be used to manage the air within a closed loop hydronic system. Depending on the method chosen, the system may include one or more of the following ancillary components: tank-steel (expansion, compression, diaphragm or bladder), air separator and air vent.

Consult your local engineer to determine which method will be used and where these components must be installed.

Depending on the complexity of the system, various other devices may be specified—refer to site-specific drawings. Some of the devices that may be required are: pressure gauges, flow switches, automatic air separator, tempering valves, standby pumps and sensors for electrical controls.

5.2 Preparing to Fill the System

NOTICE

Risk of improper handling of glycol products. Can cause environmental damage.

Before using any glycol products, review the latest manufacturer's Material Safety Data Sheets and ensure that you can use the product safely. The installer must read, understand and comply with the information on the product packaging and in the current Material Safety Data Sheets. Make this information available to anyone responsible for operation, maintenance and repair of the Vertiv™ Liebert® Drycooler and related equipment.

Because government regulations and use conditions are subject to change, it is the user's responsibility to determine that this information is appropriate and suitable under current, applicable laws and regulations.

NOTICE

Risk of using the wrong type of glycol. Can cause piping damage, coolant fluid leaks, and catastrophic and expensive building and equipment damage.

Do not use automotive antifreeze as it contains chemicals that can damage the piping system.

Typical inhibited formula ethylene glycol and propylene glycol are supplied with corrosion inhibitors and do not contain a silicone anti-leak formula. Commercial ethylene glycol and propylene glycol, when pure, are generally less corrosive to the common metals of construction than water itself. Aqueous solutions of these glycols, however, assume the corrosivity of the water from which they are prepared and may become increasingly corrosive with use when not properly inhibited.

Remove any dirt, oil, or metal filings that may contaminate the cooling system piping to prevent contamination of the fresh glycol solution and fouling of the Liebert® Drycooler piping. Flush the system thoroughly using a mild cleaning solution or high-quality water and then completely drain before charging with glycol.

Cleaning a new system is just as important as cleaning an old one. New systems can be coated with oil or a protective film. Dirt and scale are also common. Any residual contaminants could adversely affect the heat-transfer stability and performance of your system. In most cases, special cleaners are needed to remove scale, rust, and hydrocarbon foulants from pipes, manifolds, and passages. For more information on cleaners and degreasers, contact your Vertiv representative. Follow the manufacturer's instructions when using these products.

Calculate the internal volume of the system as closely as possible. The Liebert® Drycooler volumes are shown in **5.2** on the previous page, and **5.2** on the previous page. Use **Table 5.5** below, for field-installed piping volumes. Indoor unit volumes are found in their respective user manuals.

Table 5.5 Glycol Volume in Standard Type "L" Copper Piping

Diameter, in.		Volume	
Outside	Inside	gal/ft	l/m
1-3/8	1.265	0.065	0.81
1-5/8	1.505	0.092	1.15
2-1/8	1.985	0.161	2.00
2-5/8	2.465	0.248	3.08
3-1/8	2.945	0.354	4.40
3-5/8	3.425	0.479	5.95
4-1/8	3.905	0.622	7.73

When considering the use of any glycol products in a particular application, review the latest Material Safety Data Sheets and ensure that the intended use can be accomplished safely. For Material Safety Data Sheets and other product safety information, contact the supplier nearest you. Before handling any other products mentioned in the text, you should obtain available product safety information and take necessary steps to ensure safety of use.

Table 5.6 Glycol Concentrations for Freeze Protection by Ambient Temperature

Coolant	Minimum Outdoor Ambient Temperature, °F (°C)							
	20 (-7)	10 (-12)	0 (-18)	-10 (-23)	-20 (-29)	-30 (-34)	-40 (-40)	-50 (-46)
Propylene Glycol, % by volume	18*	29*	36	42	46	50	54	57
Ethylene Glycol, % by volume	17*	26*	35	41	46	50	55	59

Based on Dowfrost (PG) and DOWtherm (EG) product literature.

*Inhibitor levels should be adjusted to properly protect the system if solution concentrates are less than 30%.

There are two basic types of additives:

- Corrosion inhibitors
- Environmental stabilizers

The corrosion inhibitors function by forming a surface barrier that protects the metals from attack. Environmental stabilizers, while not corrosion inhibitors in the strictest sense, decrease corrosion by stabilizing or favorably altering the overall environment. An alkaline buffer, such as borax, is a simple example of an environmental stabilizer, because its prime purpose is to maintain an alkaline condition (pH above 7).

The percentage of glycol to water must be determined by using the lowest design outdoor temperature in which the system is operating. **Table 5.6** above, indicates the solution volume of inhibited glycol required to provide freeze protection at various ambient temperatures.

5.3 Filling the Vertiv™ Liebert® Drycooler System

We recommend installing hose bibs at the lowest point of the system.

When filling a glycol system, keep air to a minimum. Air in glycol turns to foam and is difficult and time consuming to remove. (Consider anti-foam additives.)

To fill the system:

1. Open all operating systems to the loop.
2. With the top vent(s) open, fill the system from the bottom of the loop.

The glycol will push the air out of the top of the system, minimizing trapped air.

3. Fill to approximately 80% of calculated capacity, then continue to fill slowly from this point, checking fluid levels until full.

NOTE: For glycol solution preparation and periodic testing, follow manufacturer's recommendations. Do not mix products of different manufacturers.

6 Electrical Connections

Line-voltage electrical service is required for all models. Electrical service must conform to national and local electrical codes. Refer to equipment nameplate regarding wire size and circuit protection requirements. Refer to electrical schematic when making connections. Refer the appropriate submittal drawing, listed in **Table 6.1** on the next page, for electrical service entrances into unit.

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

All internal wiring is completed at the factory.



WARNING! Arc flash and electric shock hazard. Open all local and remote electric power-supply disconnect switches, verify with a voltmeter that power is Off and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death. Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable. Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power. The Vertiv™ Liebert® iCOM™ controller does not isolate power from the unit, even in the “Unit Off” mode. Some internal components require and receive power even during the “Unit Off” mode of the Liebert® iCOM™ controller. The factory-supplied disconnect switch is inside the unit. The line side of this switch contains live high-voltage. The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic. Follow all local codes.



WARNING! Risk of improper wiring, piping, moving, lifting and handling. Can cause equipment damage, serious injury or death. Installation and service of this equipment should be done only by qualified personnel who have been specially-trained in the installation of air-conditioning equipment and who are wearing appropriate, OSHA-approved PPE.



WARNING! Risk of improper wire sizing/rating and loose electrical connections. Can cause overheated wire and electrical connection terminals resulting in smoke, fire, equipment and building damage, injury or death. Use correctly sized copper wire only and verify that all electrical connections are tight before turning power On. Check all electrical connections periodically and tighten as necessary.

NOTICE

Risk of improper power-supply connection. Can cause equipment damage and loss of warranty coverage.

Prior to connecting any equipment to a main or alternate power source (for example: back-up generator systems) for start-up, commissioning, testing, or normal operation, ensure that these sources are correctly adjusted to the nameplate voltage and frequency of all equipment to be connected. In general, power-source voltages should be stabilized and regulated to within $\pm 10\%$ of the load nameplate nominal voltage. Also, ensure that no three-phase sources are single-phased at any time.

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

NOTE: Installation and service of this equipment should be done only by properly-trained and qualified personnel who are specially-trained in the installation of air-conditioning equipment.

The electrical connections are described in the submittal documents included in the [Submittal Drawings Contents](#) on page 63

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

Table 6.1 Electrical Field Connection Drawings

Document Number	Title
DPN000277	Electrical field connections, 1 fan DSF/DDF drycooler with pump control
DPN000276	Electrical field connections, 1, 2, 3 and 4 fan DSO/DDO drycooler with pump control
DPN000703	Electrical field connections, 6 and 8 fan DSO/DDO drycooler with pump control
DPN000702	Electrical field connections, 6 and 8 fan DDNC drycooler without pump control
DPN000704	Electrical field connections, 6 and 8 fan DDNL/DDNT drycooler without pump control
DPN000282	Electrical field connections, Fluid-temperature control drycooler, Quiet-Line
DPN000722	Electrical field connections, 6- and 8-fan Quiet-Line drycooler with no control
DPN000723	Electrical field connections, 6- and 8-fan Quiet-Line drycooler with DSO/DDO pump control
DPN000724	Electrical field connections, 6- and 8-fan Quiet-Line drycooler with DDNL and DDNT pump control

6.1 Line Voltage Wiring



WARNING! Risk of electrical fire and short circuit. Can cause property damage, injury or death. Select and install the line side electrical supply wire and overcurrent protection device(s) according to the specifications on the unit nameplate(s), per the instructions in this manual and according to the applicable national, state and local code requirements. Use copper conductors only. Verify that all electrical connections are tight. Unit-specific wiring diagrams are provided on each unit.

NOTICE

Risk of improper power-supply connection. Can cause equipment damage and loss of warranty coverage. Prior to connecting any equipment to a main or alternate power source (for example: back-up generator systems) for start-up, commissioning, testing, or normal operation, ensure that these sources are correctly adjusted to the nameplate voltage and frequency of all equipment to be connected. In general, power-source voltages should be stabilized and regulated to within $\pm 10\%$ of the load nameplate nominal voltage. Also, ensure that no three-phase sources are single-phased at any time.

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

Line voltage electrical service is required for all Liebert® Drycoolers at the location of the drycooler. If the Liebert® Drycooler contains pump controls, the pump package voltage must match the drycooler voltage. See the unit's serial tag for specific electrical requirements of the Liebert® Drycooler and any pump package. A unit disconnect is standard on all Liebert® Drycoolers. Site disconnect (s) may also be required per local code to isolate the Liebert® drycooler/pumps for maintenance. Route the supply power to the site disconnect switch and then to the Liebert® Drycooler. Route the conduit through the hole provided in the cabinet. Connect earth ground to lug provided near the terminal board. Refer to the appropriate drawing in the [Submittal Drawings Contents](#) on page 63.

NOTE: A separate neutral wire does not need to be run to the Liebert® Drycooler.

Table 6.2 60Hz Electrical Values—Vertiv™ Liebert® Drycoolers without Pump Controls

No. of Fans	Model No.	Voltage	Phase	FLA	WSA	OPD
Standard Models						
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
Liebert® Quiet-Line Models						
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

Table 6.2 60Hz Electrical Values—Vertiv™ Liebert® Drycoolers without Pump Controls (continued)

No. of Fans	Model No.	Voltage	Phase	FLA	WSA	OPD
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 6.3 50Hz Electrical Values—Liebert® Drycoolers without Pump Controls

No. of Fans	Model #	Voltage	Phase	FLA
Standard Models				
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
Quiet-Line Models				
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 6.4 60Hz Electrical Values—Standard Liebert® Drycoolers with Integral Pump Controls, 1 to 4 Fans

No. 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
208/230/60													
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
460/60													
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
575/60													
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 6.5 60Hz Electrical Values—Standard Liebert® Drycoolers with Integral Pump Controls, 6 – 8 Fans

No. 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
208/230/60							
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
460/60							
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
575/60							
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 6.6 Hz Electrical Values-Liebert® Quiet-line Drycoolers with Integral Pump Controls

No. of Fans:		1			2			3			4			6			8					
Model #:		40, 57, 60			80, 111, 121			158, 173, 178			205, 248			347, 356			453, 498					
Pump hp	Ph	F	W	O	F	W	O	F	W	O	F	W	O	F	W	O	F	W	O			
		L	S	P	L	S	P	L	S	P	L	S	P	L	S	P	L	S	P			
		A	A	S	A	A	D	A	A	D	A	A	D	A	A	D	A	A	D	A	A	D
208/230/3/60																						
0.75	3	5.3	6.2	15	7.1	8.0	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	10.2	11.9	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	11.1	13.0	20	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	14.2	16.9	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	20.3	24.5	40	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	27.8	33.9	50	29.6	35.7	50	31.4	37.5	60	35.0	41.1	60	38.6	44.7	60			
10.0 *	3	32.6	40.3	70	34.4	42.1	70	36.2	43.9	70	38.0	45.7	70	41.6	49.3	80	45.2	52.9	80			
15 *	3	48.0	59.6	100	49.8	61.4	100	51.6	63.2	100	53.4	65.0	110	57.0	68.6	110	60.6	72.2	110			
460/3/60																						
0.75	3	2.5	2.9	15	3.4	3.8	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	4.8	5.6	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	5.2	6.1	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	6.6	7.8	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	9.4	11.3	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	12.8	15.6	25	13.7	16.5	25	14.6	17.4	25	16.4	19.2	30	18.2	21.0	30			
10.0	3	14.9	18.4	30	15.8	19.3	30	16.7	20.2	30	17.6	21.1	35	19.4	22.9	35	21.2	24.7	35			
15 *	3	21.9	27.2	45	22.8	28.1	45	23.7	29.0	45	24.6	29.9	50	26.4	31.7	50	28.2	33.5	50			
575/3/60																						
0.75	3	2.0	2.3	15	2.7	3.0	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	3.8	4.4	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	4.1	4.8	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	5.3	6.3	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	7.5	9.0	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	10.4	12.7	20	11.1	13.4	20	11.8	14.1	20	13.2	15.5	20	14.6	16.9	25			
10.0	3	11.7	14.5	25	12.4	15.2	25	13.1	15.9	25	13.8	16.6	25	15.2	18.0	25	16.6	19.4	30			
15	3	17.7	22.0	35	18.4	22.7	35	19.1	23.4	40	19.8	24.1	40	21.2	25.5	40	22.6	26.9	40			
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 6.7 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.

6.2 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 6.8** below, **Table 6.10** on the facing page, **Table 6.10** on the facing page, and **Table 6.11** on page 46 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 drawings contained in **Table 6.1** on page 38 as well as the indoor unit manual for location of terminals on Liebert® Drycoolers and indoor units. Refer to the electrical schematics supplied with the Liebert® Drycooler and indoor units for proper wiring of terminals 70 and 71.

Table 6.8 Minimum Recommended Control Circuit Wire Size, AWG, 60 Hz Models/Liebert® Drycooler Types with Pump Controls

Control Wire Run, ft (m)	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)	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 6.9 Minimum Recommended Control Circuit Wire Size, AWG, 60 Hz Models/Liebert® Drycooler Types without Pump Controls

Control Wire Run, ft (m)	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 6.10 Minimum Recommended Control Circuit Wire Size, mm2, 50 Hz Models/Liebert® Drycooler Types with Pump Controls

Control Wire Run, ft (m)	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 6.11 Minimum Recommended Control Circuit Wire Size, mm2, 50 Hz Models/Liebert® Drycooler Types without Pump Controls

Control Wire Run, ft (m)	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 16AWG minimum wire size, 0.4 amp per contactor, 1 to 1.5 volt maximum drop and 104°F (40°C) average ambient temperature.

7 Checklist for Completed Installation

NOTE: After installation, proceed with the following list to verify that the installation is complete. Complete and return the Warranty Inspection Check Sheet which is shipped with the unit and return to the address indicated on the check sheet.

7.1 Moving and Placing Equipment

1. Unpack and check received material.
2. Proper clearance for service access has been maintained around the equipment.
3. Equipment is level and mounting fasteners are tight.

7.2 Electrical Installation Checks

1. Line voltage connected and matches equipment nameplate.
2. Power-line circuit breakers or fuses have proper ratings for equipment installed.
3. Control wiring connections completed between indoor cooling unit and Vertiv™ Liebert® Drycooler.
4. All internal and external high- and low-voltage wiring connections are tight.
5. Liebert® Drycooler to pump wiring is completed and checked for proper phase rotation (as required).
6. Monitoring wiring connections completed, when equipped, to indoor cooling unit or external monitoring panel.
7. Confirm that unit is properly grounded to an earth ground.
8. Control transformer setting matches incoming power.
9. Electrical service conforms to national and local codes.
10. Check fans for proper phase rotation. Blades should rotate clockwise when viewing the unit from the fan guard side.

7.3 Piping Installation Checks

1. Piping is properly sized for efficiency.
2. Piping completed to corresponding indoor cooling-unit glycol drycooler circuit.
3. Piping is routed to reduce potential of rub-through or chafing.
4. Piping is leak-checked, evacuated and charged with specified /appropriate glycol/water mixture.
5. Piping is insulated, if required, to prevent damage caused by condensation.

7.4 Other Installation Checks

1. Adjust aquastat setpoints to match setpoints on the electrical schematic supplied with the Liebert® Drycooler to match indoor unit coil and fluid regulating valve types and number of drycoolers on loop.
2. Foreign material removed from in and around all equipment installed (construction materials, construction debris, etc.).
3. Installation materials and tools have been removed from equipment (literature, shipping materials, construction materials, tools, etc.).
4. Locate blank start-up sheet, ready for completion by installer or start-up technician.

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8 Troubleshooting

Table 8.1 Troubleshooting Symptoms and Checks

Symptom	Possible Cause	Check Or Remedy
Unit will not operate	No main power	Check L1, L2 and L3 for rated voltage
	Disconnect switch open	Close disconnect switch
	Blown fuse or circuit breaker tripped	Check fuses or circuit breaker
	Control fuse or circuit breaker tripped	Check for 24VAC. If no voltage, check for short. Replace fuse or reset circuit breaker.
	Improperly wired	Check wiring diagram
	No output voltage from transformer	Check for 24VAC. If no voltage, check primary voltage.
Unit runs, but motor protector keeps tripping	Motor protector defective	Replace protector
	Motor protector too small	Check amp. draw
	Fan or pump motor has shorted winding	Repair motor
	Low or unbalanced voltage	Determine reason and correct
Outlet temperature from unit too high	Low or no coolant flow	See Pump will not operate or no coolant flow on the next page entry in this table.
	Ambient air temperature higher than design	Correct possible hot air discharge to fans from another source.
	Heat load higher than design	Check for misapplication, need larger cooler. Correct possible additional heat load being added to cooling circuit.
	Throttling valve improperly	Reset valve to proper differential pressure.
Liquid squirts from surge tank fill cap when pump is turned off	Air in system	Vent all high points, repeat as necessary. Check liquid level in surge tank.
Pump suddenly stops pumping	Clogged strainer or impeller	Clean out debris.
Pumping suddenly slows	Clogged impeller, diffuser or line	Clean out debris and use strainer.

Table 8.1 Troubleshooting Symptoms and Checks (continued)

Symptom	Possible Cause	Check Or Remedy
Excessive leakage around the pump shaft while operating	Worn seal or packing	Replace seal or packing.
Pump performance poor	Worn impeller or seal	Replace with new impeller or seal.
	Suction lift too high	Relocate pump closer to supply.
	Motor not up to speed; low voltage	Larger lead wires may be required. Check for proper line voltage, $\pm 10\%$.
	Worn bearings	Replace pump.
Pump has noisy operation	Worn motor bearings	Replace pump.
	Low discharge head	Throttle discharge -- improve conditions
	Debris lodged in impeller	Remove cover and clean out.
	Cavitating pumps	Adjust system pressures.
Pump discharge pressure too high	Throttling valve improperly set	Reset valve to proper differential pressure.
	Valve closed in circuit	Open all valves downstream of unit.
	Strainer clogged or dirty	Remove strainer plug and clean.
Pump will not operate or no coolant flow	No power to pump motor	See Unit will not operate on the previous page in this table.
	Low coolant level	Check coolant level.
	Tubes plugged in cooling coil	Flush coil with reputable cleaner.
	Valve closed downstream of cooling unit	Open all valves.
	Strainer clogged or dirty	Remove strainer plug and clean.
	Pump cavitating (erratic gauge operation)	Possibility of air in lines. Bleed all components. Check surge tank to pump inlet connection. Check for piping restrictions.

9 Operation



WARNING! Risk of electric shock. Can cause equipment damage, injury or death. Open all local and remote electric power supply disconnect switches and verify with a voltmeter that power is off before working within any electric connection enclosures. Service and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers' specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.

9.1 Start-up Checklist

NOTICE

Risk of overheated pump seals. Can cause piping system damage, coolant fluid leaks, and substantial building damage.

Do not run pumps without fluid in the system. Pump seals require fluid to keep them cool; running them without fluid for any amount of time will damage the seals, which may cause a failure.

Refer to [Electrical Installation Checks](#) on page 47 and verify that all installation items have been completed prior to proceeding.

- Turn the drycooler disconnect ON.
- Turn on indoor units and set for cooling to allow operation of drycooler fan and pump controls.
- Check the fans for proper rotation (air discharging up).
- Check the pumps for proper rotation.

9.2 Vertiv™ Liebert® Drycooler Settings

The fan-off temperature of the aquastat (fluid temperature controls) should be set according to factory-supplied schematic, shipped inside the drycooler's electric panel. Settings may need to be field adjusted based on the indoor unit's glycol regulating valve type, Liebert® Drycooler size and the number of drycoolers on the loop.

Applications with the Optional Stat Setting require field piping to be insulated to prevent condensation. **Table 9.1** on the next page, shows acceptable applications where stats must be adjusted to Optional Setting.

Aquastats must be field-adjusted to Optional Setting for:

- Vertiv™ Liebert® GLYCOOL/Dual Cool applications
- Glycol loop applications with only one Liebert® Drycooler and one indoor unit containing motorized ball valve controls (MBV). MBVs are used in all Vertiv™ Liebert® CRV and Vertiv™ Liebert® PDX water/glycol units and those Vertiv™ Liebert® DS water/glycol units with digital scroll compressors (7th digit of model number = D, e.g., DS/VSxxxxD).
- Drycoolers with DSF or DDF controls should have setpoint temperature adjusted based on AQ1 temperatures. See **Table 9.2** on the next page

Table 9.1 Water/Glycol System Conditions Requiring Optional Settings for Aquastats

Flow Control:	MBV				WRV			
Cooling Type:	Glycol		GLYCOOL		Glycol		GLYCOOL	
Drycoolers in Loop	1	Multiple	1	Multiple	1	Multiple	1	Multiple
Stat Setting*	Optional	Factory	Optional	Optional	Factory	Factory	Optional	Optional
Insulate Field Piping	Yes	No	Yes	Yes	No	No	Yes	Yes
* See Table 9.2 below through Table 9.3 below MBV = motorized ball valve, WRV = water regulating valve								

Table 9.2 Aquastat Settings—2 Fan through 4 Fan Liebert® Drycoolers

Dial Setting (Stat Open Temp) Set for Mid Differential 8°F (4.4°C) Rise to Close				
Aquastat #	Fans	Factory Setting (Glycol) (see Notes 1 and 2)	Optional Setting (GLYCOOL) (see Note 3)	Minimum Allowed Settings for CRV
AQ1	F1	65°F (18.3°C)	35°F (1.7°C)	45°F (7.2°C)
AQ2	F2 & F3 ⁴	75°F (23.9°C)	45°F (7.2°C)	55°F (12.8°C)
AQ3 ⁵	F4 ⁵	70°F (21.1°C)	40°F (4.4°C)	50°F (10.0°C)

1. All drycoolers are shipped at Factory Setting.
2. Factory Setting is used for all glycol applications, except single drycooler loops with motor ball valve controls.
3. Stats must be field-adjusted to Optional Setting for GLYCOOL/Dual Cool applications and all single drycooler loops using motorized-ball-valve flow controls
4. F3 fan available only on drycoolers with 3 or 4 fans.
5. AQ3 and F4 applicable only on drycoolers with 4 fans.

Source: DPN001602 Rev. 5

Table 9.3 Aquastat Settings—6 Fan and 8 Fan Liebert® Drycoolers

Dial Setting (Stat Open Temp) Set for Mid Differential 8°F (4.4°C) Rise to Close				
Aquastat #	Fans	Stat Location Cabinet	Factory Setting (Glycol) (see Notes 1 and 2)	Optional Setting (GLYCOOL) (see Note 3)
AQ1	F1	Main	65°F (18.3°C)	35°F (1.7°C)
AQ2	F2	Main	70°F (21.1°C)	40°F (4.4°C)
AQ3	F3 & F4	Auxiliary	73°F (22.8°C)	43°F (6.1°C)
AQ4	F5 & F6	Auxiliary	75°F (23.9°C)	45°F (7.2°C)
AQ5 ⁴	F7 & F8 ⁴	Main	78°F (25.6°C)	48°F (8.9°C)

1. All drycoolers are shipped at Factory Setting.
2. Factory Setting is used for all glycol applications, except single drycooler loops with motor ball valve controls.
3. Stats must be field-adjusted to Optional Setting for GLYCOOL/Dual Cool applications and all single drycooler loops using motor ball valve flow controls.
4. 'AQ5 and F7 and F8 applicable only on Drycoolers with 8 fans.

Source: DPN001602 Rev. 5

10 Maintenance



WARNING! Arc flash and electric shock hazard. Open all local and remote electric power-supply disconnect switches, verify with a voltmeter that power is Off and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death. Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable. Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power. The Vertiv™ Liebert® iCOM™ controller does not isolate power from the unit, even in the “Unit Off” mode. Some internal components require and receive power even during the “Unit Off” mode of the Liebert® iCOM™ controller. The factory-supplied disconnect switch is inside the unit. The line side of this switch contains live high-voltage. The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic. Follow all local codes.



WARNING! Risk of electric shock. Can cause equipment damage, injury or death. Open all local and remote electric power supply disconnect switches and verify with a voltmeter that power is off before working within any electric connection enclosures. Service and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers’ specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.



WARNING! Risk of electric shock. Can cause serious injury or death. The Liebert® iCOM™ microprocessor does not isolate power from the unit, even in the "Unit Off" mode. Some internal components require and receive power even during the "unit off" mode of the Liebert® iCOM™ control. Open all local and remote electric power disconnect switches and verify with a voltmeter that power is Off before working on any component of the system.



CAUTION: Risk of contact with sharp edges, splinters and exposed fasteners. Can cause personal injury.

Only properly trained and qualified personnel wearing appropriate safety headgear, gloves, shoes, and glasses should attempt to service unit.

- Good maintenance practices are essential to minimizing operation costs and maximizing product life.
- Read and follow monthly and semi-annual maintenance schedules included in this manual. These MINIMUM maintenance intervals may need to be more frequent based on site-specific conditions.
- We recommend the use of trained and authorized service personnel, extended service contracts and factory-specified replacement parts. Contact your Vertiv sales representative.

10.1 General Maintenance

Record the unit model number, serial number and voltage. Please record those numbers in the spaces below.

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

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

Monthly and semi-annual inspections and maintenance are recommended for proper system operation. Use copies of [Preventive Maintenance Checklist](#) on page 57, for each of these inspections.

10.2 Vertiv™ Liebert® Drycooler Cleaning - Standard Coil

Keeping the coils in the outdoor unit clean is an important factor in maintaining peak efficiency, reliability, and long life of the equipment. The unit will operate more efficiently with frequent cleanings. If you delay cleaning until heavy build-up occurs, head-pressure problems with the evaporator units can develop.

10.2.1 When to Clean the Vertiv™ Liebert® Drycooler Coil

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

10.2.2 What to Use to Clean the Vertiv™ Liebert® Drycooler Coil

NOTICE

Risk of improper cleaning agent selection, including non-base paint solvents. Can cause building and equipment damage and loss of refrigerant charge.

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

Start with removing dirt, leaves, fibers, etc. with a soft brush or vacuum cleaner fitted with a soft-brush attachment. Do not use a wire brush or scrape the coil with a metal vacuum hose. The best overall coil cleaner is plain water. If the coil is maintained and cleaned at regular intervals, water is sufficient to remove dirt and debris from the fins. Water pressure from a garden hose and sprayer usually works well. If a pressure washer is used, make sure that the equipment is set to a lower pressure setting and that the nozzle is set to the fan spray, not stream. Otherwise, damage to the fins could result. If a cleaner is required, we recommend using a neutral cleaner, neither acidic nor base. Acid-type cleaners can damage the coil fins and surrounding areas. Many sites do not allow the use of acidic cleaners for environmental reasons.

10.2.3 Cleaning the Vertiv™ Liebert® Drycooler Coil

The absolute best way to clean coils is from the inside out. Although this does extend the time involved, the results are well worth it. Clean the coil at least once a year

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

1. Disconnecting the power supply from the Liebert® Drycooler before working on the unit.
2. Remove the fan guards and fan blades to access to the coil surface.
3. Work the sprayer across the coil using the water/cleaning solution, pushing the dirt and debris out the bottom of the coil.
4. If you are using a cleaner along with the spraying process, follow recommended manufacturer instructions and be sure to rinse the coil thoroughly. Any residue left on the coil can act as a magnet to dirt.
5. Reinstall and secure the fan blades and fan guards after the cleaning is finished.
6. Reconnect the power supply to the Liebert® Drycooler.

10.2.4 Vertiv™ Liebert® Drycooler Coil Cleaning - Heresite Coated Coil

Proper maintenance and cleaning will help preserve the performance of Heresite coated coils and avoid corrosion over the length of the product life. Two important factors for slowing corrosion are:

- Keeping the coils clean
- Keeping the coils dry

Cleaning Frequency

At a minimum, coils should be inspected and cleaned at least twice per year. In extreme environments, where the coils are exposed to high concentrations of salt air (within 25 miles of any seacoast), or where they are installed near engine exhausts, plumbing or manufacturing vents, or regularly exposed to corrosive chemicals, you may need to clean coils more often, up to 4 times per year.

Cleaning Process

1. Turn off electrical power to the unit using lock-out system.
2. Flush the coil with water to rinse off loose residue. Allow the water to soak for 10–20 minutes to loosen surface residue.
3. Flush the coil thoroughly with any mild liquid detergent and warm water (~100°F) until all signs of residue are eliminated. If harsher cleaners are required for your environment, please contact Heresite for advice.
4. Rinse the unit thoroughly with clean water (it should not be brackish or contain excessive dissolved minerals).
5. Allow the unit to dry completely prior to turning the electrical power on or returning the unit to service.

Touch Up

If coils require a touch up to protective coatings, contact Heresite for information about on-site application options.

NOTICE

- Water under high pressure, such as a high-pressure washer. Fins may fold under high pressure causing the coating to crack.
- Abrasive products or processes to scour or remove dirt
- Striking the coil with a tool to dislodge or remove soil or residue
- Corrosive, caustic or alkaline cleaners (with a pH < 5.5 or > 8.5) as these may permanently damage the coating and void the warranty. If you have questions about the cleaner that you are using, please contact Heresite.

11 Preventive Maintenance Checklist

Source: DPN003119, Rev 1

Inspection Date		Job Name	
Indoor Unit Model #		Indoor Unit Serial Number #	
Drycooler Unit Model #		Drycooler Unit Serial #	
Room Temperature/Humidity	°	%	Ambient Temperature °

Good maintenance practices are essential to minimizing operation cost and maximizing product life. Read and follow all applicable maintenance checks listed below. At a minimum, these checks should be performed semi-annually. However, maintenance intervals may need to be more frequent based on site-specific conditions. Review the unit user manual for further information on unit operation. We recommend the use of trained and authorized service personnel, extended service contracts, and factory-certified replacement parts. Contact your local sales representative for more details.

Check all that apply:

- Coil clean and free of debris
- Motor mounts tight
- Piping support/clamps secure
- Check/re-torque wire connections
- Check contactors for pitting (replace if pitted)
- Check fuses
- Verify fan operation
- Check surge-protection device status-indicator lights (if equipped)
- Ambient thermostat settings _____
- Glycol level
- Glycol solution _____%
- Water/glycol solution is flowing continuously and is clean and free of debris
- Water treatment plan is established and followed for open cooling tower application
- Check glycol lines for signs of leaks and repair as leaks are found
- Motor amp draw

#1	L1	L2	L3
(L1 and L2 on Fan Speed Control Motor)			
#2	L1	L2	L3
#3	L1	L2	L3
#4	L1	L2	L3
#5	L1	L2	L3
#6	L1	L2	L3
#7	L1	L2	L3
#8	L1	L2	L3

Glycol Pump

- Check pump rotation
- Check for glycol leaks
- Pump pressures

#1	Suction	Discharge
#2	Suction	Discharge
#3	Suction	Discharge

- Amp Draw

#1	L1	L2	L3
#2	L1	L2	L3
#3	L1	L2	L3

- Verify pump changeover (if multiple pumps)

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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

1-800-543-2778

Liebert® Channel Products

1-800-222-5877

Liebert® AC and DC Power Products

1-800-543-2378

A.2 Locations

United States

Vertiv Headquarters

1050 Dearborn Drive

Columbus, OH, 43085, 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: Submittal Drawings

Table 13.1 Submittal Drawings Contents

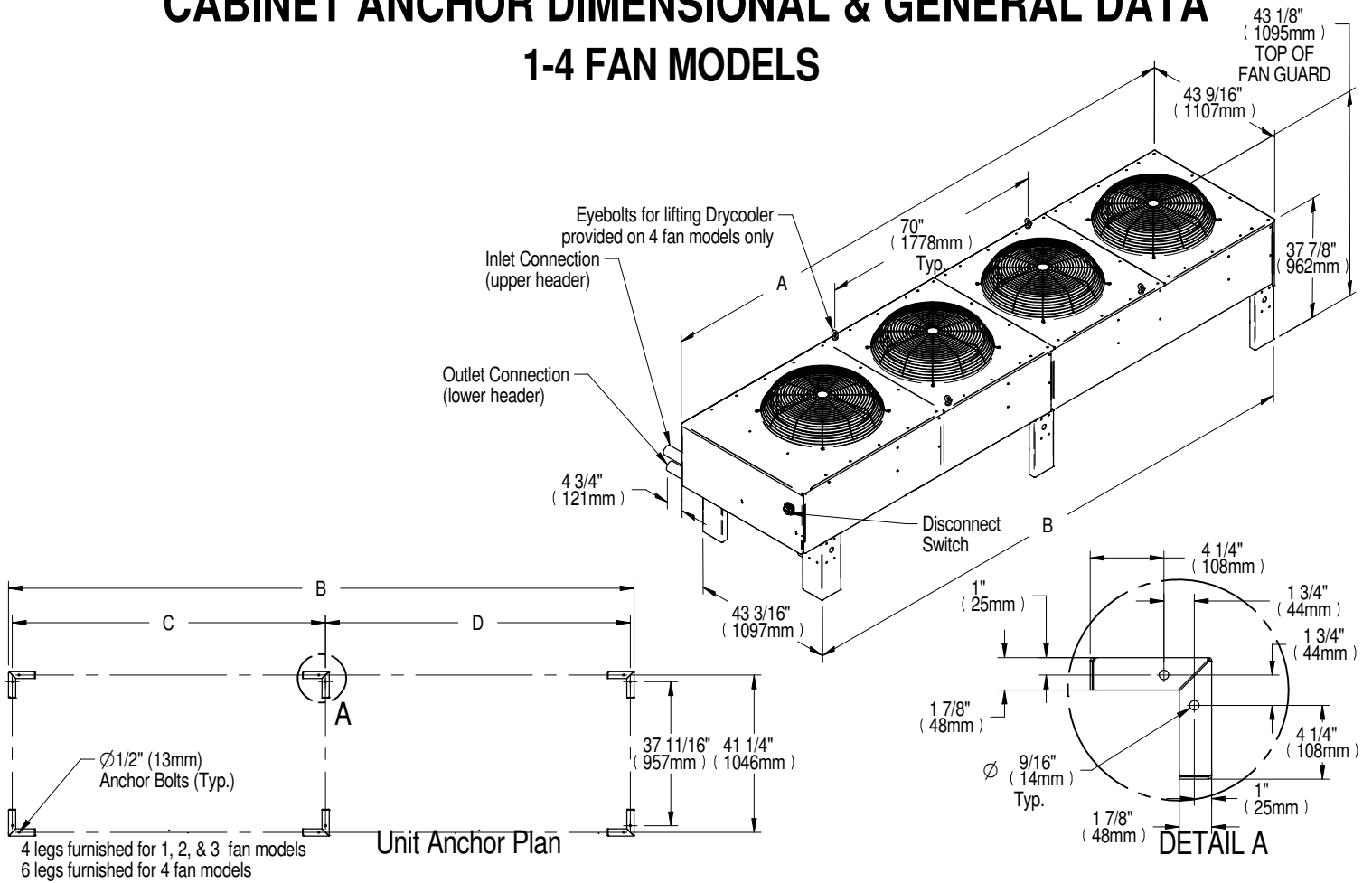
Document Number	Title
Dimension Planning Drawings	
DPN000274	Cabinet and Anchor dimensions for 1 to 4 fan drycoolers
DPN000280	Cabinet and Anchor dimensions for 1 to 4 fan Quiet-Line drycoolers
DPN000721	Cabinet and Anchor dimensions for 6 to 8 fan standard and Quiet-Line drycoolers
Drycooler Pump Drawings	
DPN000329	Pump Electrical Power Data and Piping-connection sizes.
DPN000278	Single-pump Piping connection locations and dimensional data
DPN000328	Dual-pump Piping connection locations and dimensional data
Drycooler Pump and Tank Drawings	
DPN004183	Expansion Tank General Arrangement and Dimensional Data
DPN003898	Compression Tank General Arrangement and Dimensional Data
Piping General Arrangement Drawings	
DPN000895	Piping diagram, Liebert® DS, glycol, semi-hermetic compressor models
DPN000896	Piping diagram, Liebert® DS, water/glycol, scroll compressor models
DPN001430	Piping diagram, Liebert® DS, water/glycol, digital-scroll compressor models
DPN001432	Piping diagram, Liebert® DS, GLYCOOL, digital-scroll compressor models
DPN000897	Piping diagram, Liebert® DS, GLYCOOL, semi-hermetic compressor models
DPN000898	Piping diagram, Liebert® DS, GLYCOOL, scroll compressor models
DPN002931	Piping diagram, Liebert® PDX with water/glycol
DPN002932	Piping diagram, Liebert® PDX with GLYCOOL
DPN003822	Typical piping arrangement with multiple drycoolers and multiple indoor units
Piping Connection Drawings	
DPN000275	Connection locations for standard 1 fan, 2 fan, 3 fan, and 4 fan units
DPN000281	Connection locations for Quiet-Line 1 fan, 2 fan, 3 fan, and 4 fan units
DPN002429	Connection locations for standard 6 fan and 8 fan units
DPN002430	Connection locations for Quiet-Line 6 fan and 8 fan units
Electrical Field Connection Drawings	
DPN000277	Electrical field connections, 1 fan DSF/DDF drycooler with pump control
DPN000276	Electrical field connections, 1, 2, 3 and 4 fan DSO/DDO drycooler with pump control
DPN000703	Electrical field connections, 6 and 8 fan DSO/DDO drycooler with pump control
DPN000702	Electrical field connections, 6 and 8 fan DDNC drycooler without pump control
DPN000704	Electrical field connections, 6 and 8 fan DDNL/DDNT drycooler without pump control

Table 13.1 Submittal Drawings Contents (continued)

Document Number	Title
DPN000282	Electrical field connections, Fluid-temperature control drycooler, Quiet-Line
DPN000722	Electrical field connections, 6 and 8 fan Quiet-Line drycooler with no control
DPN000723	Electrical field connections, 6- and 8 fan Quiet-Line drycooler with DSO/DDO pump control
DPN000724	Electrical field connections, 6- and 8 fan Quiet-Line drycooler with DDNL and DDNT pump control

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)

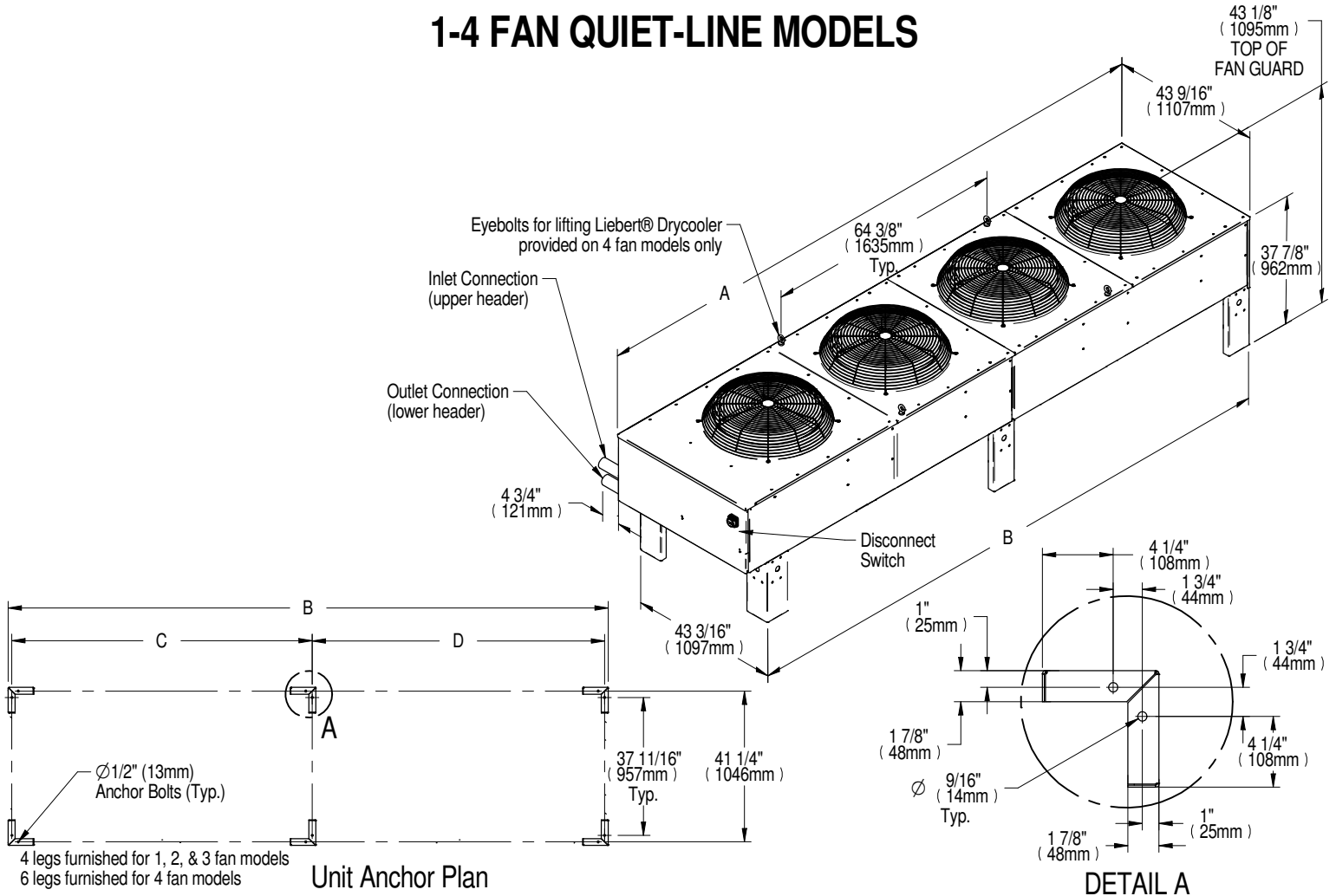
Notes:

- 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

CABINET ANCHOR DIMENSIONAL & GENERAL DATA 1-4 FAN QUIET-LINE MODELS

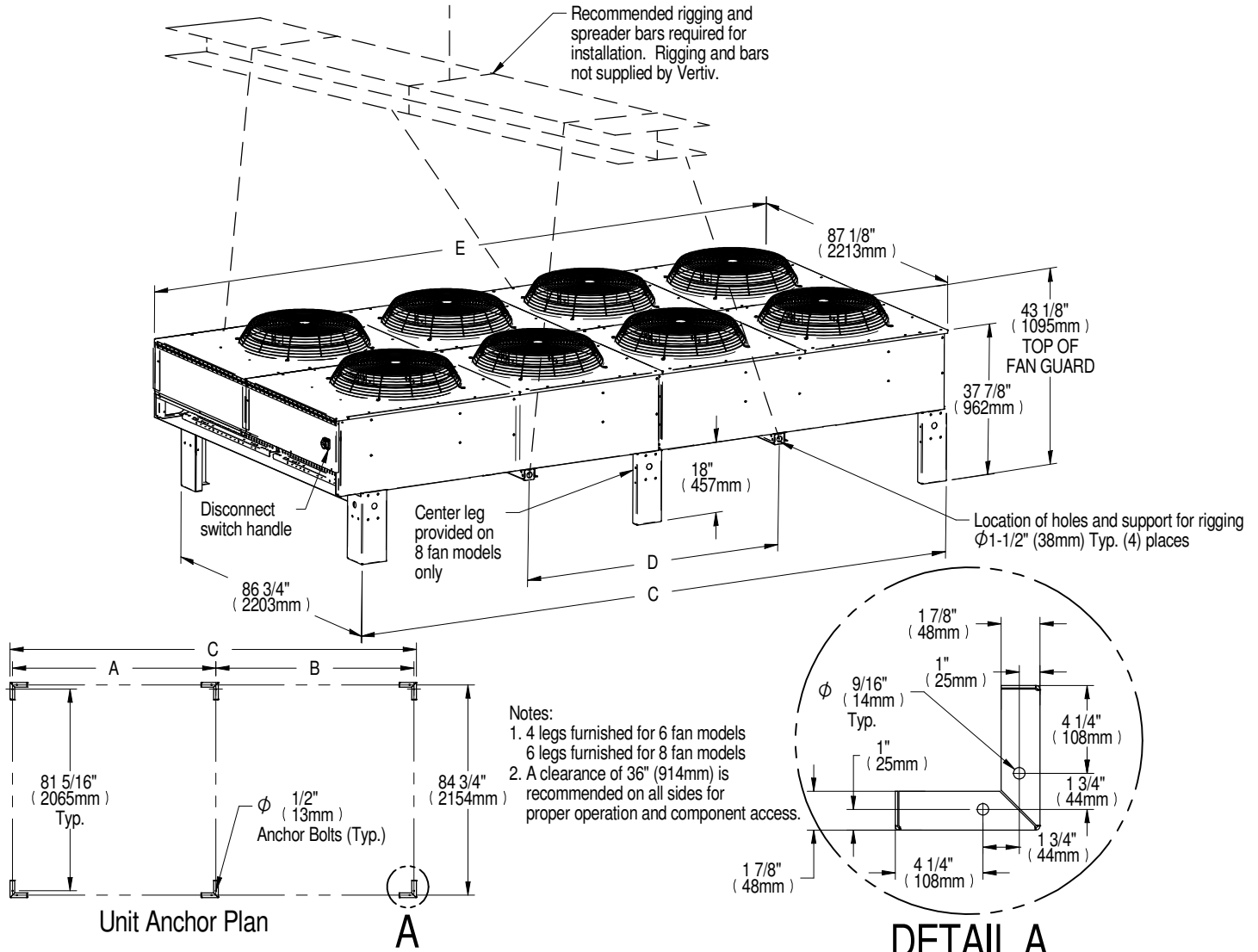


Quiet-Line Model	No. of fans	A in. (mm)	B in. (mm)	C in. (mm)	D in. (mm)	CFM (l/s)		Internal Volume Gal. (Liters)	Dry Wt. Lbs. (kg)
						60Hz (See note 1)	50Hz (See note 1)		
*D**040	1	51-1/2 (1308)	44 (1118)	42 (1067)	N/A	3110 (5285)	2592 (4404)	2.4 (9.1)	375 (170)
*D**057						2990 (5081)	2492 (4234)	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)
*D**248					11360 (19303)		9467 (16086)	17.4 (65.9)	1020 (463)

- Notes:
- All Liebert® Drycooler fan motors are 1/4H.P.
 - 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)

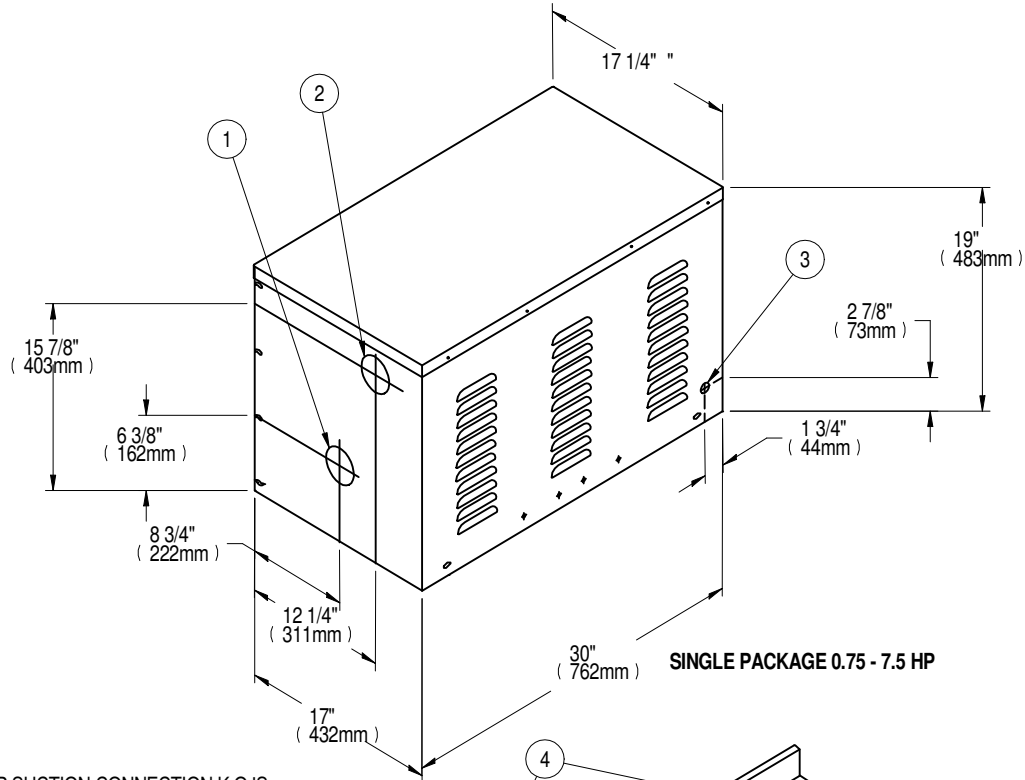


LIEBERT® DRYCOOLER

ELECTRICAL & PIPING CONNECTION DATA PUMP PACKAGE

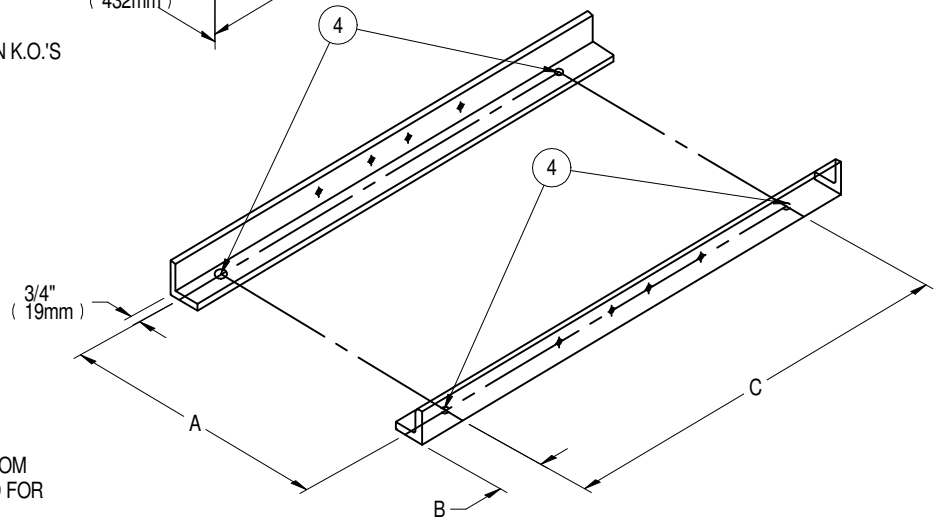
GLYCOL PUMP DATA							
HP	ELECTRICAL DATA 60Hz					PIPING CONNECTIONS NPT FEMALE IN.	
	PHASE	FLA (FULL LOAD AMPS)				SUCTION	DISCHARGE
		208V	230V	460V	575V		
3/4	1	7.6	6.9	N/A	N/A	1-1/4	3/4
1-1/2	3	3.5	3.2	1.6	1.3		
2		6.6	6.0	3.0	2.4		
3		7.5	6.8	3.4	2.7		
5		10.6	9.6	4.8	3.9	1-1/2	1
7.5		16.7	15.2	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					

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

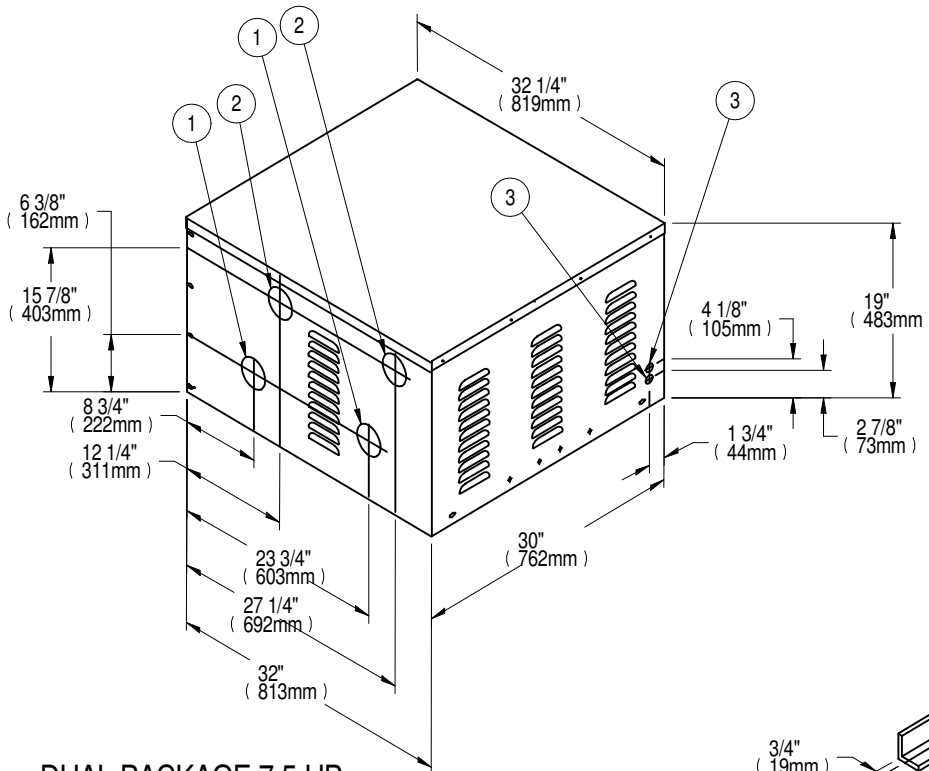
NOTE:
ANGLES LOCATED INSIDE, BOTTOM
OF PUMP PACKAGE. VIEW USED FOR
MOUNTING REFERENCE.

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)

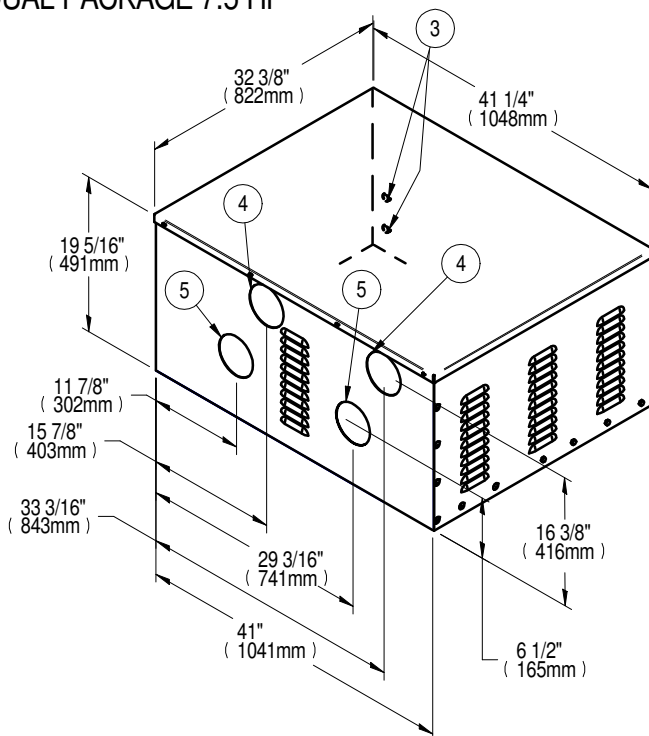
PIPING CONNECTIONS & DIMENSIONAL DATA DUAL PUMP PACKAGE

DUAL PACKAGE 0.75 - 5 HP

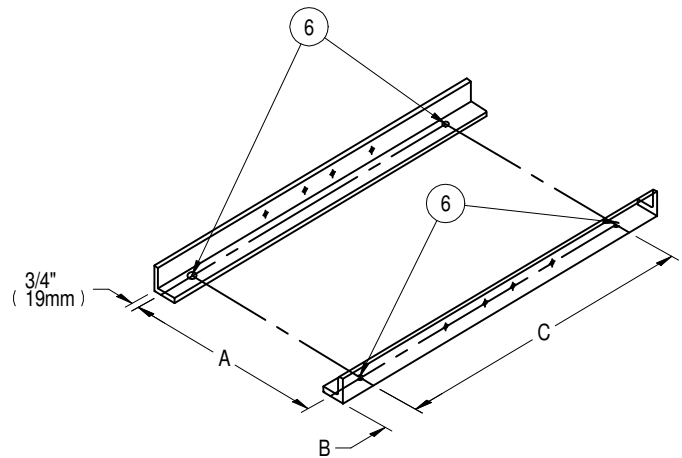


- ① 3" (76.2mm) DIA. PUMP SUCTION CONNECTION K.O.'S
- ② 3" (76.2mm) DIA. PUMP DISCHARGE CONNECTION K.O.'S
- ③ 7/8" (22.2mm) DIA. ELECTRICAL K.O.'S
- ④ 5" (127mm) DIA. PUMP DISCHARGE CONNECTION HOLE
- ⑤ 5" (127mm) DIA. PUMP SUCTION CONNECTION HOLE
- ⑥ 1/2" (12.7mm) DIA. HOLES FOR MOUNTING

DUAL PACKAGE 7.5 HP



PUMP PACKAGE MOUNTING ANGLES

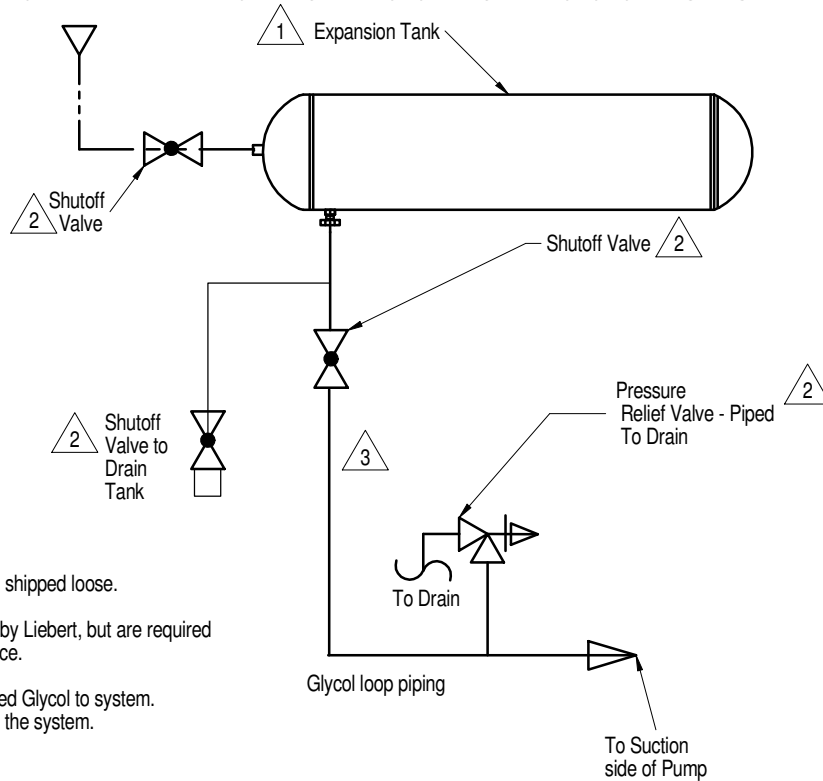


NOTE:
ANGLES LOCATED INSIDE, BOTTOM
OF PUMP PACKAGE. VIEW USED FOR
MOUNTING REFERENCE.

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)

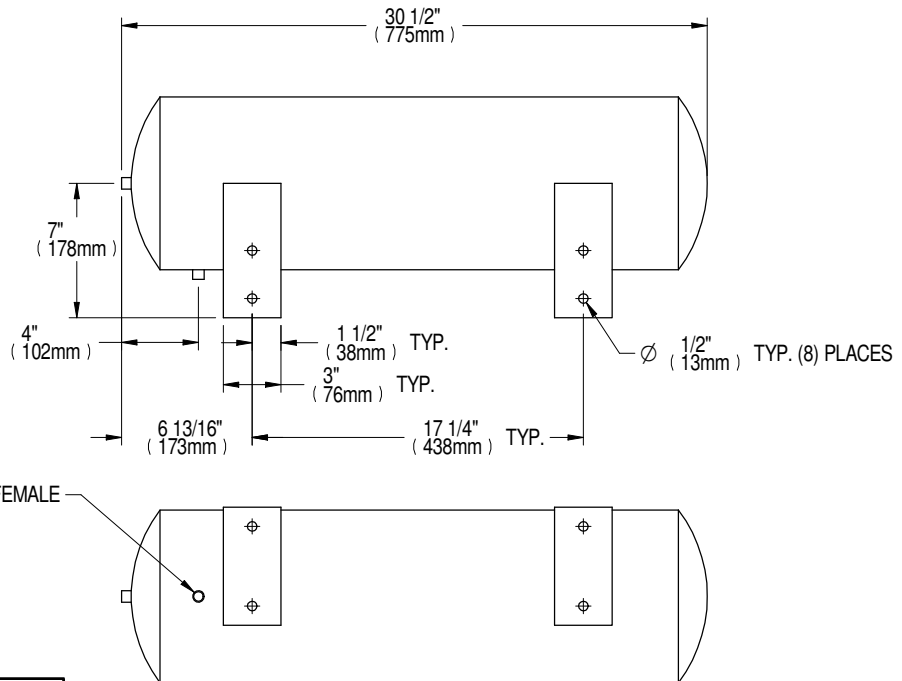
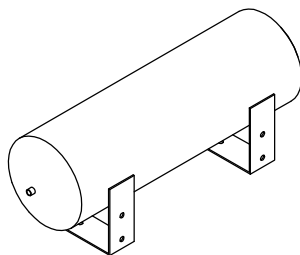
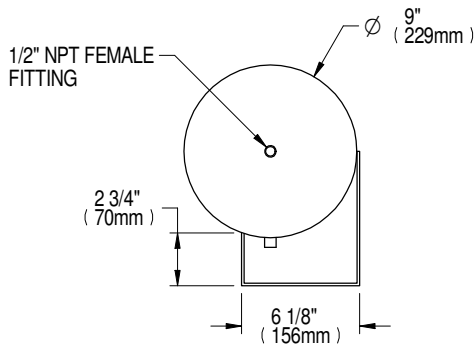
Mounting Hole Dimensional Data in. (mm)			
Pump Package	A	B	C
Dual (0.75-5HP)	30-1/4 (768)	2-1/2 (64)	22-1/2 (572)
Dual (7.5HP)	39-5/16 (999)	1-3/4 (45)	26-7/8 (683)

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



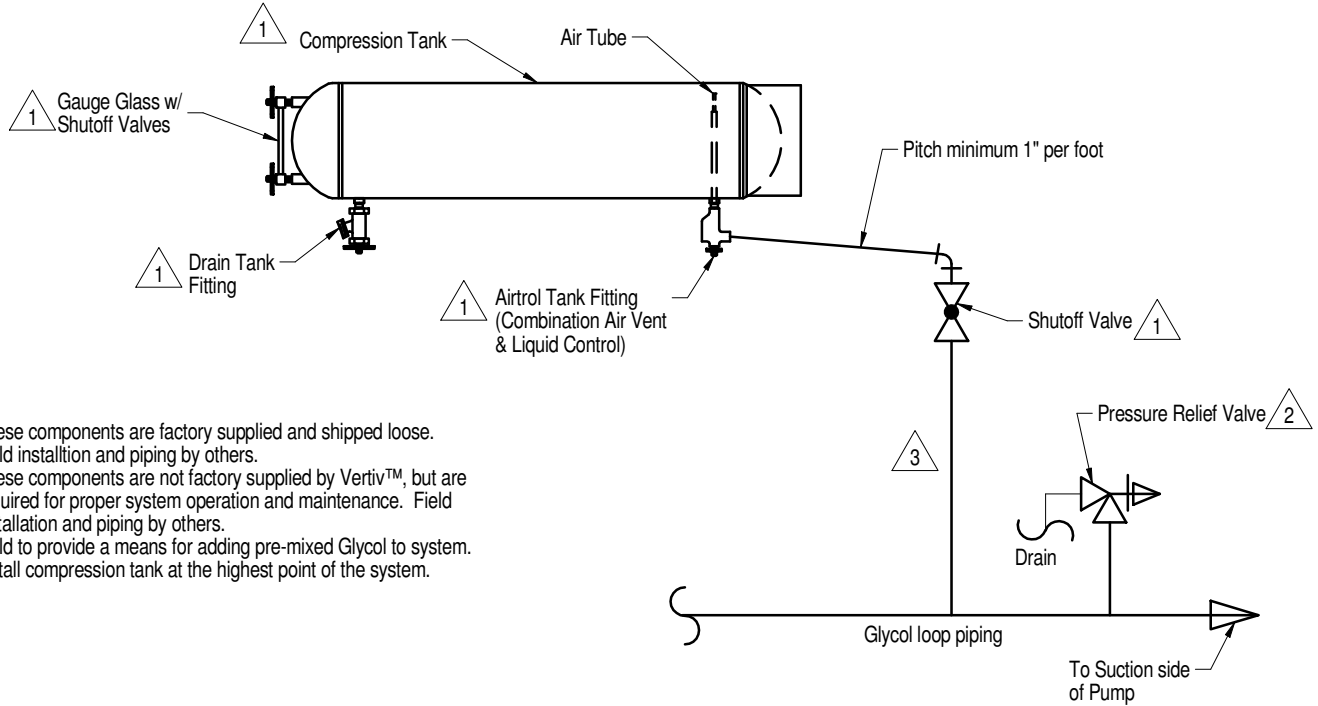
Notes:

- 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.



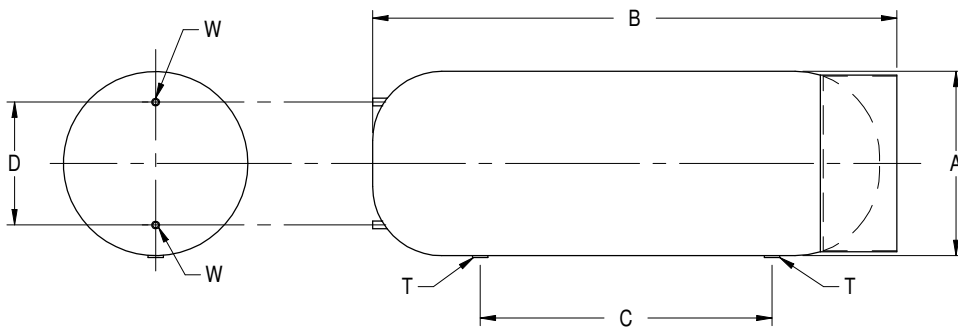
Expansion Tank Volume Gal (L)	Approx. Dry Weight lbs. (kg)	Maximum System Volume Gal (L)	
		Open System	Closed System
Tank Only			
8.8 (33.3)	26 (11.8)	75 (280)	140 (530)

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



Notes:

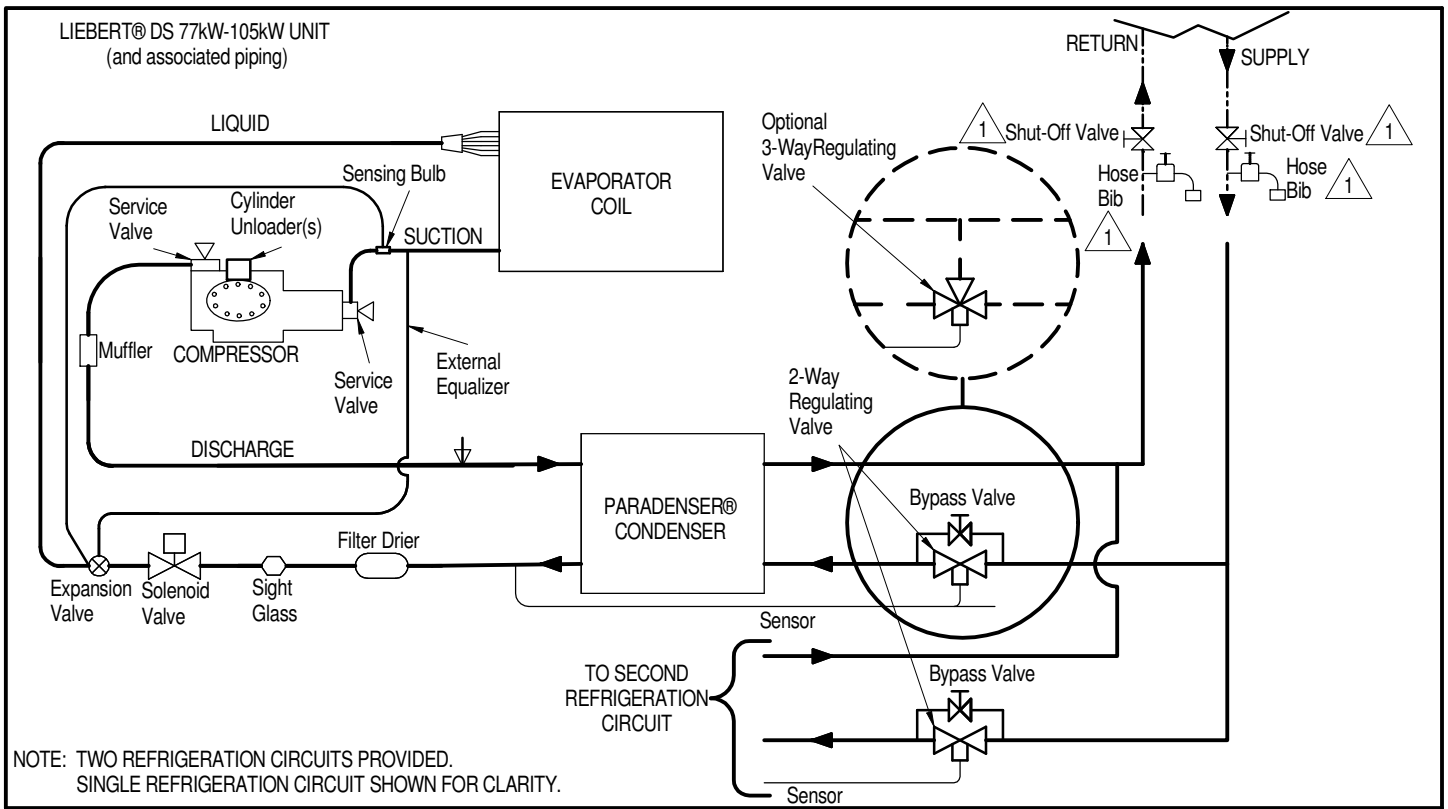
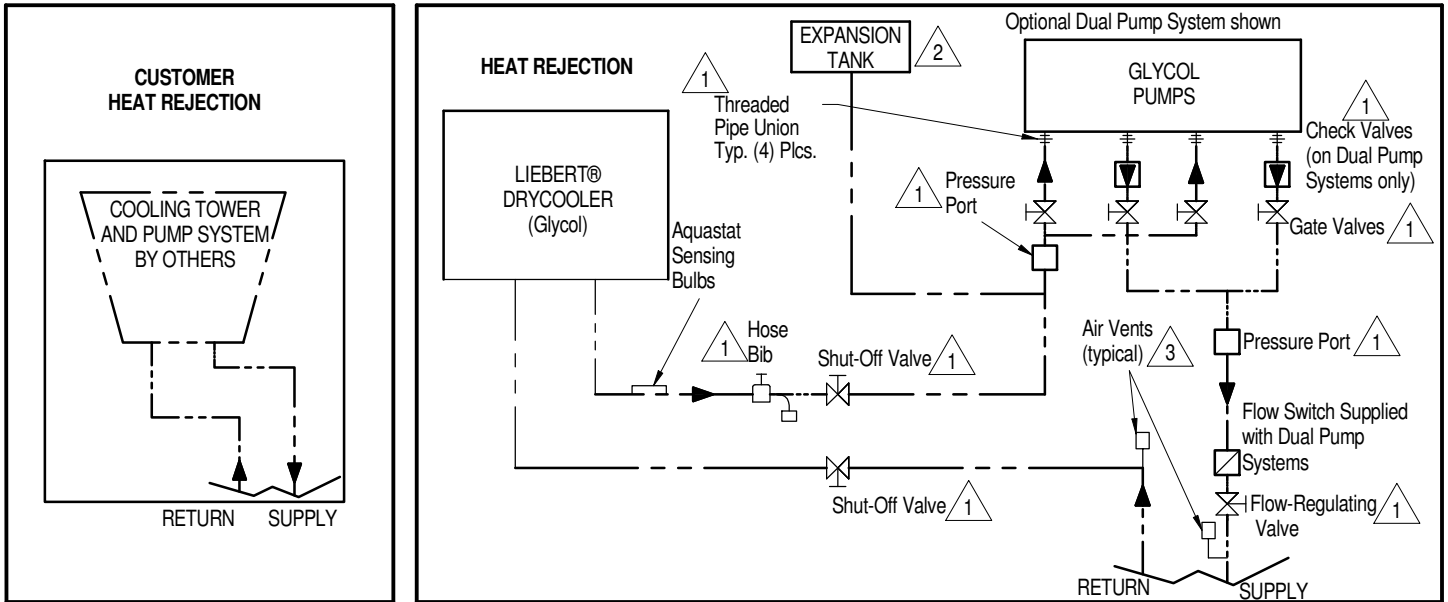
1. These components are factory supplied and shipped loose. Field installation and piping by others.
2. These components are not factory supplied by Vertiv™, but are required for proper system operation and maintenance. Field installation and piping by others.
3. Field to provide a means for adding pre-mixed 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)

PIPING SCHEMATIC

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



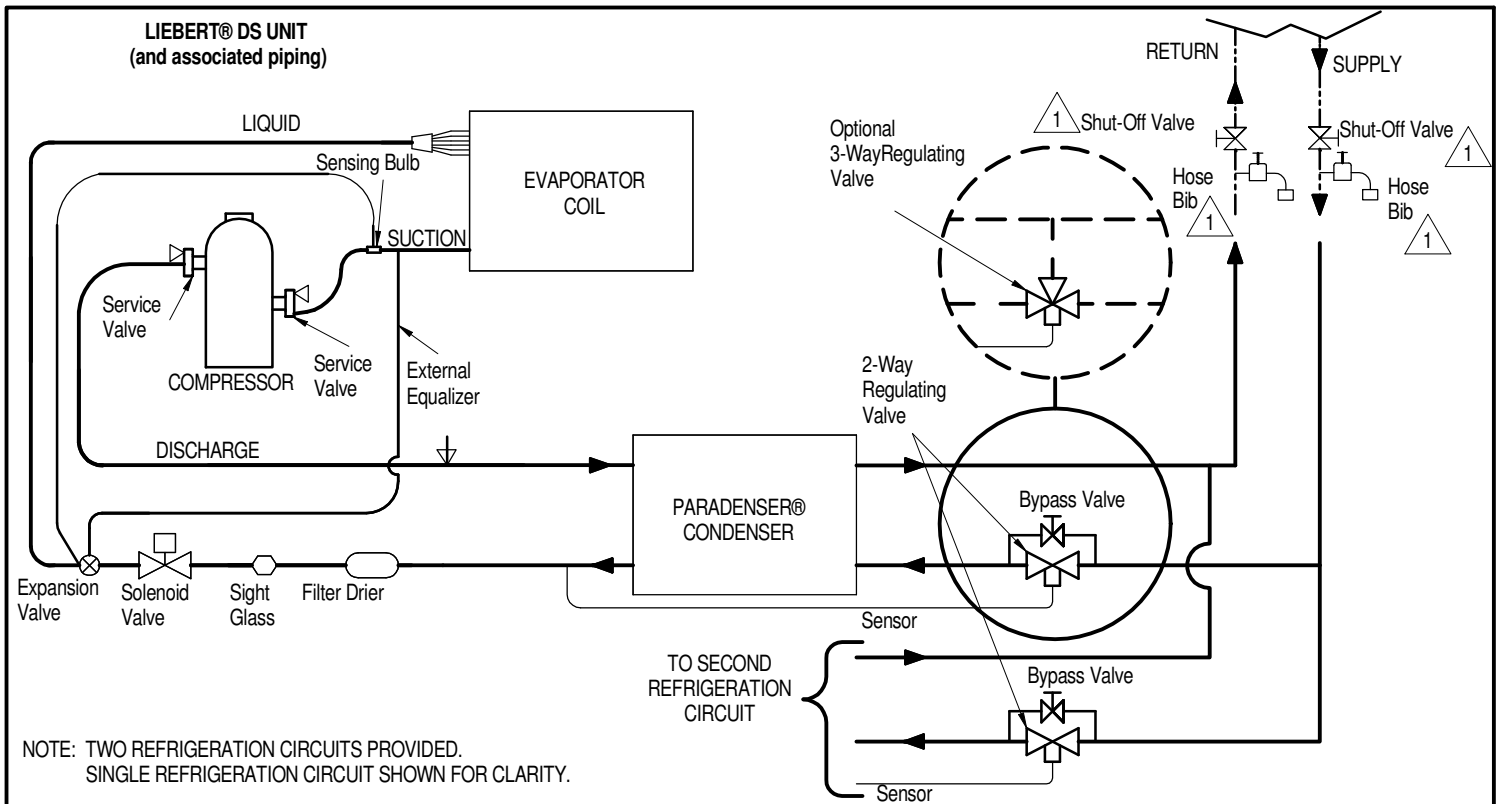
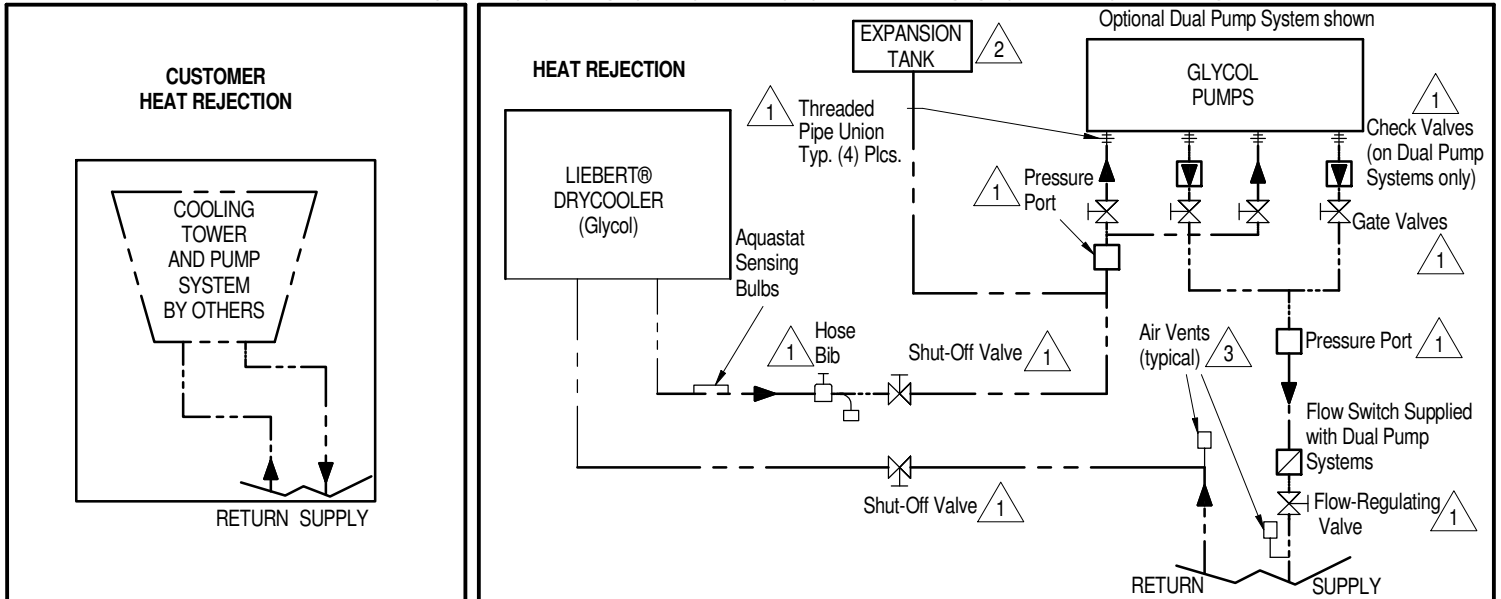
NOTE: TWO REFRIGERATION CIRCUITS PROVIDED. SINGLE REFRIGERATION CIRCUIT SHOWN FOR CLARITY.

- 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

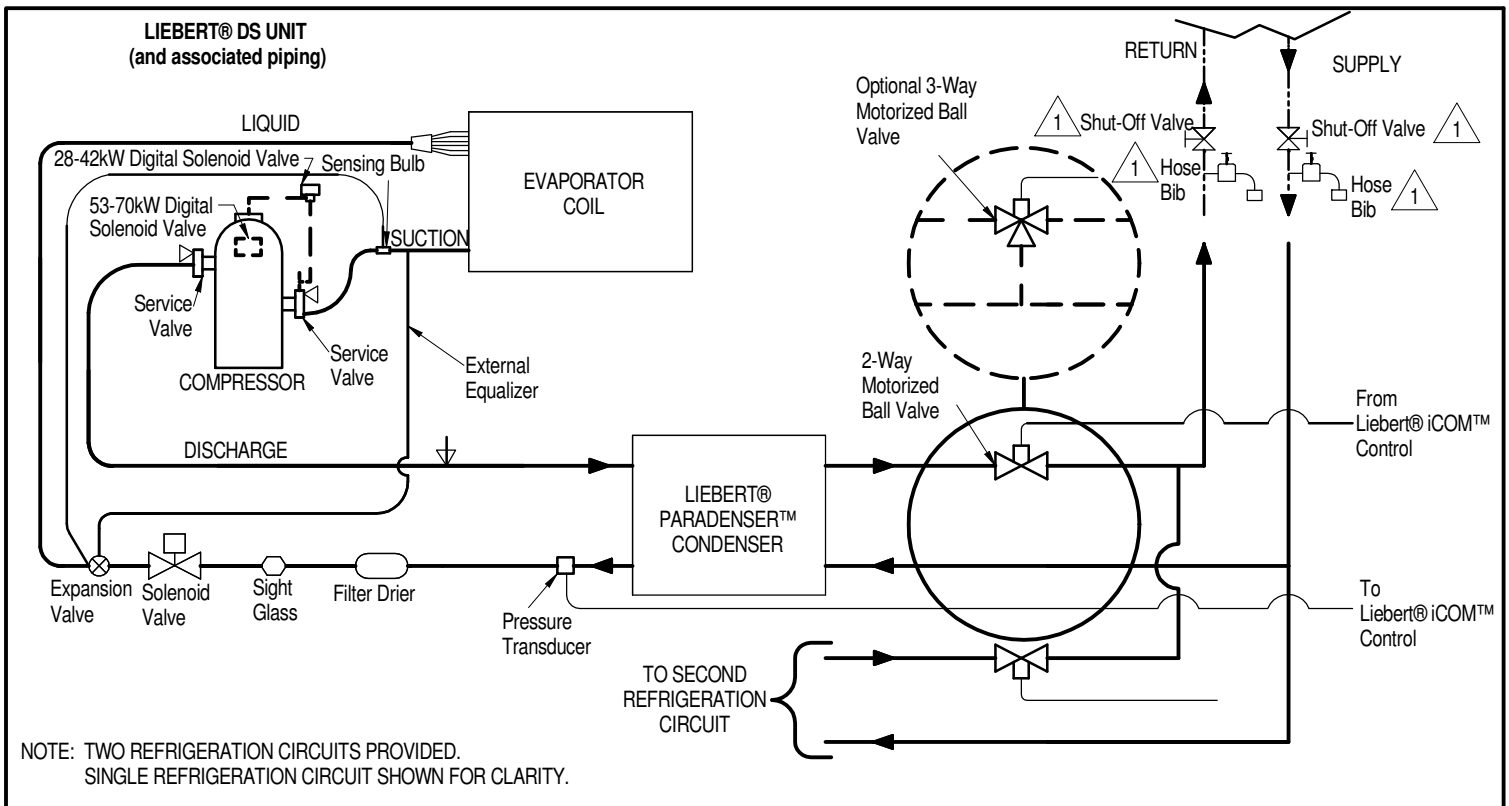
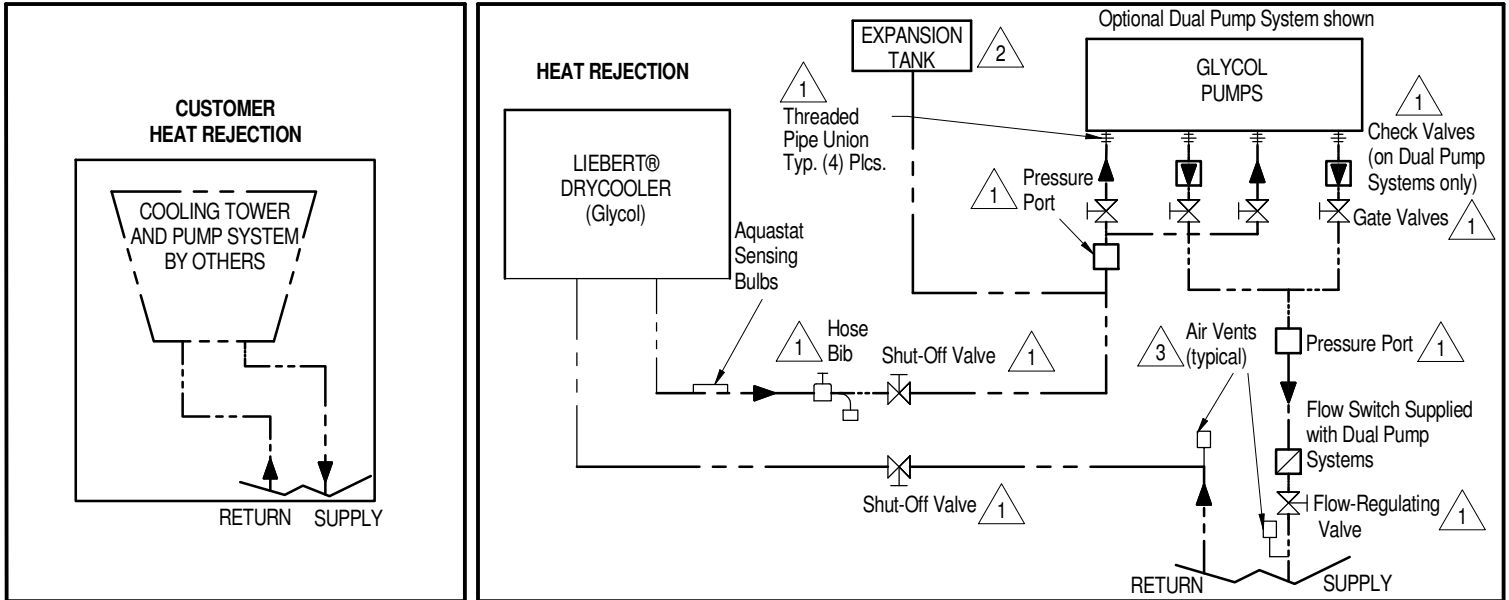


- FACTORY PIPING
- - - FIELD PIPING
- - - - - OPTIONAL FACTORY PIPING
- ▽ SERVICE / SCHRADER (ACCESS) CONNECTION NO VALVE CORE
- ▽ SERVICE / SCHRADER (ACCESS) CONNECTION WITH VALVE CORE

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

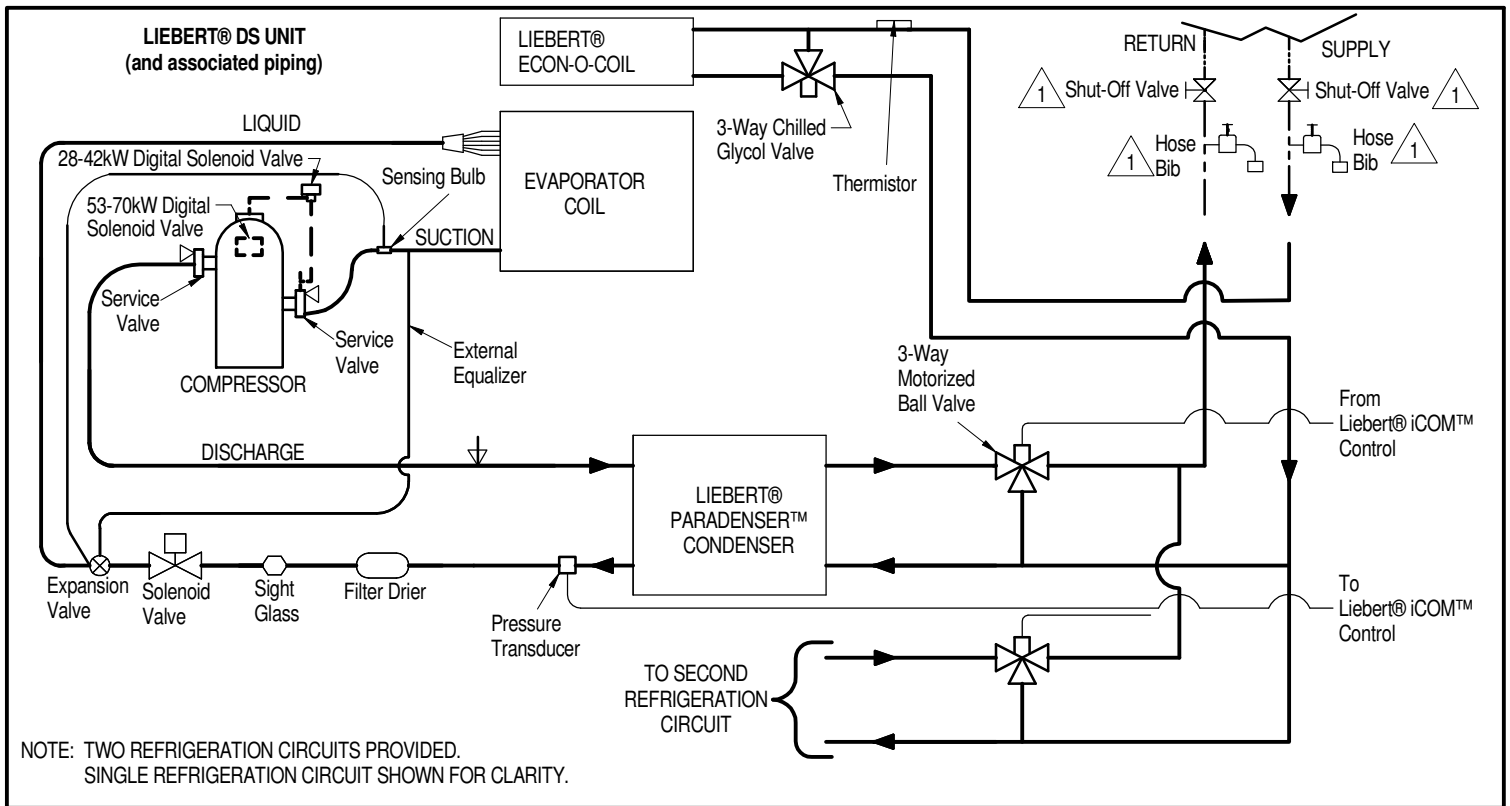
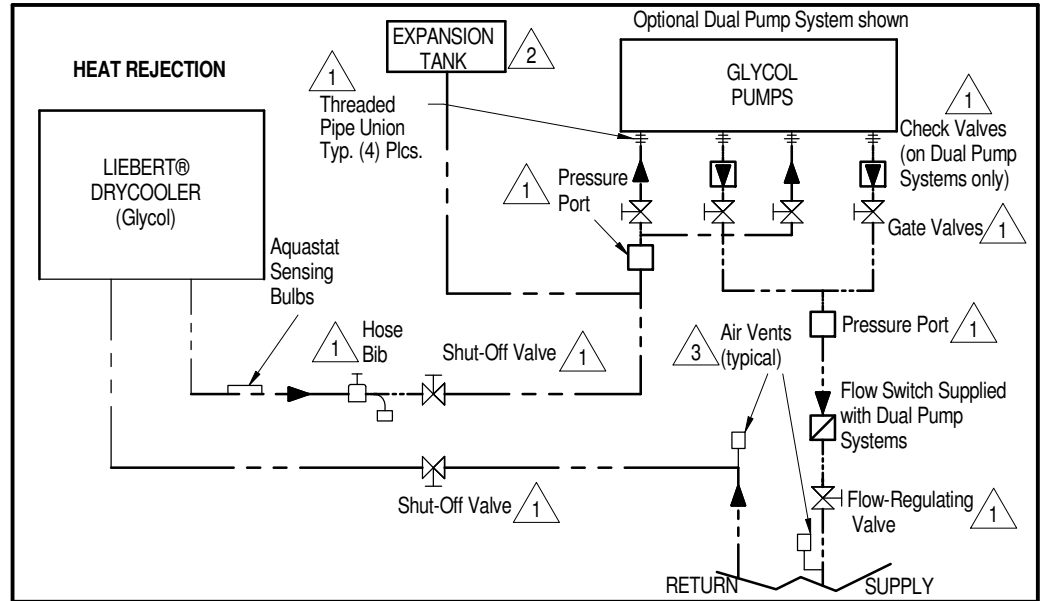


- FACTORY PIPING
- - - - - FIELD PIPING
- - - - - OPTIONAL FACTORY PIPING
- ▽ SERVICE / SCHRADER (ACCESS) CONNECTION NO VALVE CORE
- ▽ SERVICE / SCHRADER (ACCESS) CONNECTION WITH VALVE CORE

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

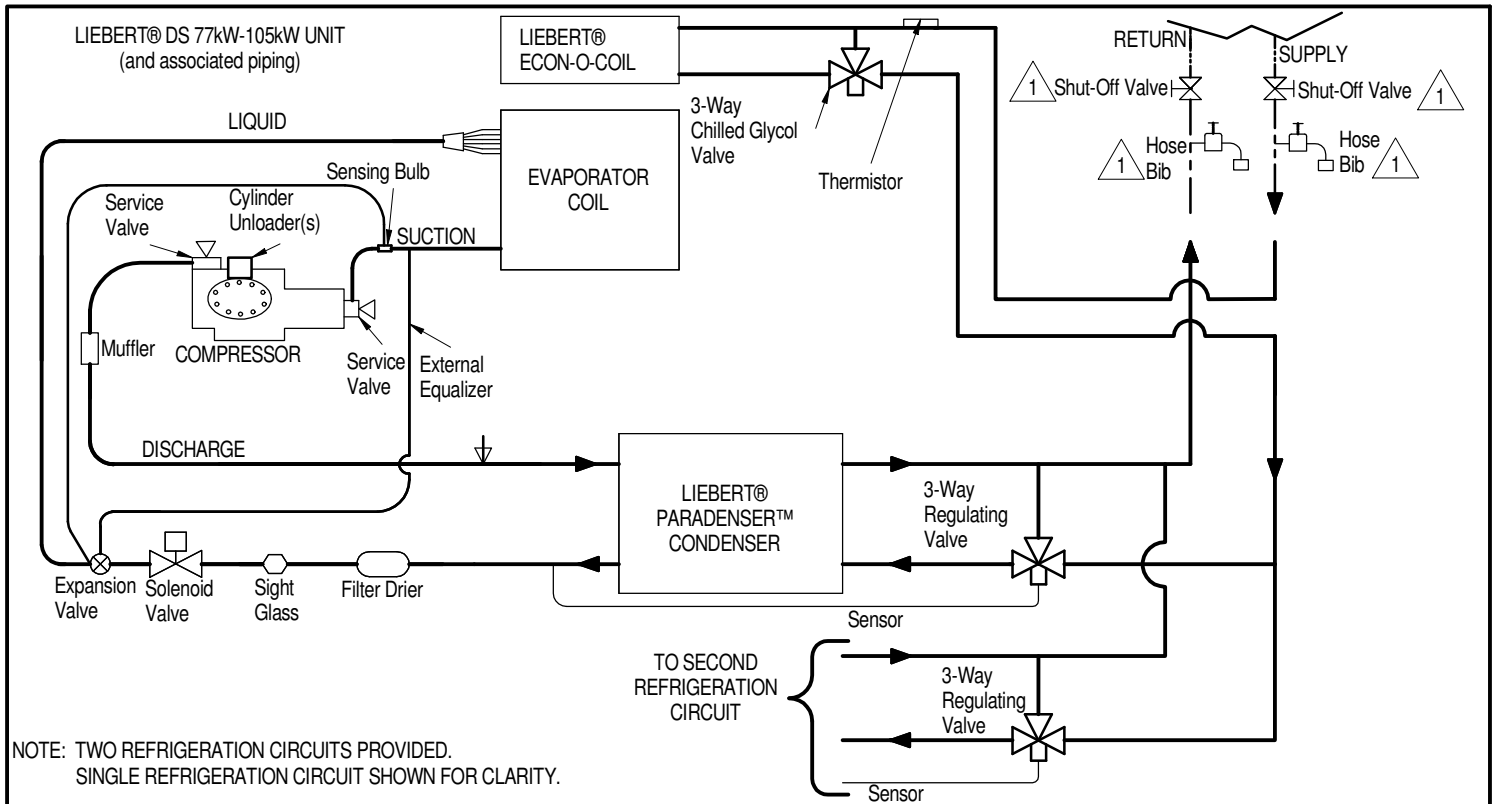
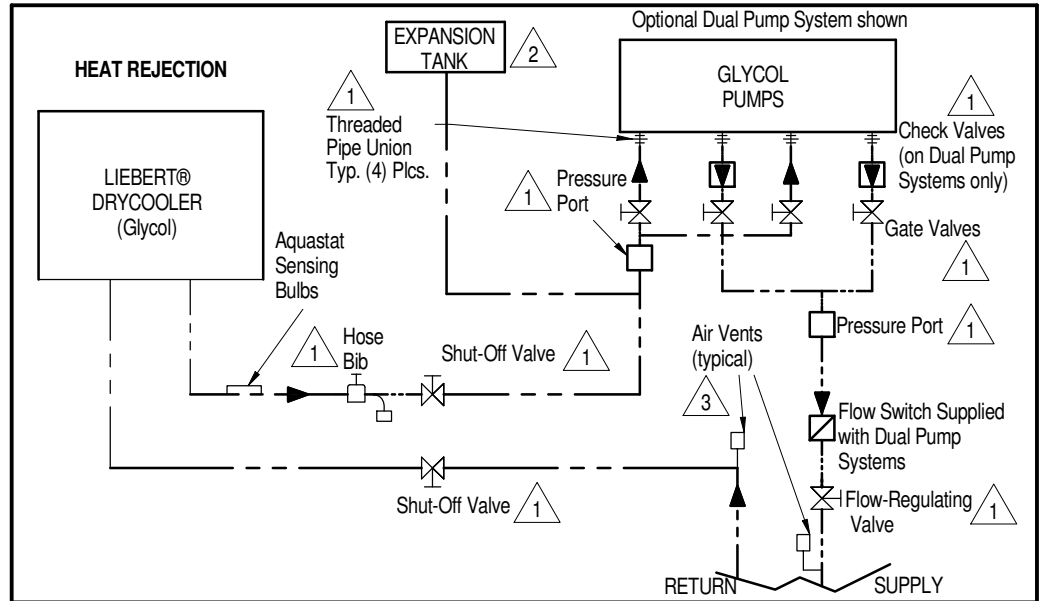


- OPTIONAL FACTORY PIPING
- ==== FACTORY PIPING
- - - - FIELD PIPING
- ▽ SERVICE / SCHRADER (ACCESS) CONNECTION NO VALVE CORE
- ▽ SERVICE / SCHRADER (ACCESS) CONNECTION WITH VALVE CORE

- 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

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

PIPING SCHEMATIC GLYCOOL 77kW - 105kW SEMI-HERMETIC COMPRESSOR MODELS

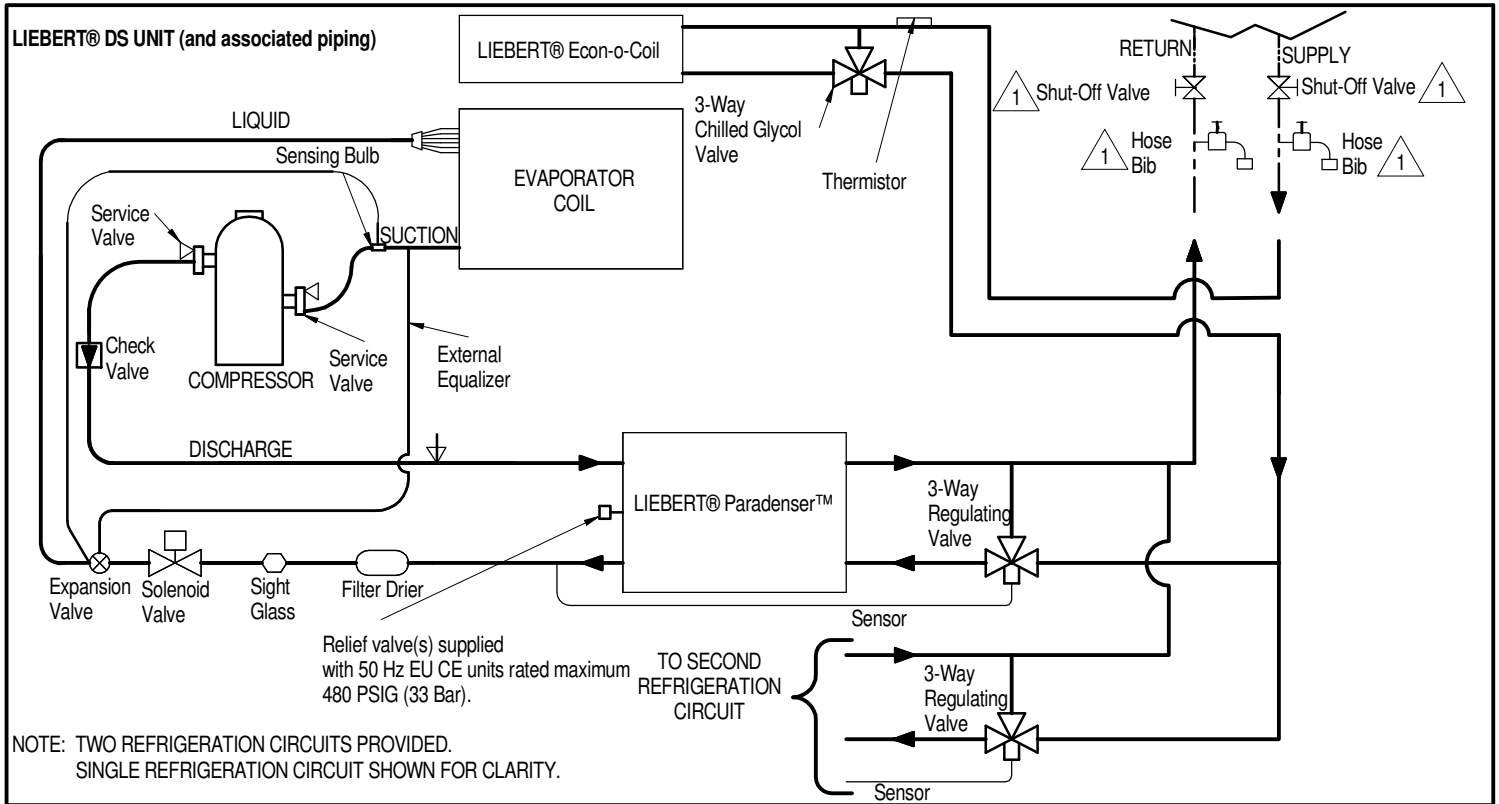
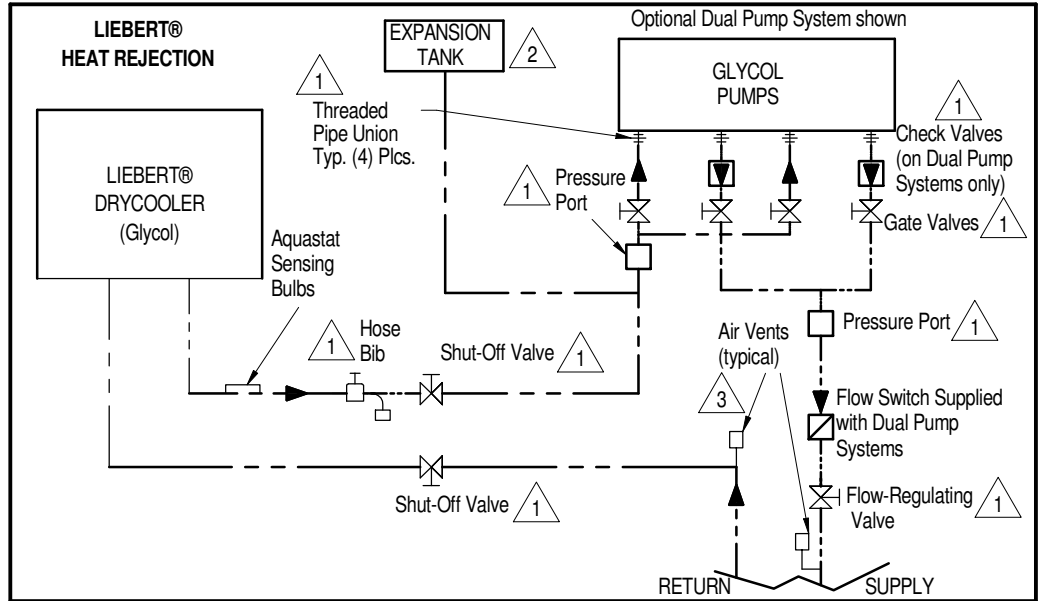


FACTORY PIPING
 FIELD PIPING
 SERVICE / SCHRADER (ACCESS) CONNECTION WITH VALVE CORE
 SERVICE / SCHRADER (ACCESS) CONNECTION NO VALVE CORE

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.

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

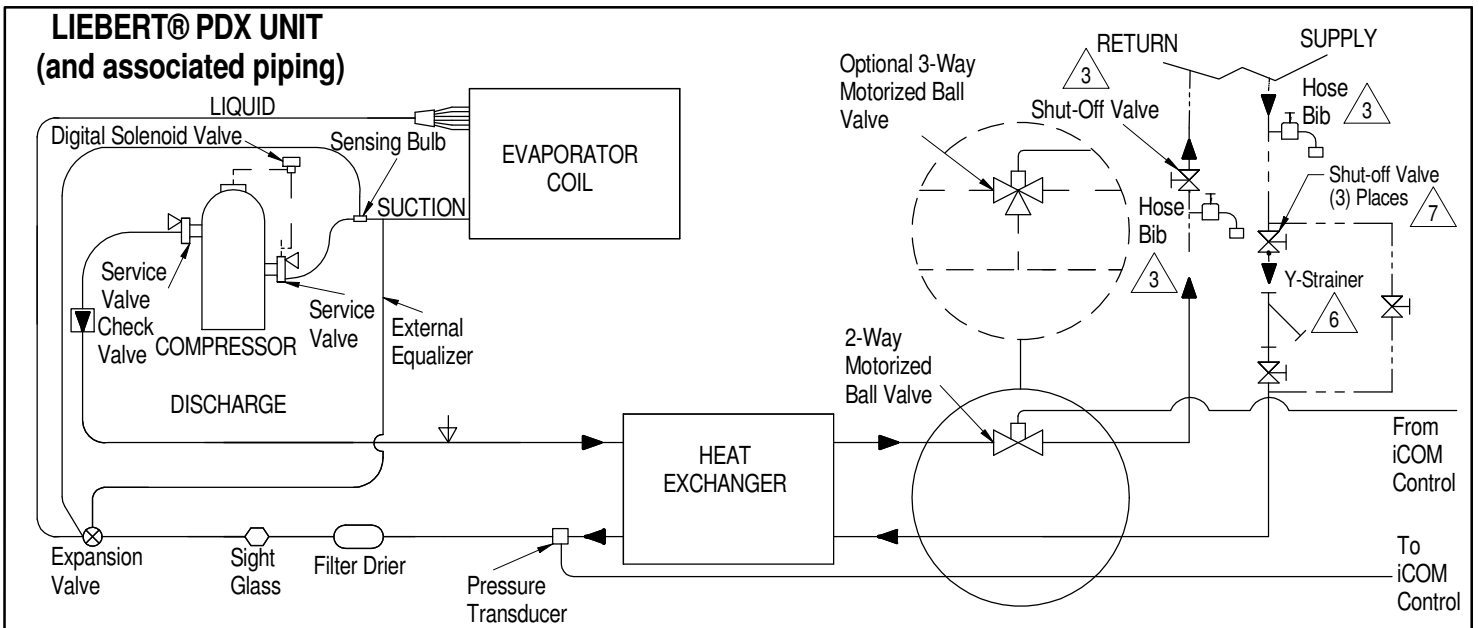
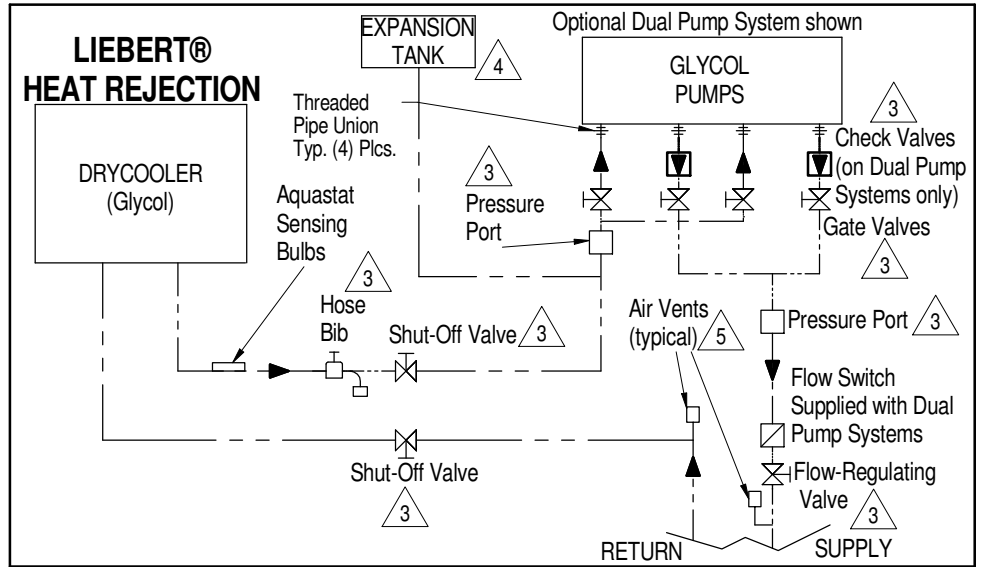
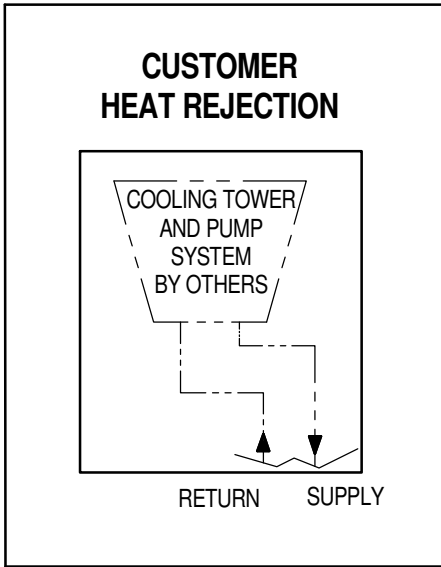
PIPING SCHEMATIC GLYCOOL SCROLL COMPRESSOR MODELS



———— 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

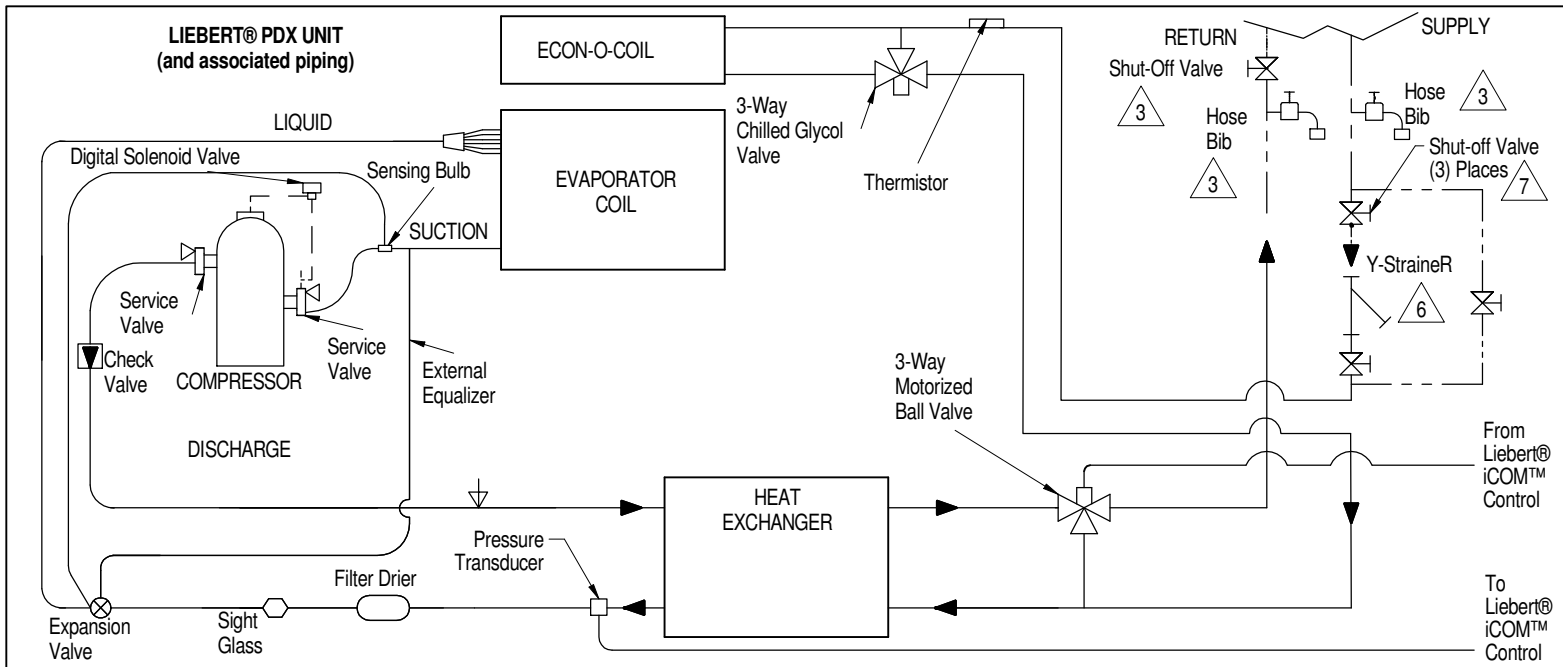
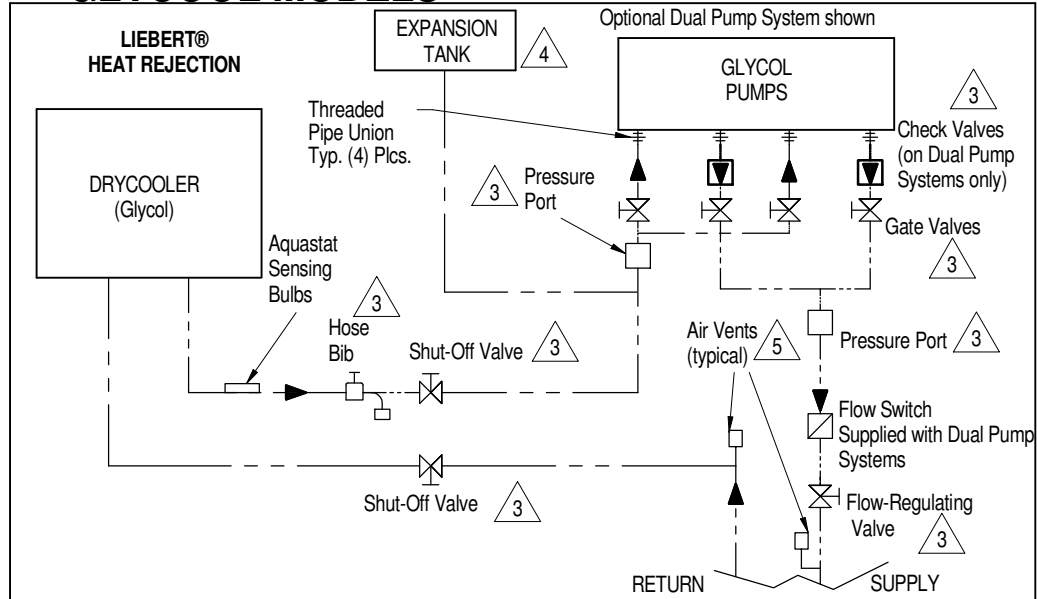
PIPING SCHEMATIC WATER/GLYCOL MODELS



- 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 GLYCOL MODELS



— FACTORY PIPING
- - - FIELD PIPING

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

Notes:

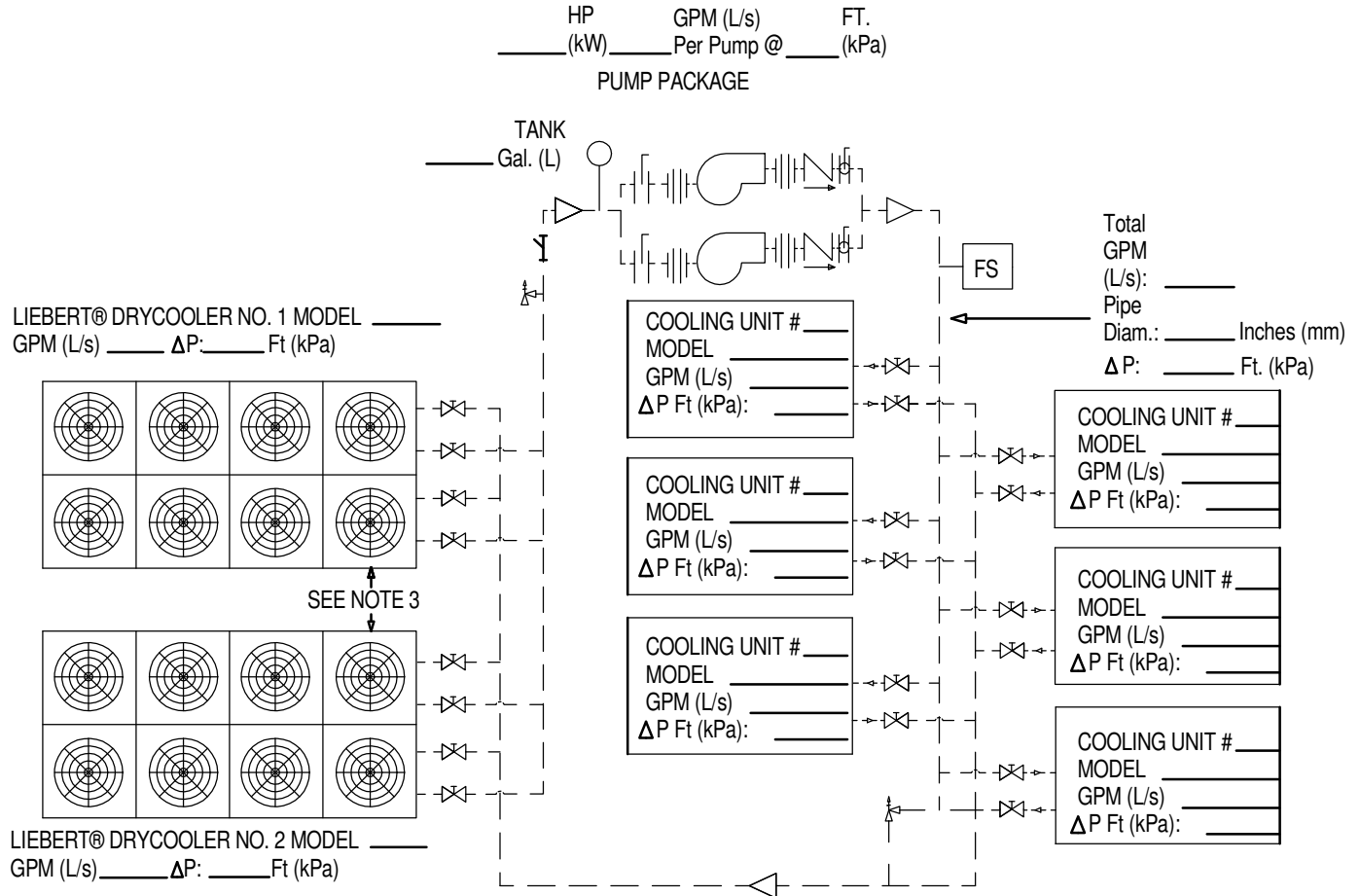
1. Schematic representation shown. Do not use for specific connection locations.
2. Install a 20 mesh strainer, in an easily accessible location, on the water/glycol supply to prevent particles from entering the heat exchanger. Strainer bypass valves are recommended to allow the strainer to be cleaned 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

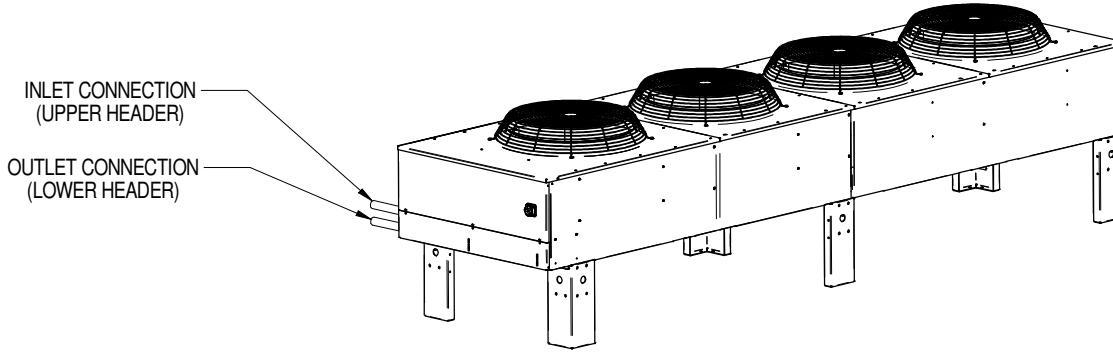
- GATE VALVE
- CHECK VALVE
- BUTTERFLY VALVE
- RELIEF VALVE
- UNION
- BALL OR FLOW CONTROL VALVE
- FLOW SWITCH
- ΔP : PRESSURE DROP
- STRAINER/FILTER

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

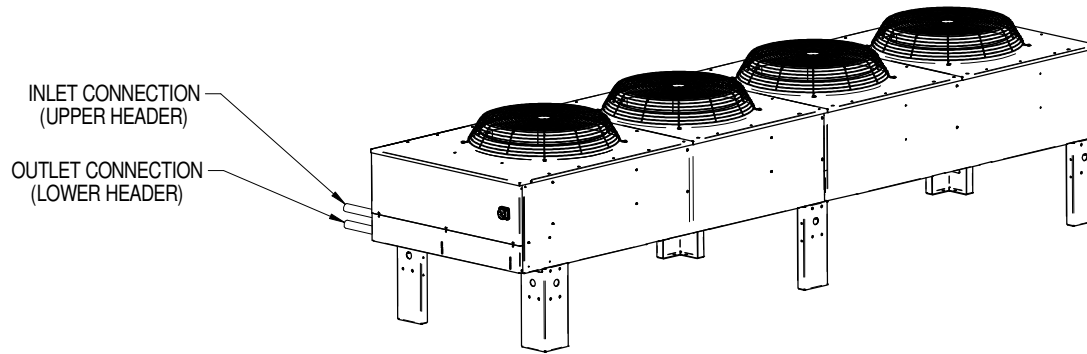
PIPING CONNECTIONS



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

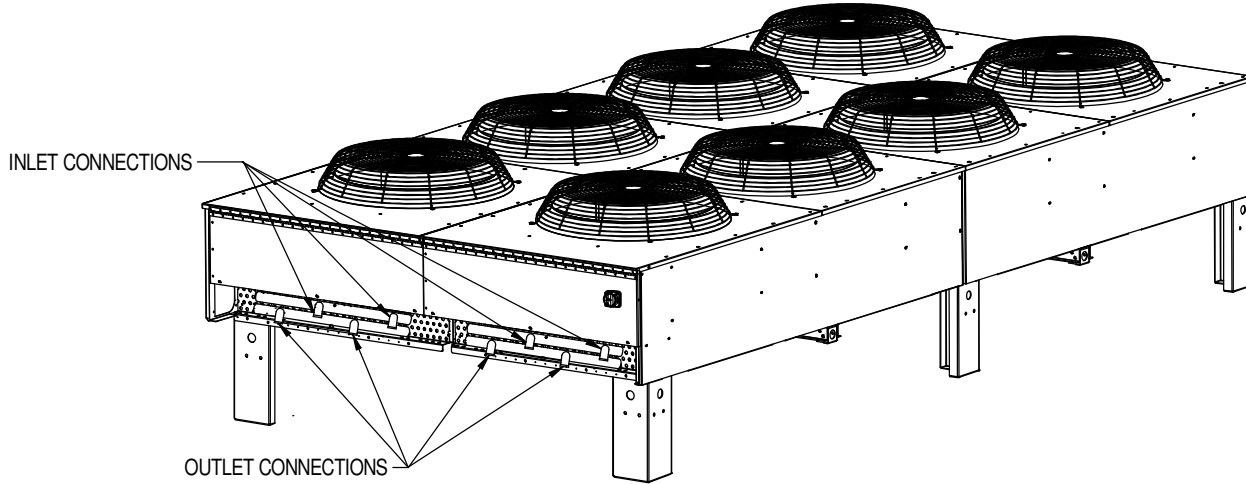


PIPING CONNECTION SIZES (O.D. Cu)		
MODEL NUMBER	NUMBER OF COIL CIRCUITS	INLET & OUTLET PIPE DIAMETER (INCHES)
-040	4, 8*	1 3/8
-057	12*	1 5/8
-057	16	2 1/8
-060	8	1 3/8
-060	16*	2 1/8
-080	8, 16*	2 1/8
-111	16*, 24	2 1/8
-121	16*, 32	2 1/8
-158	16, 24*	2 1/8
-173	16, 32*	2 1/8
-178	16, 32*	2 1/8
-178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

* = Standard Circuiting

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PIPING CONNECTIONS 6 & 8 FAN MODELS



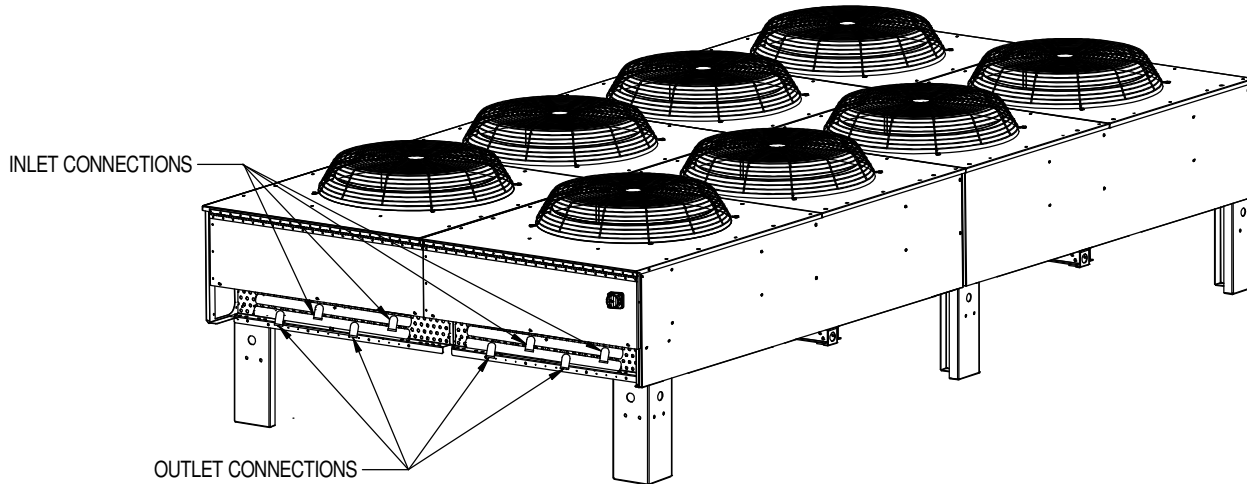
4 INLET, 4 OUTLET
CONNECTIONS SHOWN
SEE TABLE FOR ACTUAL
NUMBER PROVIDED.

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"	
-650		64*			4
		40			
		52*			
-700		80	2		
		32	4		
	64*				
-790	8	96	2		
		32			4
		64*			
-880		52	2		
		80*			4
		32			
-940	64	2			
	96*		4		
	32				

* STANDARD CIRCUITING

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PIPING CONNECTIONS 6 & 8 FAN QUIET-LINE MODELS

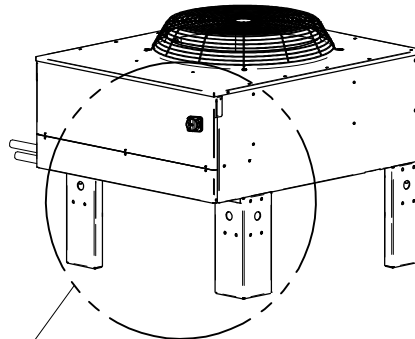


4 INLET, 4 OUTLET
CONNECTIONS SHOWN
SEE TABLE FOR ACTUAL
NUMBER PROVIDED.

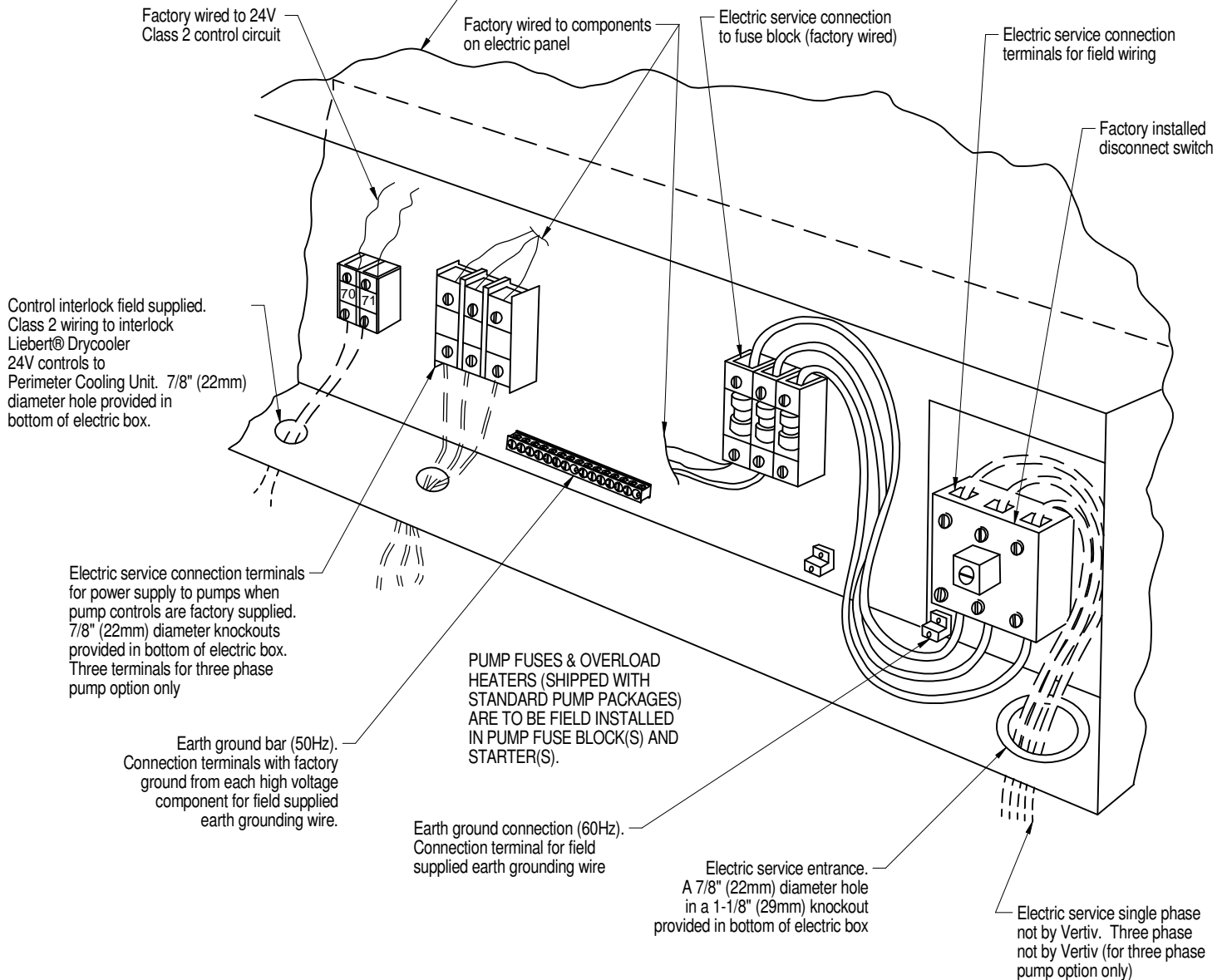
Model No.	Fan Qty.	No. of Internal Circuits	No. of Inlets & Outlets	Inlet & Outlet Connection Size (IDS, Cu)
-347	6	32	2	2-1/8"
		64*		
-356		32	4	
		64*		
-453	8	96	2	
		32		
-498		64	4	
		96*		

* STANDARD CIRCUITING

ELECTRICAL FIELD CONNECTIONS FAN SPEED CONTROL



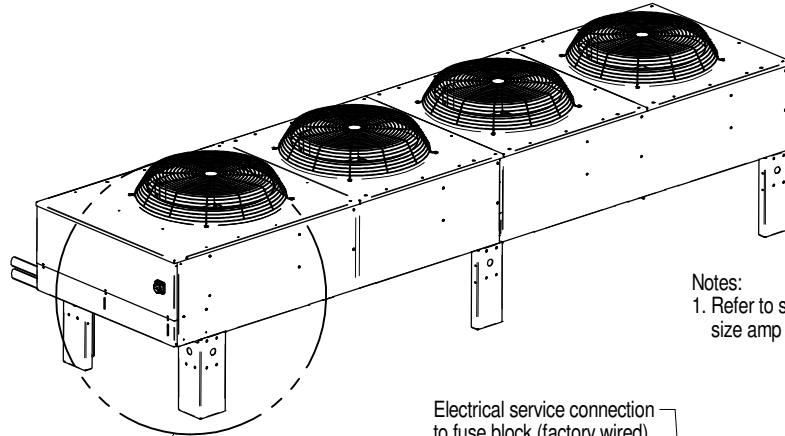
Note:
Refer to specification sheet for
full load amp and wire size
amp ratings



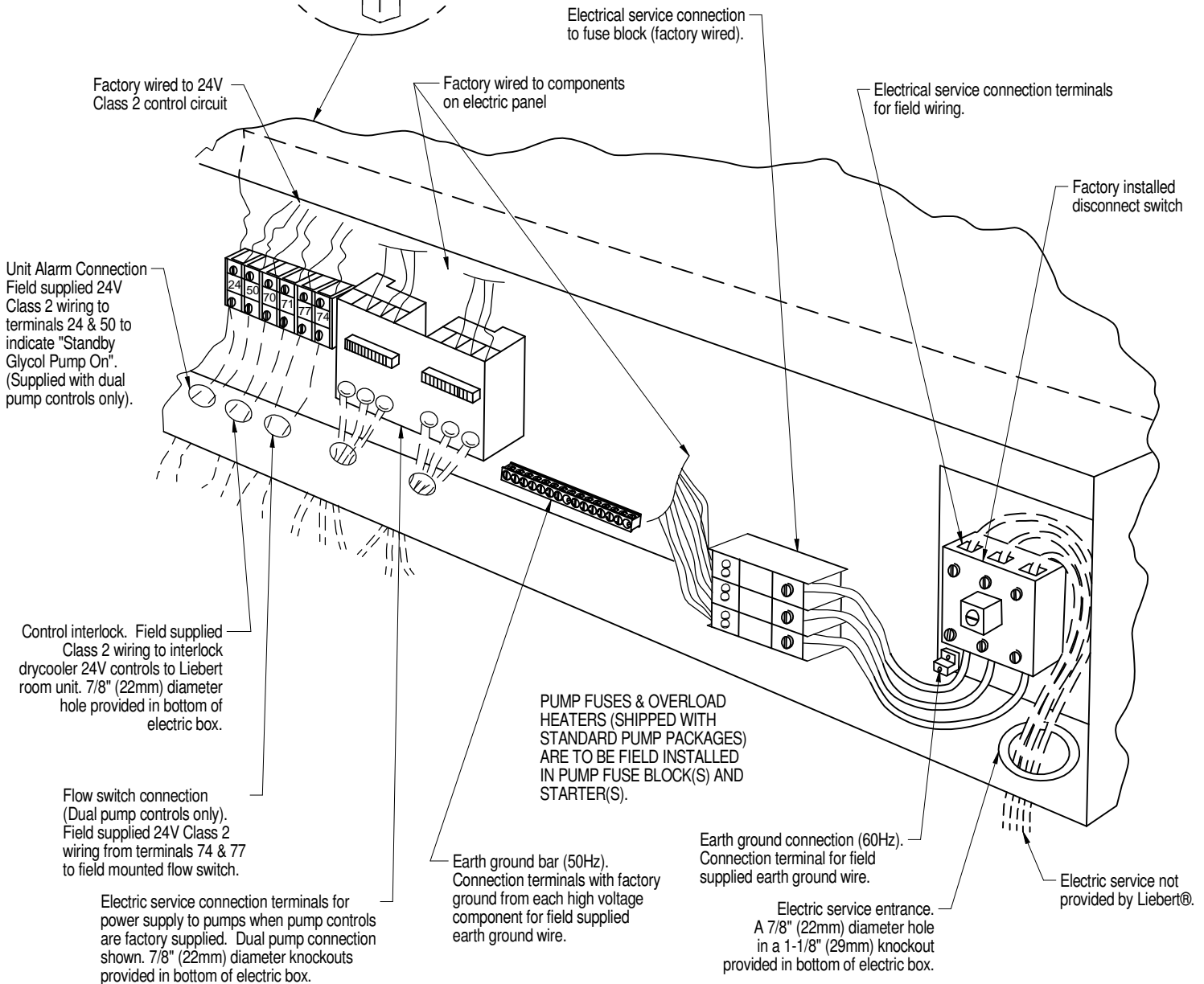


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ELECTRICAL FIELD CONNECTIONS FLUID TEMPERATURE CONTROL



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

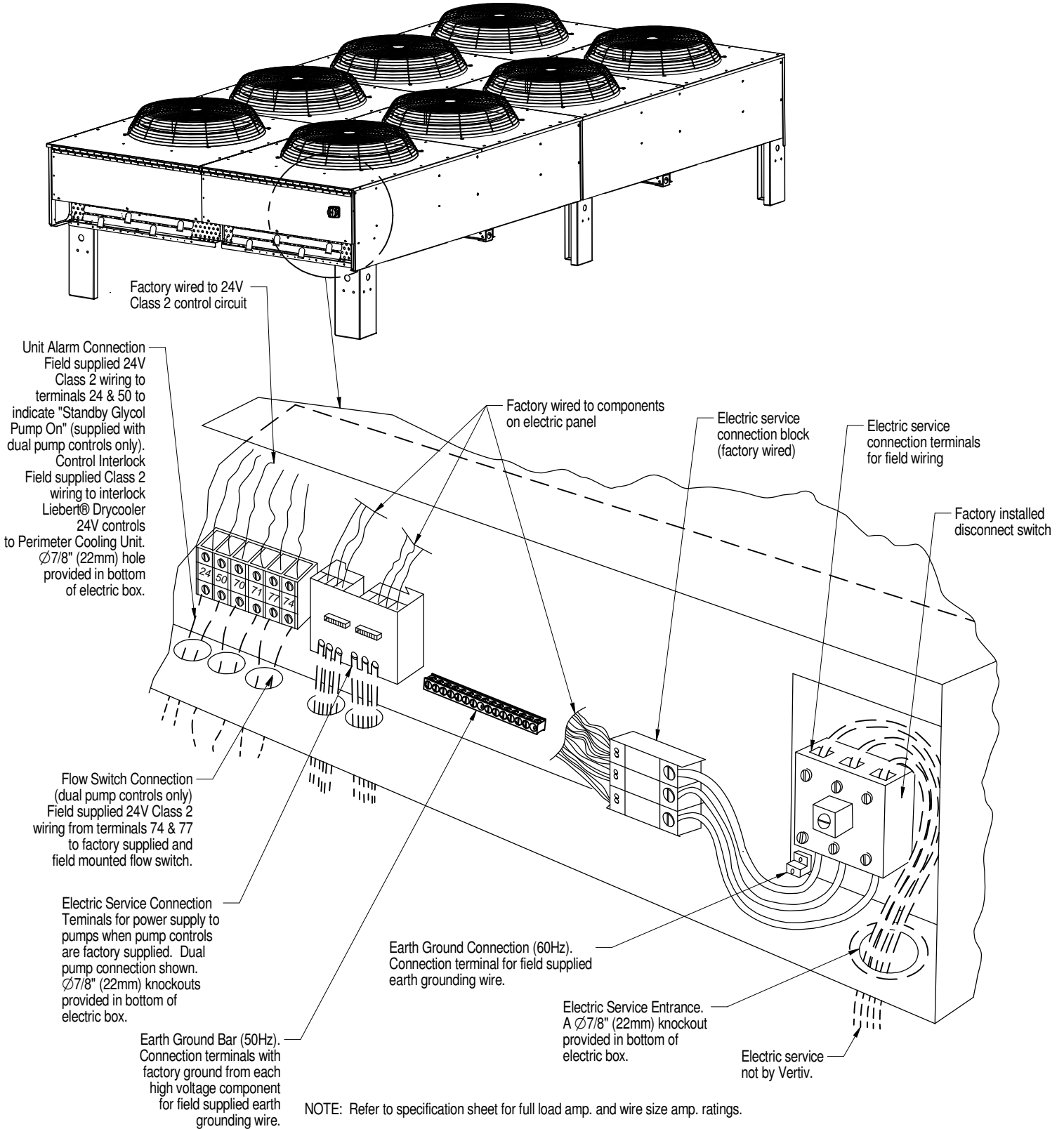


Form No.: DPN001040_REV14

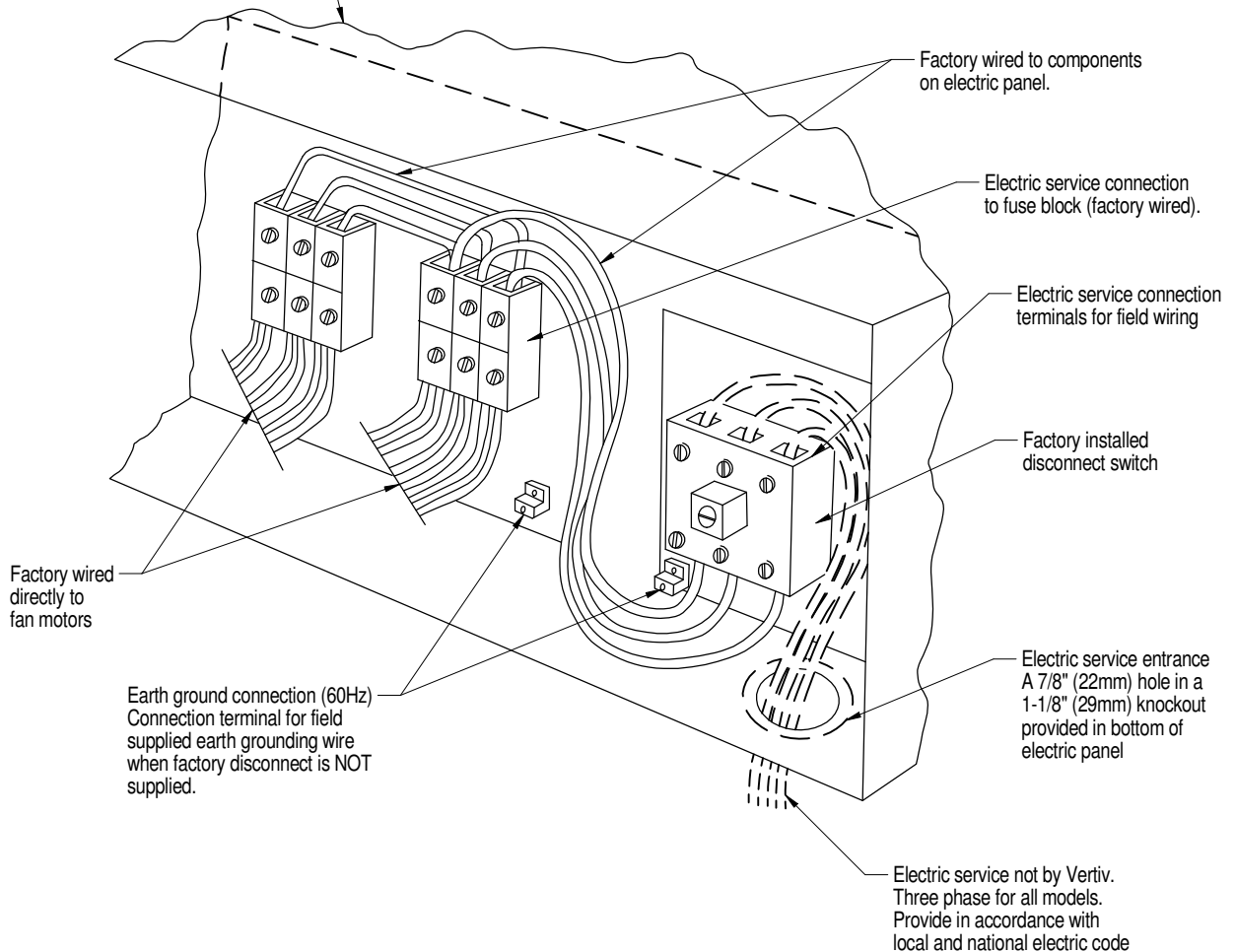
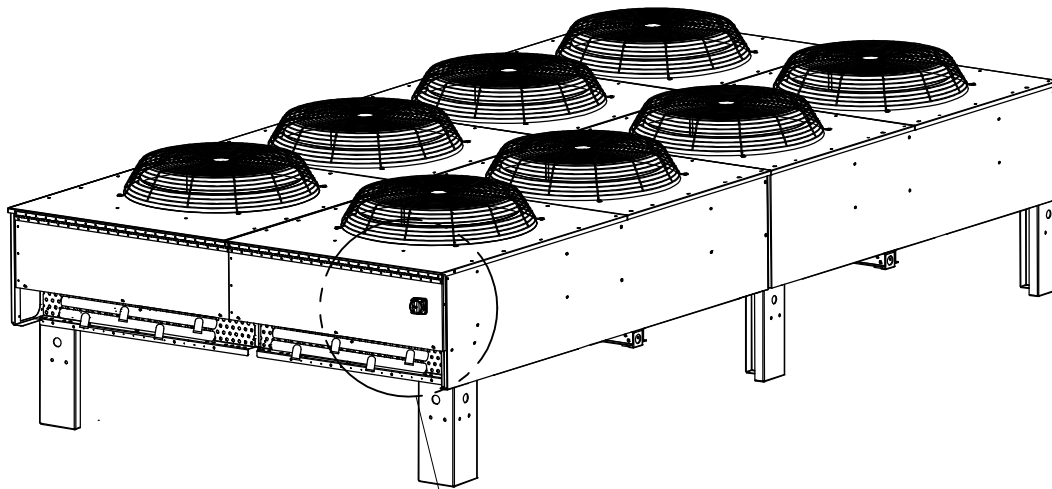


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ELECTRICAL FIELD CONNECTIONS 6 & 8 FAN MODELS W/ DSO/DDO PUMP CONTROL



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

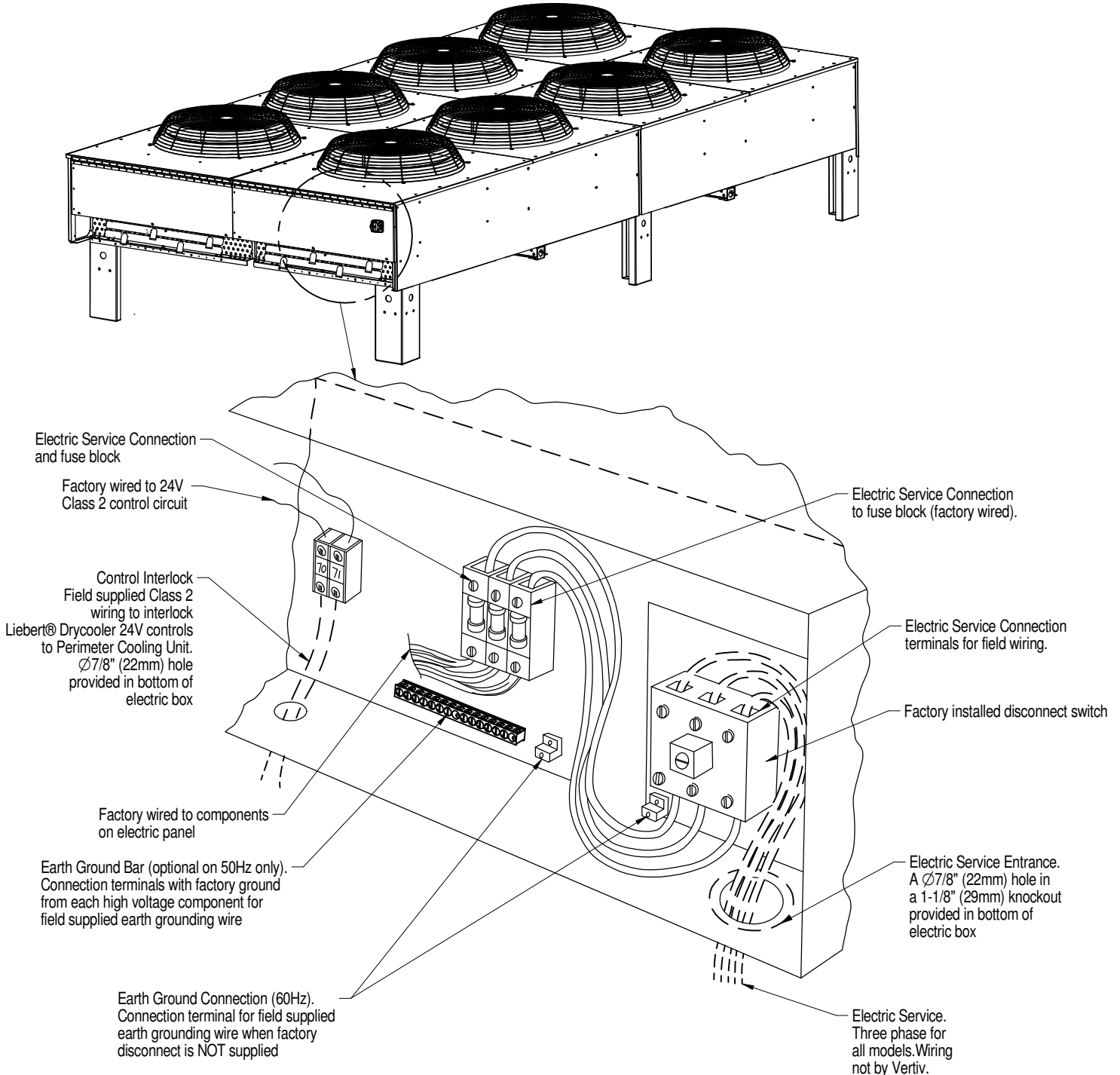


NOTE: Refer to specification sheet for full load amp. and wire size amp. ratings.



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

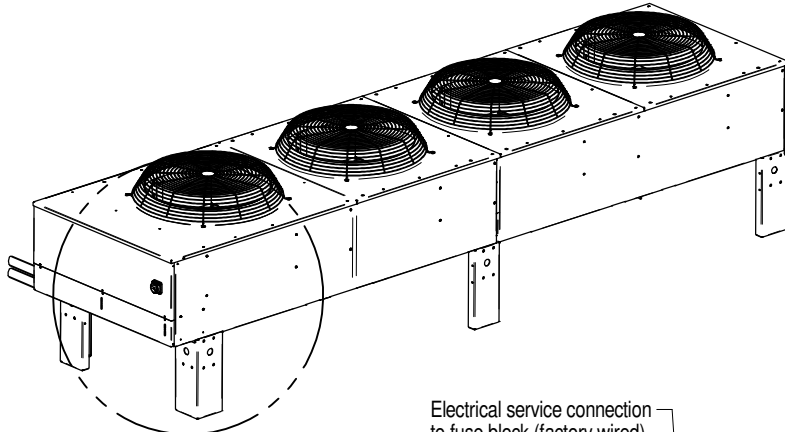


NOTE: Refer to specification sheet for full load amp. and wire size amp. ratings.

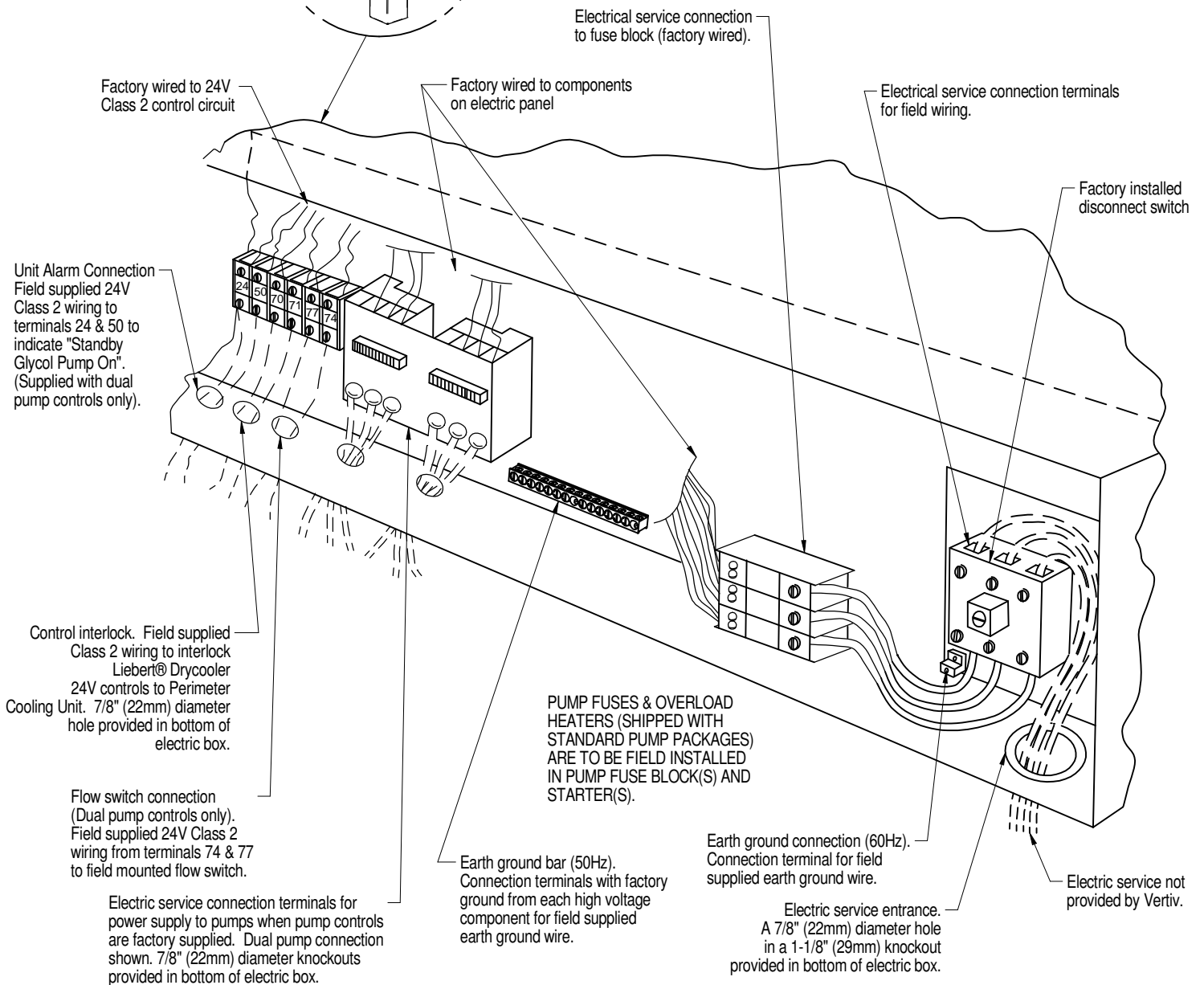


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ELECTRICAL FIELD CONNECTIONS FLUID TEMPERATURE CONTROL QUIET-LINE MODELS

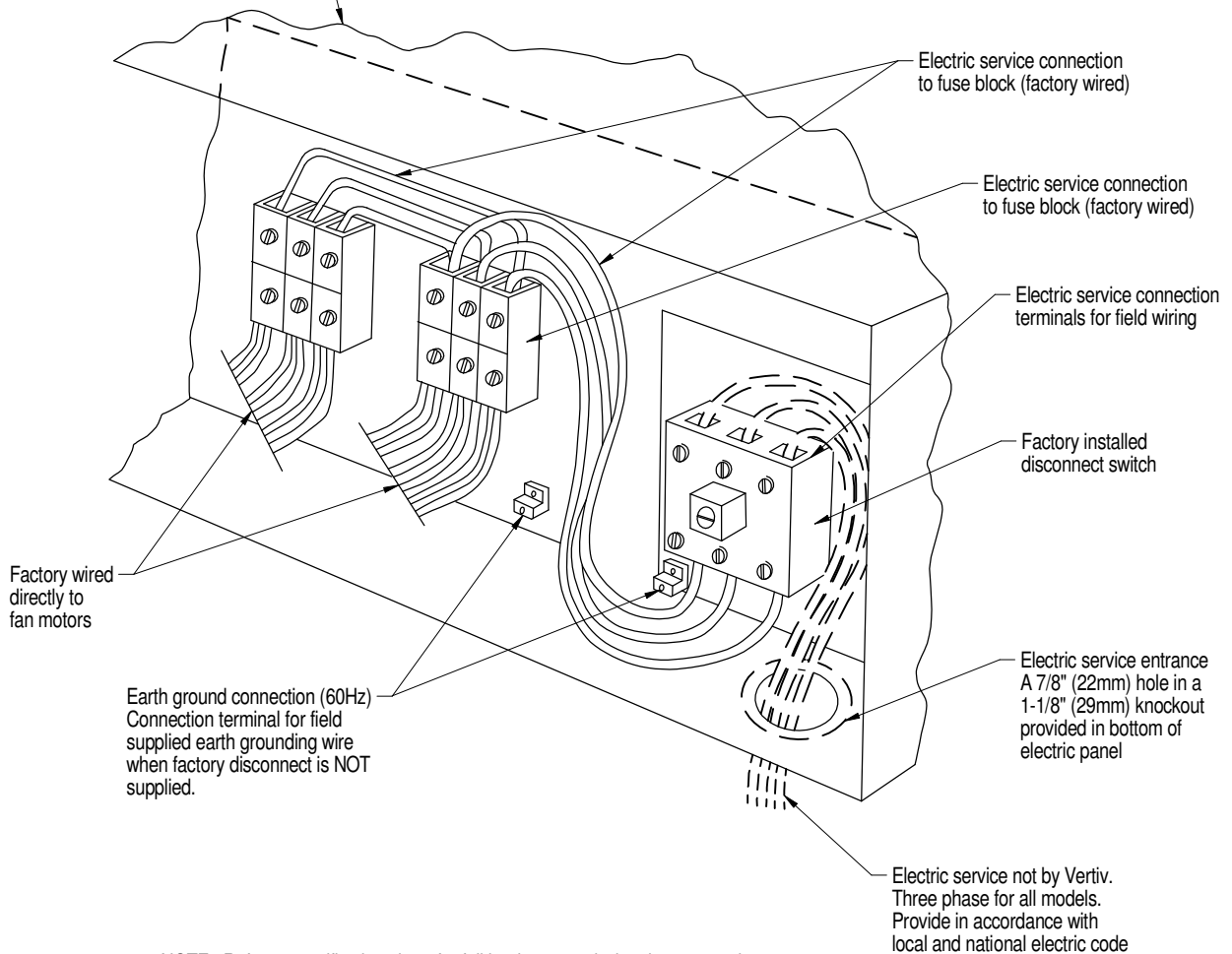
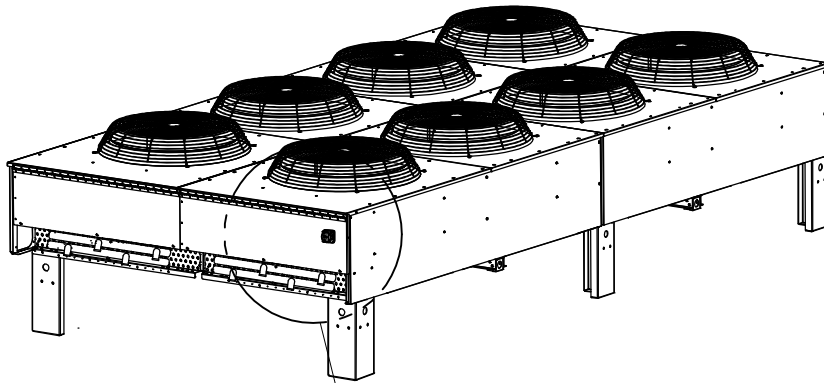


Note:
Refer to specification sheet
for full load amp and wire
size amp ratings.



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

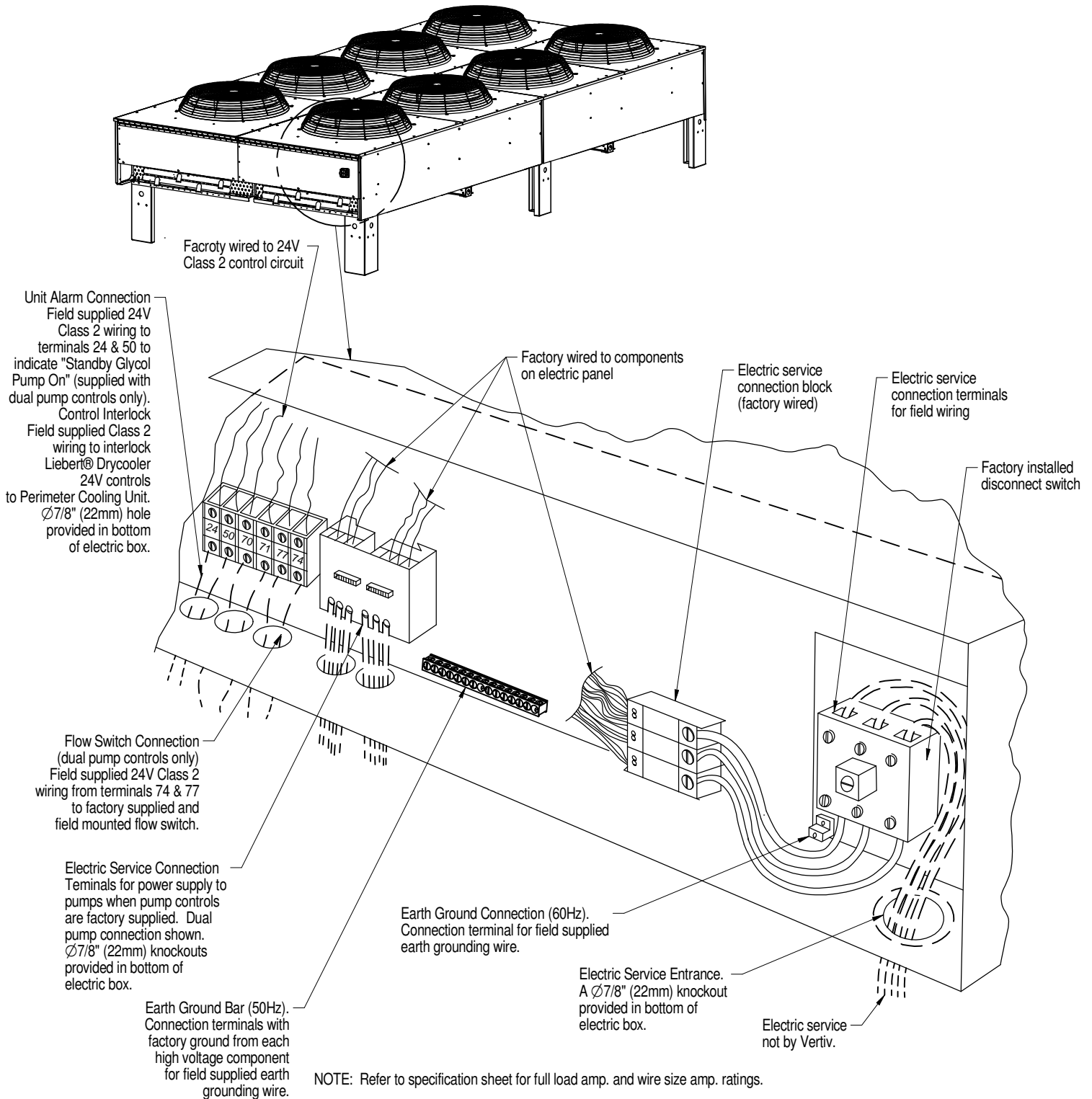


NOTE: Refer to specification sheet for full load amp. and wire size amp. ratings.



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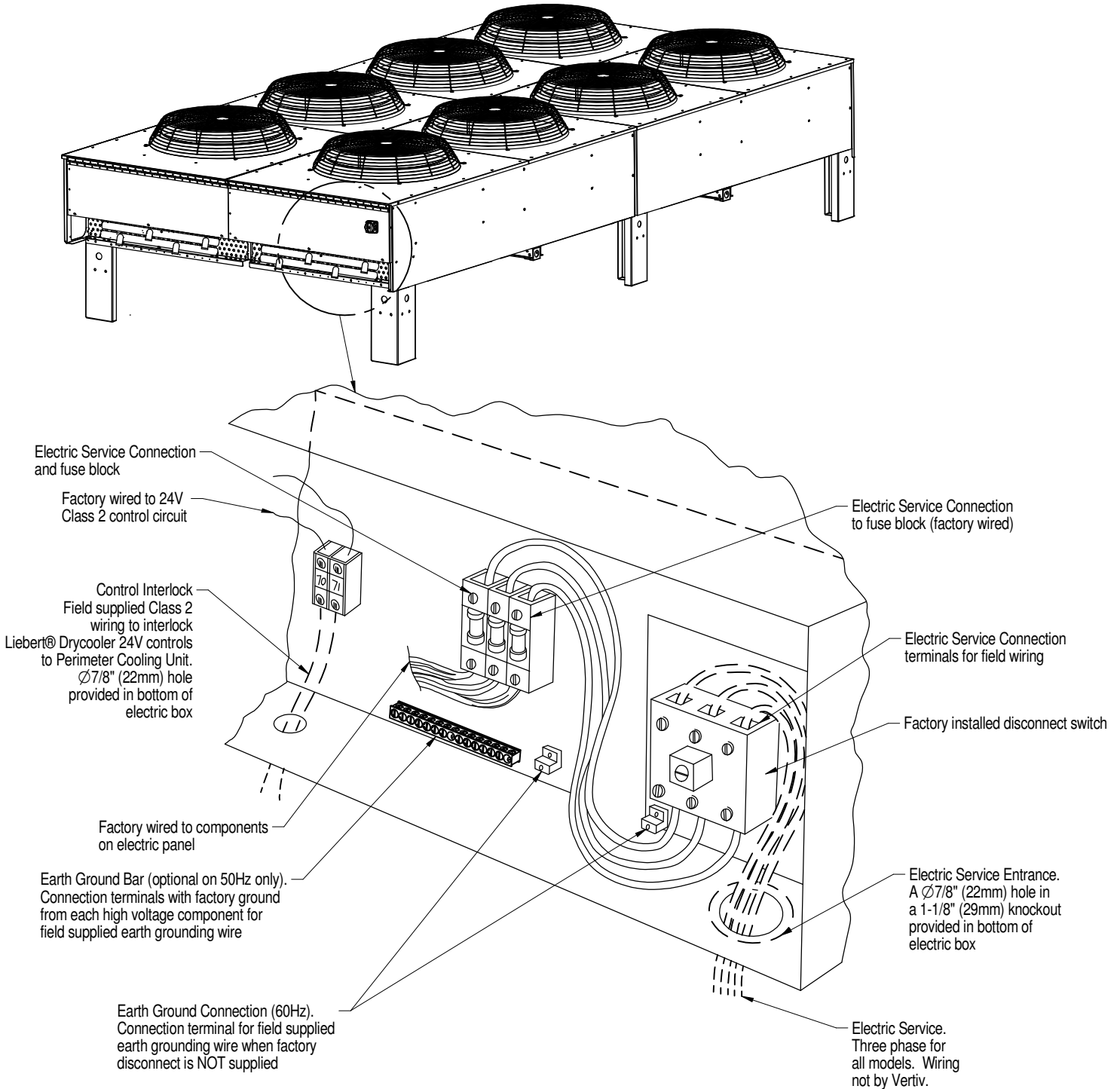
ELECTRICAL FIELD CONNECTIONS 6 & 8 FAN QUIET-LINE MODELS W/ DSO/DDO PUMP CONTROL





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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.

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