Precision Cooling
For *Business-Critical Continuity™*

Liebert® Xtreme Density™

System Design Manual

EMERSON
Network Power

TABLE OF CONTENTS

FIGURES

TABLES

1.0 SYSTEM DESCRIPTION

The Liebert XD™ family of cooling units delivers efficient, sensible cooling to high-heat environments. Liebert XD systems are designed to cool computer racks and hot zones in a data center or computer room without taking up expensive floor space for cooling components.

The Liebert XD family includes:

- **Liebert XDC**—Liebert XD Chiller; cools and pumps refrigerant to cooling modules
- **Liebert XDP**—Liebert XD Pumping unit; pumps refrigerant to cooling modules
- **Liebert XDA**—mounts on the rear of the equipment cabinet
- **Liebert XDCF**—Liebert XD CoolFrame; mounts on the rear of an Egenera BladeFrame EX cabinet
- **Liebert XDH**—Liebert XD Horizontal row cooler; integrated into hot aisle-cool aisle room layout
- **Liebert XDO**—Liebert XD Overhead unit; suspended from the ceiling structure
- **Liebert XDV**—Liebert XD Vertical unit; mounted on top of the equipment cabinet or suspended from the ceiling structure

Systems combining Liebert XDO and Liebert XDV units can remove more than 20 kW (5.7 tons) of heat per cabinet. A set of Liebert XDCF modules also can remove 20kW (5.7 tons) of heat from an Egenera BladeFrame EX cabinet. A system with Liebert XDH units can remove more than 30kW (8.5tons) of heat per rack.

For minimum Liebert XDP and Liebert XDC load recommendations, see **1.9.1 - Liebert XDP Minimum Load**; **1.8.1 - Liebert XDC Minimum Load**; and **Tables 39** and **43**.

The Liebert XD system also performs at high efficiency rates. Properly spaced cooling modules and the Liebert XD system's fluid phase change technology, combine to reduce a Liebert XD system's energy consumption to at least 27 percent less than a traditional cooling system.

The Liebert XD family maintains this energy efficiency by employing the heat absorption properties of a liquid (pumped refrigerant) through a phase change. Refrigerant is pumped as a liquid, becomes a gas within the heat exchangers of the cooling modules (either the Liebert XDCF, Liebert XDH, Liebert XDO or Liebert XDV) and then is returned to either the Liebert XDP or Liebert XDC where it condenses to a liquid. This eliminates the compression cycle required by traditional systems. And, if a leak were to occur, the environmentally friendly refrigerant in the data center would escape as a gas, causing no harm to critical equipment. Because no compressor is used in the pumped refrigerant circuit, no oil is needed.

Liebert XD cooling modules further increase efficiency with optional control board that reduces fan use when maximum cooling levels are not required. The control board is available on Liebert XDH, Liebert XDO and Liebert XDV units.

1.1 European Union Fluorinated Greenhouse Gas Requirements

Stationary air conditioning, refrigeration, heat pump equipment and stationary fire protection systems in the European Community market and operating with fluorinated greenhouse gases (f-gas), such as R407C, R134a, R410A, must comply with the F-Gas Regulation: (EC) No. 842/2006 (F-gas). The regulation prohibits, among other actions, venting fluorinated greenhouse gases to the atmosphere.

The F-Gas Regulation requires operators to use all measures that are technically feasible and do not entail disproportionate cost to prevent leakage of these gases, to test for leakage regularly and to recover f-gas before disposing of equipment, as well as during service and maintenance.

Refer to the full regulation for additional details.

1.2 Generic Piping Layouts

Liebert XD systems are available in two configurations—differentiated essentially by the method of heat rejection (see **Figures 1** and **2**). The Liebert XDP is a pumping unit connected to a building chilled water system to control and circulate the refrigerant. Liebert XDPs pump refrigerant to Liebert XDCF, Liebert XDH, Liebert XDO or Liebert XDV modules, isolate refrigerant circuit from building chilled water supply with an internal heat exchanger and maintains refrigerant temperature above the actual dew point. The Liebert XDC incorporates the pumping functions with the chiller, which must be connected to a separate heat rejection system. Pumping and refrigerant control are performed by Liebert XDC.

Figure 1 Liebert XDP generic piping layout

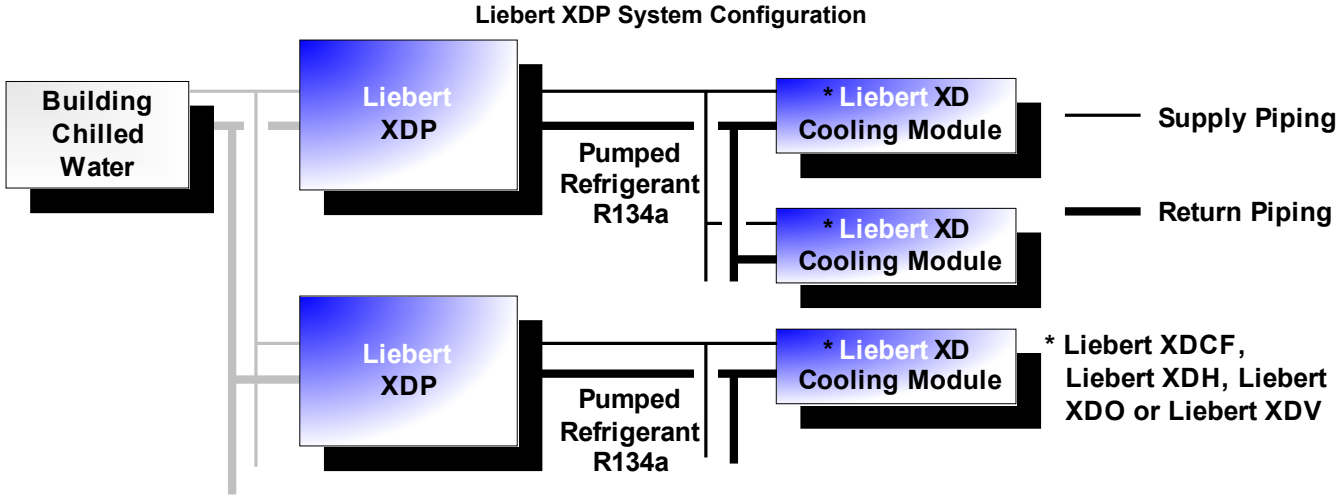
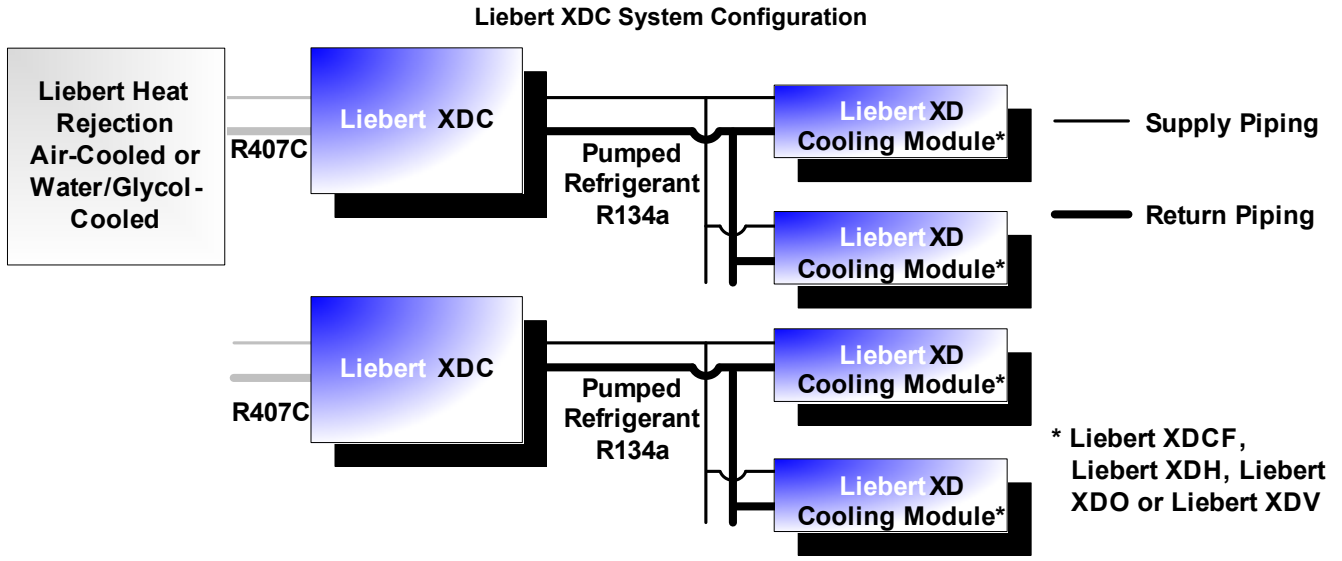


Figure 2 Liebert XDC generic piping layout



1.3 Liebert XDA—Air Flow Enhancer

The Liebert XDA is a fan unit that boosts the airflow through densely populated enclosures, removing hot spots from within the racks. One or two units can be mounted on the rear of most rack enclosures.

Figure 3 Liebert XDA—air flow enhancer—on equipment enclosure

1.4 Liebert XDCF—Liebert XD CoolFrame

The Liebert XDCF is a self-contained module designed to cool Egenera's BladeFrame EX cabinets and equipment without exhausting heat into the room. Two modules (top and bottom) may be mounted on the rear of a BladeFrame cabinet. Liebert XDCF modules consist of a sheet-metal frame, coil and filter dryer. It has no moving parts and needs no electricity.

The unit is available with optional, Liebert XD Flex Pipes (flexible metal pipes) with quick-connect couplings at each end for easy connection to the refrigerant distribution pipes.

Figure 4 Liebert XDCF units on Egenera's BladeFrame EX cabinets

1.5 Liebert XDH—Horizontal Cooling Module

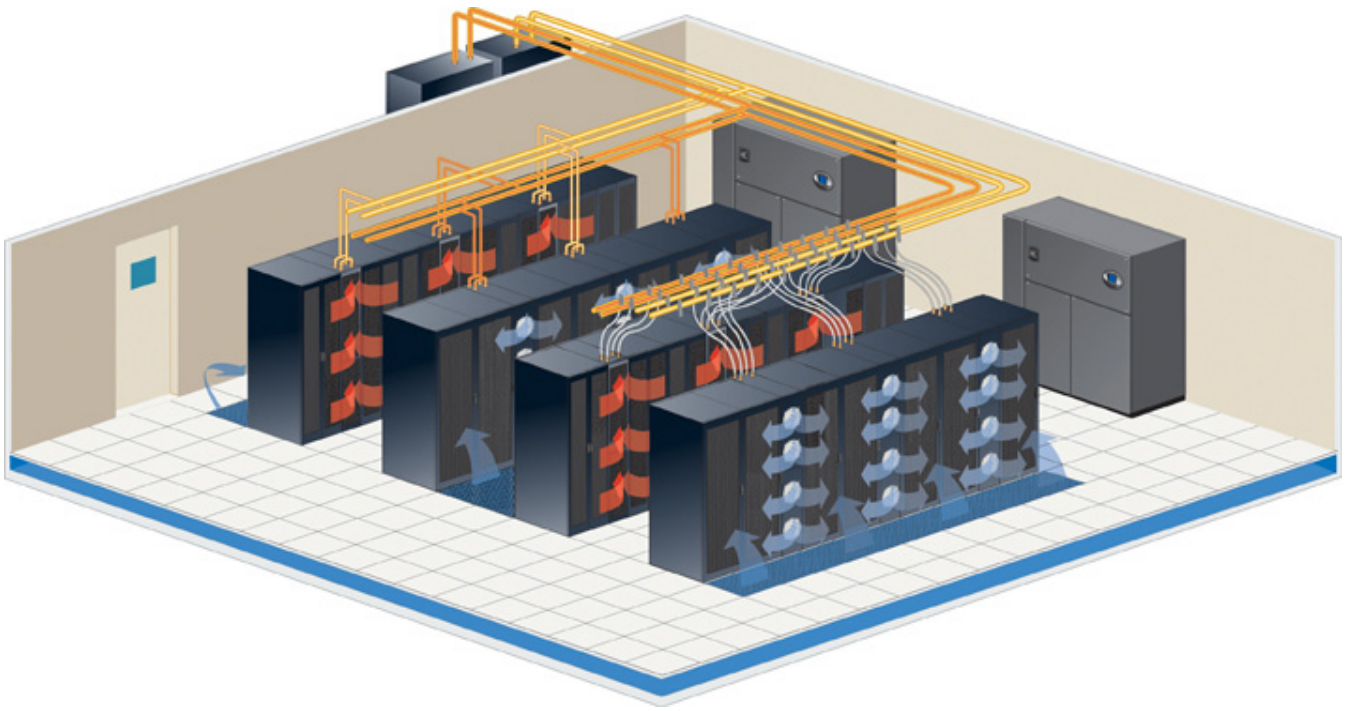
The Liebert XDH is designed for placement within a row of computer cabinets in the data center in a hot-aisle-cold-aisle arrangement to maximize the Liebert XDH's cooling. The Liebert XDH, available in a half-rack-width unit (12" [305mm]), is intended for use with a Liebert XD pumped refrigerant cooling system, supplied by either a Liebert XDP or Liebert XDC. The unit takes in hot air through the rear from the hot aisle, cools the air by air-to-fluid heat exchangers and discharges the air through the front of the unit into the cold aisle in a diffuse pattern. The cooling air is then drawn into the enclosures to cool the equipment.

Replaceable front panels on the Liebert XDH may be customized to match the appearance of various computer manufacturer's equipment, allowing the Liebert XDH to blend in with adjacent server equipment and enclosures. Unidirectional and bidirectional diffusers are available to direct cooling air for more efficient cooling, depending on the Liebert XDH's positioning in a row or at the end of a row. Chilled R-134a refrigerant is provided to the Liebert XDH by a Liebert XD Pumping unit (Liebert XDP) or by a Liebert XD Chiller (Liebert XDC). The Liebert XDH has dual refrigeration circuits, one in the upper half of the unit and the other in the lower half. This permits increasing and decreasing cooling levels in response to server room conditions. The dual refrigeration circuits permits interlaced connection of two Liebert XD refrigerant sources to enhance system reliability. The Liebert XDH may be installed in a Liebert XD piping system that includes other Liebert XD cooling modules.

Controls on the front of the Liebert XDH permit independent operation of the two banks of fans. Dual power connections ensure continued fan operation if one of two electrical sources fails. Optional smart modules allow remote shutdown, fan failure alarms, condensate detection and switching fan per bank On and Off. This saves energy by permitting the unit to run with two fans per bank and switching on the middle when the temperature requires all fans for cooling.

The Liebert XDH is available for hard-piped configurations and with flexible metal pipes with quick-connect couplings (one-shot or removable) at each end for easy connection to the header system. The Liebert XDH and Liebert XD Flex Pipes are also available for shipment with a pre-charge of R134a. This option requires the use of the one-shot flexible pipes.

Figure 5 Liebert XDH—horizontal cooling module in hot aisle-cold aisle arrangement



1.6 Liebert XDO—Overhead Cooling Module

The Liebert XDO is an overhead cooling system designed for installation above heat-dissipating equipment. A fan draws hot air exhausted from the equipment through two cooling coils and discharges cool air back down to the equipment (see **Figure 6**).

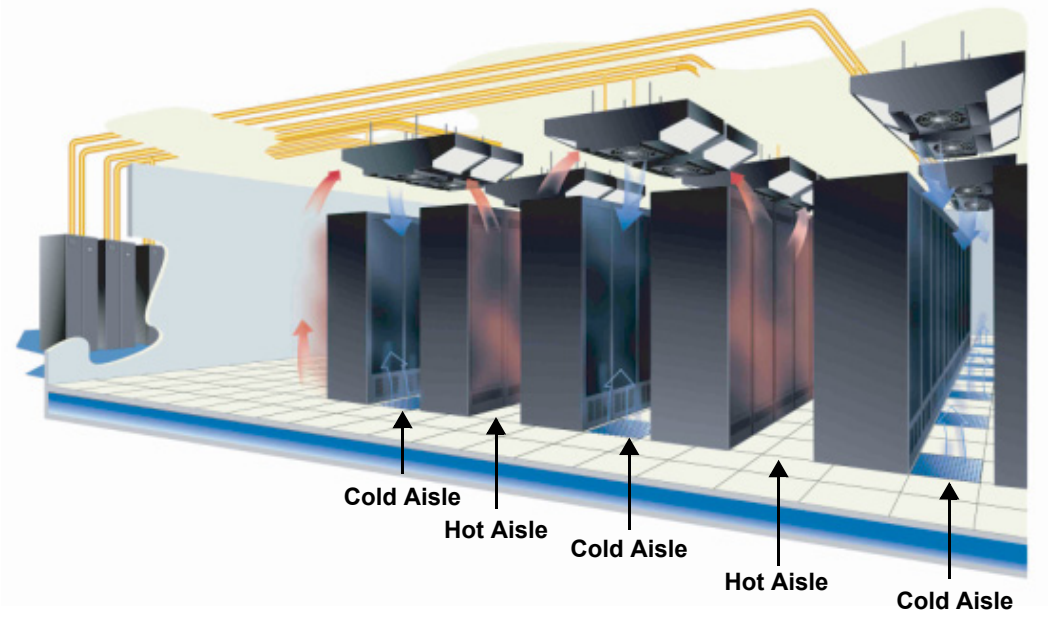
A Liebert XDO smart module will allow remote monitoring, shutdown, fan failure alarms, condensate detection and automatically cycling the fan On and Off as the heat load requires. The Liebert XDP/Liebert XDC monitors room conditions and prevents coil condensation by maintaining the temperature of the refrigerant pumped to the Liebert XDOs above the room dew point.

The Liebert XDO is available for hard-piped configurations or with Liebert XD Flex Pipes with quick-connect couplings (one-shot) for easy connection to the header system. When the pre-charged option is selected, the Liebert XDO and the one-shot flexible pipes contain R134a.

NOTE

The Liebert XDO is the most sensitive module to system load. The Liebert XDO's air intake and the discharge are not separated by a rack. This can lead to the Liebert XDO pulling in cold air rather than hot air. The Liebert XDP and Liebert XDC minimum loads must be met to prevent this from occurring.

Figure 6 Suspended Liebert XDO modules in hot aisle-cold aisle arrangement



1.7 Liebert XDV—Vertical, Above-Cabinet Cooling Module

The Liebert XDV cooling system is designed to be attached to the top of a computer cabinet or rack containing heat-dissipating equipment. Two fans draw hot air exhausted from the equipment or from the hot aisle, pass it through a cooling coil and discharge cool air back down to the cold aisle, where the equipment's air intake is located.

The Liebert XDV comes from the factory ready to draw heated air through a perforated grille on the back of the unit. The Liebert XDV is easily modified to draw hot air through the bottom of the unit, should that cooling method be better suited to your application.

Liebert XDV smart modules allow remote shutdown, fan failure alarms and automatically switching the second fan On and Off. This saves energy by permitting the unit to run with one fan and switching on a second fan when the temperature requires both fans for cooling.

The Liebert XDV is available for hard-piped configurations or with Liebert XD Flex Pipes with quick-connect couplings (one-shot or removable) for easy connection to the header system. The Liebert XDV and flexible pipes are also available for shipment with a pre-charge of R134a. This option requires the use of the one-shot flexible pipes

Figure 7 Top-mounted Liebert XDV modules with hard piping in hot aisle-cold aisle arrangement

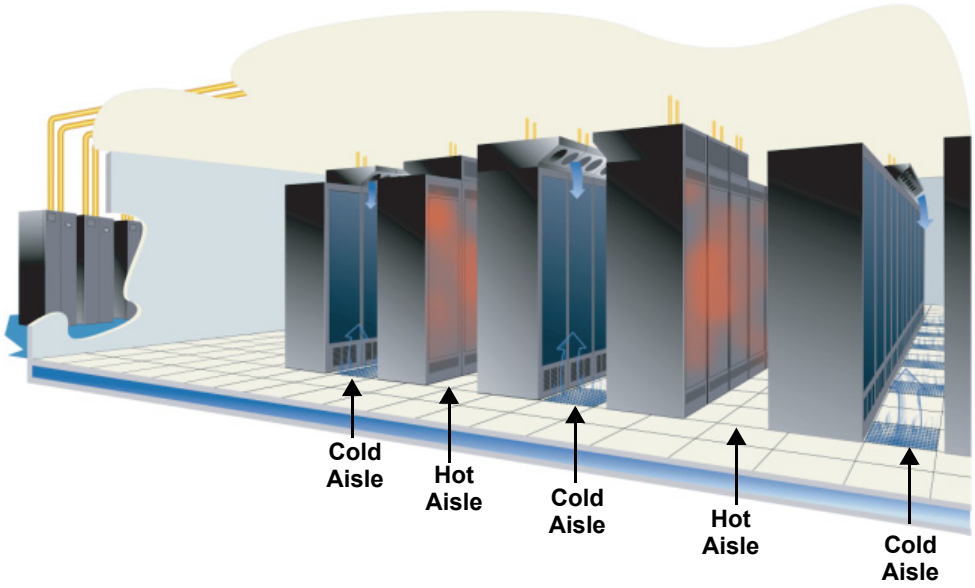
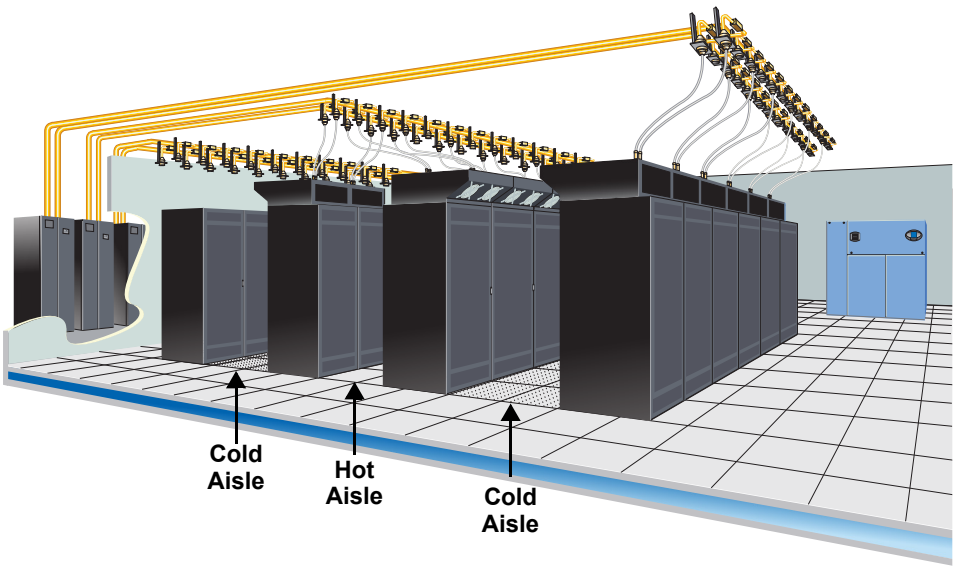


Figure 8 Top-mounted Liebert XDV modules with Liebert Flex Pipe in hot aisle-cold aisle arrangement



1.8 Liebert XDC—Refrigerant Chiller

The Liebert XDC is an indoor chiller that connects directly to the Liebert XD cooling modules and provides refrigerant circulation and control. The Liebert XDC keeps the refrigerant temperature above the room dew point at the sensors. The Liebert XDC contains a refrigerant to refrigerant heat exchanger along with two tandem scroll compressor circuits. This allows heat rejection to the outdoor ambient air by using either the air-cooled condensers or water/glycol shell-and-tube condensers much like a standard computer room air conditioning unit. The Liebert XDC employs two remote sensors (for redundancy) to determine the temperature and humidity in the air and instantly adjusts refrigerant supply temperature to compensate for changing conditions.

1.8.1 Liebert XDC Minimum Load

The Liebert XDC's minimum recommended operating load is 40% of system nominal capacity. For example, a Liebert XDC160 60Hz system's minimum load would be 64 kW. Loading below this value can unfavorably affect system operation.

Figure 9 Liebert XD Chiller unit

1.9 Liebert XDP—Pumping Unit

The Liebert XDP isolates the building's chilled water circuit from the pumped refrigerant circuit. The Liebert XDP circulates refrigerant to Liebert XD cooling modules while preventing condensation by maintaining the refrigerant's temperature above the room dew point at the sensors. The Liebert XDP employs two sets (for redundancy) of remote sensors to determine the temperature and humidity in the air and instantly adjusts refrigerant supply temperature to compensate for changing conditions.

The Liebert XDP's uses the Liebert iCOM®. This advanced control enables the user to monitor essentially all aspects of the Liebert XD Precision Cooling system, from operating status to maintenance. The Liebert iCOM also permits networking cooling units for precise, efficient operation.

1.9.1 Liebert XDP Minimum Load

The Liebert XDP's minimum recommended operating load is 30% of system nominal capacity. For example, a Liebert XDP160 60Hz system's minimum load would be 48 kW. Loading below this value can unfavorably affect system operation.

Figure 10 Liebert XDP pumping unit

1.10 Liebert XD Piping

Liebert XD Piping is prefabricated distribution piping that is installed in anticipation of a growing system. Liebert XD cooling modules are added as required and are quickly made operational with flexible connection piping with threaded couplings. This unique system allows the room cooling capacity to increase to more than 30kW per rack with no additional disruptive piping installation. The flexible connection piping also allows the cooling modules to be re-positioned without interruption in operation.

1.10.1 Liebert XD Field Piping

Flexible Piping Kit

Flex pipe kits are available in lengths of 4, 6, 8 and 10 feet (1.2, 1.8, 2.4 and 3 meters). Connection style to the module end may be straight or 90 degrees with one-shot style couplings or removable couplings. The one-shot flexible pipes are charged at the factory with R134a. Connection to the prefabricated piping assembly is a threaded coupler. For information on acquiring the correct kit for your installation refer to DPN000780, available by calling 1-800-LIEBERT and from your local Emerson Network Power representative. Contact the factory when ordering additional flex piping kits for Liebert XD systems installed before 2007.

Prefabricated Headers

Field piping kits are available in several versions

- 10 ft. (3.05m) with 5 or 10 ports
- 8 ft. (2.44m) with 2 or 4 ports

Each version is available in two pipe sizes:

- Supply pipe: 1-1/8"; return pipe: 2-1/8"
- Supply pipe: 1-3/8"; return pipe: 2-5/8"

Each kit contains one (1) supply pipe and one (1) return pipe. Each port has a threaded coupling at the end with automatic shutoff when disconnected. Each port also has a ball valve for manual shutoff. For more information refer to section **3.12 - Liebert XD Piping System Design**.

Liebert XD Connection Port Kit

The connection ports in the Liebert XD Field Piping Kits are available as Liebert XD Connection Port Kit. Each port has a threaded coupling, with automatic shutoff when disconnected, at the end. Each port also has a ball valve for manual shutoff. Each kit contains one supply and one return port. Two kit sizes are available:

- Supply pipe: 1-1/8"; return pipe: 2-1/8"
- Supply pipe: 1-3/8"; return pipe: 2-5/8"

Figure 11 Liebert XD connection port kit

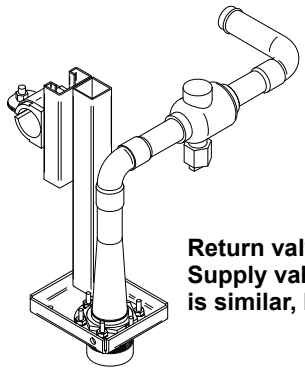


Table 1 Liebert XD field-installed port kits header connection size

Assembly P#	Supply Header Diameter	Return Header Diameter
183169G3	1-1/8"	2-1/8"
183169G4	1-3/8"	2-5/8"

2.0 STARTING A NEW EQUIPMENT COOLING PROJECT

2.1 Determining Cooling Equipment Needs

1. Is adequate space available for a Liebert XD installation?
2. Is the hot aisle/cold aisle approach being utilized for this room design or can it be utilized in this room design?
3. Is redundant cooling equipment required?
4. Are there access considerations for all components (possible rigging problems)
5. What heat load growth is anticipated over the next few years?
6. How are the cabinets going to be populated (density of heat generation)?
7. What monitoring requirements are desired or needed?
8. Who will be involved in this project (stakeholders)?
9. Is there existing computer room environmental cooling systems for humidity control and filtration?
10. Is the vapor barrier sufficient?
11. Is a chilled water system available?
    a. What is the system's capacity?
    b. What is the system's chilled water supply temperature?
    c. Does the chilled water supply temperature vary during the year or is the temperature constant?
12. How much power is available for cooling equipment?
13. What is the maximum distance between the Liebert XDP/Liebert XDC unit and the farthest Liebert XD cooling module in the proposed layout?
14. If an air cooled Liebert XDC is used – is an area available for the remote condenser?
15. Does the Liebert XD system refrigerant volume exceed 13 lb/1000ft^3? If so, a refrigerant detection and removal equipment may be required. Refer to **3.17 - Liebert XD Refrigerant**.

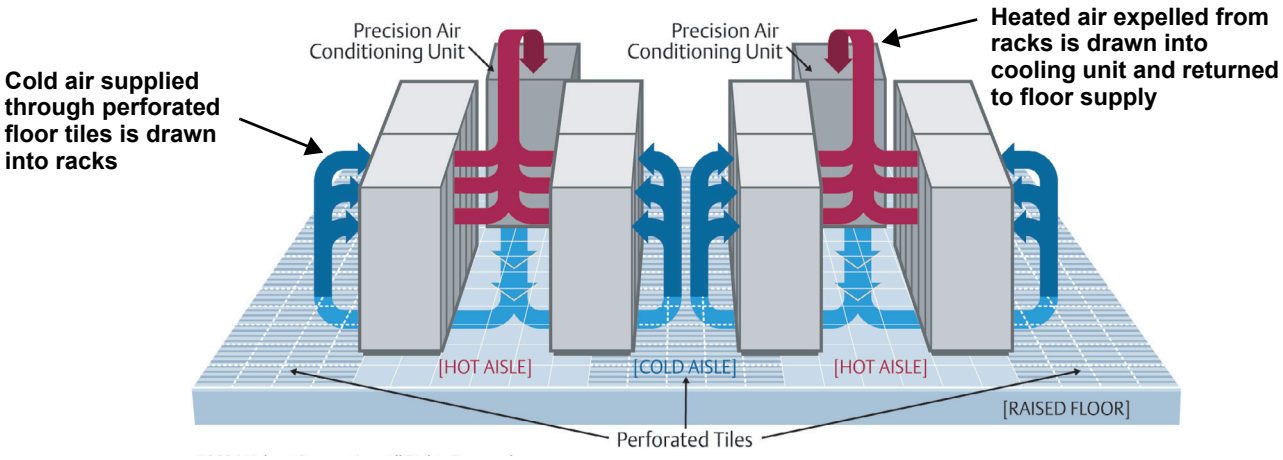
2.2 Implementing a Hot-Aisle/Cold Aisle Design

A best practice is to place equipment racks in alternating rows of cold aisles and hot aisles. This is best accomplished when the layout of the file-server farm area is first being planned. It is exceedingly more difficult to accomplish when the computer room is already populated with operating hardware.

In the cold aisle, the equipment racks are arranged face-to-face so the cooling air from the computer room cooling unit discharged up through the perforated floor tiles is drawn into the face of the computer hardware and exhausted out the back of the equipment rack into the adjacent hot aisles.

Hot aisles are literally hot because the objective of the alternating cold and hot aisle design is to separate the source of cooling air from hot air discharge, which returns to the computer-room cooling unit. Therefore, no perforated tiles should be placed in the hot aisles. This would mix hot and cold air, thereby lowering the temperature of the air returning to the cooling units. This will reduce their usable capacity.

Figure 12 Hot aisle-cold aisle arrangement with under-floor source



3.0 DESIGNING A LIEBERT XD SOLUTION

Liebert XD systems are intended for use with precision air conditioning equipment, such as the Liebert Deluxe System/3 and Liebert DS. The precision air conditioning equipment is required for the humidification and filtration of the room air.

The Liebert XD systems provide efficient, highly effective heat removal (sensible cooling only), without providing humidity control. The Liebert XD control system maintains the refrigerant temperature just above the dew point of the space to prevent condensation. Since the capacity of the system is limited by the dew point in the space, sufficient dehumidification and an adequate vapor barrier must be provided to maintain the dew point at or below the level necessary to achieve the required capacity.

The Liebert XD system is optimized for hot aisle/cold aisle equipment configurations, the industry's highest recommended method for dealing with extremely high heat loads.

Refer to the technical data manual of either the Deluxe System/3 (SL-18100) or the Liebert DS (SL-18810) for additional installation and application guidelines that apply to all critical space cooling applications.

3.1 Determine Cooling Requirements and Select Liebert XD System

1. Calculate the total cooling required
2. Determine placement of the Liebert XD units
3. Determine required pipe sizes
4. Calculate the refrigerant volume of the Liebert XD systems
5. Complete design details including, electrical, mounting, piping, etc.

3.2 Calculate the Heat Load to be Handled by Liebert XD System

When designing a cooling solution using the Liebert XD system, the initial steps are similar to those required to cool a conventional critical space. The total heat load must be calculated, including sensible and latent cooling requirements. These should be increased by the reserve capacity needed for pull-down situations where the room temperature must be reduced and to provide for unexpected increases in heat load.

NOTE

Reserve capacity is distinct from redundant capacity in that redundant capacity may or may not be available concurrently with normal operating capacity. Reserve capacity is available concurrently with normal operating capacity.

The next step is to determine how much of the required cooling capacity is to be provided by Liebert Deluxe or Liebert DS units. If the facility is new, typically up to 150 watts per square foot (1500W/m^2) of cooling can be obtained from Liebert precision air conditioning units supplying air through a raised floor. In existing facilities, such factors as raised floor height, under-floor obstructions or other limitations may reduce this to less than 50 watts per square foot (500 watts per m^2).

Once the total required sensible cooling capacity is known, subtract the sensible cooling portion to be provided by Liebert Deluxe or Liebert DS units. This yields the cooling capacity to be provided by the Liebert XD system. Confirm the minimum heat load for the Liebert XDP/Liebert XDC is still present in the data center (48kW & 64kW respectively)

3.3 Selecting Liebert XD Cooling Modules

The next step is to select the Liebert XD cooling modules to be configured into the solution. Liebert XD modules that use pumped refrigerant can be connected to the same Liebert XDP/Liebert XDC piping circuit. This includes the Liebert XDCF, Liebert XDH, Liebert XDO and Liebert XDV.

Generally, the Liebert XDO is selected for use in new installations or renovations where the unit can be installed on the ceiling or in the overhead space.

The Liebert XDV is designed to permit mounting directly on top of an equipment cabinet, for ease of installation in existing facilities. The Liebert XDV may also be suspended from overhead, using suitable mounting methods.

The Liebert XDCF is a self-contained module designed to cool Egenera's BladeFrame EX cabinets and equipment without exhausting heat into the room. Two modules may be mounted on the rear of a BladeFrame cabinet.

The Liebert XDH is installed among equipment cabinets and is particularly suited for new installations.

3.4 Airflow Requirements for Liebert XD Solutions

Computer manufacturers typically specify a temperature change from intake to exhaust (delta T) of 18-27°F (10-15°C) for the air passing through a rack enclosure. The heat generated by electronic equipment combined with the tight quarters of equipment cabinets mean high volumes of air must move through an enclosure to meet this cooling specification.

A Liebert XD system can supply the cold air to satisfy this cooling demand, but airflow through the enclosure must be adequate to extract the heat from the cabinet. Liebert's XDA units can boost the airflow to levels necessary to protect critical equipment. The Liebert XDA is particularly suited to the hot aisle/cold aisle arrangement.

3.5 Configuring a Liebert XD System

3.5.1 Number of Modules Supported by a Liebert XDP or Liebert XDC

The numerals designating the model size of a Liebert XD unit may be used to configure a cooling system. For example, a Liebert XDO20 has a model size of 20 and a Liebert XDP160 will accommodate cooling modules with a cumulative model size of 160.

Similarly, the minimum number of modules connected to a Liebert XDP or Liebert XDC may be calculated using the model size number for the Liebert XDP or Liebert XDC and the modules. See **Table 2**.

Table 2 Maximum and minimum modules supported by a Liebert XDP or Liebert XDC

Cooling Module Type	Liebert XDC		Liebert XDP	
	Max	Min	Max	Min
Liebert XDCF	16	6	16	5
Liebert XDH20	8	4	8	3
Liebert XDH32	5	2	5	2
Liebert XDO16	10	4	10	3
Liebert XDO20	8	4	8	3
Liebert XDV8	20	8	20	6
Liebert XDV10	16	7	16	5

Different types of Liebert XD cooling modules may be connected to the same Liebert XDP or Liebert XDC as long as the sum of their cooling capacity does not exceed the supporting Liebert XDP's or Liebert XDC's model size number.

NOTE

Connecting only Liebert XDCF modules to a Liebert XD unit is not recommended because the Liebert XDCF heat loading is dependent on server airflow and server load. Consult factory to determine if sufficient heat load is available from the server for the Liebert XD system to operate effectively.

3.6 Liebert XDCF Placement

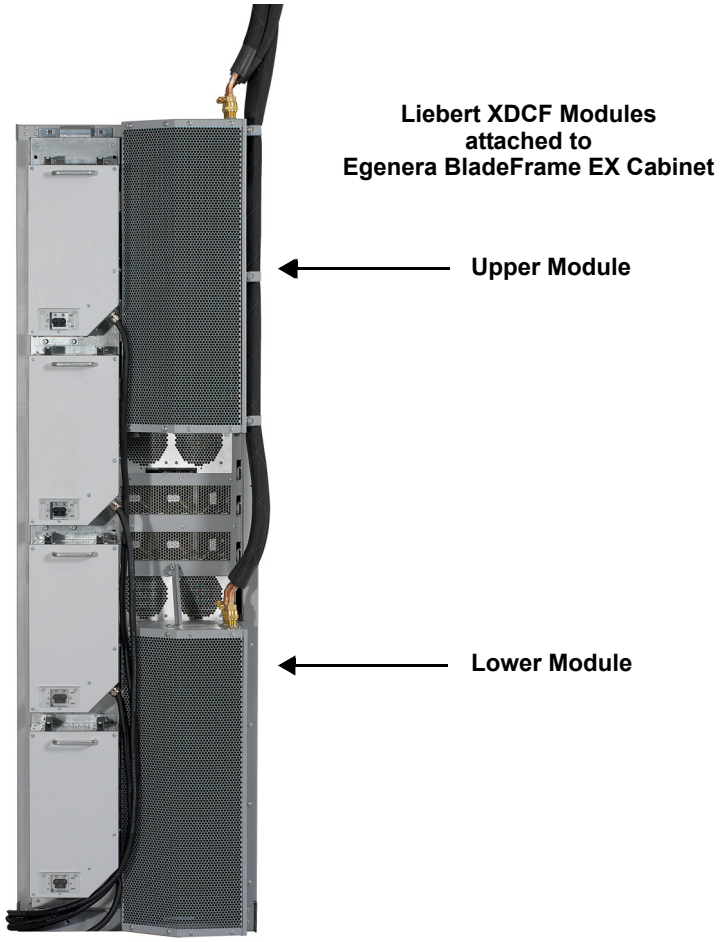
The Liebert XDCF is a self-contained module designed to cool Egenera's BladeFrame EX cabinets and equipment. Liebert XDCF modules attach to the rear of the Egenera BladeFrame EX cabinet, beside the power modules (see **Figure 13**). No cutting or drilling is required to attach the modules; all mounting holes, slots and pins required are fabricated at the factory. The Liebert XDCF does not require electrical connections.

The number of Liebert XDCF modules required is determined by the heat load of the cabinet—cabinets cannot share cooling from a Liebert XDCF module.

The Egenera BladeFrame EX cabinet has provisions for mounting two Liebert XDCF modules, should the heat load require two modules. If only one Liebert XDCF will be needed, Liebert recommends using the lower Liebert XDCF module.

The complete system consists of Liebert XDCF modules, piping, Liebert XDP or Liebert XDC refrigerant distribution units and those units' chillers or drycoolers.

Figure 13 Liebert XDCF unit mounting locations



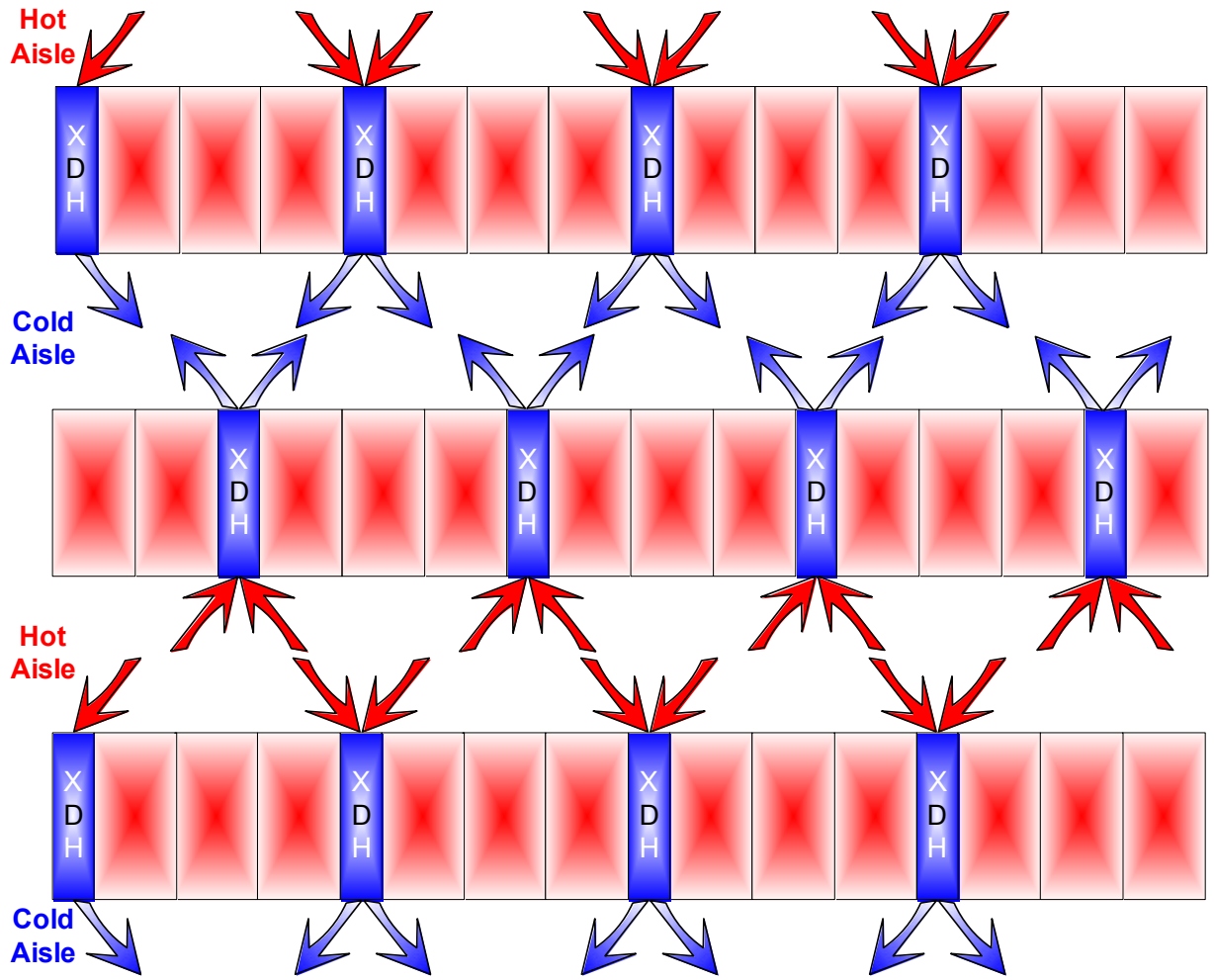
3.7 Liebert XDH Placement

The free-standing Liebert XDH cooling unit is best placed among the equipment cabinets in a hot aisle-cold aisle arrangement (see **Figure 14**). The Liebert XDH draws in air from the hot aisle, cools it and discharges the cooled air into the cold aisle where it is drawn into the equipment cabinets. Even spacing aids in optimizing cooling.

Liebert XDH units should be placed among the cabinets that generate the greatest amount of heat. If heat loads are dispersed evenly throughout the room, the Liebert XDH modules may be spread out accordingly. Bi-directional air diffusers should be used on Liebert XDH modules installed between racks.

If a Liebert XDH is installed at the end of a row, uni-directional air diffusers should be used on that Liebert XDH. The uni-directional diffusers can be used for left or right air discharge by removing them from the Liebert XDH, turning them 180 degrees, then reattaching them to the Liebert XDH.

Figure 14 Liebert XDH placement (top view)



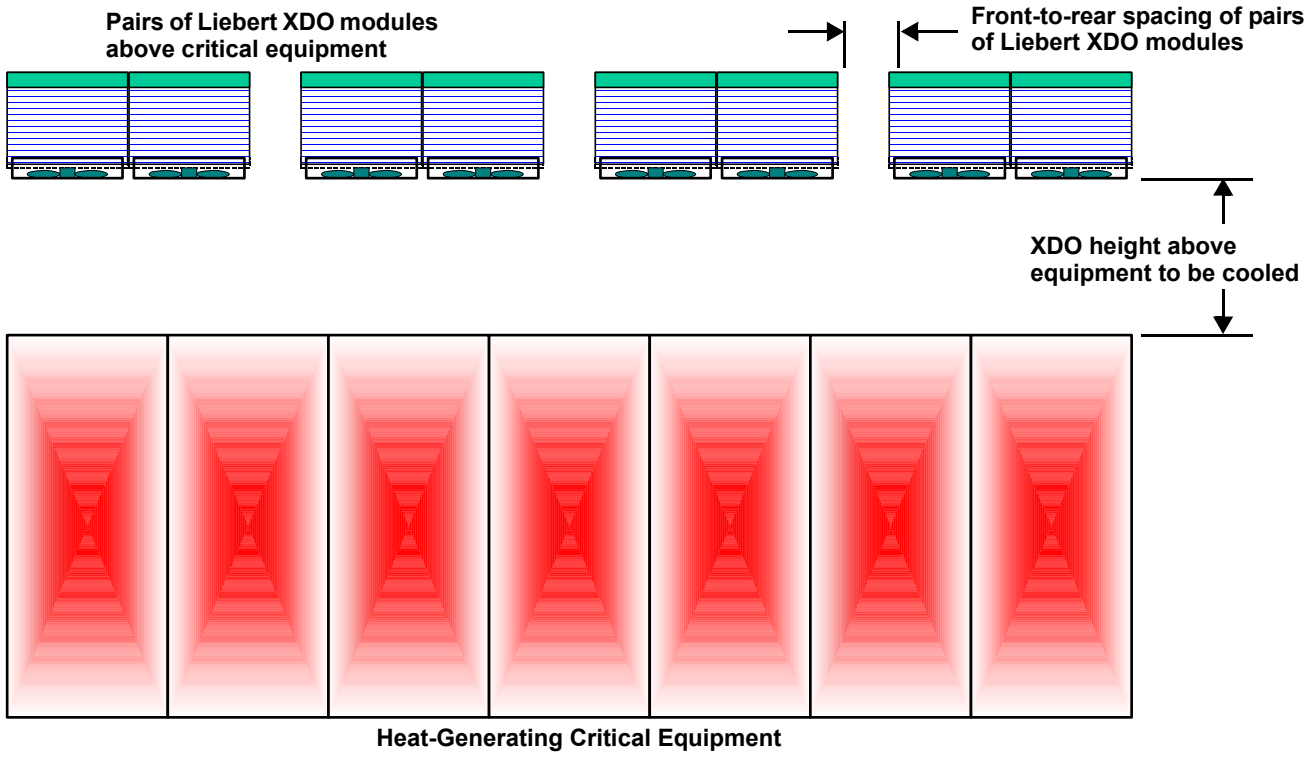
3.8 Liebert XDO Placement

3.8.1 Determining Spacing of Liebert XDOs in an Aisle

Liebert XDO units should be placed in rows directly above the cold aisles of a room for optimum cooling. Each Liebert XDO serves an area equal in width to the cold aisle spacing, typically 12 to 16 feet (3.7 to 4.9m). The length of the area served includes any space between Liebert XDO modules in a row. Depending on the cooling capacity to be achieved, spacing between Liebert XDO modules in a row may vary from zero to as much as 6 feet (1.8m). When the spacing increases to more than 6 feet (1.8m), overall performance of the system may be negatively affected and gaps in cooling may occur.

Install one Liebert XDO at the end of each aisle being cooled and to space the remainder between these end units as shown in **Figure 15**. This layout will block the incursion of hot air around the side of the end cabinets. Allowing space between the Liebert XDO groups facilatates maintenance by allowing access to the overhead space.

Figure 15 Liebert XDO spacing—horizontal (side view)



3.8.2 Determining Vertical Placement of Liebert XDOs Above the Cold Aisle

In the maximum density configuration, Emerson recommends placing the Liebert XDOs between 18 and 24 inches (457-609mm) above the equipment cabinets. In some cases where the required density is less, the front-to-rear spacing of Liebert XDOs in a row will be increased. To ensure coverage of the wider spaces between the Liebert XDO units, the vertical distance between the cabinets and the Liebert XDOs should be increased. However, the recommended maximum height of the Liebert XDO above the cabinets is 30 inches (762mm). See **Figure 16**.

Figure 16 Liebert XDO placement over cold aisle

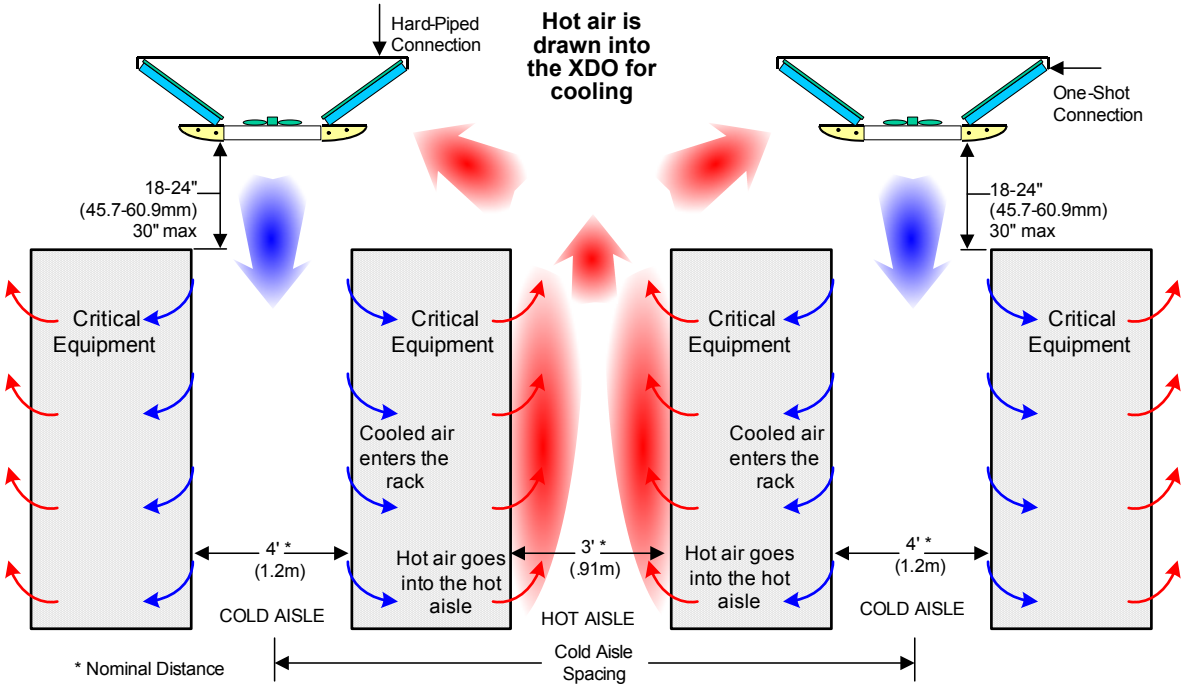


Table 3 can be used to determine the correct number and spacing of Liebert XDOs.

Table 3 Calculating quantity and spacing of Liebert XDO modules (example below is Liebert XDO20)

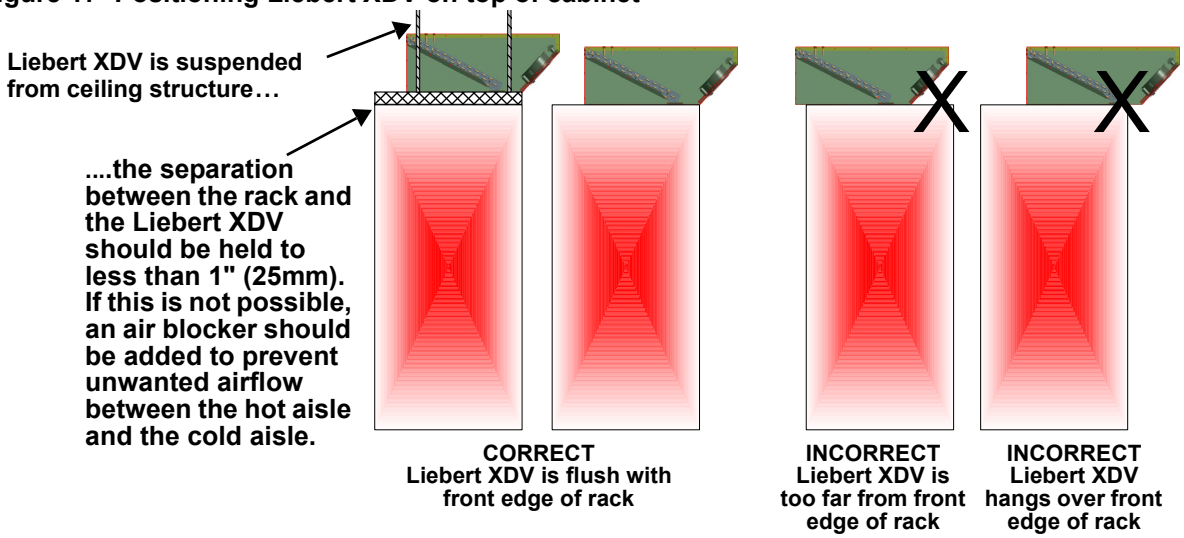
Input Information	Step	Result
Total heat load in the room, kW	A	
Reserve capacity needed (10% to 25% of A is recommended)	B	
	C	Required cooling capacity, kW = A + B
Existing/planned Liebert Deluxe/DS unit sensible capacity, kW	D	
	E	Required Liebert XD system cooling capacity, kW = C – D
	F	Number of Liebert XDO20s required = E ÷ 20, rounded up (60Hz) = E ÷ 16, rounded up (50Hz)
	G	Number of Liebert XDP/Liebert XDC modules required = F ÷ 8, rounded up (60Hz and 50Hz)
Room area, square feet	H	
	I	Area served by each Liebert XDO20 = H ÷ F
Spacing of cold aisles, center-to-center, typically 12-16 ft (3.7 to 4.9m)	J	
	K	Spacing between each Liebert XDO = (I ÷ J) - 2
	L	Required Liebert XD system cooling density = E x 1000 ÷ H OK if under 640; otherwise, additional cooling is required from Liebert Deluxe or Liebert DS units.

3.9 Liebert XDV Unit Placement

Liebert XDV units should be placed on top of the cabinets that generate the greatest amount of heat. If heat loads are dispersed evenly throughout the room, the Liebert XDV modules may be spread out accordingly.

The Liebert XDV must be placed toward the front of the equipment cabinet, so that its front bottom edge is flush with the front top edge of the cabinet. Placing the unit farther back on the top of the unit will restrict airflow into the cold aisle. Placing the unit farther to the front will decrease the amount of hot air drawn into the unit.

Figure 17 Positioning Liebert XDV on top of cabinet



Both of the Liebert XDV's power cords should be connected to power sources. If only one power source is available, then only the power cord labeled "SECONDARY" should be connected to the power source.

Piping for the Liebert XDV is routed upward to the main return and supply pipes to and from the Liebert XDP/Liebert XDC.

Table 4, below, may be used to determine the correct number of Liebert XDV modules.

Table 4 Determine required number of Liebert XDV modules (example below is Liebert XDV10)

Input Information	Step	Results
Total heat load in the room, kW	A	
Reserve capacity needed (10% to 25% of A is recommended)	B	
	C	Required cooling capacity, kW = A + B
Existing/planned Liebert Deluxe/DS sensible capacity, kW	D	
	E	Required Liebert XD system cooling capacity, kW = C – D
	F	Number of Liebert XDV10 modules required = E ÷ 10, rounded up (60Hz) = E ÷ 8, rounded up (50Hz)
	G	Number of Liebert XDP/Liebert XDC modules required = F ÷ 16, rounded up (60Hz and 50Hz)
Room area, square feet	H	
	I	Area served by each Liebert XDV10 = H ÷ F
	L	Required Liebert XD system cooling density = E x 1000 ÷ H OK if under 580 for 12-foot cold aisle spacing OK if under 435 for 16-foot cold aisle spacing Otherwise, additional Liebert Deluxe or Liebert DS unit capacity is needed.

3.10 Liebert XDP/Liebert XDC Placement

The Liebert XDP/Liebert XDC may be placed in the critical space or in an adjacent equipment room. The allowable distance between the Liebert XDP/Liebert XDC and its connected cooling modules is determined by the piping design and by the amount of refrigerant required. Refer to **3.17 - Liebert XD Refrigerant** and **3.12 - Liebert XD Piping System Design**.

The maximum height of any of the main or connecting piping should be no more than 20 feet (6m) above the top of the Liebert XDP/Liebert XDC unit. Liebert XDV/Liebert XDO modules should be placed as close to the same level as possible. The differences in elevation between the highest and lowest Liebert XDV or Liebert XDO module in a system should be no more than 6 feet (2m).

3.11 Examples of Expansion and Interlaced Connection of Liebert XD Cooling Modules

Figure 18 Liebert XDV units mounted on racks emitting 3kW of heat, top view

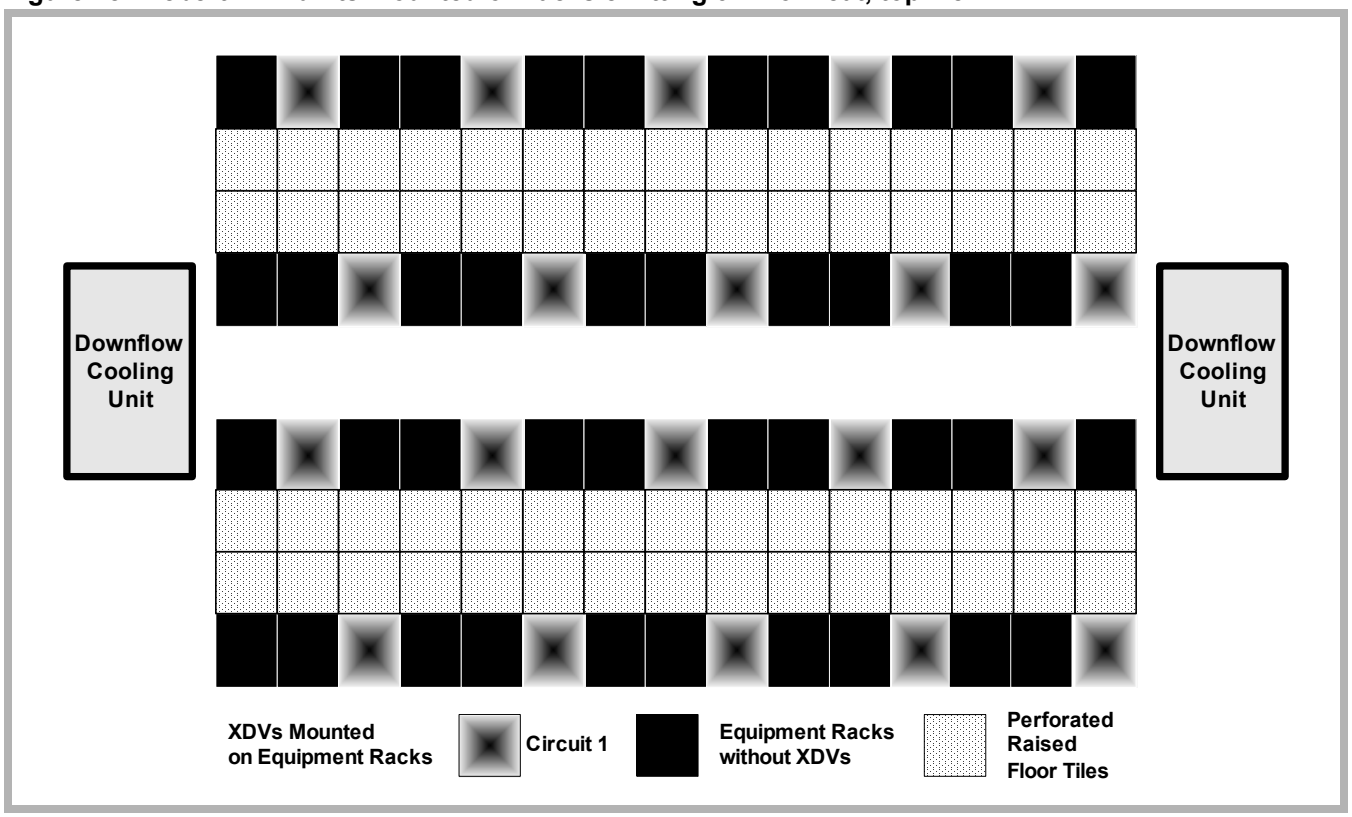


Figure 19 Liebert XDV units mounted on racks emitting 5kW of heat, top view

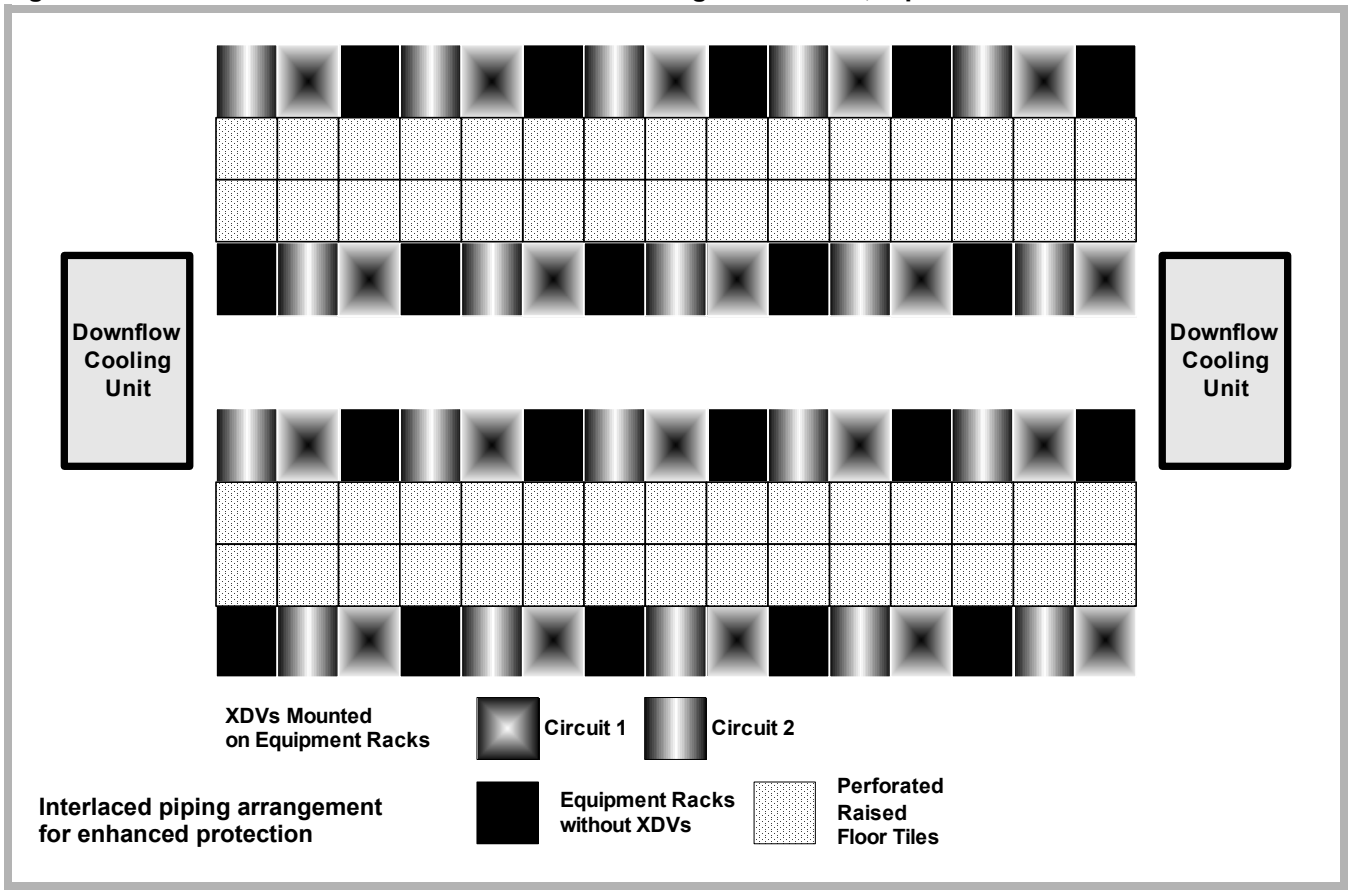


Figure 20 Liebert XDV units mounted on racks emitting 8kW of heat top view

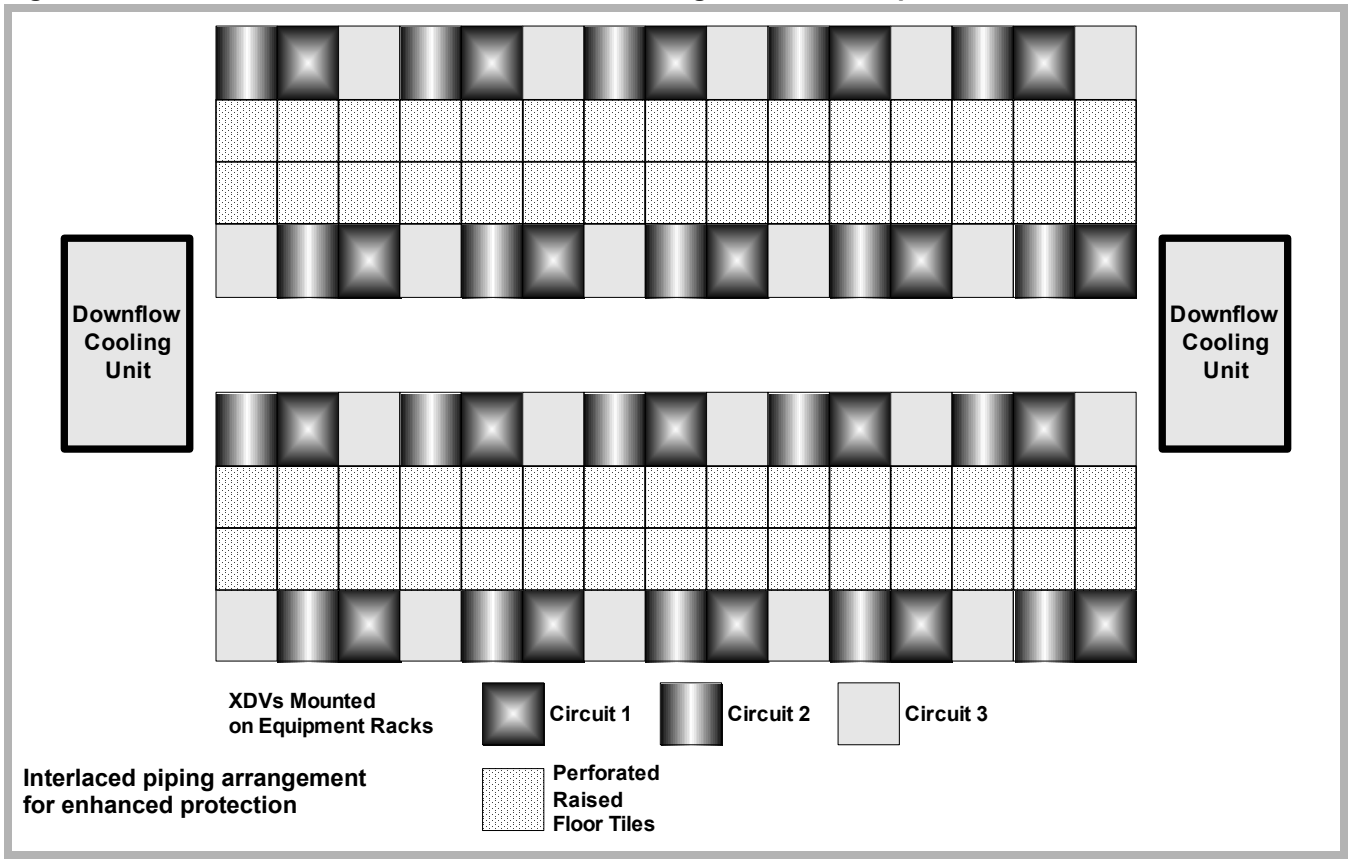
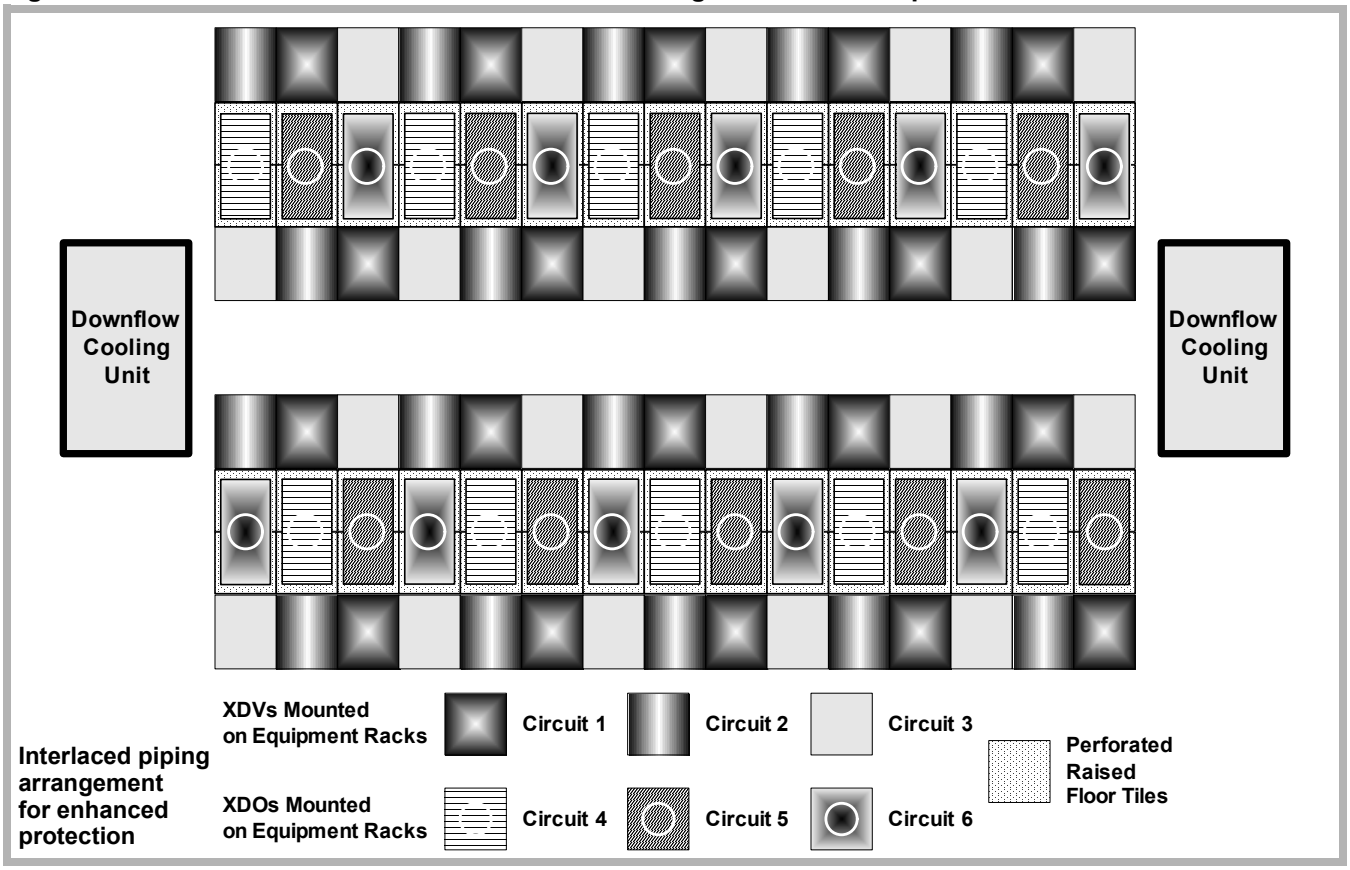


Figure 21 Liebert XDV units mounted on racks emitting 16kW of heat top view

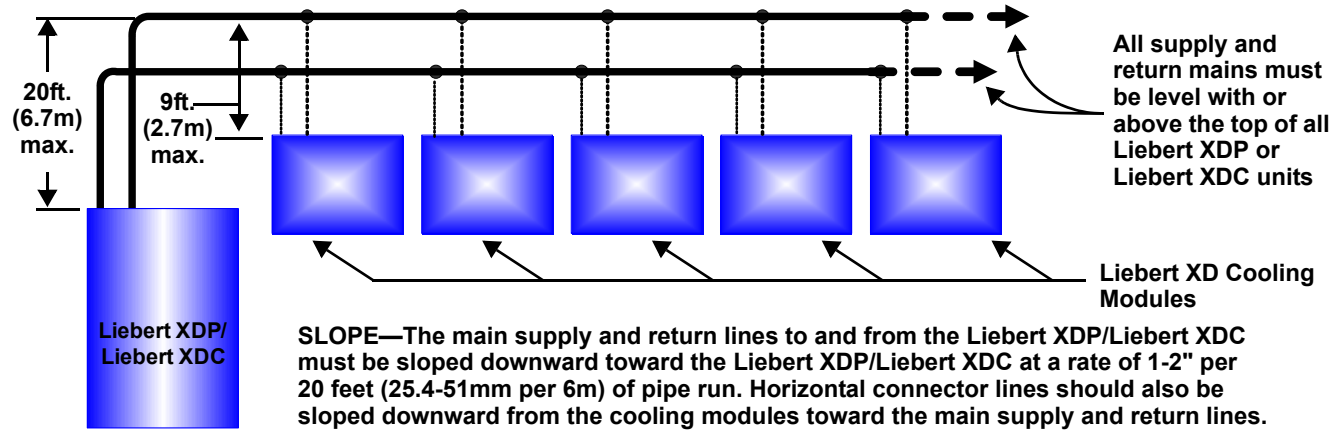


3.12 Liebert XD Piping System Design

All piping must be ASTM (American Society for Testing and Materials) Type "ACR" copper pipe. The typical maximum operating pressure in the system is 90 psi (620kPa).

Piping for the Liebert XD system is arranged in a manner similar to piping for a chilled water system. Liebert XD cooling modules are connected in parallel between the main return and supply pipes going to and from the Liebert XDP/Liebert XDC. **Figure 22** represents a typical configuration. **The guidelines provided for pipe size must be strictly followed. Failure to size the main lines and connection lines adequately may result in reduced cooling capacity.** The critical aspects of pipe sizing are related to refrigerant volume and pressure drop. Each must be minimized.

Figure 22 Piping for Liebert XDP/Liebert XDC used with Liebert XD cooling units



The assembly and connection means used for piping in the Liebert XD system are similar to that of conventional refrigeration systems. All piping should be installed with high temperature brazed joints. Soft solder is not recommended. The lines being brazed MUST be filled with flowing dry nitrogen during brazing to prevent excessive oxidation and scale formation inside the piping. Prevailing good refrigeration practices must be employed for piping supports, leak testing, dehydration and charging. Failure to use good system practices may result in damage to the system. Refer to the ASHRAE refrigeration handbook for general good-practice refrigeration piping.

Follow all guidelines in **3.12 - Liebert XD Piping System Design** and **3.13 - Liebert XD Piping Slope** during installation.

Insulate all piping lines to prevent condensation in applications where the dew point approaches the R-134a refrigerant temperature. This might occur where Liebert XD module piping is above a dropped ceiling or in other areas not measured by sensors connected to the Liebert XDP or Liebert XDC.

See **Table 5** for recommended pipe sizes and **Figure 23** for piping segment locations.

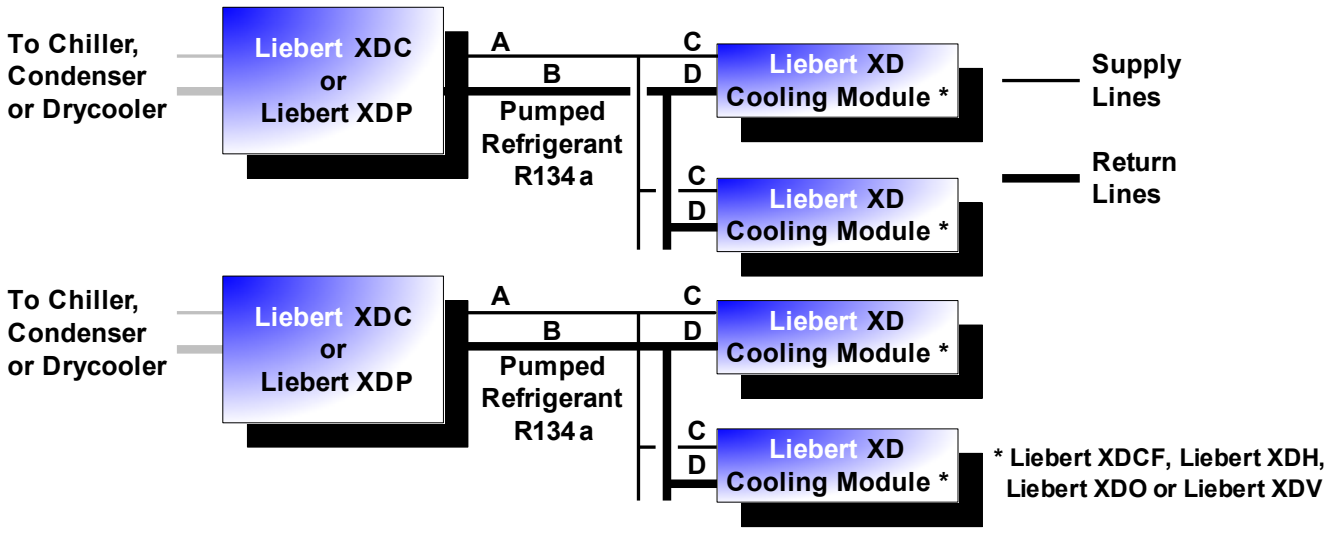
Table 5 Supply, return pipe sizes for refrigerant loop

Pipe Function	Key to Piping in Figure 23	Size / Equivalent Pipe Length
Liebert XDP supply line, from Liebert XDP supply to farthest Liebert XD cooling module	a	1-1/8" OD for lengths up to 60 feet
		1-3/8" OD for lengths over 60 but less than 175 feet
Liebert XDP return line, from farthest Liebert XD cooling module to Liebert XDP return	B	2-1/8" OD for lengths up to 60 feet
		2-5/8" OD for lengths over 60 but less than 175 feet
From any model Liebert XDO/Liebert XDH supply to supply line of Liebert XDP	C	1/2" OD for lengths up to 10 feet
		7/8" OD for lengths over 10 but less than 25 feet
From any model Liebert XDO/Liebert XDH return to return line of Liebert XDP	D	7/8" OD for lengths up to 10 feet
		1-1/8" OD for lengths over 10 but less than 25 feet
From any model Liebert XDV/Liebert XDCF supply to supply line of Liebert XDP	C	1/2" OD for lengths up to 10 feet
		5/8" OD for lengths over 10 but less than 35 feet
From any model Liebert XDV/Liebert XDCF return to return line of Liebert XDP	D	5/8" OD for lengths up to 10 feet
		7/8" OD for lengths over 10 but less than 35 feet

For additional information about piping connections, see the unit's user manual: Liebert XDP, 16644; Liebert XDC, SL-16671; Liebert XDO, SL-16666; Liebert XDV, SL-16626; Liebert XDCF, SL-16678; and Liebert XDH SL-17210.

NOTE
To minimize the amount of refrigerant required, do NOT oversize the piping.

Figure 23 Generic piping layout



3.13 Liebert XD Piping Slope

The main supply and return lines to and from the XDP/XDC must be sloped downward toward the XDP/XDC at a rate of 1-2" per 20 feet (25-51mm per 6m) of pipe run. Horizontal connector lines should also be sloped downward from the cooling modules toward the main supply and return lines.

3.14 Bypass Flow Controllers

To ensure the XDP/XDC pumps operate within the optimum range, some installations require one or more bypass flow controller(s). These devices are added to the field piping, and simulate the flow of additional cooling modules.

Each bypass flow controller should be installed with one shutoff valve to allow the controller to be disabled when cooling modules are added to a Liebert XD system.

If bypass flow controllers are required, they should be connected between the main supply and the main return lines of the field piping. The connection points to the main supply and return lines should be in a convenient and accessible location between the Liebert XDP/Liebert XDC and the first Liebert XD module in the circuit. See **Figures 25** and **24** for piping details of the bypass flow controller.

Refer to **Table 6** to determine the number of bypass flow controllers needed, based on the total nominal cooling capacity of the cooling modules in each Liebert XD system.

Table 6 Bypass flow controllers for Liebert XDC- or Liebert XDP-based systems

Cooling Modules - Cumulative Model Size	Required Number of Bypass Flow Controllers	
	Liebert XDP	Liebert XDC
48 to 63	3	N/A
64 to 95	2	2
96 to 127	1	1
128 to 160	0	0

Figure 24 Bypass flow controller details, dimensions

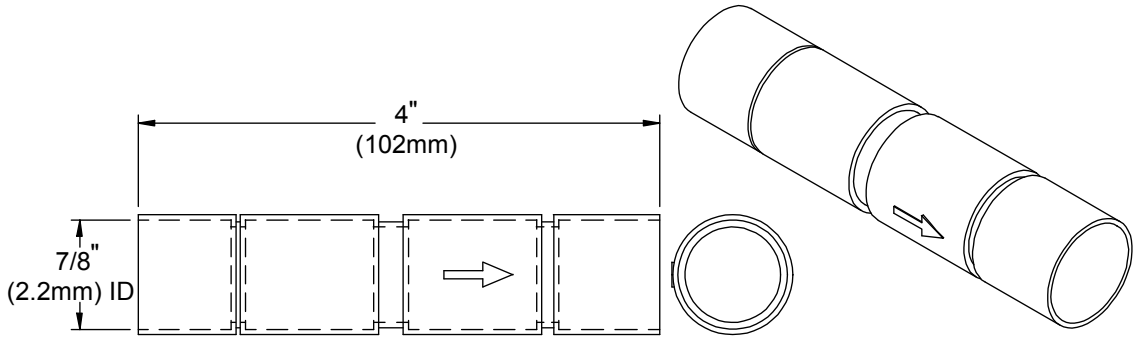


Figure 25 Bypass flow controller arrangement

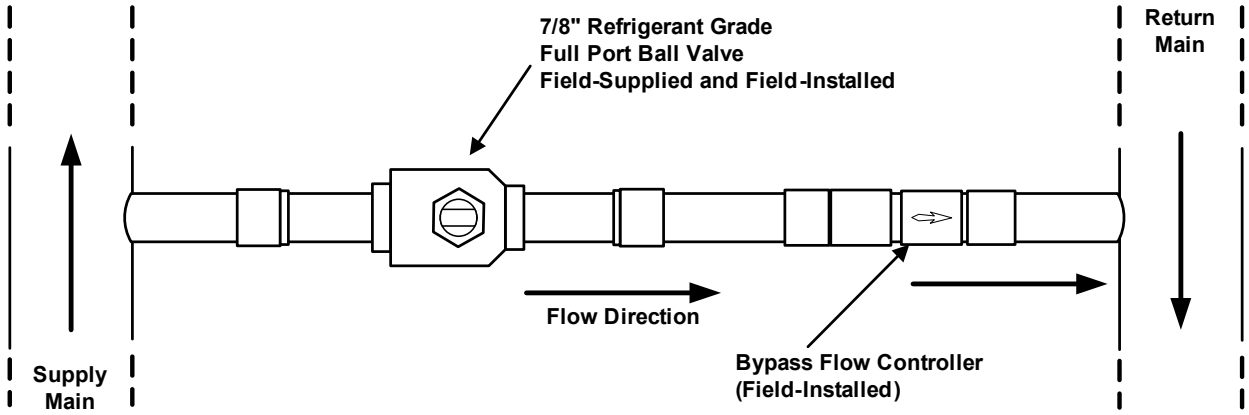


Figure 26 Bypass flow controller piping

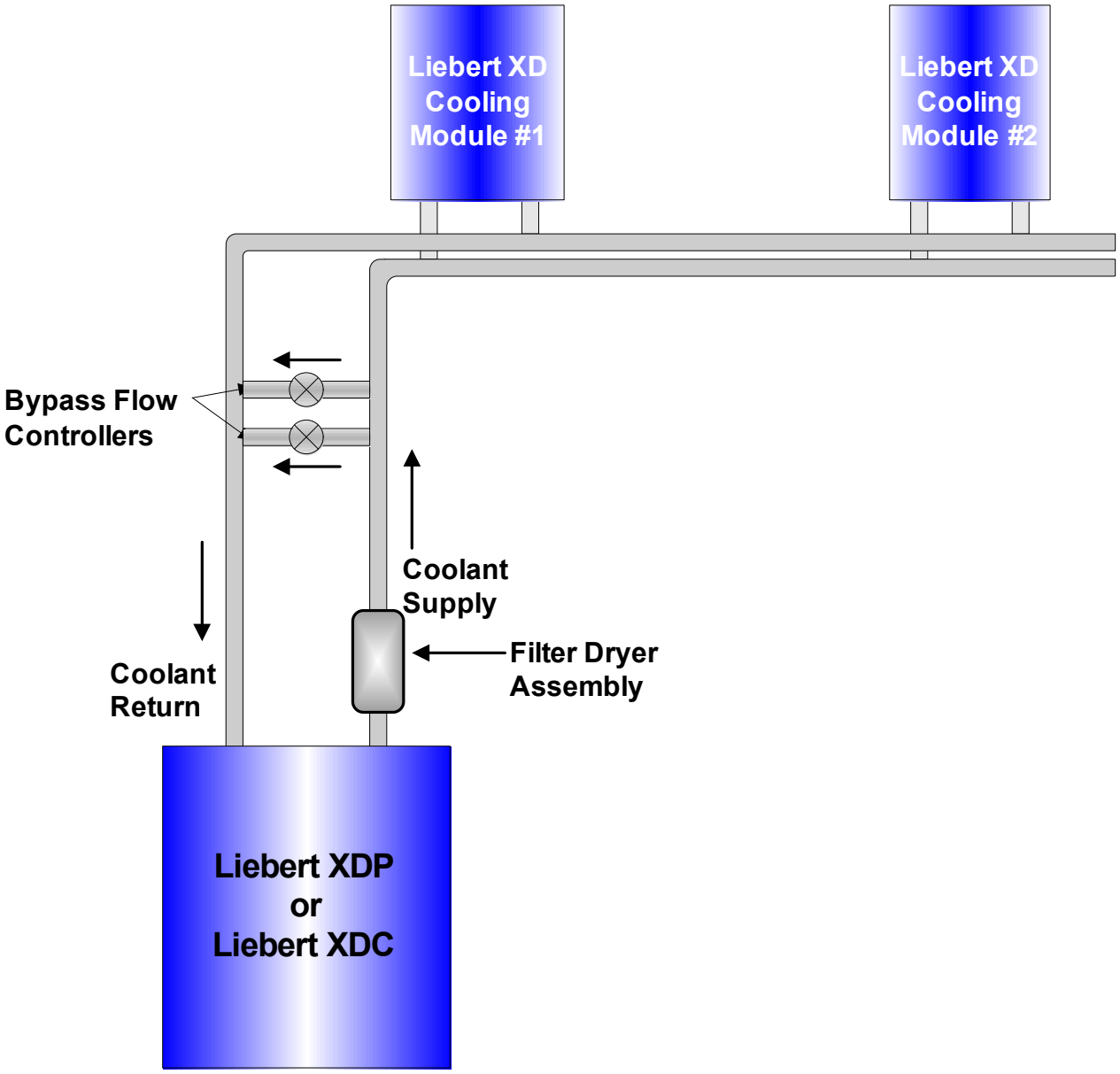
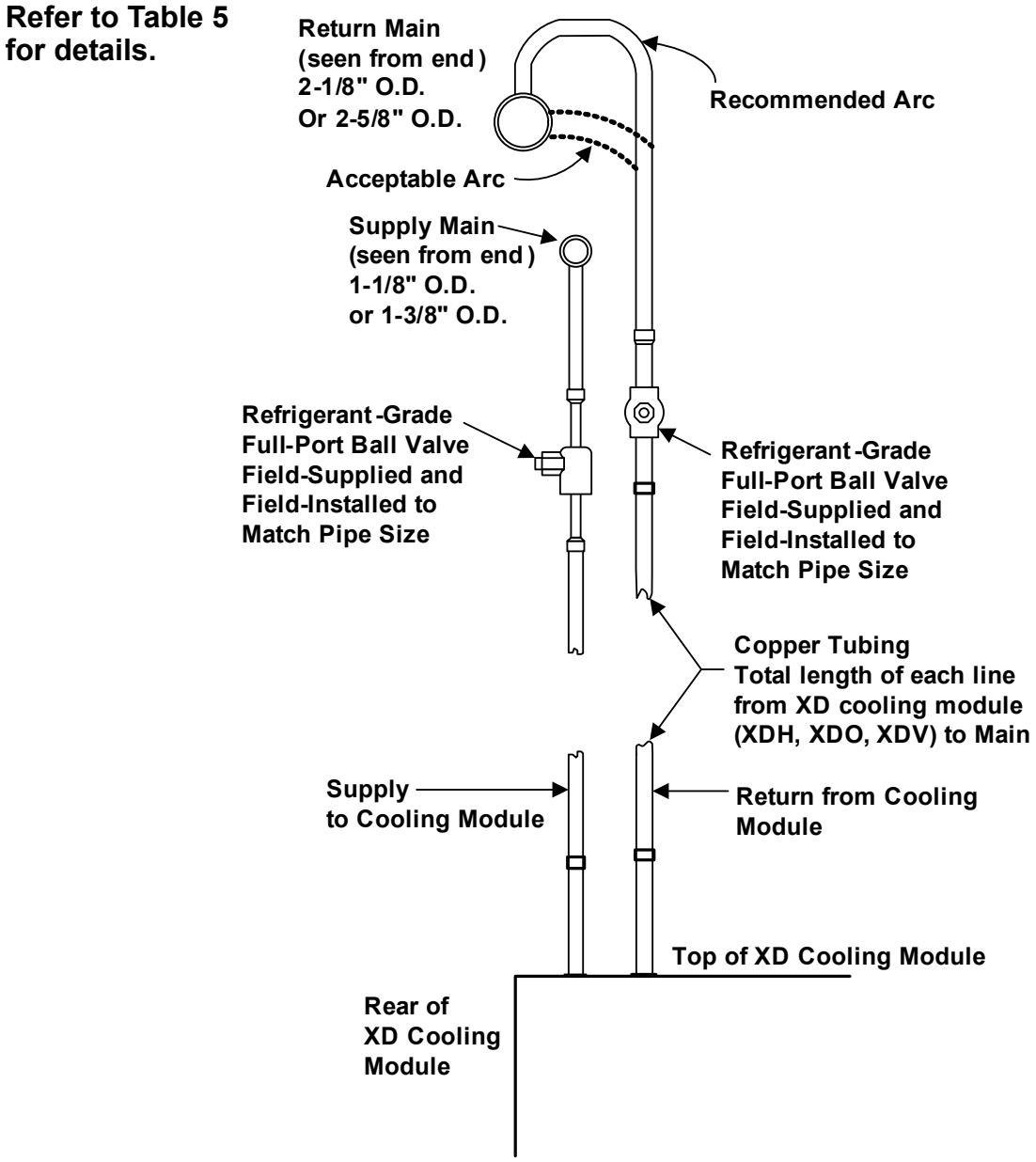


Figure 27 Hard-pipe connection diagram for Liebert cooling modules



3.15 Piping Installation Method Prefabricated Headers

The assembly and connection means used for piping in the Liebert XD system are similar to those used for conventional refrigeration systems. All piping should be installed with high-temperature brazed joints. Soft solder is not recommended. During brazing, the lines must be filled with flowing dry nitrogen to prevent excessive oxidation and scale formation inside the piping. Prevailing good refrigeration practices must be employed for piping supports, leak testing, dehydration and charging. Failure to use good system practices may result in damage to the system. Refer to the ASHRAE refrigeration handbook for general good-practice refrigeration piping.

Follow all guidelines in **3.12 - Liebert XD Piping System Design** and **3.13 - Liebert XD Piping Slope** during installation.

Figure 28 Two-port prefabricated piping for Liebert XD cooling modules

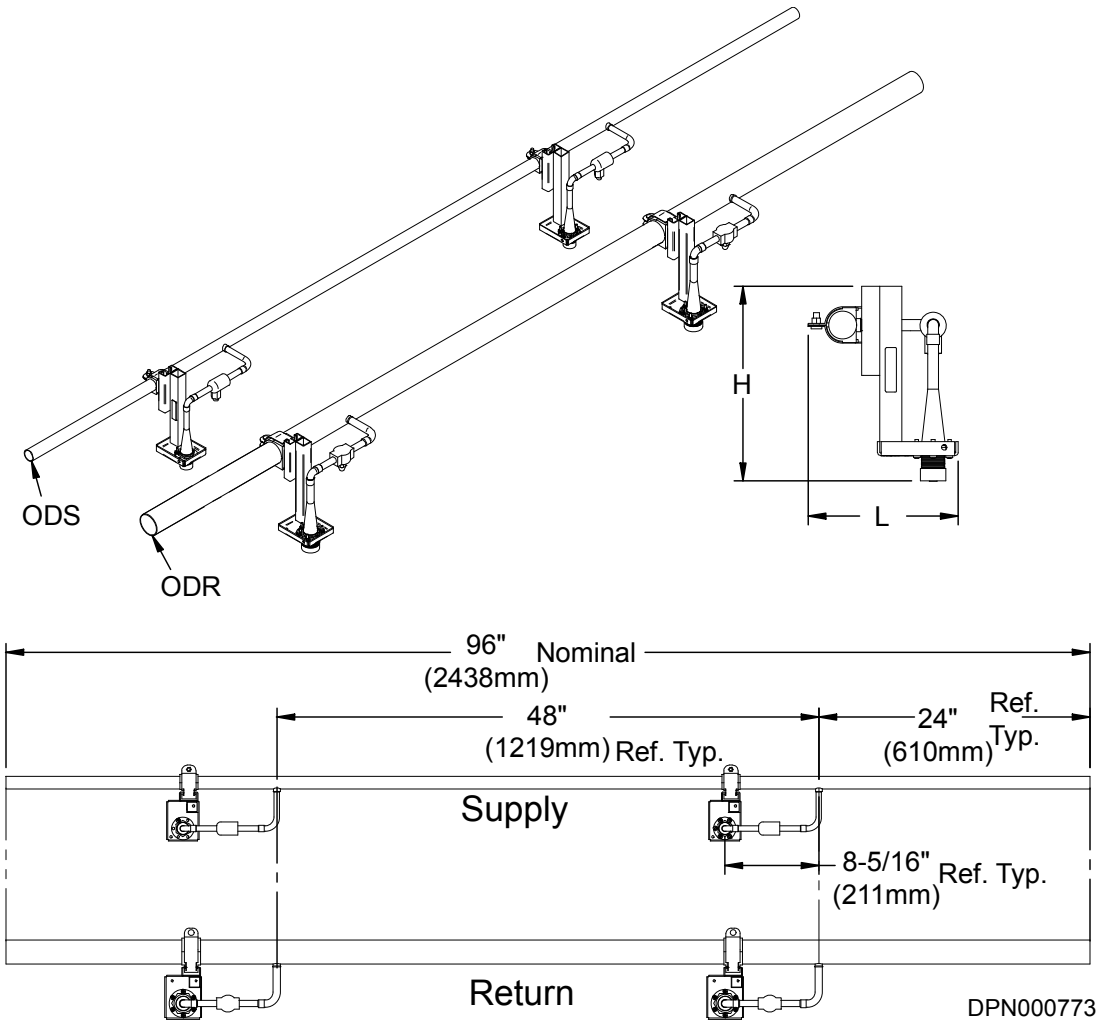


Table 7 Two-port prefabricated piping legend

Branch Piping		Standard Run	Long Run *
Two Port		185797G21	185800G21
Supply inch (mm)	Outside Diameter (ODS)	1-1/8	1-3/8
	Height (H)	8-3/4 (222)	8-3/4 (222)
	Length (L)	6-3/4 (171)	6-7/8 (175)
Return inch (mm)	Outside Diameter (ODR)	2-1/8	2-5/8
	Height (H)	10-1/2 (267)	10-1/2 (267)
	Length (L)	8-3/4 (222)	9-1/8 (232)

* Pipe runs greater than 60 equivalent feet

Figure 29 Four-port prefabricated piping for Liebert XD cooling modules

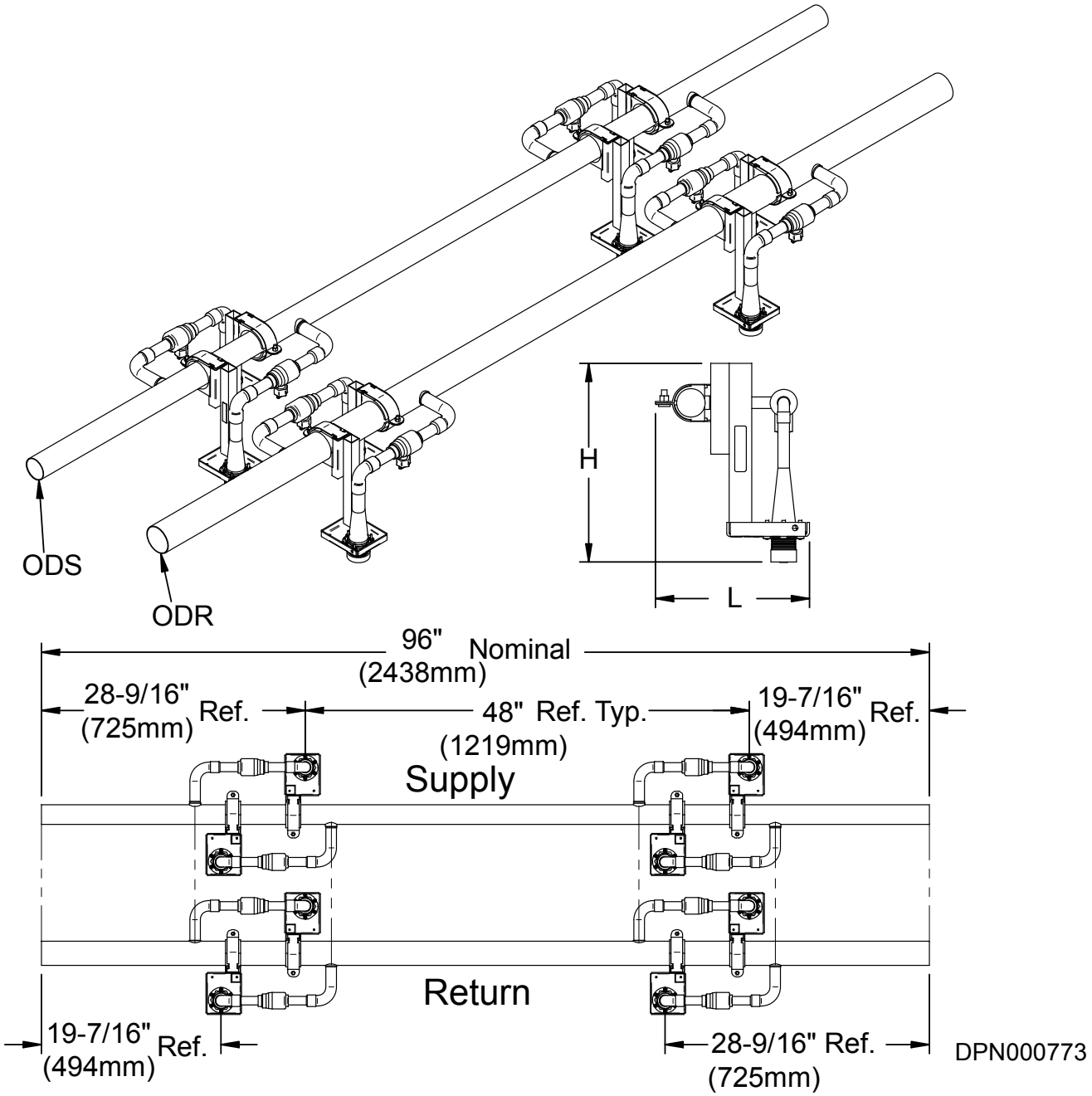


Table 8 Four-port prefabricated piping legend

Branch Piping		Standard Run	Long Run *
Four Port		186551G21	186552G21
Supply inch (mm)	Outside Diameter (ODS)	1-1/8	1-3/8
	Height (H)	8-3/4 (222)	8-3/4 (222)
	Length (L)	6-3/4 (171)	6-7/8 (175)
Return inch (mm)	Outside Diameter (ODR)	2-1/8	2-5/8
	Height (H)	10-1/2 (267)	10-1/2 (267)
	Length (L)	8-3/4 (222)	9-1/8 (232)

* Pipe runs greater than 60 equivalent feet

Figure 30 Five-port prefabricated piping for Liebert XD cooling modules

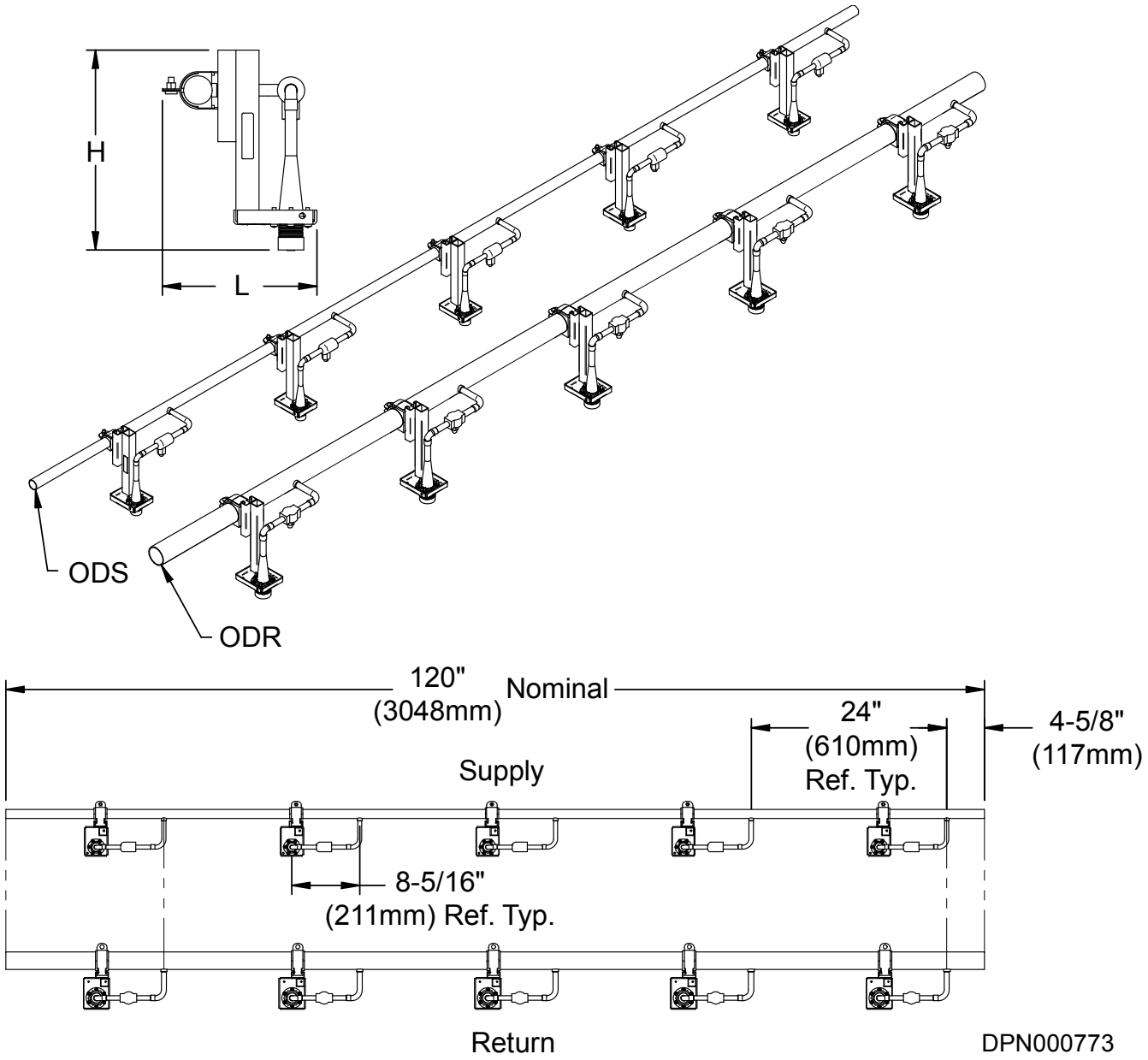


Table 9 Five-port prefabricated piping legend

Branch Piping		Standard Run	Long Run *
Five Port		185797G51	185800G51
Supply inch (mm)	Outside Diameter (ODS)	1-1/8	1-3/8
	Height (H)	8-3/4 (222)	8-1/2 (216)
	Length (L)	6-3/4 (171)	7 (178)
Return inch (mm)	Outside Diameter (ODR)	2-1/8	2-5/8
	Height (H)	10-1/2 (267)	10-1/2 (267)
	Length (L)	8-3/4 (222)	9-1/8 (232)

* Pipe runs greater than 60 equivalent feet

Figure 31 Ten-port prefabricated piping for Liebert XD cooling modules

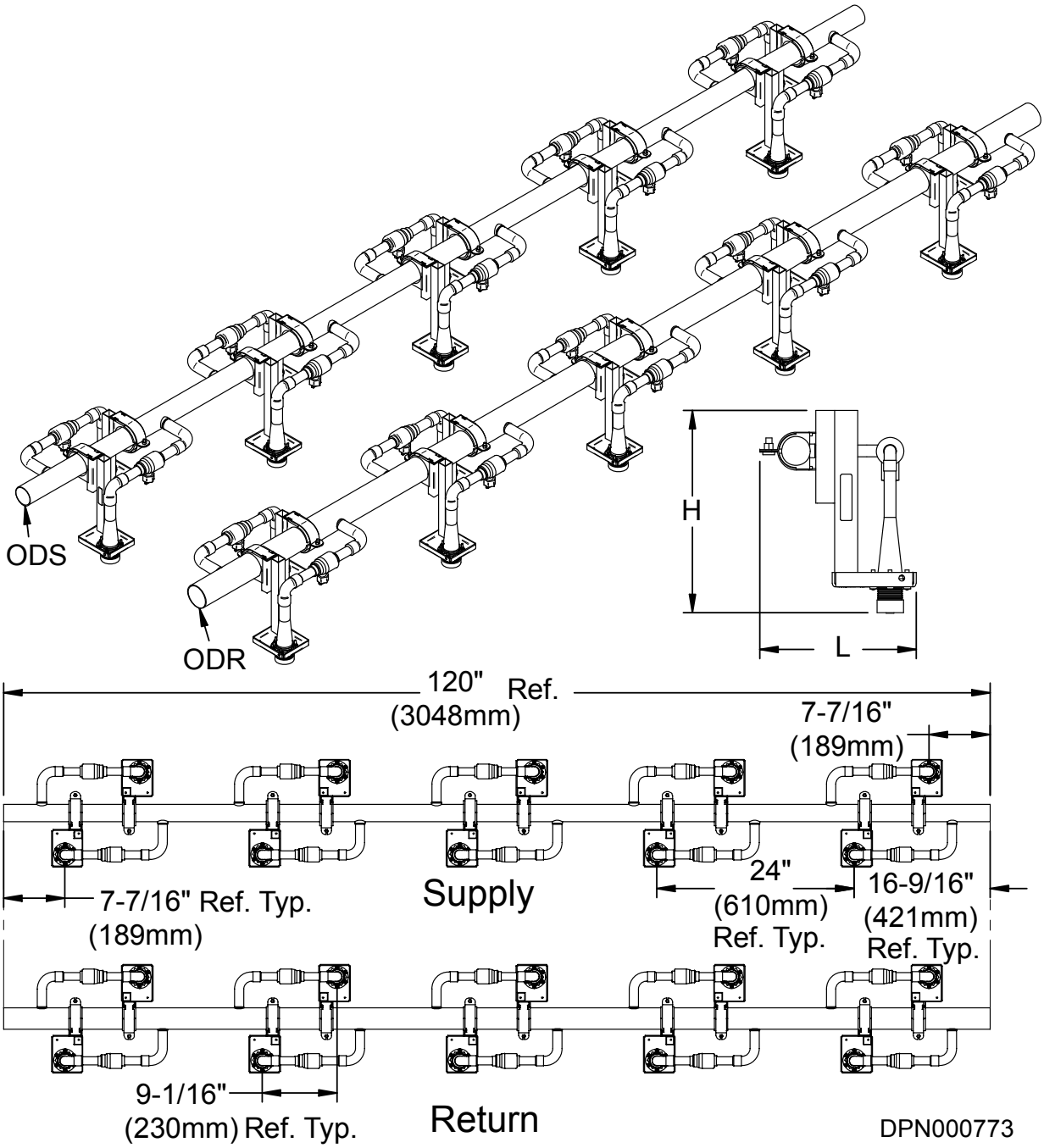


Table 10 Ten-port prefabricated piping legend

Branch Piping		Standard Run	Long Run *
Ten Port		186650G51	186553G51
Supply inch (mm)	Outside Diameter (ODS)	1-1/8	1-3/8
	Height (H)	8-3/4 (222)	8-3/4 (222)
	Length (L)	6-3/4 (171)	6-7/8 (175)
Return inch (mm)	Outside Diameter (ODR)	2-1/8	2-5/8
	Height (H)	10-1/2 (267)	10-1/2 (267)
	Length (L)	8-3/4 (222)	9-1/8 (232)

* Pipe runs greater than 60 equivalent feet

3.16 Liebert XD Flex Pipe Kit

Liebert XD Flex Pipe kits are available in lengths of 4, 6, 8 and 10 feet (1.2, 1.8,2.4 and 3 meters). Connection style to the unit end may be straight or 90 degrees with one-shot or removable connections. Connection to the prefabricated piping assembly is a threaded coupler. For data on acquiring the correct kit for your installation, see **Table 11**.

Table 11 Liebert XD Flex Pipe assemblies, supply and return

Description	Liebert XDV		Liebert XDCF	Liebert XDO	Liebert XDH	
	One-Shot Couplings	Removable Couplings	One-Shot Couplings	One-Shot Couplings	One-Shot Couplings	Removable Couplings
4ft long (1.2m), 0º	186568G4	187867G4	186568G4 [2]	186566G4	2 x 186566G4	2 x 187865G4
4ft long (1.2m), 90º	186567G4	187866G4	—	186565G4	2 x 186565G4	2 x 187864G4
6ft long (1.8m), 0º	186568G1	187867G1	186568G1 [2]	186566G1	2 x 186566G1	2 x 187865G1
6ft long (1.8m), 90º	186567G1	187866G1	—	186565G1	2 x 186565G1	2 x 187864G1
8ft long (2.5m), 0º	186568G3	187867G3	186568G3 [3]	186566G3	2 x 186566G3	2 x 187865G3
8ft long (2.5m), 90º	186567G3	187866G3	—	186565G3	2 x 186565G3	2 x 187864G3
10ft long (10m), 0º	186568G2	187867G2	186568G2 [3]	186566G2	2 x 186566G2	2 x 187865G2
10ft long (10m), 90º	186567G2	187866G2	—	186565G2	2 x 186565G2	2 x 187864G2
Min Bend Radius, Supply [1]	7" (178mm)			7" (178mm)		
Min Bend Radius, Return [1]	8" (203mm)			9" (229mm)		

1. The minimum bend radius is for the flexible portion of the Liebert XD Flex Pipe. Because a section of hard pipe is at each end of the Liebert XD Flex Pipe, the minimum bend radius can be larger.
2. Top Module
3. Bottom Module

3.17 Liebert XD Refrigerant

The refrigerant used in the Liebert XD system is HFC-134a (1,1,1,2-tetrafluoroethane), made by a number of manufacturers. The amount of refrigerant used by the Liebert XD system may be significantly higher than in typical DX cooling systems.

NOTICE

Risk of improper oil use. Can cause equipment damage.

The Liebert XD pumped R-134a refrigerant circuits do not use refrigerant oil. Do NOT put oil in the R-134a system.

All the major components of a Liebert XD system must be installed in a space with a volume of at least 1,000 ft^3 (28.3m^3) for each 13 pounds of refrigerant in that system from ANSI/ASHRAE Standard 34-2007, *Designation and Safety Classification of Refrigerant* If the Liebert XDP/Liebert XDC is placed in a separate area, such as a machine room, then this area must also meet the volume requirement. Inside the critical space, this includes the space under the raised floor, and the space between the top of the raised floor and the bottom of a suspended ceiling. If the suspended ceiling is all open grates, then this additional space, up to the overhead deck, would also be included.

Example

A space is 5,000 square feet, with an 18" raised floor and an 8' 6" suspended ceiling. Liebert XDOs and a Liebert XDP are to be placed in this raised-floor area.

The volume of the space is (1.5 + 8.5) x 5,000 or 50,000 cubic feet.

The maximum amount of R-134a refrigerant that can be used in a single Liebert XDP/Liebert XDC/Liebert XD module system within this space is **13 * (50000/1000) = 13 * 50 = 650 lb**.

Multiple Liebert XD systems can be installed in this space, as long as the amount of R-134a refrigerant in any one system does not exceed 650lb. (294.8kg).The maximum amount of refrigerant is 650lb (294.8kg) per Liebert XD loop.

NOTE

Local codes might permit exceeding the maximum refrigerant limit above if a refrigerant detector and an exhaust system are installed. Installing oxygen sensors may meet some local codes.

3.18 Determining Refrigerant Volume

After the preliminary system design is completed, **Tables 12** through **21** may be used to determine the amount of refrigerant required. Perform the calculation below for each Liebert XD system being configured.

NOTE

All lengths in **Tables 12**, **13**, **14** and **15**, *are actual pipe lengths, not equivalent pipe lengths.*

3.18.1 Liebert XDP/Liebert XDC Pumped R-134a Circuit Volume

This is the refrigerant circuit from the Liebert XDP/Liebert to the Liebert XD cooling module.

NOTE

System refrigerant volume calculations in **Tables 12**, **13**, **14** and **15**, *are based on a fully loaded system. Additional charge may be required for lightly loaded systems.*

Table 12 System R-134a charge for a Liebert XDP/Liebert XDC with any model Liebert XDH/Liebert XDO/Liebert XDV/Liebert XDCF

Refrigerant Charge, lb (kg)	Per Liebert XD Unit (Excludes Connector Lines to and from Liebert XD Cooling Module)
157 lb. (71.2kg)	Liebert XDP/Liebert XDC
3.55 lb. (1.61kg)	Liebert XDO
2.32 lb. (1.05kg)	Liebert XDV
2.66 lb. (1.21kg)	Liebert XDH (per circuit)
1.41 lb. (0.64kg)	Liebert XDCF

Table 13 System refrigerant charge for the supply and return mains

Refrigerant Charge, lb/foot (kg/m)	Supply/Return Main Length and Diameter
0.45 (0.67)	Main supply actual length per 1-1/8" OD copper tubing
0.68 (1.01)	Main supply actual length per 1-3/8" OD copper tubing
0.28 (0.42)	Main return actual length per 2-1/8" OD copper tubing
0.43 (0.64)	Main return actual length per 2-5/8" OD copper tubing

Table 14 R-134a refrigerant charge for hard-piped connector lines to and from any model Liebert XDH/Liebert XDO/Liebert XDV

Refrigerant Charge, lb/foot (kg/m)	Hard-Piped Connector Length and Diameter
0.08 (0.12)	1/2" OD Liebert XDO/Liebert XDH/Liebert XDV supply connector actual length
0.13 (0.19)	5/8" OD copper tubing Liebert XDV supply connector actual length
0.26 (0.39)	7/8" OD Liebert XDO/Liebert XDH supply connector actual length
0.02 (0.03)	5/8" OD copper tubing Liebert XDV return connector actual length
0.04 (0.06)	7/8" OD copper tubing Liebert XDV return connector actual length
0.04 (0.06)	7/8" OD copper tubing Liebert XDH/Liebert XDO return connector actual length
0.07 (0.1)	1-1/8" OD copper tubing Liebert XDH/Liebert XDO return connector actual length

Table 15 R-134a refrigerant charge for Flex Pipe connector lines to and from any model Liebert XDO/Liebert XDH/Liebert XDV/Liebert XDCF

Refrigerant Charge, lb. (kg)	Metal Flex Pipe Connector Length
Supply Line Diameter 1/2"	
0.3 lb. (0.14)	4 ft. Flex Pipe All Liebert XD Cooling Module
0.5 lb. (0.23)	6 ft. Flex Pipe All Liebert XD Cooling Module
0.7 lb. (0.32)	8 ft. Flex Pipe All Liebert XD Cooling Module
0.8 lb. (0.36)	10 ft. Flex Pipe All Liebert XD Cooling Module
Return Line Diameter 5/8"	
0.01 lb. (0.01)	4 ft. Flex Pipe existing Liebert XDV/Liebert XDCF systems
0.02 lb. (0.01)	6 ft. Flex Pipe existing Liebert XDV/Liebert XDCF systems
0.03 lb. (0.01)	8 ft. Flex Pipe existing Liebert XDV/Liebert XDCF systems
0.03 lb. (0.01)	10 ft. Flex Pipe existing Liebert XDV/Liebert XDCF systems
Return Line Diameter 1"	
0.13 lb. (0.06)	4 ft Flex Pipe Liebert XDH/Liebert XDO supply
0.2 lb. (0.09)	6 ft Flex Pipe Liebert XDH/Liebert XDO supply
0.27 lb. (0.12)	8 ft Flex Pipe Liebert XDH/Liebert XDO supply
0.33 lb. (0.15)	10 ft Flex Pipe Liebert XDH/Liebert XDO supply

3.18.2 Calculating Refrigerant R134a Charge—Example

Using **Tables 12**, **13**, **14** and **15**, calculate the refrigerant charge of the individual sections of your Liebert XD system. Add the calculated charge amounts to determine the amount of R-134a refrigerant required for one system combining a Liebert XDP with Liebert XD cooling modules (Liebert XDCF, Liebert XDH, Liebert XDO and Liebert XDV). The example below combines one Liebert XDP with 20 Liebert XDV8 cooling modules.

Table 16 Calculating refrigerant charge—example

Components	Number of Units or Piping Length, feet	Pounds Per Component	Total, lb.
Liebert XDP/Liebert XDC	1	157	157
Liebert XDV8 Cooling Modules	20	2.32	46.4
Supply Main, 1-1/8"	100	0.45	45
Return Main, 2-1/8"	100	0.28	28
Liebert XDV 1/2" supply Liebert XD Flex Pipes	20	0.8	16
Liebert XDV 5/8" return Liebert XD Flex Pipes	20	0.03	0.6
		Total	**293**

Table 17 Worksheet to calculate refrigerant charge

Components	Number of Units or Piping Length	Pounds Per Component	Total
		Total	

Verify that the refrigerant volume of the Liebert XD system with the longest piping length is within the allowable limit. If the allowable limit is exceeded, the Liebert XDP/Liebert XDC should be moved closer to the cooling modules (refer to **3.17 - Liebert XD Refrigerant** for limits and related details). Another way to shorten the total pipe length is to reroute the pipe runs.

3.18.3 Liebert XDC DX R-407c Circuit Volume

NOTICE

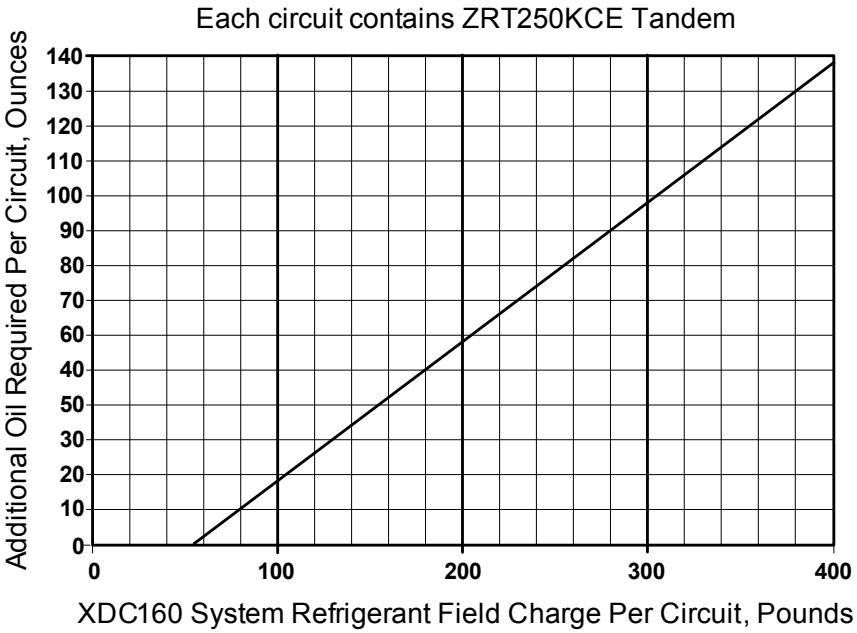
Risk of improper lubrication. May cause equipment damage.

Liebert XDCs refrigerant R-407c circuits with refrigerant charges over 55 lb (24.9 kg) require additional oil. See **Figure 32** for the amount required for various charge levels.

Once the system has been fully charged with refrigerant, use a hand pump to add the additional oil at the suction side of the system while the system is running.

The amount of oil added by field service must be recorded on a tag attached at the tandem the amount added along with the date it was added. This will be documented on a tag located at the tandem compressor and marked “Oil Added Field Service Record.” Refer to the Liebert XDC user manual, SL-16671, available at Liebert’s Web site, www.liebert.com

Figure 32 Additional oil requirements for refrigerant charge



To calculate the oil required, use the following formula:

*Additional Oil Required per Circuit = (Refrigerant Charge * 0.4 - 22)*

Enter the refrigerant charge in pounds to determine the oil required in ounces

NOTICE

Risk of improper compressor lubrication. Can cause compressor and refrigerant system damage.

Failure to use oil types, viscosities and quantities recommended by the compressor manufacturer may reduce compressor life and void the compressor warranty. See oil types specified in **Table 18**.

- Do not mix polyol ester (POE) and mineral-based oils.
- Do not mix oils of different viscosities.

Consult Emerson or the compressor manufacturer if questions arise.

Table 18 Compressor oil types

Compressor Type	Refrigerant Type
	R-407c
Copeland Scroll and Digital Scroll	POE OIL - ISO 32 Viscosity

Use Copeland® POE Oil ULTRA 22 CC, Mobil EAL Arctic 22 CC, Copeland brand Ultra 22 CC, Copeland brand Ultra 32 CC, Copeland brand Ultra 32-3MAF, Mobil EAL™ Arctic 22 CC or Uniqema RL32-3MAF or other Copeland-approved oil.

Weigh in the calculated charge based on **Tables 19**, **20** and **21** for Liebert XDC's with air-cooled condensers.

Weigh in the calculated charge based on **Tables 19** & **22** for Liebert XDCs with water/glycol-cooled condensers. For Liebert XDCs with the water/glycol-cooled condenser remotely located, use **Tables 19**, **21** & **22**.

Table 19 Indoor unit refrigerant charge—R-407c

Model 60/50 Hz	Charge/Circuit, lb. (kg)
Liebert XDC160	17.5 (8.0)

Table 20 Outdoor condenser charge—R-407c

Model	Charge / Circuit, lb (kg)
CDL830	200 (90.8)
CSL616	254 (115.2)
CSL415	200 (90.8)

Table 21 Air cooled systems - liquid line charge - R-407c refrigerant per 100 ft (30 m) of Type "ACR" copper tube

O.D., inches	Liquid Line, lb (kg)	Hot Gas Line, lb (kg)
3/8	3.7 (1.7)	—
1/2	6.9 (3.1)	—
5/8	11.0 (5.0)	2.2 (1.0)
3/4	15.7 (7.1)	3.1 (1.4)
7/8	23.0 (10.4)	17.5 (8.0)
1-1/8	39.3 (17.8)	7.8 (3.5)
1-3/8	59.8 (27.1	11.8 (5.4)
1-5/8	—	16.7 (7.6)

Table 22 Indoor water/glycol cooled condenser module charge—R-407c

Model 60 Hz	Charge / Circuit, lb (kg)
Liebert XDC160	30.0 (13.2) per circuit

3.19 Chilled Water Piping

The Liebert XDP is offered only with a two-way chilled water control valve. Some applications may require the use of a pressure activated bypass valve, to prevent dead-heading of the chilled water pump. This bypass valve must be specified by the engineer responsible for design of the chilled water field piping system.

Chilled water connections to the Liebert XDP are near the bottom of the unit. Refer to the Liebert XDP user manual (SL-16644) for further information. Piping is routed downward from the unit to chilled water piping under the raised floor. Connections are made using standard practices for copper chilled water piping. Field-supplied Victaulic® connections may be used to simplify installation in existing facilities. Refer to **Table 43** for additional information.

3.20 Electrical

Make all wiring and electrical connections in accordance with local and national codes. Refer to the applicable table in **6.0 - Specifications and Model Number Nomenclature** regarding wire size and circuit protection requirements. Refer to electrical schematic when making connections.

3.21 Temperature/Humidity Sensor Locations

The display panel sensor & Liebert iCOM sensor (shipped loose) must always be installed in the conditioned space. The display panel sensor & Liebert iCOM sensor may be mounted on the Liebert XDC/XDP's front door if the unit is located in the area that it conditions.

The remote temperature / humidity sensor for the Liebert XDP and the Liebert XDC should be located in the higher-temperature portion of the cold aisle where the XD modules are located. Alternatively, it can be placed on the return air side of the primary air mover (e.g., Liebert DS™) in the room if it represents the conditions where all the XD cooling modules are located. It should not be installed where ambient air might cause false readings, for example, near unsealed doors, windows and similar areas.

4.0 LIEBERT XD COOLING MODULES—LIEBERT XDCF, LIEBERT XDH, LIEBERT XDO AND LIEBERT XDV

4.1 Liebert XDCF Standard Features

The Liebert XDCF is a self-contained module designed to cool Egenera's BladeFrame EX cabinets and equipment without exhausting heat into the room.

Upper and lower modules may be mounted on the rear of an Egenera BladeFrame. Liebert XDCF modules use R-134a refrigerant. When attached to a fully loaded BladeFrame EX rack, each Liebert XDCF module has a nominal cooling capacity of 10kW (2.8 tons; 34,000 BTUh). Performance is based on:

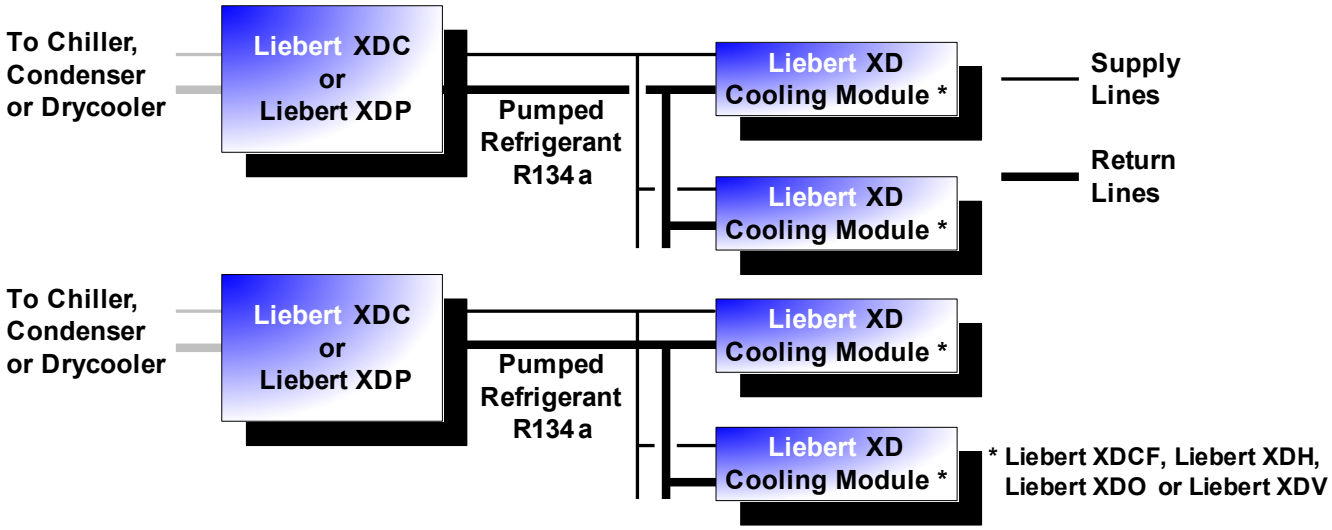
- Entering fluid temperature—55°F (12.8°C) and
- Dew point—50°F (10°C) or lower.

Liebert XDCF modules consist of a sheet-metal frame, coil and filter dryer. It has no moving parts and needs no electricity.

The Liebert XDCF system (see **Figure 33** below) consists of:

- **Liebert XDCF Modules**—upper and lower models are available
- **Flex Pipe**—connects Liebert XDCF units to supply and return piping
- **Liebert XD Piping**—delivers pumped R-134a refrigerant through flexible piping
- **Liebert XDP or Liebert XDC**—supplies R-134a refrigerant to Liebert XDCF modules (see Liebert XDP or Liebert XDC user manual for required chiller or drycooler)

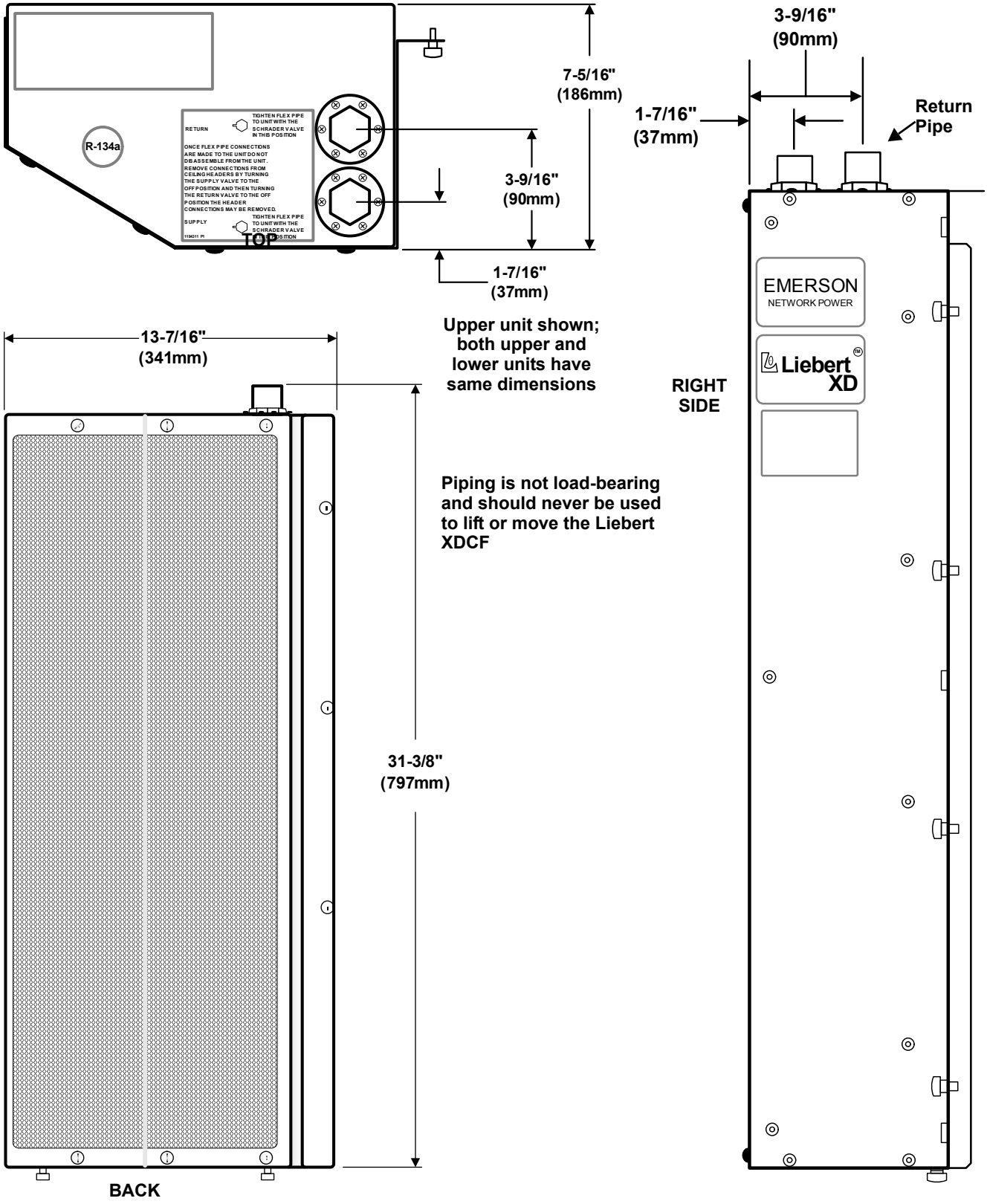
Figure 33 Liebert XDCF generic piping layout



4.2 Liebert XDCF Mechanical Considerations

The Liebert XDCF is engineered to fit on the rear of the Egenera BladeFrame enclosure. **Figure 34** illustrates the unit's dimensions and the location of pipes. **Figure 35** shows the attachment positions of each module.

Figure 34 Overall dimensions

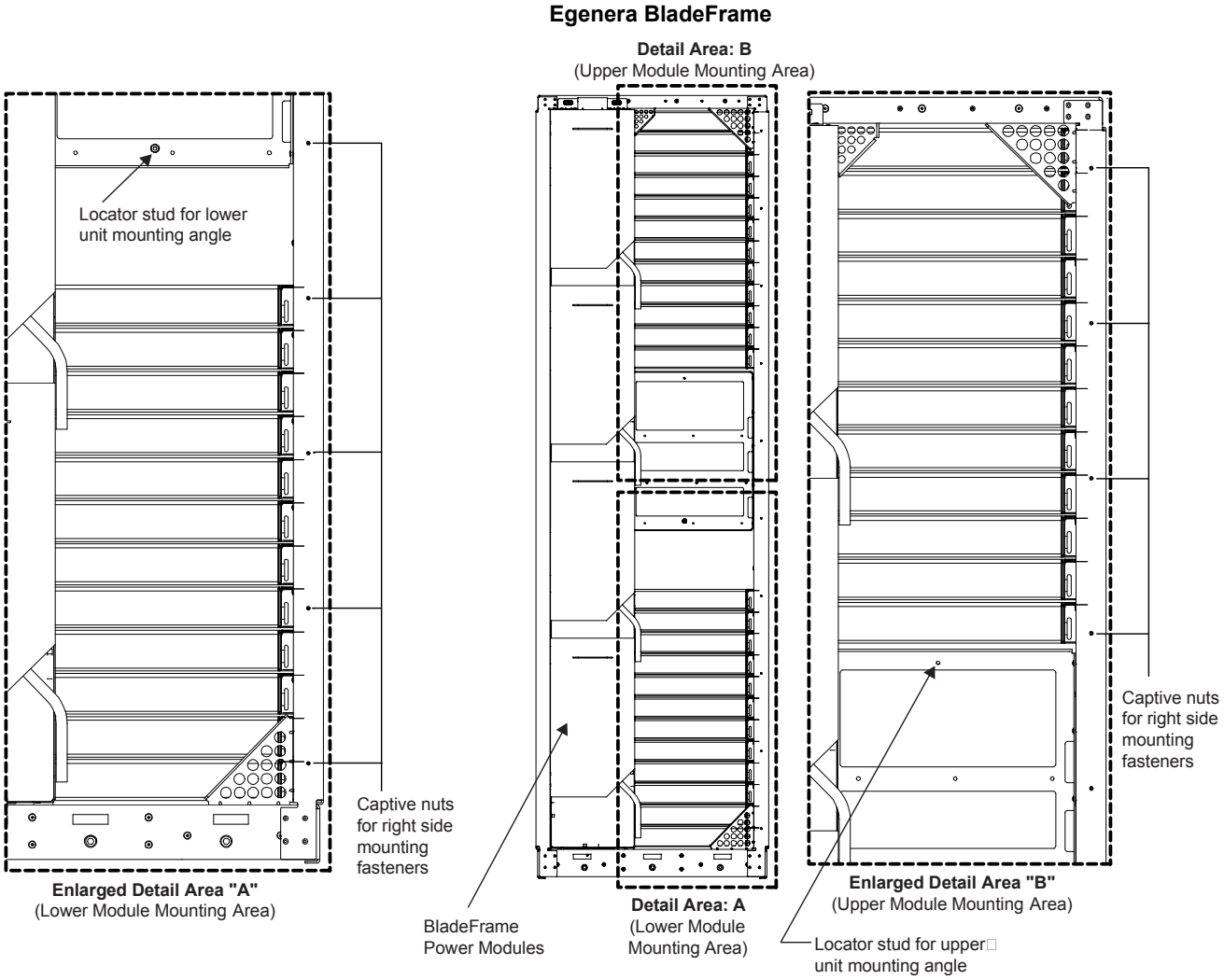


4.3 Liebert XDCF Installation Considerations

No cutting or drilling is required to attach the modules to the rear of the Egenera BladeFrame cabinet. All mounting holes, slots and pins required are fabricated at the factory.

Liebert XDCF modules attach beside the power modules on the rear of the Egenera BladeFrame (see **Figure 35**).

Figure 35 Liebert XDCF unit mounting locations



4.4 Liebert XDCF Piping Connection Methods and Points

The assembly and connection means used for piping in the Liebert XD system are the same as those used in conventional refrigeration systems. Observe all standard practices during installation and startup to prevent damage and contamination.

Supply piping connection is 1/2" OD copper pipe, and return piping connection is 5/8" OD copper. Both supply and return fittings are one-shot connections. These fittings contain pressurized R-134a refrigerant inside the Liebert XDCF.

WARNING

Risk of explosive discharge. Can cause death, injury and equipment damage.

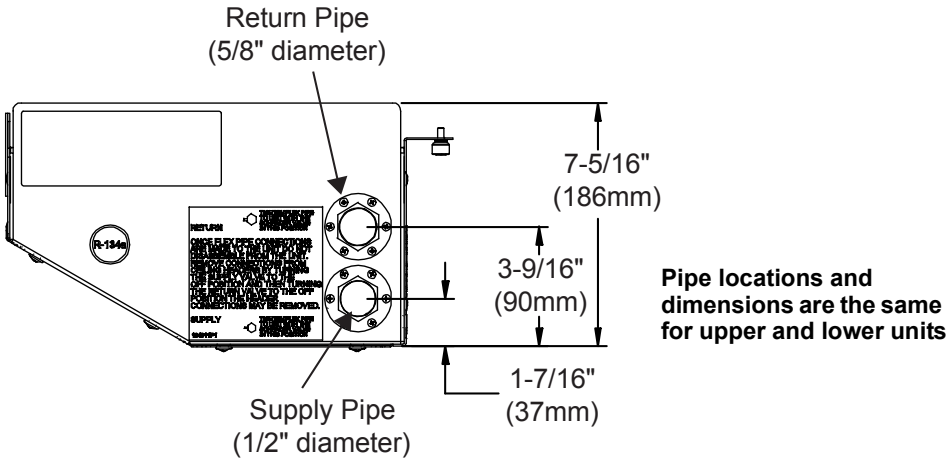
Do not disconnect one-shot connections after they have been connected. Disconnection will release pressurized R-134a refrigerant from the Liebert XDCF.

The Liebert XDCF has supply and return piping access on the top of each module.

4.4.1 Header System

The Liebert XDCF module system requires use of the Liebert XD prefabricated piping assembly or port kit. The prefabricated piping is compatible with the flex pipe required to attach to the Liebert XDCF modules.

Figure 36 Liebert XDCF supply and return piping access points



4.5 Liebert XDH Standard Features

- **Dual Refrigeration Circuits**—Each Liebert XDH has two refrigeration circuits, one in the upper half of the unit and one in the lower half. Dual refrigeration circuits permit altering cooling levels in response to server room conditions. The dual refrigeration circuits permits interlaced connection of two refrigerant sources to enhance system reliability.
- **Dual Power Cords and Power Inlets**—The Liebert XDH is supplied with two (2) detachable power cords 10 ft (3m) long that attach to two IEC power inlets on the rear of the unit. Each power cord has a NEMA 5-15P (IEC 320-C14) plug at the opposite end. The dual power cords allow the unit to be powered by two separate power sources. If the secondary power cord is connected to a UPS, the Liebert XDH unit fans will continue to operate if utility power fails.
- **Top Piping Access**—The Liebert XDH has supply and return piping access on the top of each module. Supply piping connection is 1/2" OD copper pipe, and return piping connection is 7/8" OD copper.
- **Corner Stabilizers**—A stabilizer in each corner permits rolling the Liebert XDH with greater ease and less chance of tipping.
- **Air Diffusers**—Two diffusers, one on the upper half of the unit and one on the lower half, enhance flow of cooling air. Uni-directional and bi-directional diffusers are available.

4.6 Optional Features—Liebert XDH

- **Smart Module**—Smart modules will allow remote shutdown, fan failure alarms and automatically switching the second fan bank On and Off. The controls save energy by permitting the unit to turn one fan in each fan bank Off based on the supply and return temperature. For electrical connection details, refer to the Liebert XDH user manual, SL-17210, available on the Liebert Web site: **www.liebert.com**
- **Refrigerant Precharge**—The Liebert XDH can be precharged with refrigerant. The unit will have one-shot fittings and will be pressurized. The one-shot Liebert XD Flex Piping will also be precharged with refrigerant.
- **Field-Installed Flexible Piping** (for use with prefabricated piping assemblies)—Field-installed flexible piping kits are available in lengths of 4, 6, 8 and 10 feet (1.2, 1.8, 2.4 and 3 meters). Connection style to the unit end may be straight or 90 degrees with one-shot style couplings or removable couplings. Flex pipes with one-shot connections will have pressurized R134a. Flex pipes with removable connections will have a low pressure nitrogen charge Connection to the prefabricated piping assembly is with a threaded coupler. For information on acquiring the correct kit for your installation, refer to DPN000780, available by calling 1-800-LIEBERT and from your local Emerson representative.

- **Tie-Down Bracket**—An optional tie-down bracket may be installed on the Liebert XDH to secure it in the row. The bracket keeps space between the Liebert XDH and adjacent equipment constant, preventing vibration.

Figure 37 Liebert XDH dimensions

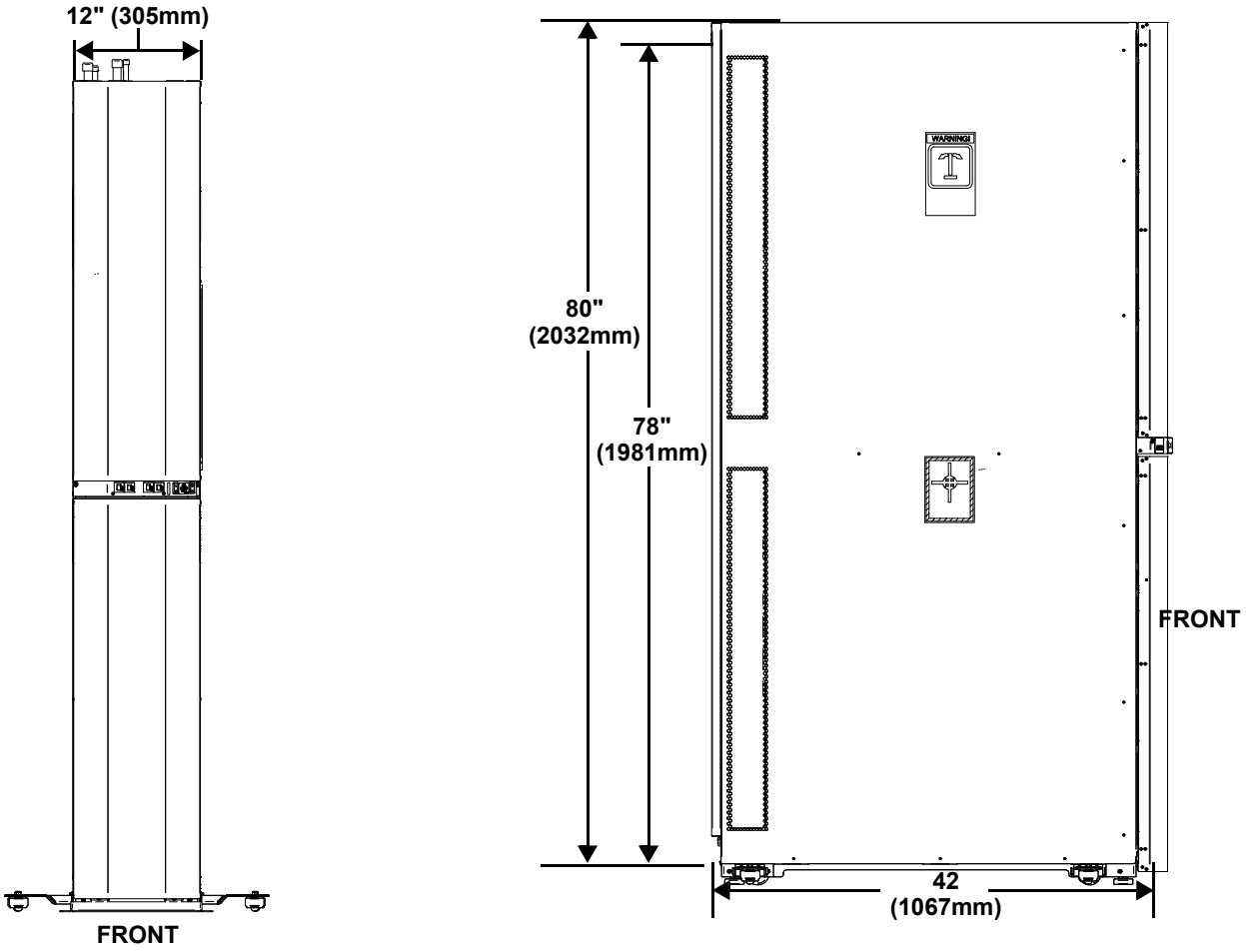
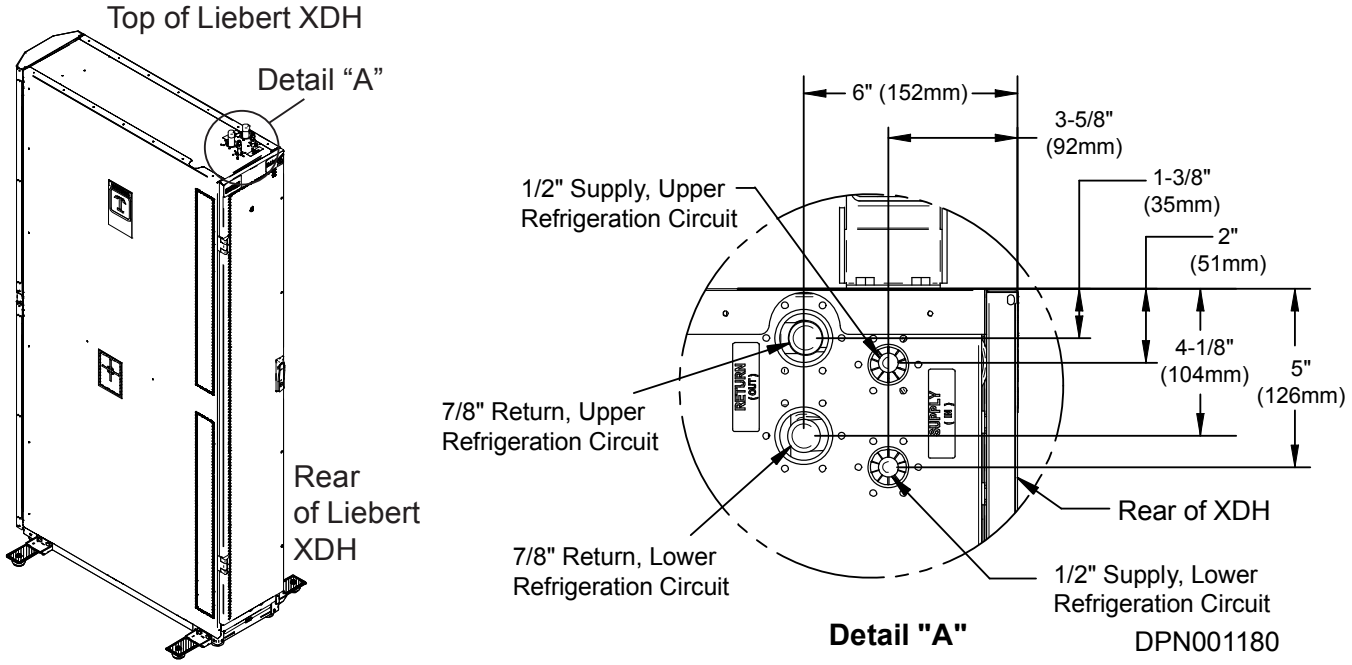


Figure 38 Supply and return piping connections



4.7 Liebert XDO Standard Features

- **Micro Channel Heat Exchanger**—The Liebert XDO unit includes two all-aluminum micro channel heat exchangers.
- **Fan**—Air is drawn in the sides of the unit through the heat exchangers and is discharged by the fan to the area below—The Liebert XDO fan tray hinges down to allow access to replace or service all electrical components.
- **Internal Mounting**—The Liebert XDO unit is typically suspended from the overhead building structure by inserting field-supplied threaded rods into the internal mounting brackets.

4.8 Optional Features Liebert XDO

- **Refrigerant Pre-Charge**—The Liebert XDO can be precharged with refrigerant. The unit will have the one-shot fittings and be pressurized. The one-shot Liebert XD Flex Piping will also be precharged with refrigerant.
- **Field-Installed Flexible Piping** (for use with prefabricated piping assemblies or port kits)—Field-installed flexible piping kits are available in lengths of 4, 6, 8 and 10 feet (1.2, 1.8, 2.4 and 3 meters). Connection style to the unit end may be straight or 90 degrees with one-shot connections. Flex pipes with one-shot connections will have pressurized R134a. Connection to the prefabricated piping assembly is with a threaded coupler. For information on acquiring the correct kit for your installation, refer to DPN000780, available by calling 1-800-LIEBERT and from your local Emerson Network Power representative.
- **External Mounting Brackets**—The Liebert XDO unit can be suspended by external mounting brackets that are attached to the front and rear panels of the unit. The external mounting brackets are optional ship-loose items.
- **Smart Modules**—The Liebert XDO is available with an optional factory-installed control board. A Liebert XDO smart module will allow remote monitoring, shutdown, fan failure alarms, condensate detection and automatically cycling the fan On and Off as the heat load requires.
- **Lighting Fixture**—Field-installable lighting fixtures are available in two voltages, 120V and 277V. The lighting fixture maybe attached to the bottom of the light panel to the left and right of the fan. Each fixture consists of housing, reflector, ballast and diffuser. Fixtures are compatible with standard 48" fluorescent bulbs. Bulbs are not included.

Figure 39 Dimensional data—Liebert XDO hard-piped units

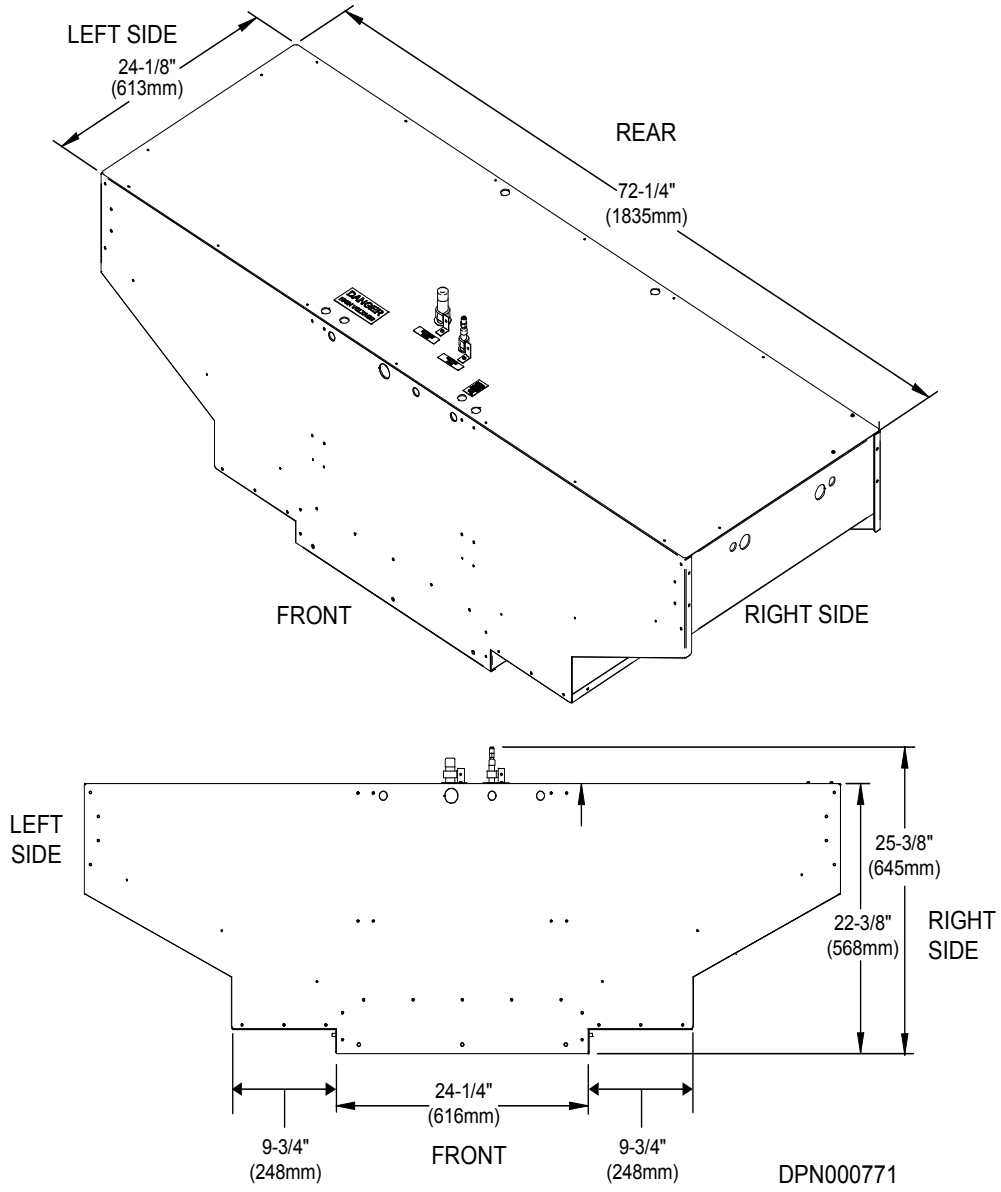


Figure 40 Dimensional data—Liebert XDO with pre-charged option

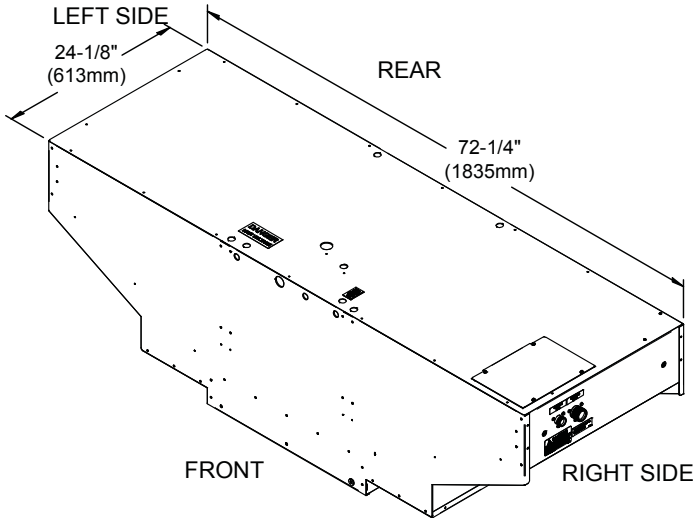


Figure 41 Liebert XDO internal mounting location

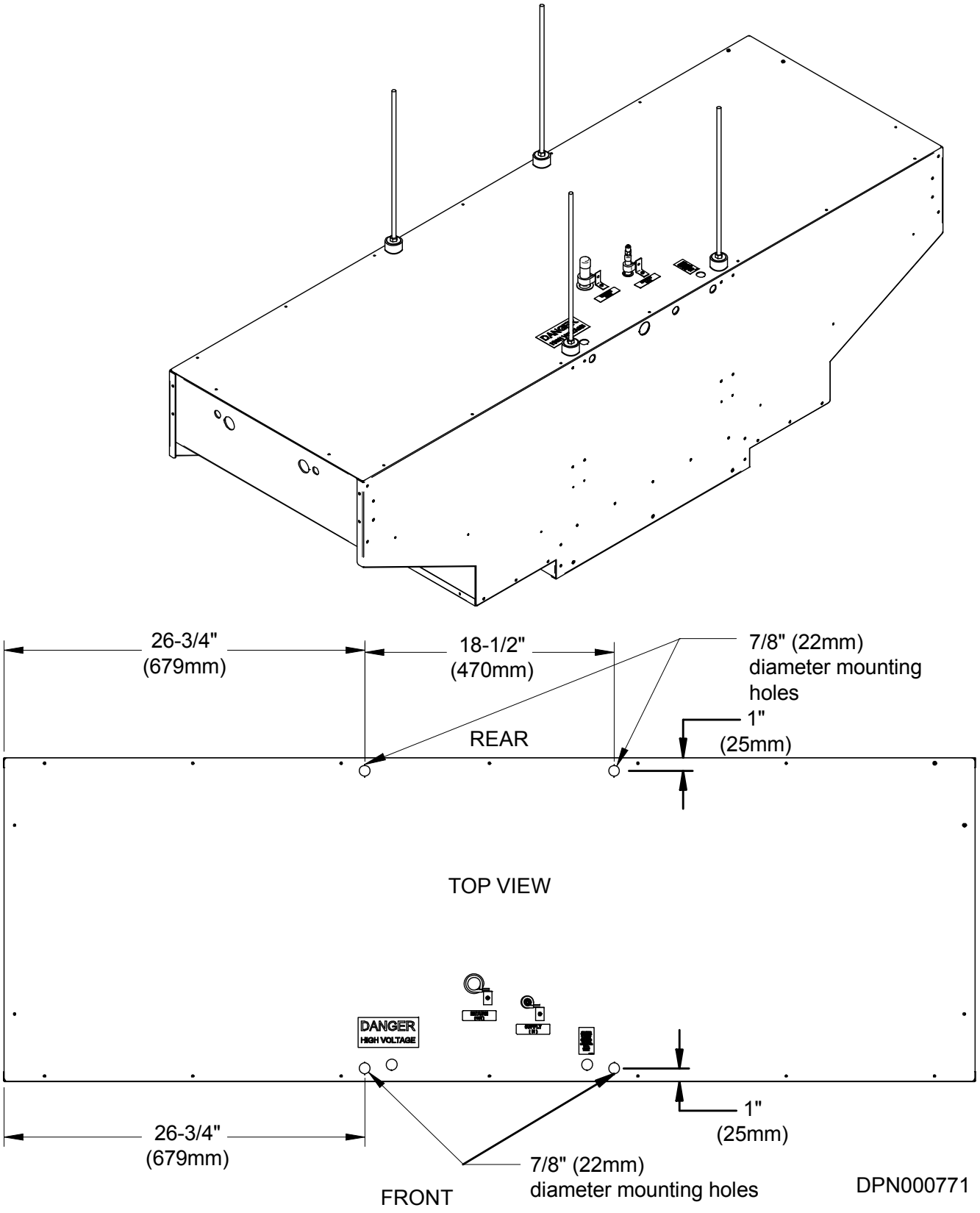


Figure 42 Top and front electrical access points and terminal block—standard Liebert XDO modules

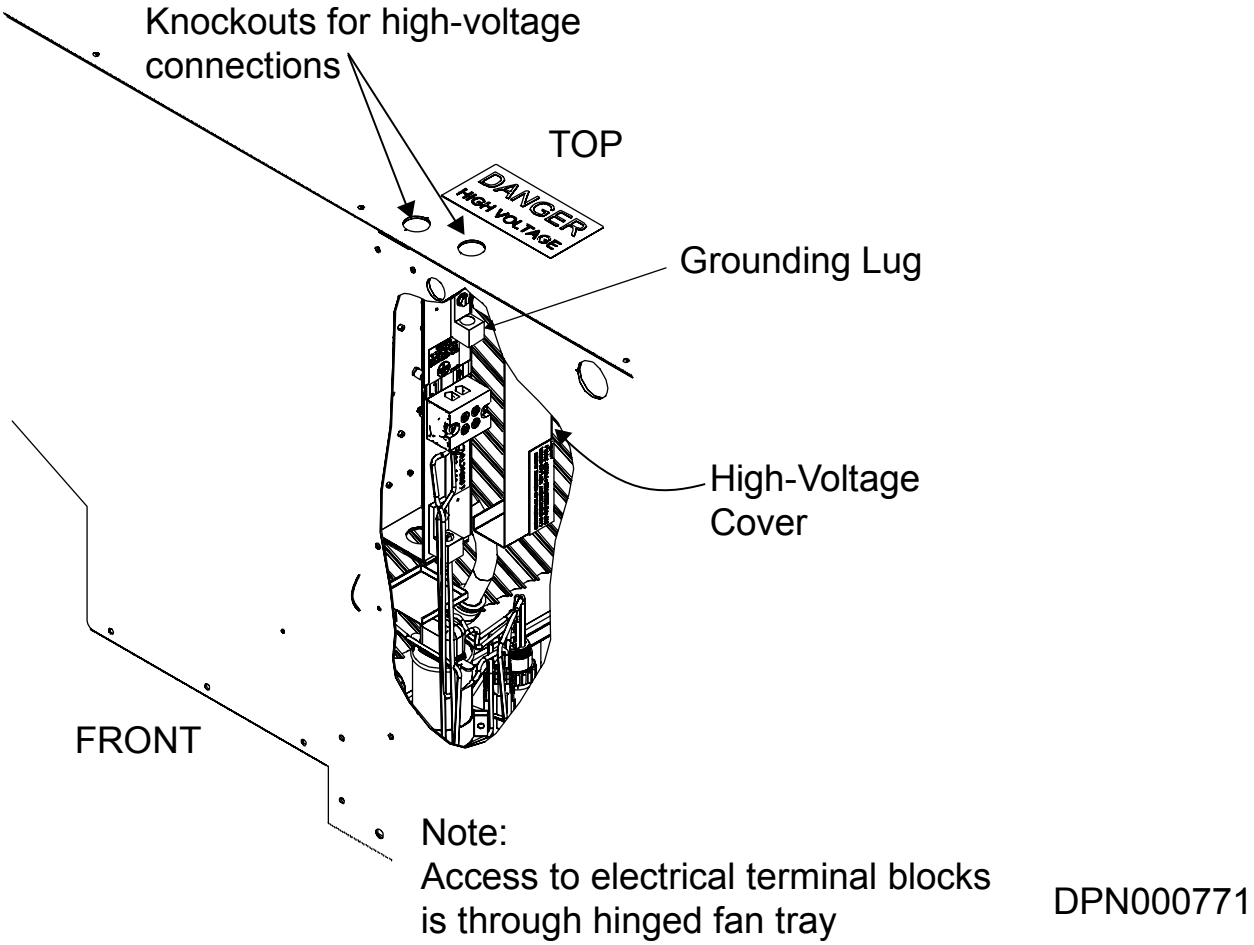
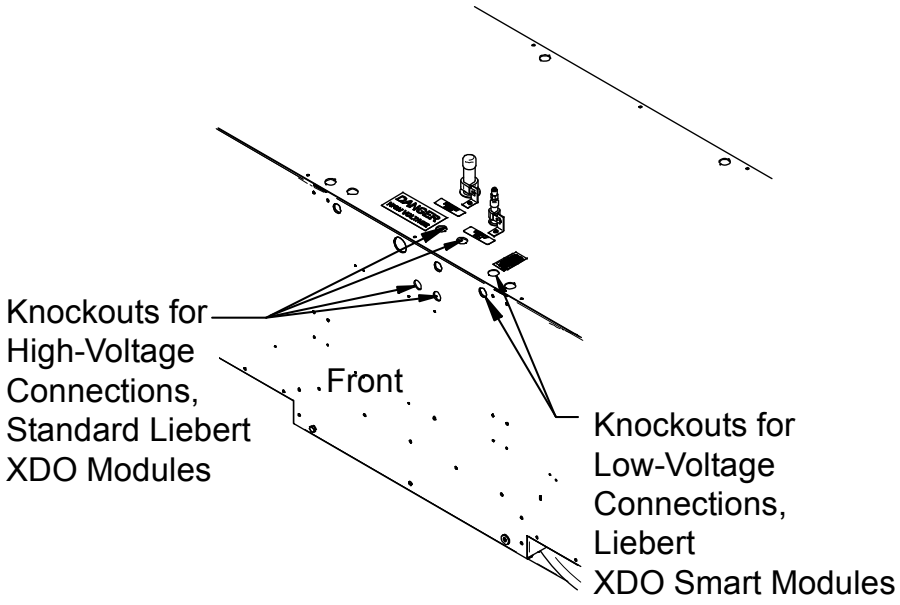


Figure 43 Top and front electrical access points—Liebert XDO smart modules



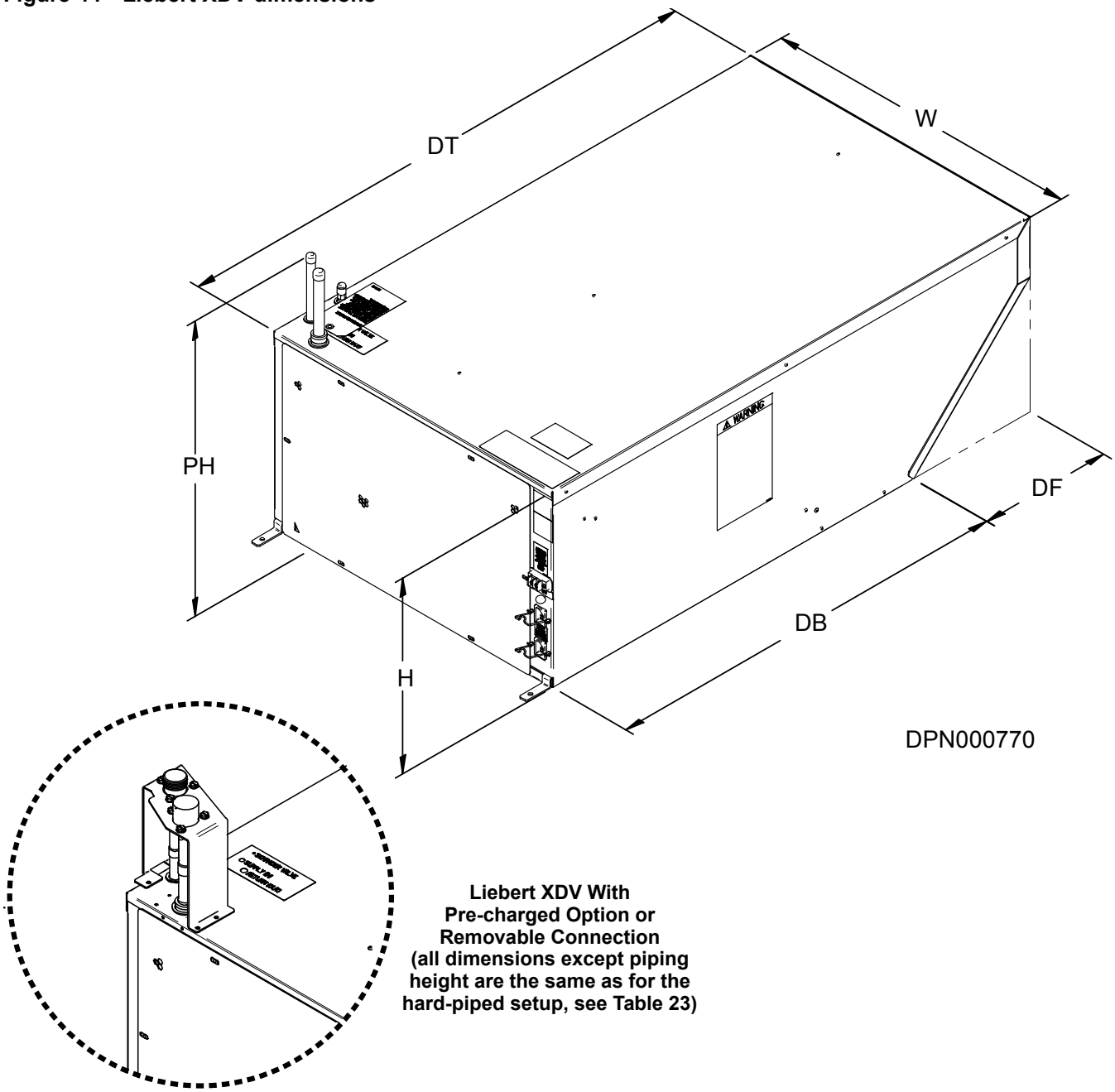
4.9 Liebert XDV Standard Features

- **Micro Channel Heat Exchanger**—The Liebert XDV unit includes one all-aluminum micro channel heat exchanger.
- **Dual IEC Power Cords and Power Inlets**—The Liebert 115V, 60Hz Liebert XDV unit is supplied with two detachable, 10 ft (3m) power cords that attach to two IEC power inlets in the rear of the unit. Each power cord has a NEMA 5-15P (IEC 320-C14) plug at the opposite end. The Liebert 230V, 60/50 Hz Liebert XDV unit is supplied with two non-detachable 10 ft (3m) power cords. This feature allows the unit to be powered by two separate power sources.
- **Dual Air Inlets**—The Liebert XDV unit can be configured to allow air to enter from the rear grille or the bottom of the unit.
- **Dual Fans**—Airflow is provided by two fans on the front of the unit. Dual switches—Controls on the front of the unit permit the use of one fan or both fans.
- **Foundation Mounting**—There are two 1/4-20 cage nuts located on the underside of unit which allow direct attachment to any Liebert Foundation cabinet, bolts provided with Liebert XDV unit.
- **Mounting Clips for Non-Liebert Cabinets**—The Liebert XDV unit is supplied with mounting clips that allow attachment to a non-Liebert cabinet (Some drilling may be required).

4.10 Optional Features—Liebert XDV

- **Refrigerant Pre-Charge**—The Liebert XDV can be precharged with refrigerant. The unit will have the one-shot fittings and will be pressurized. The one-shot Liebert XD Flex Piping will also be precharged with refrigerant.
- **External Mounting Brackets**—The Liebert XDV can be suspended from the overhead building structure. The external mounting brackets are ship-loose items.
- **Field-Installed Flexible Piping** (for use with prefabricated piping assemblies)—Field-installed flexible piping kits are available in lengths of 4, 6, 8 and 10 feet (1.2, 1.8, 2.4 and 3 meters). Connection style to the unit end may be straight or 90 degrees with one-shot or removable connections. Flex pipes with one-shot connections will have pressurized R134a. Flex pipes with removable connections will have a low pressure nitrogen charge Connection to the prefabricated piping assembly is with a threaded coupler. For information on acquiring the correct kit for your installation, refer to DPN000781, available from Liebert by calling 1-800-LIEBERT and from your local Emerson Network Power representative.
- Smart Module—Liebert XDV smart modules allow remote shutdown, fan failure alarms and automatically switching the second fan On and Off. This saves energy by permitting the unit to run with one fan and switching on a second fan when the temperature requires both fans for cooling. For electrical connection details, refer to the Liebert XDV user manual, SL-16626, available on the Liebert Web site: **www.liebert.com**

Figure 44 Liebert XDV dimensions



Liebert XDV With Pre-charged Option or Removable Connection (all dimensions except piping height are the same as for the hard-piped setup, see Table 23)

Table 23 Dimensional data

Illustration Key	Dimension	Measurement, in. (mm)
DT	Depth Top	39-1/2 (1003)
DB	Depth Bottom	29-5/8 (752)
W	Width	22-7/8 (581)
H	Height	14 (356)
PH	Piping Height, hard-piped	18-5/8 (473)
	Piping Height, one-shot option or removable connection	19-5/8 (498)
DF	Depth Front	9-7/8 (250)

Figure 45 Liebert XDV dimensions with one-shot connection

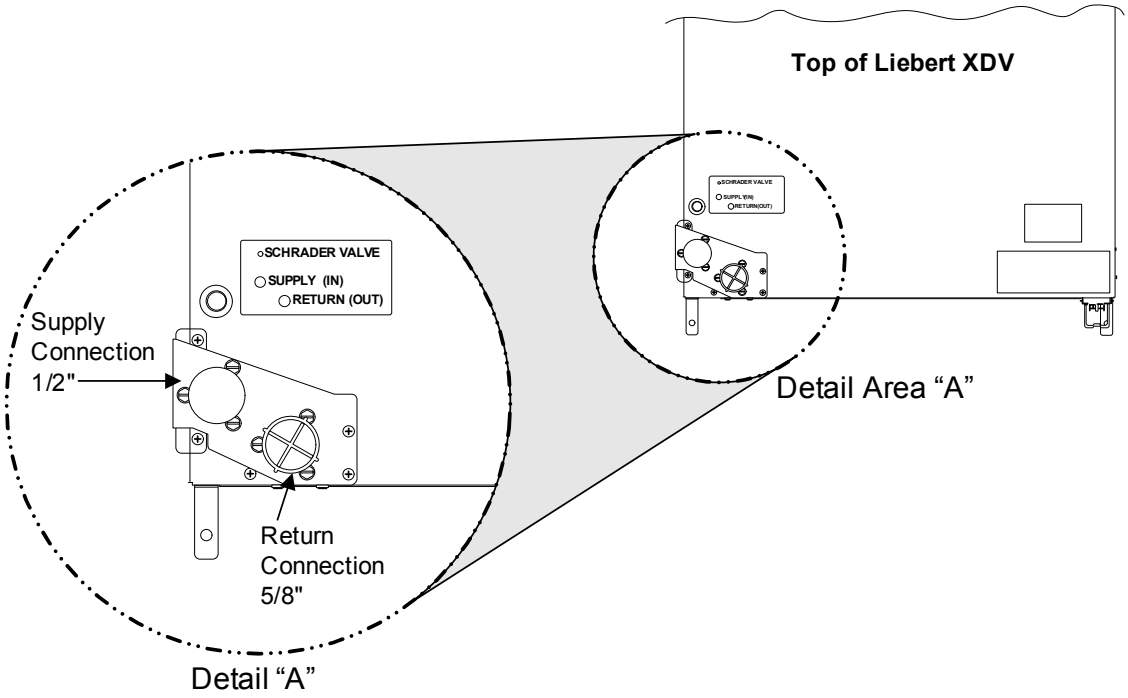


Figure 46 Suspending single Liebert XDV from Unistruts

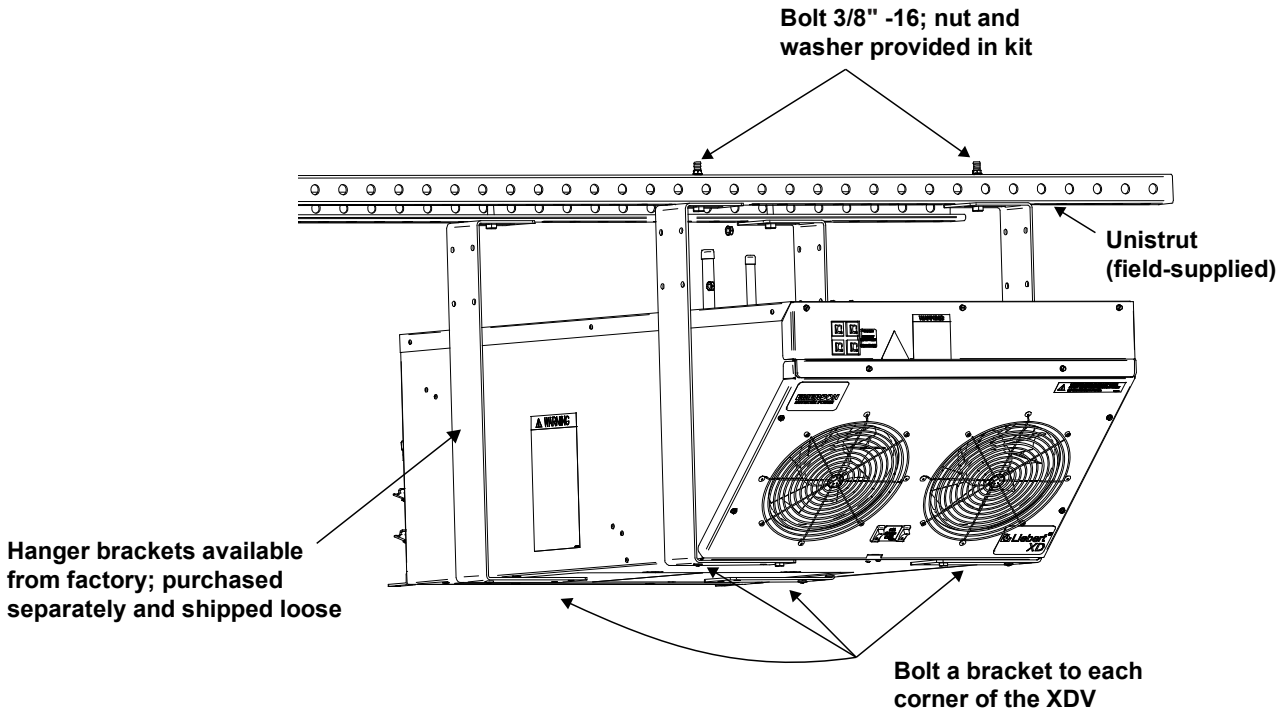


Figure 47 Suspending single Liebert XDV from the roof structure

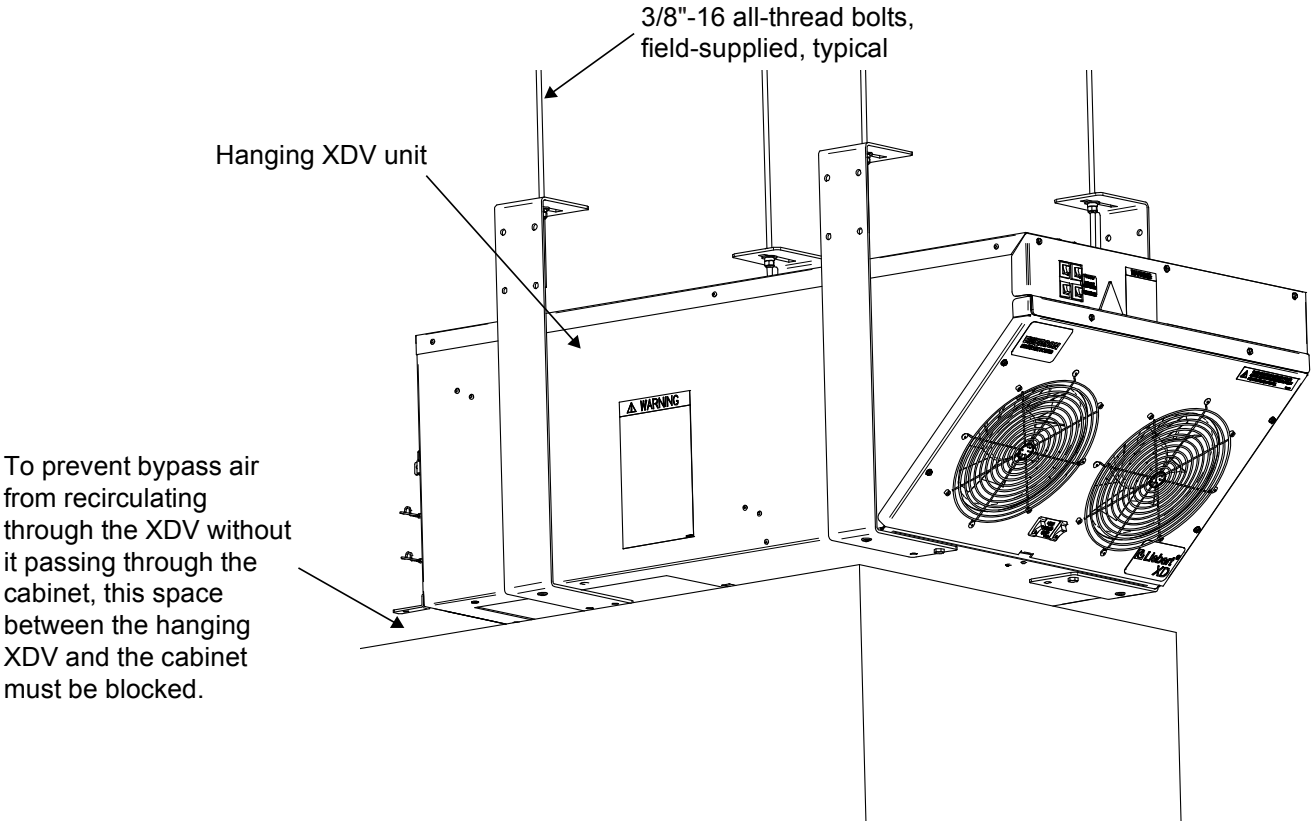
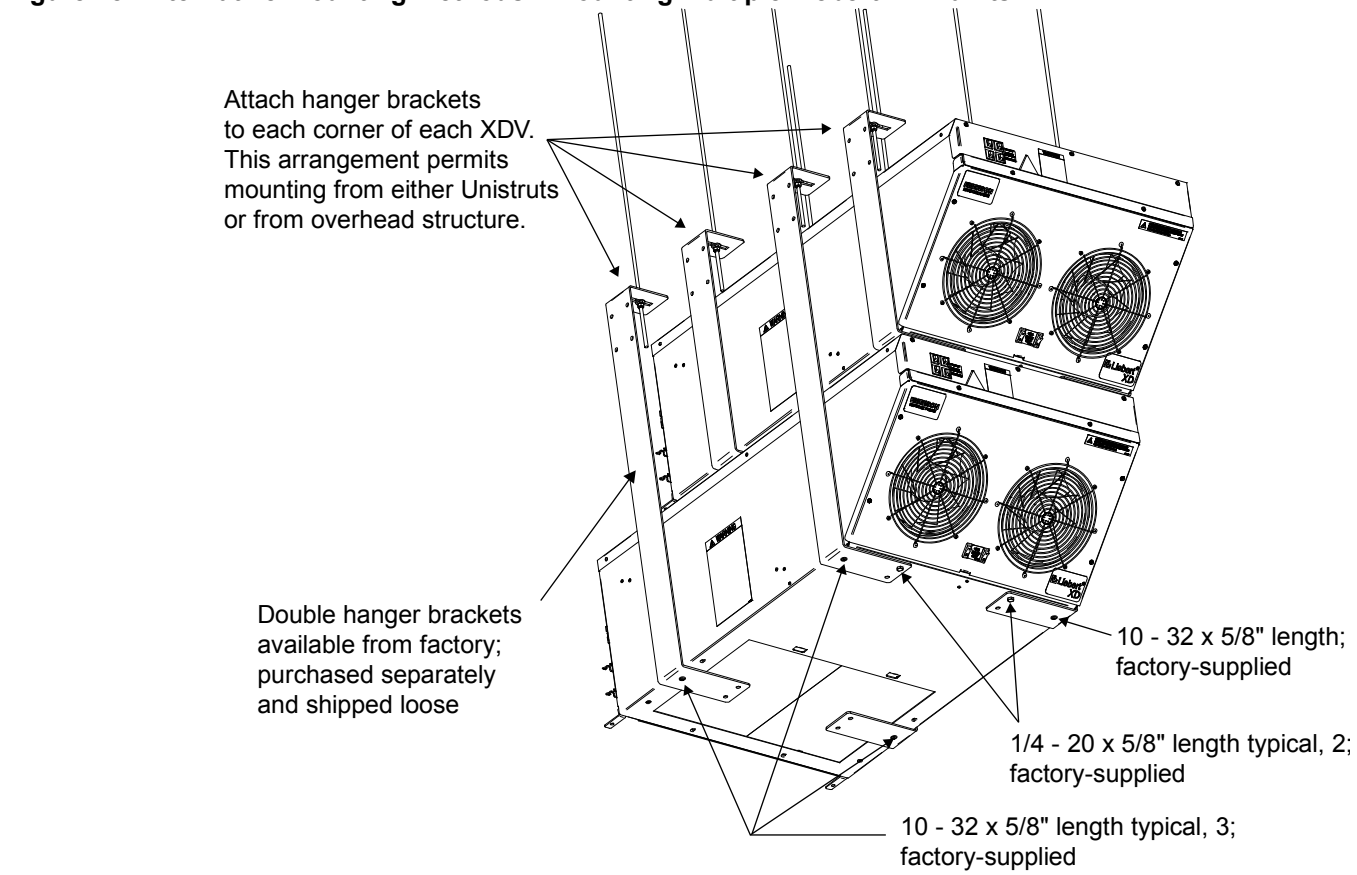
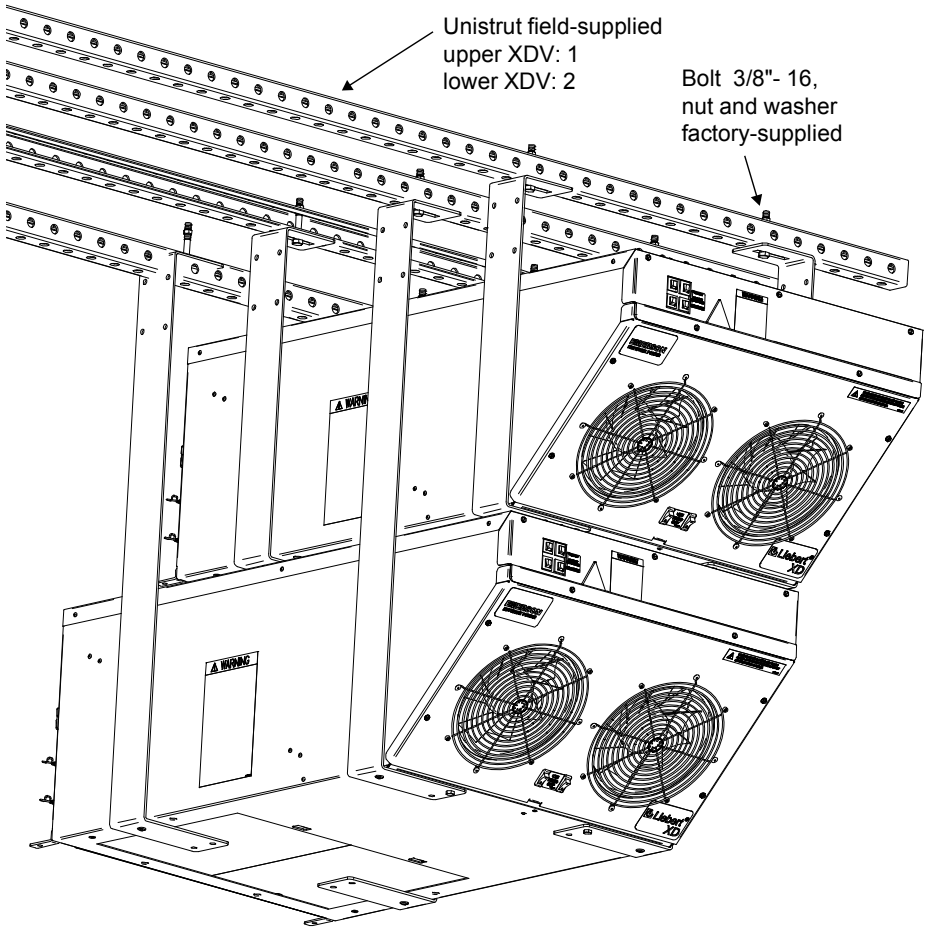


Figure 48 Alternative mounting methods—mounting multiple Liebert XDV units





5.0 LIEBERT XDC AND LIEBERT XDP

5.1 Liebert XDC Standard Features

- **Compressors**—Scroll with a suction gas cooled motor, vibration isolators, thermal overloads, manual reset high-pressure switch and pump down low-pressure switch.
- **Refrigeration System**—Dual refrigeration circuits each including liquid line filter dryers, refrigerant sight glass with moisture indicator, electronic control valve, adjustable externally equalized expansion valves and liquid line solenoid valves.
- **Heat Exchanger**—Brazed plate design with interwoven circuiting constructed of stainless steel plates, copper brazed.
- **Pumps**—Centrifugal type, end suction, canned rotor design.
- **Microprocessor Control**—The control system is microprocessor-based with an external LCD numerical display to allow observation of specified adjustable functions. Normal operating conditions are indicated on the LCD panel, which is mounted either on the unit or on the wall, depending on application details (see user manual, SL-16671). The control system also monitors unit operation and activates an alarm when any of the specified factory preset conditions are exceeded.
- **Cabinet and Frame**—Custom, powder-painted steel panels. A hinged control access panel opens to a second front panel, which is a protected enclosure for all high-voltage components. Frame is constructed of 14 gauge heliarc welded tubular steel and painted using an auto-deposition coating system.

5.1.1 Liebert XDC Optional Features

- **Water / Glycol Condensers**—A water/glycol floor stand condenser option is available for heat rejection requirements. The water/glycol floor stand can be located beneath the XDC unit or installed nearby.

Figure 49 Liebert XDC dimensional data

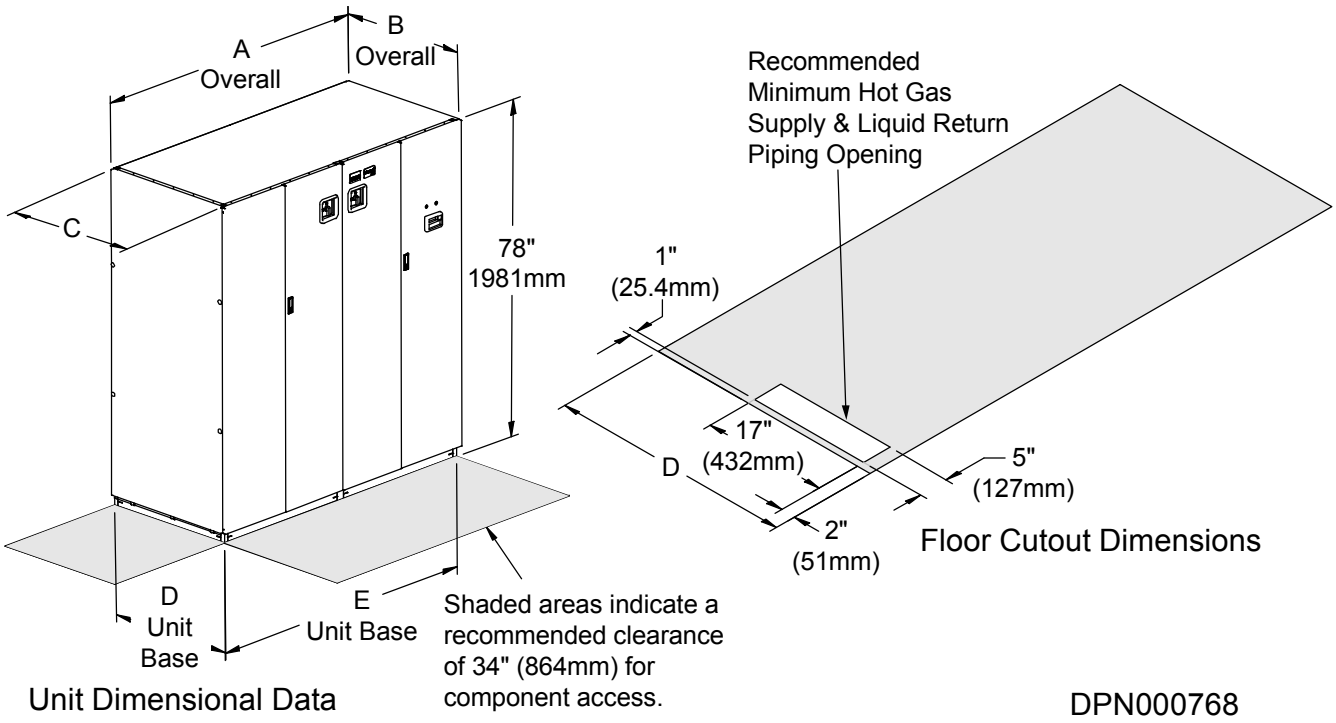
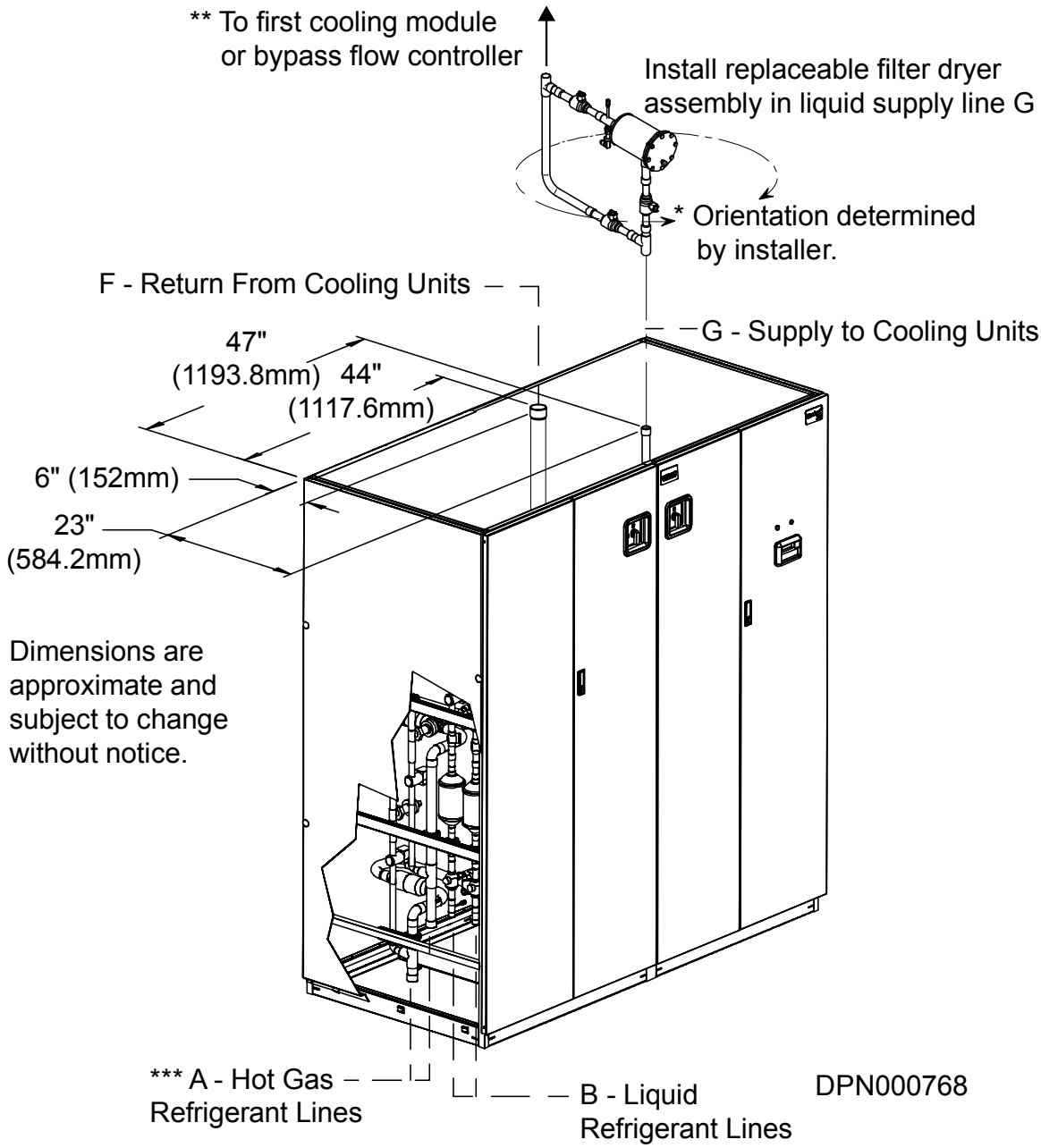


Table 24 Liebert XD Chiller dimensions, weight

Air Cooled Model	Dimensional Data, inches (mm)					Shipping Weight, lb (kg)	
	A	B *	C	D	E	Domestic	Export
Liebert XDC160	74 (1880)	34 (864)	33-1/8 (841)	33 (838)	72 (1829)	1945 (882)	2093 (949)

* Dimension does not include the bezel of the disconnect switch.

Figure 50 Liebert XDC piping locations



* Allow 8" (204mm) of clearance for filter replacement

** To ensure all refrigerant flow is filtered, install the filter dryer assembly between the discharge line of the XDC and the first bypass flow controller or the first cooling module.

*** Use double discharge risers in DX hot gas lines that are 15 feet (4.6m) in height. This will allow proper oil return to the compressors when the system is running at low loads. Refer to the Liebert XDC user manual SL-16671 for further information.

Table 25 Liebert XD Chiller piping connection sizes

Air Cooled Models	Piping Outlet Connection Sizes, OD Cu, inches						
	A	B	C	D	E	F	G
Liebert XDC160	1-3/8	7/8	-	-	-	2-1/8	1-1/8

Figure 51 Positioning a water/glycol Liebert XDC for placement on a floor stand

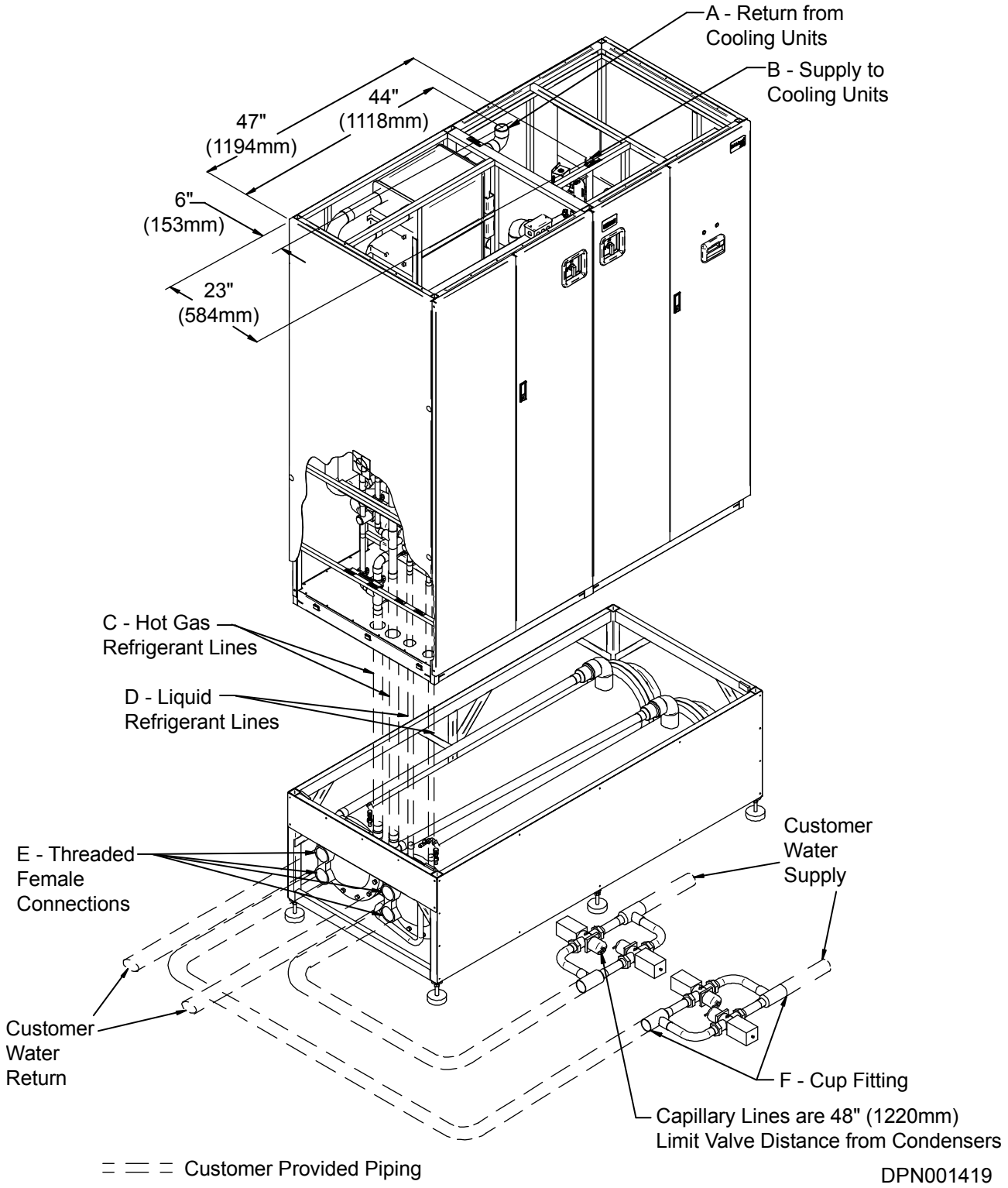


Table 26 Liebert XDC Water/Glycol Piping Connection Sizes

Model	Piping Outlet Connection Sizes, OD Cu, inches					
	A	B	C	D	E*	F**
XDC160	2-1/8	1-1/8	1-3/8	7/8	2-1/2	2-1/8 or 2-5/8

* Threaded Female Connection

** 2-1/8" for 1" WRV, 2-5/8" for 1-1/4" WRV

Figure 52 Piping locations—floor stand and valve assembly

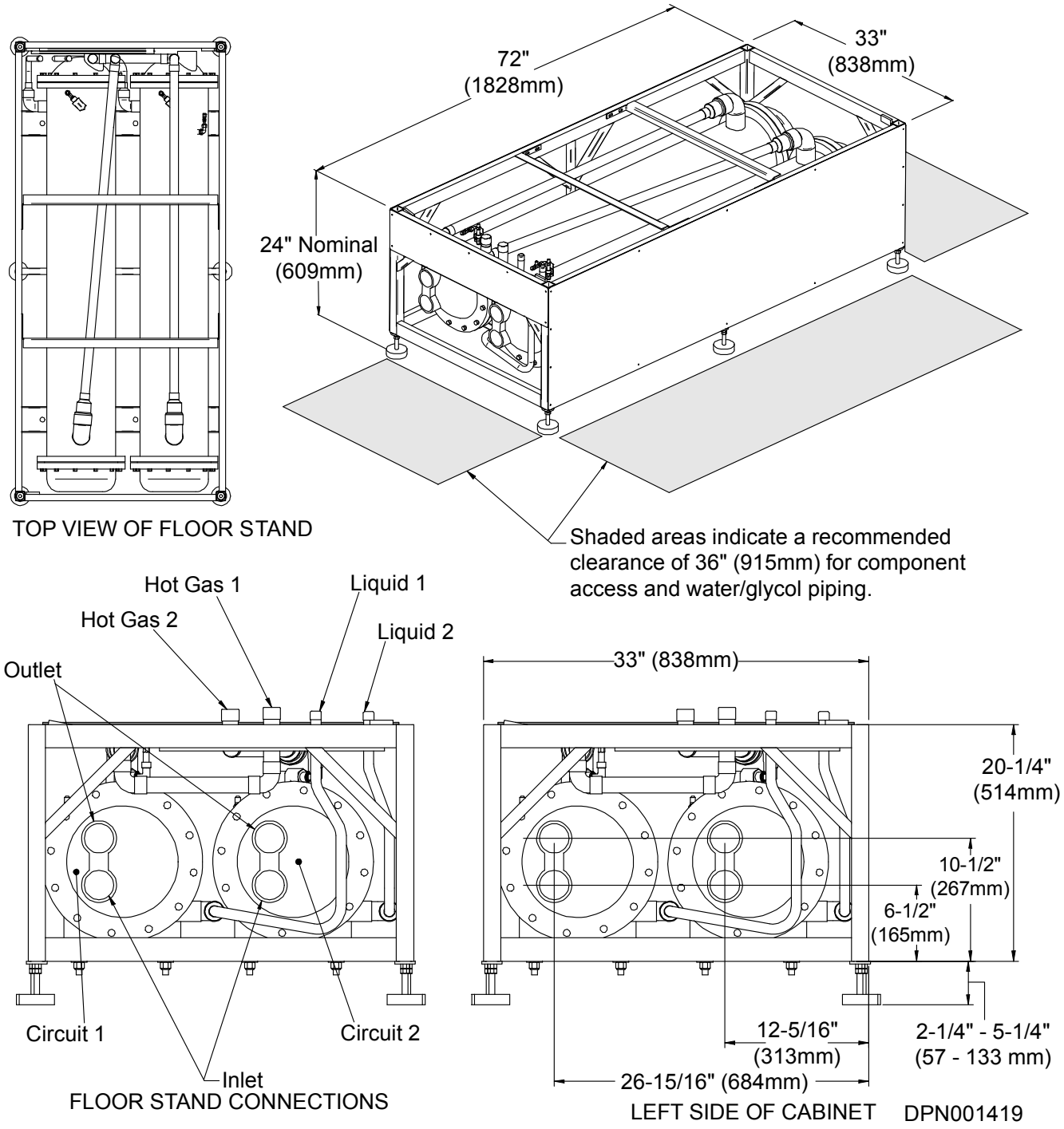


Figure 53 Front view of Liebert XDC and electrical enclosures

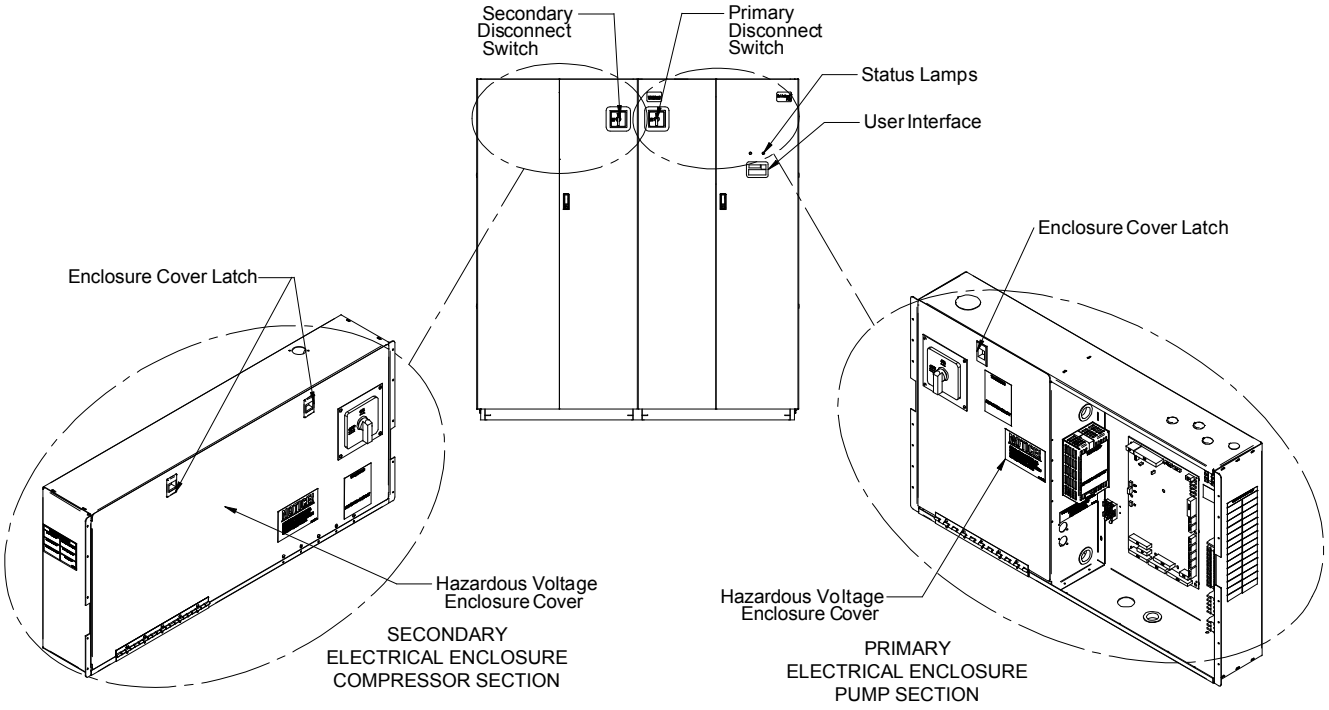


Figure 54 Liebert XDC electrical enclosure knockout locations for field wiring

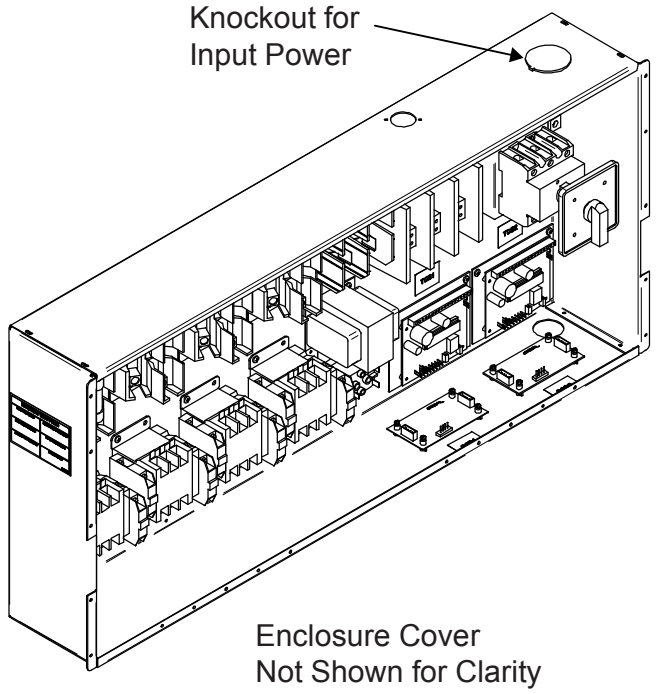


Figure 55 Liebert XDC high-voltage connections—primary disconnect switch, 60Hz models

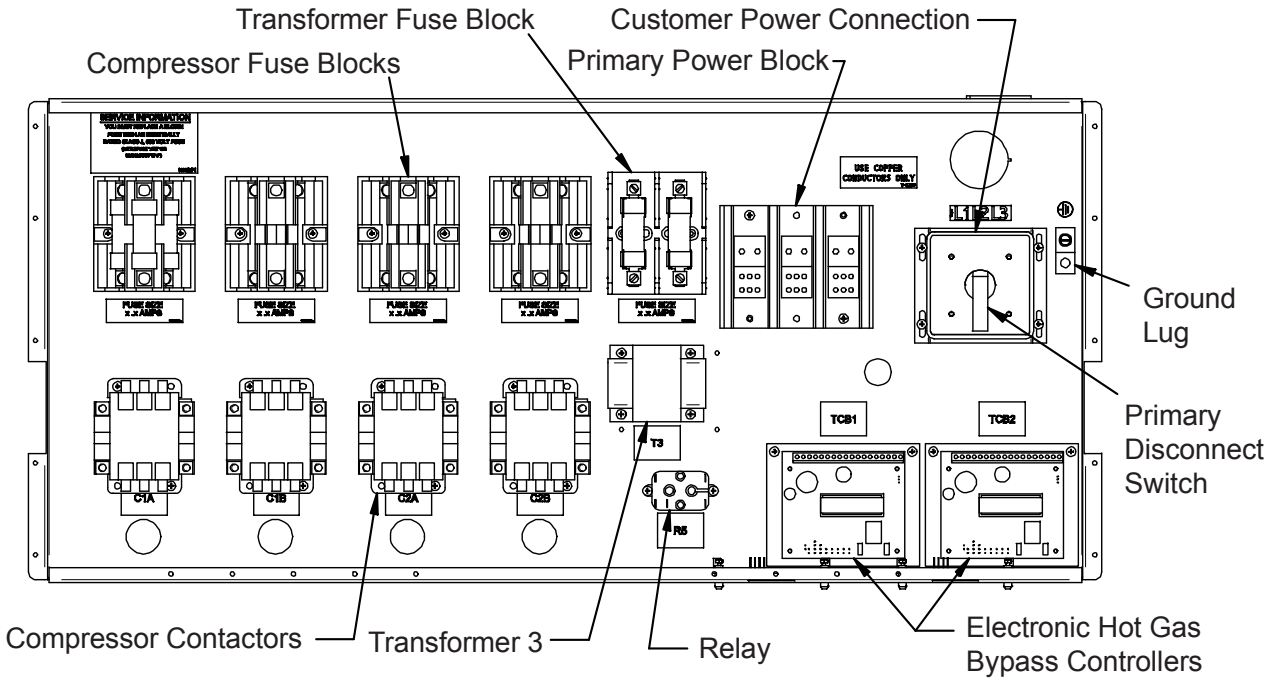


Figure 56 Liebert XDC high-voltage connections—primary disconnect switch, 50Hz models

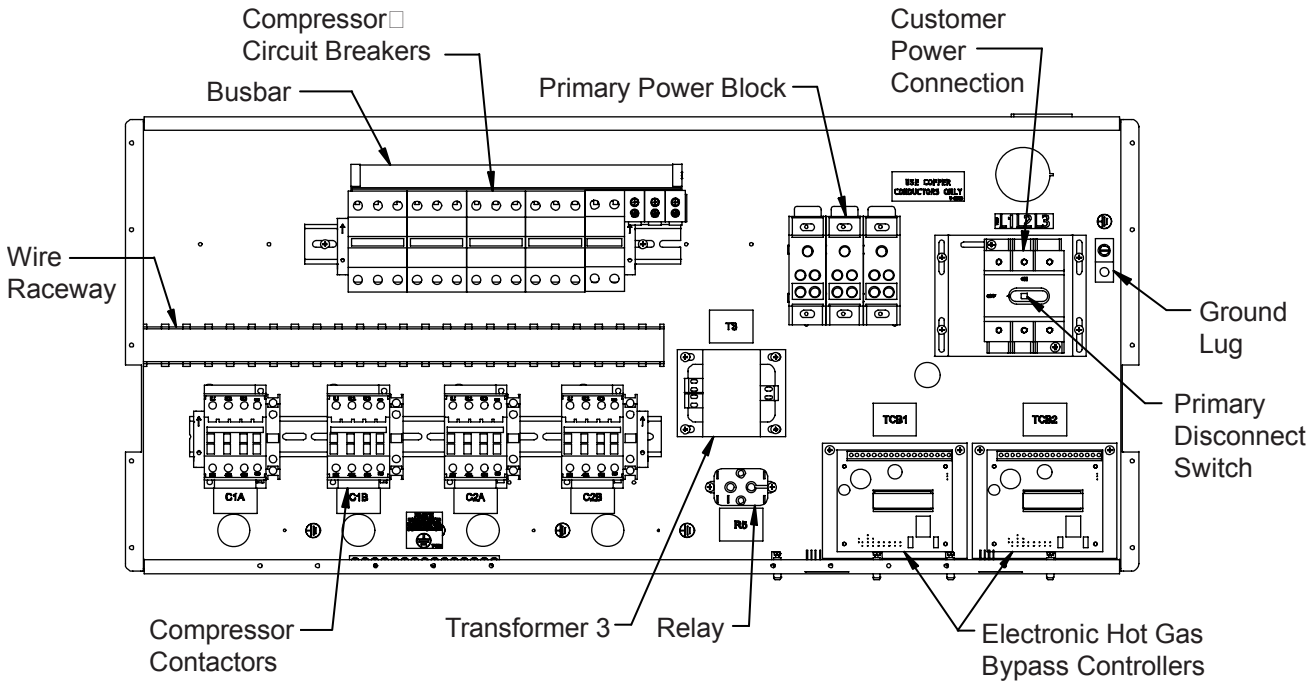


Figure 57 Liebert XDC high-voltage connections—secondary disconnect switch, 60Hz models

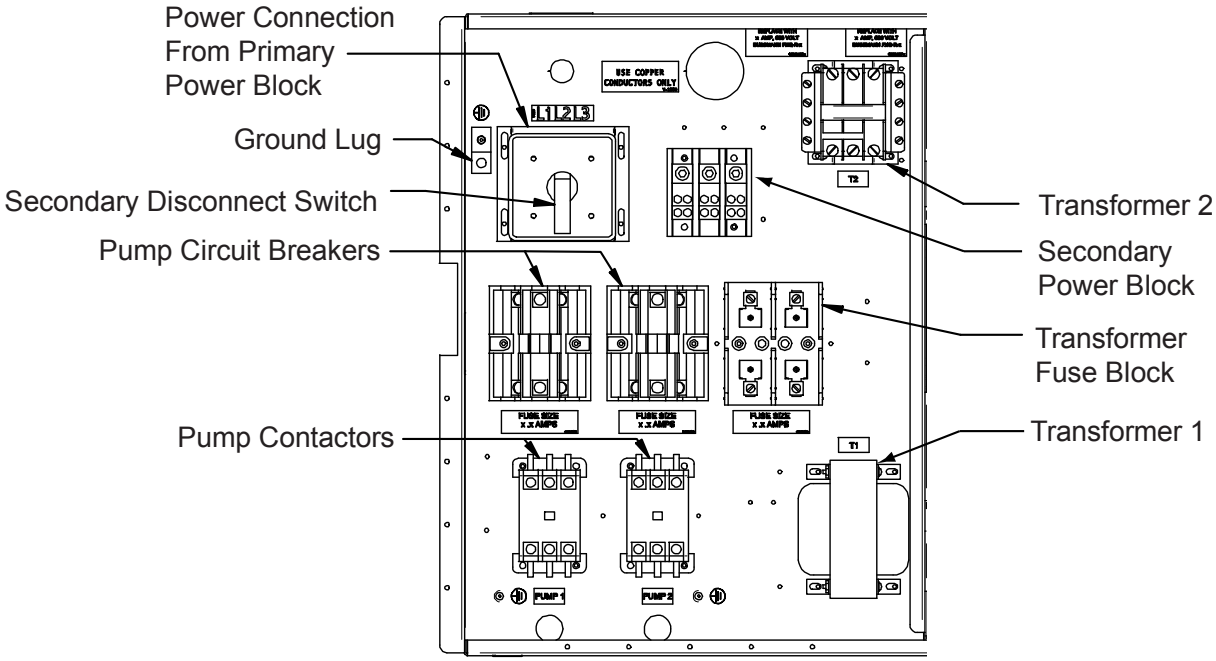


Figure 58 Liebert XDC high-voltage connections—secondary disconnect switch, 50Hz models

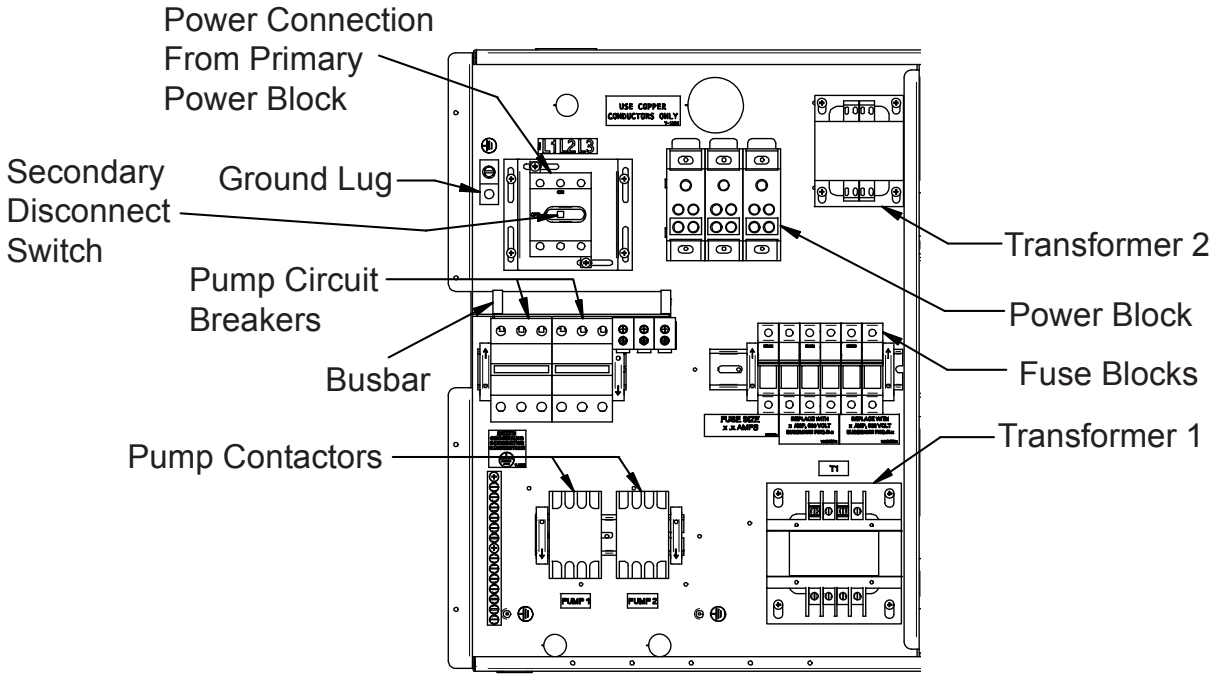


Figure 59 Liebert XDC heat rejection electrical connection points

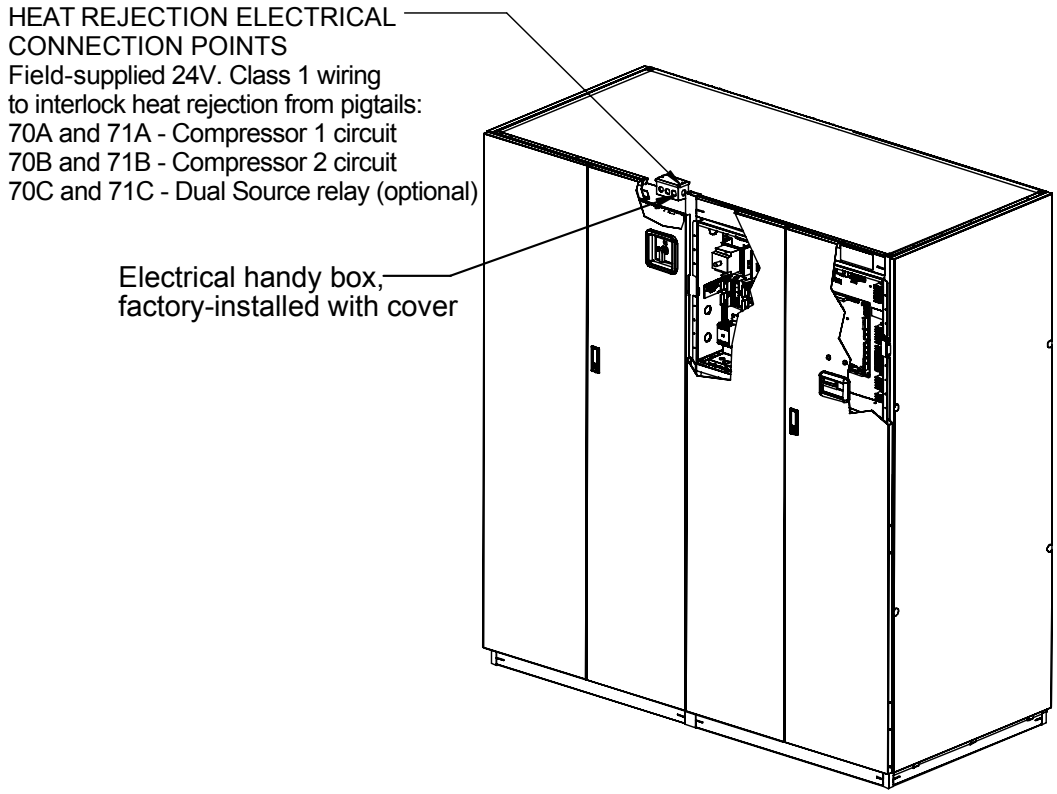


Figure 60 Liebert XDC electrical enclosure knockout locations for Extra Low-Voltage connections

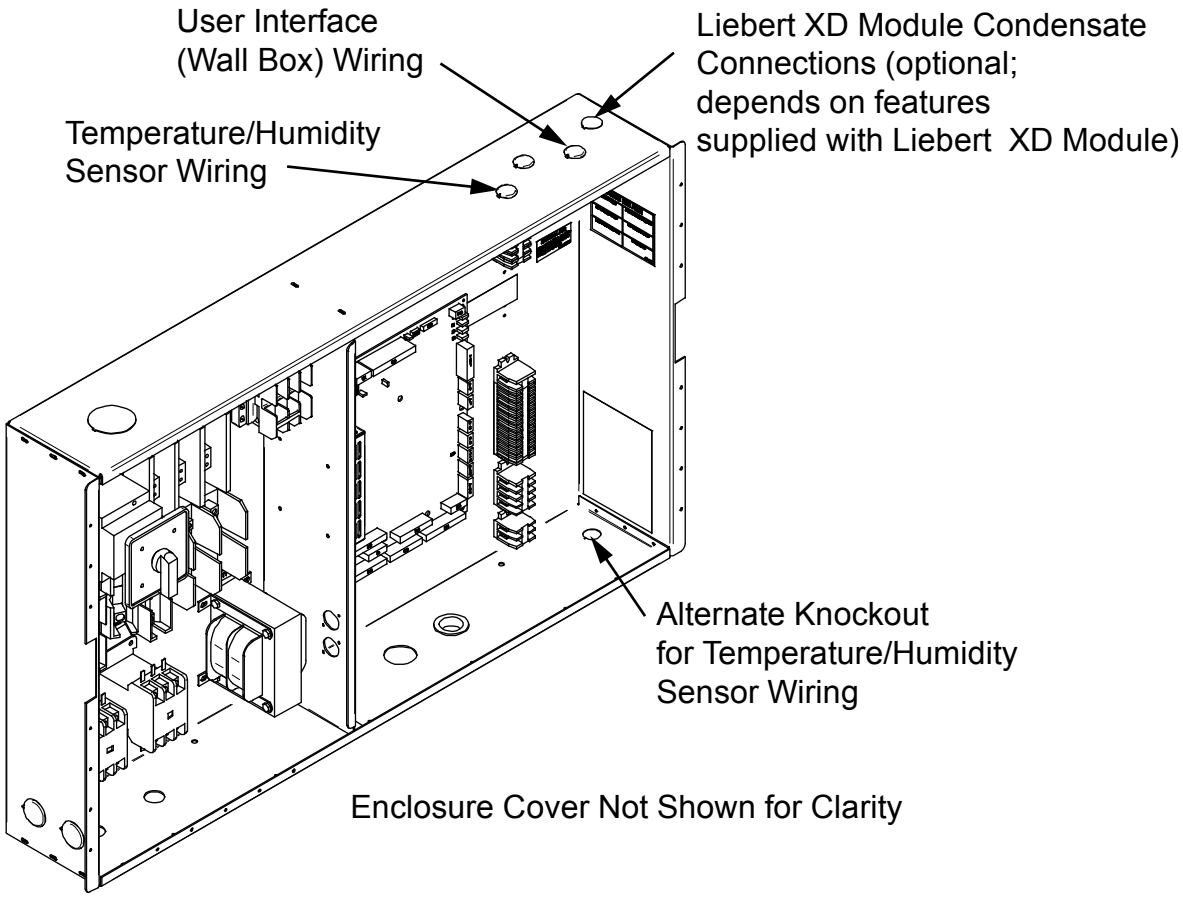
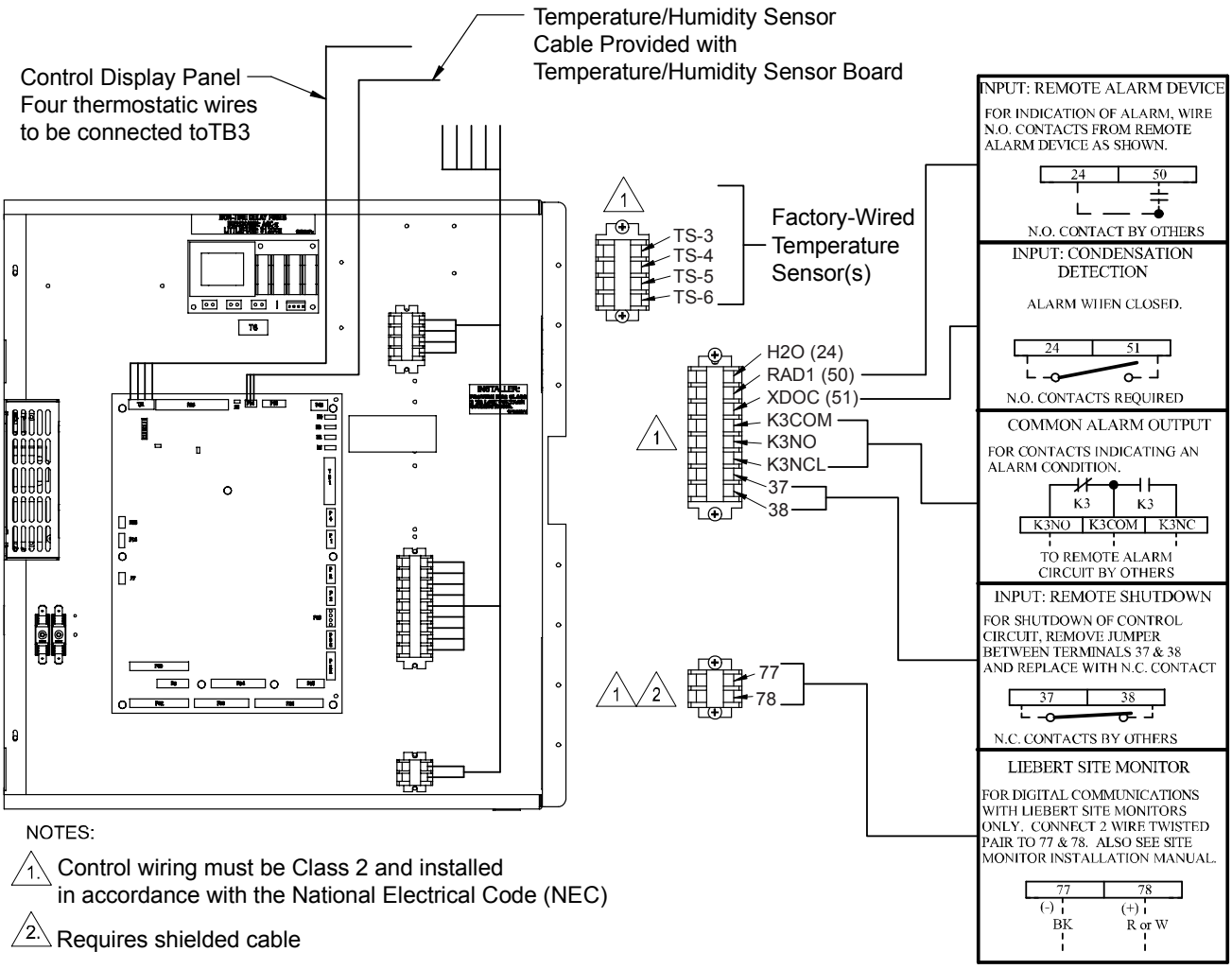


Figure 61 Liebert XDC Extra Low Voltage field-connection points



NOTES:

1. Control wiring must be Class 2 and installed in accordance with the National Electrical Code (NEC)
2. Requires shielded cable

5.2 Liebert XDP Standard Features

- **Heat Exchanger**—Brazed plate design with interwoven circuiting constructed of stainless steel plates, copper brazed.
- **Pumps**—Centrifugal type, end suction, internally cooled, canned rotor design.
- **Cabinet and Frame**—Custom powder painted steel panels. A hinged control access panel opens to a second front panel, which is a protected enclosure for all high-voltage components. Frame is constructed of 14 gauge heliarc welded tubular steel and painted using an auto-deposition coating system.
- **Liebert iCOM**—The Liebert iCOM offers the highest capabilities in unit control, communication and monitoring of Liebert Precision Cooling units. The Liebert iCOM is a factory-installed assembly. Operating conditions and status are indicated on the unit display, which is mounted either on the unit or on the wall, depending on application details (see user manual, SL-16644). The control system also monitors unit operation and activates an alarm when any of the specified factory preset conditions are exceeded.

  The unit includes two temperature-humidity sensors to aid in effective cooling.

Figure 62 Liebert XDP dimensions

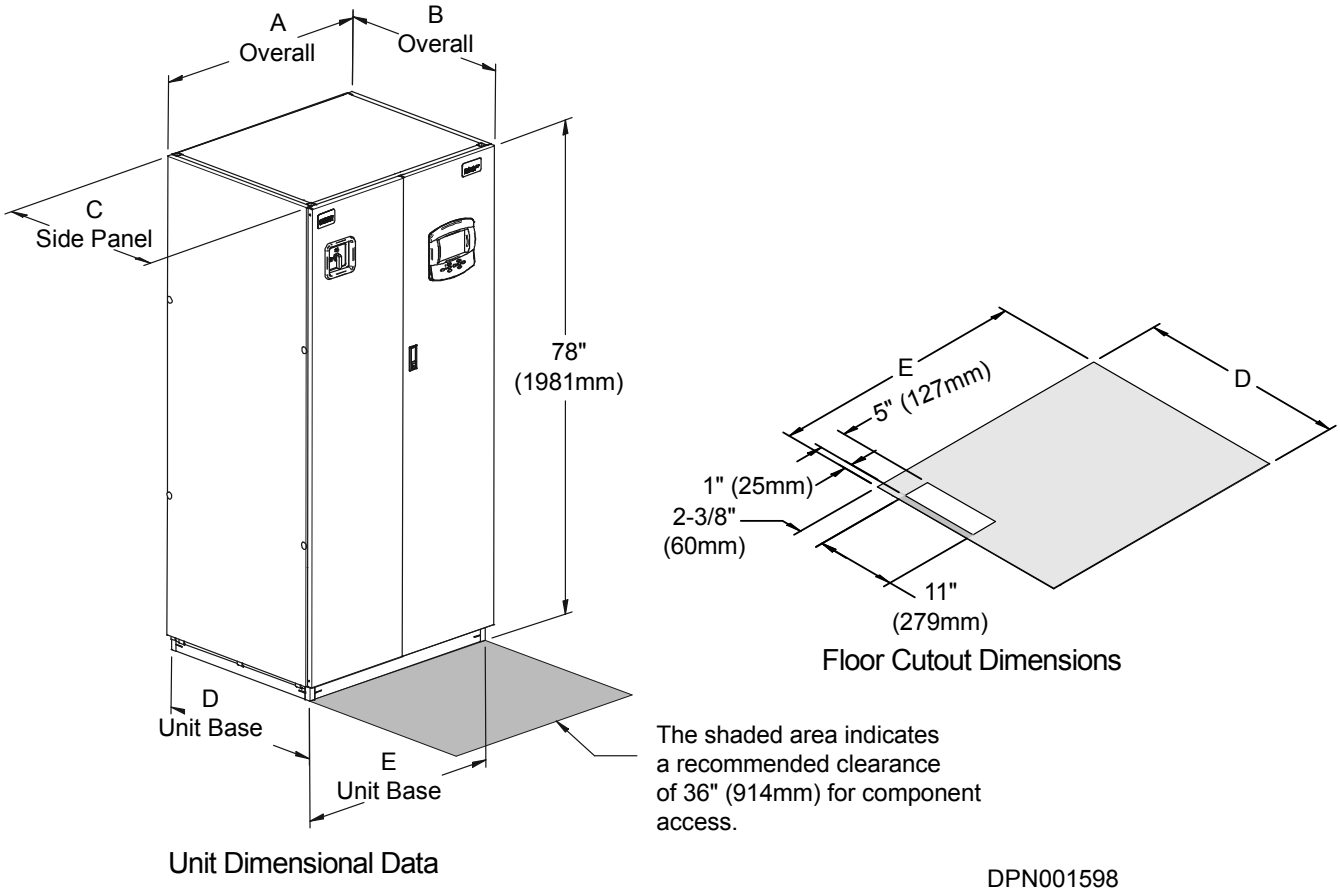


Table 27 Liebert XDP dimensions

Model	Dimensional Data inches (mm)					Shipping Weight, lb (kg)	
	A	B *	C	D	E	Domestic	Export
Liebert XDP160	38 (965)	34 (864)	33-1/8 (841)	33 (838)	36 (914)	990 (449)	1067 (484)

* The dimension does not include the bezel of the disconnect switch.

Figure 63 Liebert XDP piping access points and external features

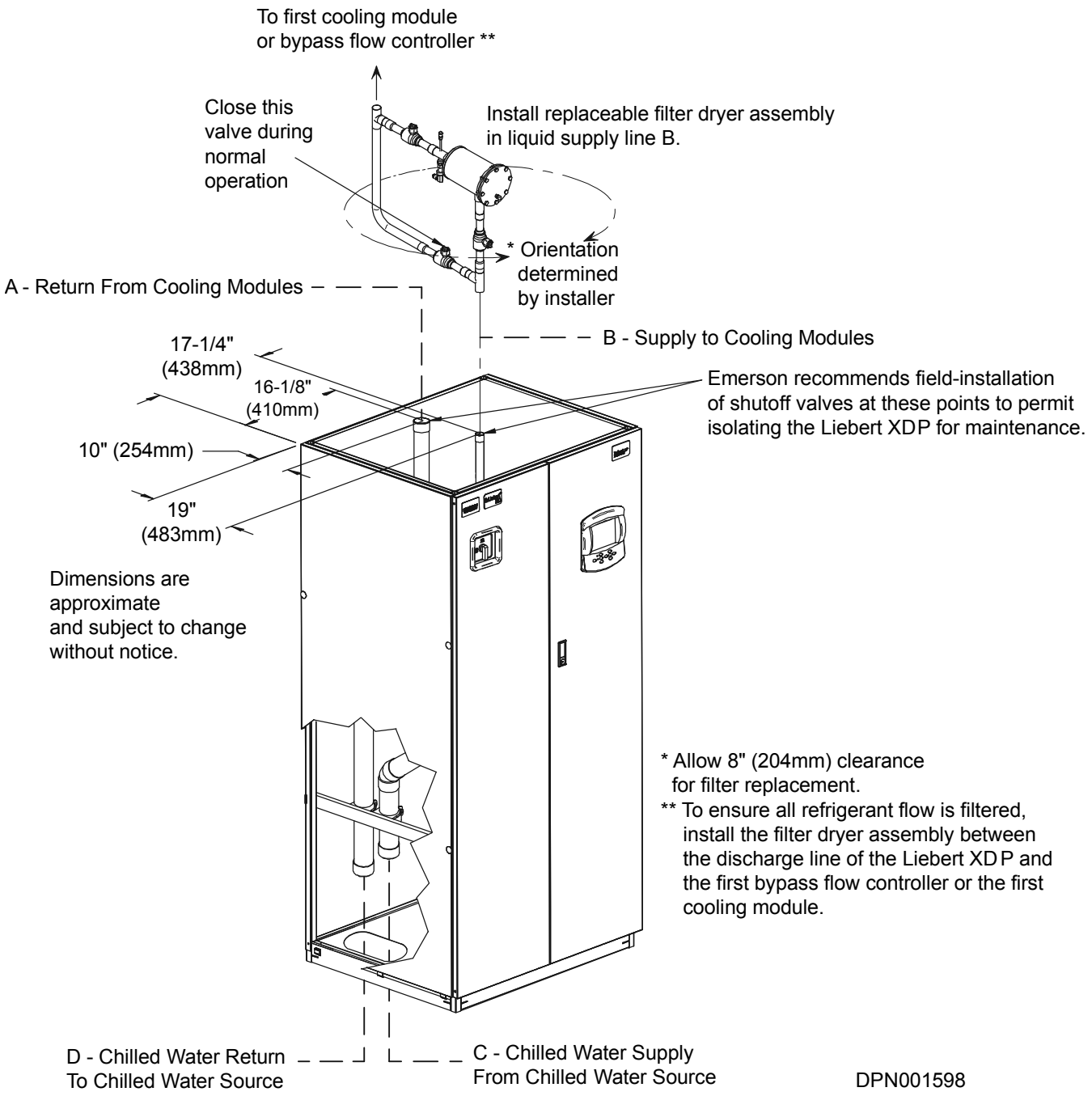


Table 28 Unit piping outlet connection sizes, inches, OD Cu

Model	Pipe Connection Point			
	A	B	C	D
Liebert XDP160	2-1/8	1-1/8	2-5/8	2-5/8

Figure 64 Front view of Liebert XDP and electrical enclosure

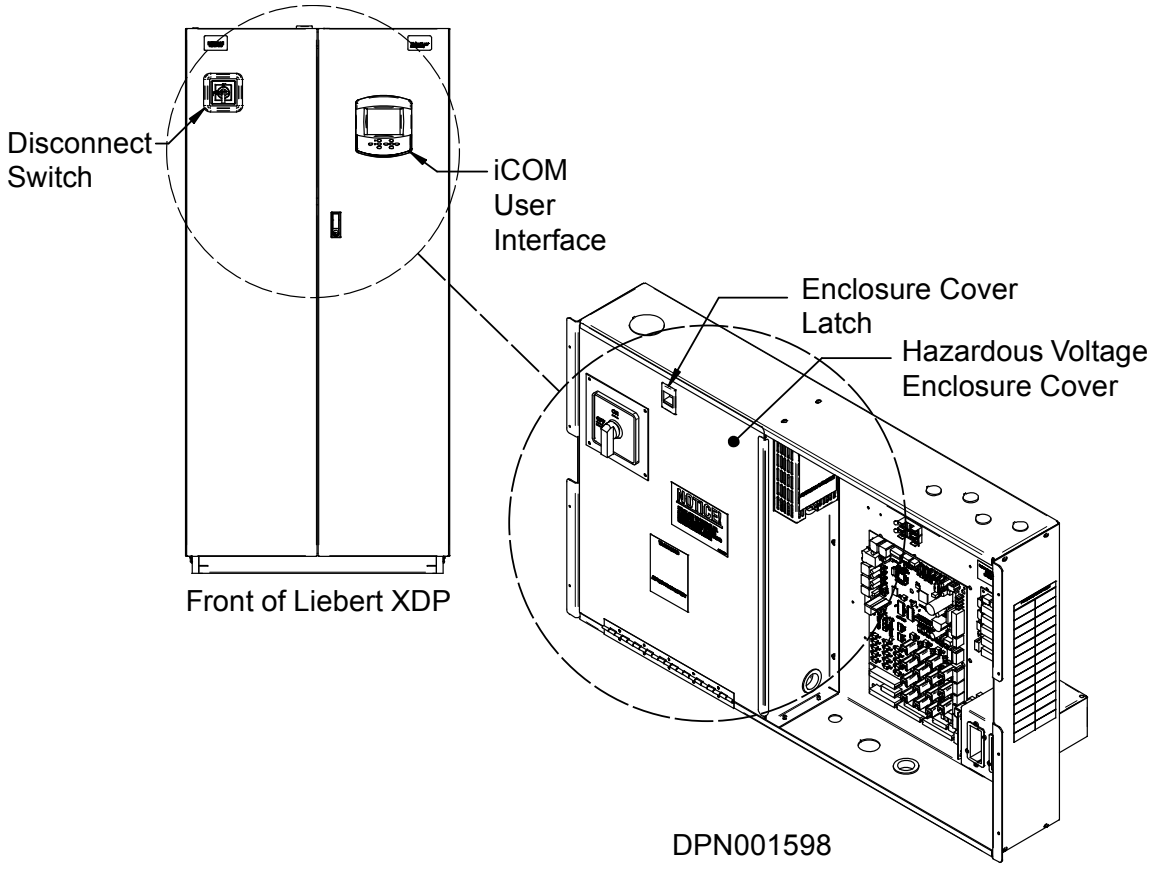


Figure 65 Liebert XDP electrical enclosure knockout location for hazardous voltage wiring

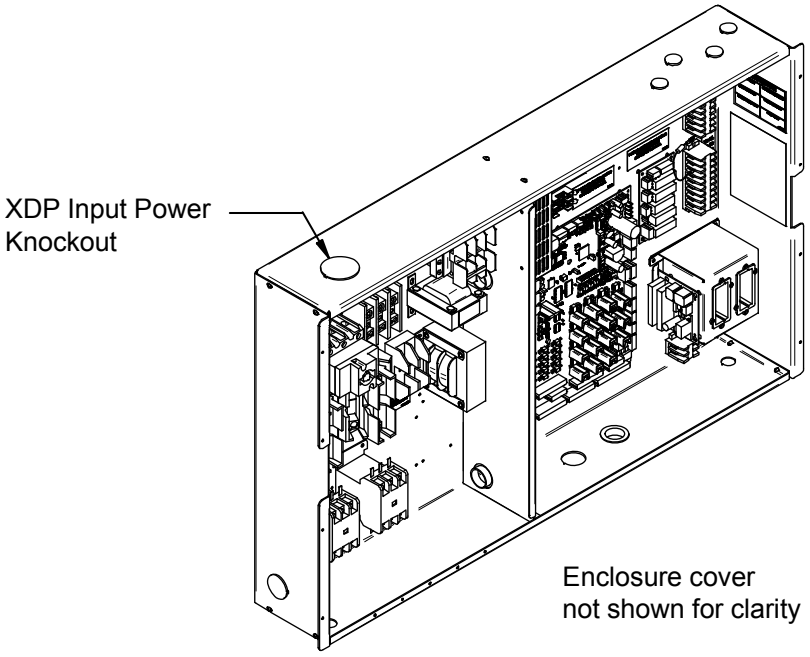


Figure 66 Liebert XDP electrical enclosure knockout locations for field wiring

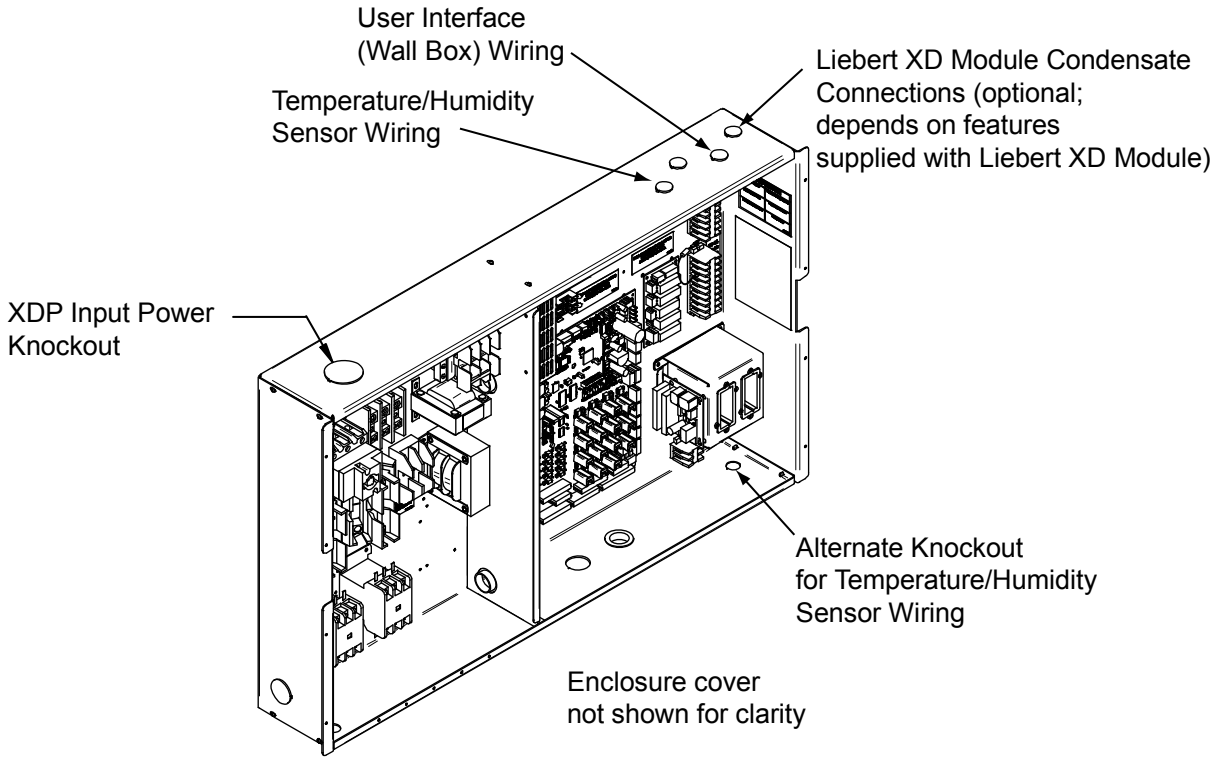


Figure 67 Liebert XDP high-voltage connections—60Hz

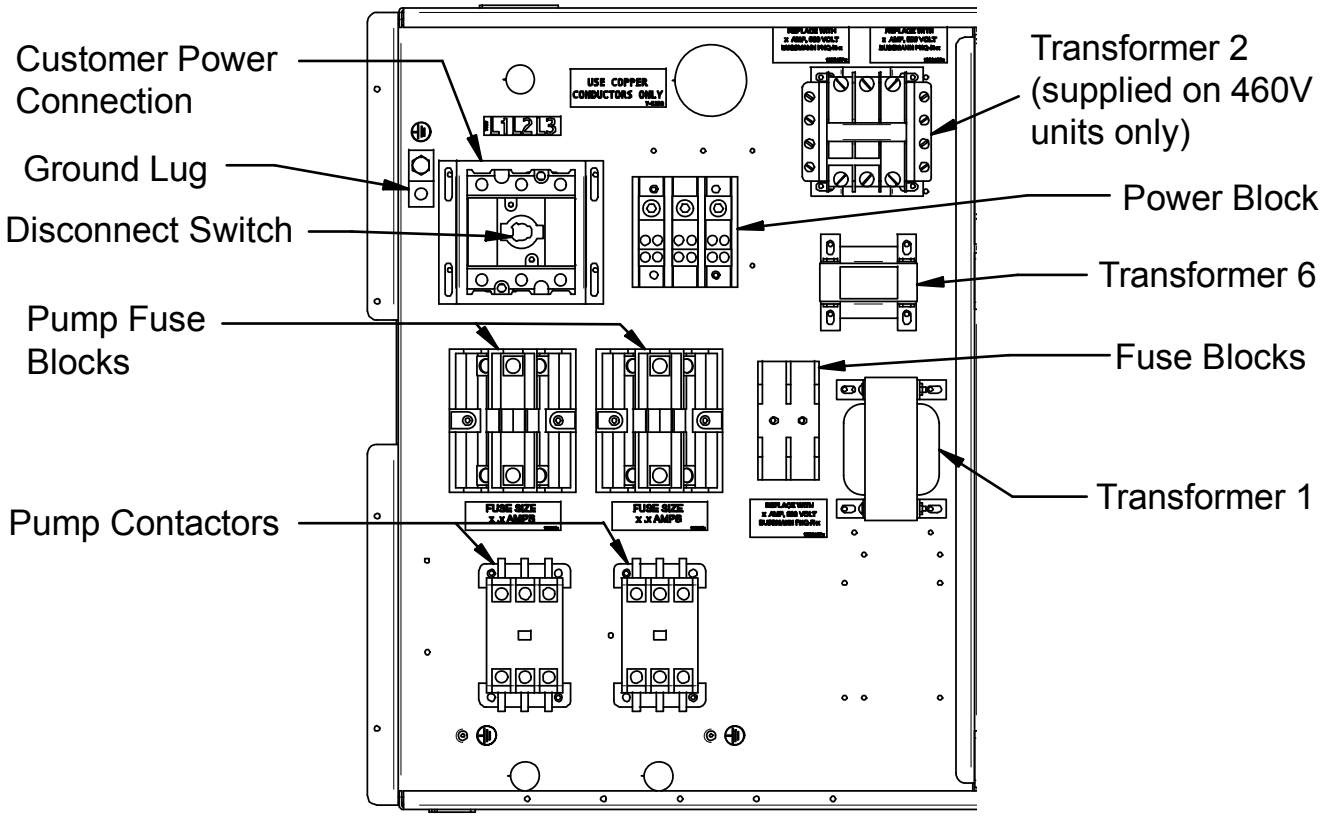
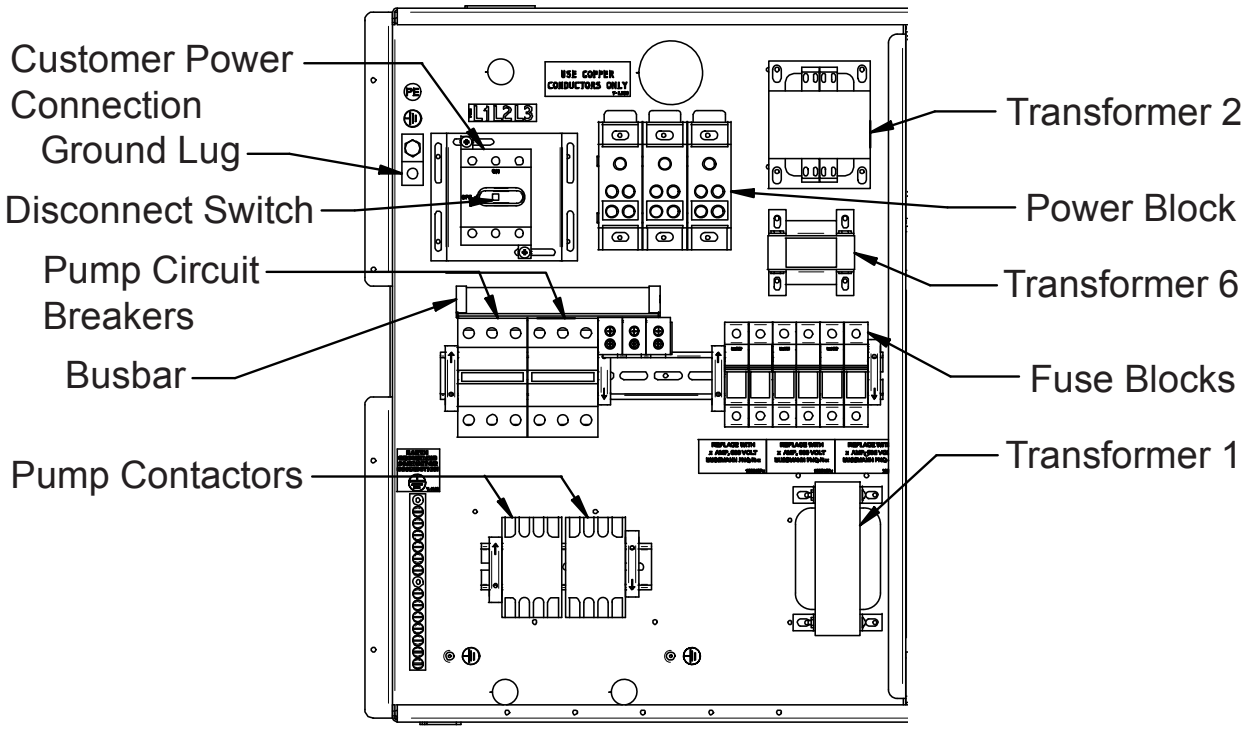


Figure 68 Liebert XDP high-voltage connections—50Hz



6.0 SPECIFICATIONS AND MODEL NUMBER NOMENCLATURE

Table 29 Liebert XDCF specifications

Models	XD-CF-10-BP-*, XD-CF-10-TP-* XD-CF-10-BPE-*, XD-CF TPE-*
Cooling capacity, maximum	10kWH / 2.8 Tons / 34,000 BTUh
Conditions	55°F (13°C) entering fluid temperature, 50°F (10°C) or lower dew point
Dimensions, inches (mm)	
Height – including pipe connections	31-3/8" (797mm)
Width	13-7/16" (341mm)
Depth	7-5/16" (186mm)
Weight, lb (kg)	
Unit only	18 (8.2)
Shipping weight	30 lb. (13.06 kg)
Pipe connections	
Refrigerant Supply from Liebert XDP/Liebert XDC	1/2" threaded one-shot coupling on the unit
Refrigerant Return to Liebert XDP/Liebert XDC	5/8" threaded one-shot coupling on the unit
Cabinet exterior finish	Gray
Agency	
Safety	CSA — CE

Figure 69 Liebert XDCF model number nomenclature

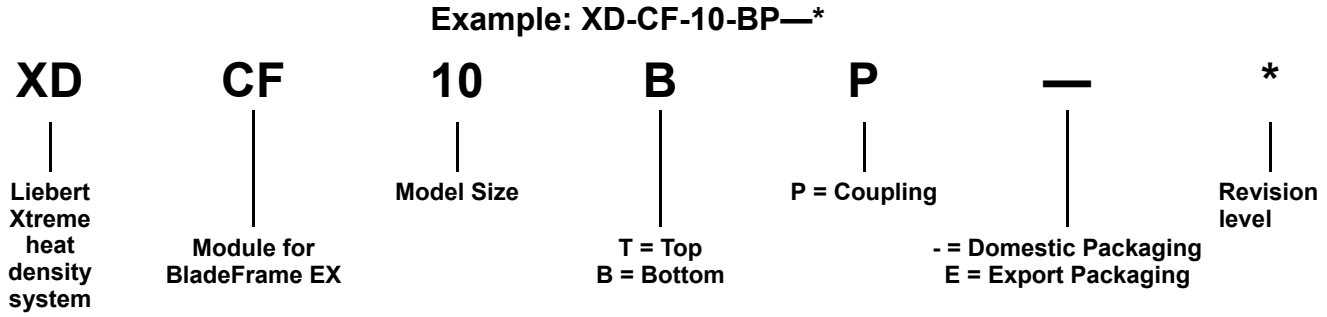


Table 30 Liebert XDH20 specifications

Models	XDH20BK [1] XDH20SK [1] (60Hz)	XDH20BS [1] XDH20SS [1] (50/60Hz)
Cooling Capacity	**XDH20**, 60Hz Nominal (98ºF [37°C] EAT): 22kW/6.3 Tons **XDH20**, 60Hz Maximum (105ºF [41°C] EAT): 25.3kW/7.2 Tons **XDH20**, 50Hz Nominal (98ºF [37°C] EAT): 21.6kW / 6.1 Tons **XDH20**, 50Hz Maximum (105ºF [41°C] EAT): 25.3kW/7.2 Tons	
Conditions	Capacity rating is @ 55ºF (13ºC) Entering Fluid Temperature and 50ºF (10ºC) or lower dew point	
Electrical Requirements		
Input	120V-1ph-60Hz	220-240V-1ph-50Hz, CE / 208-240V-1ph-60Hz, CSA
Input Power Connections	Two IEC320-C14 power inlets and two IEC power cords with NEMA 5-15P plugs	Two IEC320-C14 power inlets and two IEC power cords with IEC320-C14 plugs
Full Load Amps	5	2.5
Power Consumption, Nominal, Watts	600	575
Dimensions, inches (mm)		
Height—Unit Only	78 (1981)	
Height—Including Pipe Connections	80 (2032)	
Width	12 (305)	
Depth	42 (1067)	
Weight, lb (kg)		
Unit Only	233 (106)	233 (106)
Shipping Weight	317 (144)	317 (144)
Number of Fans	6	
Airflow, Nominal, ft^3/min (m^3/hr)	2500 (4248)	2428 (4125)
Audible Noise, Sound Power	81 dBa	81 dBa
Pipe Connections		
Refrigerant Supply	1/2" OD, Cu (optional 1/2" threaded one-shot coupling on the unit)	
Refrigerant Return	7/8" OD, Cu (optional 7/8" threaded one-shot coupling on the unit)	
Serviceable Parts	Fans and electrical components	
Cabinet Exterior Finish	Black, matte finish, heat-fused powder coat	
Options		
Smart Module control board (factory-installed)	Dry contact (24VAC - 1A maximum)	
Pre-Charged Refrigerant	R-134a refrigerant, one-shot connections	
Air Diffusers	Uni-directional or bi-directional	
Agency		
Approvals	CSA 60Hz	CE 50Hz, CSA 50/60Hz

1. Refer to **Figure 70** for complete part number.

Table 31 Liebert XDH32 specifications

Models	XDH32BK [1] XDH32SK [1] (60Hz)	XDH32BS [1] XDH32SS [1] (50/60Hz)
Cooling Capacity	**XDH32**, 60Hz Nominal (98ºF [37°C] EAT): 30kW/8.5 Tons **XDH32**, 60Hz Maximum (105ºF [41°C] EAT): 34kW/9.7 Tons **XDH32**, 50Hz Nominal (98ºF [37°C] EAT): 30kW / 8.5 Tons **XDH32**, 50Hz Maximum (103ºF [39°C] EAT): 34kW/9.7 Tons	
Conditions	Capacity rating is @ 55ºF (13ºC) Entering Fluid Temperature and 50ºF (10ºC) or lower dew point	
Electrical Requirements		
Input	120V-1ph-60Hz	220-240V-1ph-50Hz, CE / 208-240V-1ph-60Hz, CSA
Input Power Connections	Two IEC320-C14 power inlets and two IEC power cords with NEMA 5-15P plugs	Two IEC320-C14 power inlets and two IEC power cords with IEC320-C14 plugs
Full Load Amps	10	5
Power Consumption, Nominal, Watts	1200	1150
Dimensions, inches (mm)		
Height—Unit Only	78 (1981)	
Height—Including Pipe Connections	80 (2032)	
Width	12 (305)	
Depth	42 (1067)	
Weight, lb (kg)		
Unit Only	246 (112)	246 (112)
Shipping Weight	330 (150)	330 (150)
Number of Fans	6	
Airflow, Nominal, ft^3/min (m^3/hr)	4000 (6796)	3850 (6541)
Audible Noise, Sound Power	86 dBa	86 dBa
Pipe Connections		
Refrigerant Supply	1/2" OD, Cu (optional 1/2" threaded one-shot coupling on the unit)	
Refrigerant Return	7/8" OD, Cu (optional 7/8" threaded one-shot coupling on the unit)	
Serviceable Parts	Fans and electrical components	
Cabinet Exterior Finish	Black, matte finish, heat-fused powder coat	
Options		
Smart Module control board (factory-installed)	Dry contact (24VAC - 1A maximum)	
Pre-Charged Refrigerant	R-134a refrigerant, one-shot connections	
Air Diffusers	Uni-directional or bi-directional	
Agency		
Approvals	CSA 60Hz	CE 50Hz, CSA 50/60Hz

1. Refer to **Figure 70** for complete part number.

Figure 70 Liebert XDH model number nomenclature

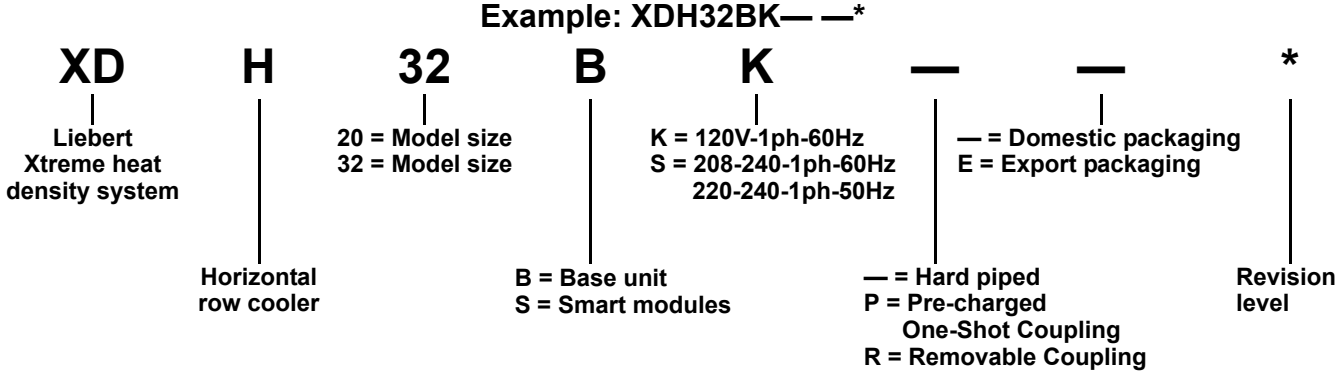


Table 32 Liebert XDO16 specifications

Models	XDO16BK [1] XDO16SK [1] (60Hz)	XDO16BS [1] XDO16SS [1] (60Hz)	XDO16BS [1] XDO16SS [1] (50Hz)
Cooling Capacity	Nominal (85°F [29.4°C] EAT): 16kW / 4.5 Tons Maximum (90°F [32°C] EAT): 17.3 kW / 4.9 Tons		Nominal (85°F [29.4°C] EAT): 14kW/4.0Tons Maximum (93°F [34°C] EAT): 17.3 kW / 4.9 Tons
Conditions	Capacity rating is @ 55°F (13°C) Entering Fluid Temperature and 50ºF or lower dew point		
Electrical Requirements			
Input Voltage	1ph-60Hz-120V	1ph-60 Hz-220-240V	1ph-50 Hz-220-240V
Input Power Connections	Terminal blocks provided internal to unit		
Full Load Amps	2.7A @ 120V	1.50 @ 230V	1.50 @ 230V
Wire Size Amps	3.4	2.0	2.0
Overcurrent Protection Device	15	15	15
Power consumption, nominal, watts	335	350	350
Dimensions, inches (mm)			
Length	72-1/4 (1835)		
Width	24-1/8 (613)		
Height	22-1/2 (572) not including electrical and piping access		
Weight, lb (kg)			
Unit only	150 (68)		
Shipping weight	238 (108)	296 (134)	
Installed, with refrigerant, without options	155 (70)		
Number of Fans	1	1	1
Airflow, Nominal, ft^3/ min (m^3/ hr)	2700 (4587)	2250 (3822)	
Audible Noise	85 dBa sound power	83 dBa sound power	
Pipe Connections			
Refrigerant Supply from Liebert XDP/Liebert XDC	1/2" OD, Copper		
Refrigerant Return to Liebert XDP/Liebert XDC	7/8" OD, Copper		
Serviceable Parts	Fan and electrical components		
Exterior Finish – Bottom, Sides, Front and Rear	Black, matte finish, heat-fused powder coat		
Exterior Finish - Top	Hot-dipped galvanized steel		
Agency			
Approvals	CSA 60 Hz	CSA 60Hz	CE 50Hz

1. Refer to **Figure 71** for full part number.

Table 33 Liebert XDO20 specifications

	XDO20BK [1] XDO20SK [1]	XDO20BS [1] XDO20SS [1]	
Models	60Hz	60Hz	50Hz
Cooling Capacity	Nominal (92°F [33°C] EAT): 20kW / 5.7 Tons Maximum (100°F [38°C] EAT): 23.1kW / 6.6 Tons		Nominal (92°F [33°C] EAT): 17.7kW / 5 Tons Maximum (103°F [39°C] EAT): 23.1kW / 6.6 Tons
Conditions	Capacity rating is @ 55ºF (13°C) Entering Fluid Temperature and 50ºF (10°C) or lower dew point		
Electrical Requirements			
Input Voltage	1ph-60Hz-120V	1ph-60Hz-220-240V	1ph-50 Hz-220-240V
Input Power Connections	Terminal blocks provided internal to unit		
Full Load Amps	2.7A @ 120V	1.64A @ 230V	1.64A @ 230V
Wire Size Amps	3.4	2.0	2.0
Overcurrent Protection Device	15	15	15
Power consumption, nominal, watts	335	350	350
Dimensions, inches (mm)			
Length	72-1/4 (1835)		
Width	24-1/8 (613)		
Height	22-1/2 (572) not including electrical and piping access		
Weight, lb (kg)			
Unit only	150 (68)		
Shipping weight	238 (108)	296 (134)	
Installed, with refrigerant, without options	155 (70)		
Number of Fans	1	1	1
Airflow, Nominal, ft^3/ min (m^3/ hr)	2700 (4590)		2250 (3820)
Audible Noise	85 dBa sound power		83 dBa sound power
Pipe Connections (without flex pipe)			
Refrigerant Supply from Liebert XDP/Liebert XDC	1/2" OD, Copper		
Refrigerant Return to Liebert XDP/Liebert XDC	7/8" OD, Copper		
Serviceable Parts	Fan and electrical components		
Exterior Finish – Bottom, Sides, Front and Rear	Black matte finish, heat-fused powder coat		
Exterior Finish - Top	Hot-dipped galvanized steel		
Agency			
Approvals	CSA 60 Hz		CE 50Hz

1. Refer to **Figure 71** for full part number.

Figure 71 Liebert XDO model number nomenclature

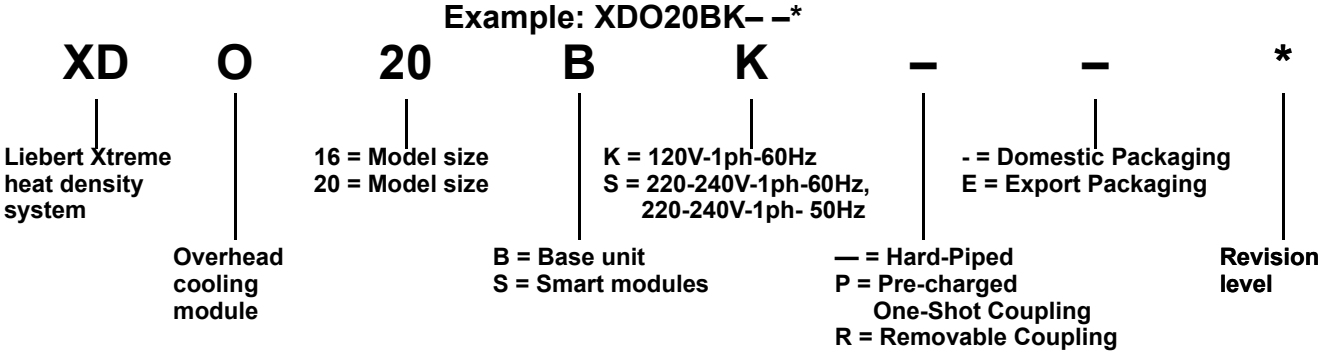


Table 34 Options for Liebert XDO20 and Liebert XDO16

Option	Liebert XDO - 60Hz Models	Liebert XDO - 50Hz Models
Lighting Fixtures (ship loose)	2 Liebert XDOs per lighting unit; 120V or 277V; 4' standard fluorescent tubes (not included)	
Power, optional lighting fixture	0.9A per 120V light fixture; 0.4A per 277V light fixture	None
Smart Module control board (factory-installed)	Dry contact 24VAC - 1A maximum	
Pre-Charged Refrigerant	R-134a Refrigerant, one-shot connections	

Table 35 Liebert XDO dimensions—domestic and export

Model	Shipping Dimensions, inches (mm)						Unit Dimension Unpacked, inches (mm)		
	Domestic			Export					
	Length	Width	Height	Length	Width	Height	Length	Width	Height *
All Models	84 (2134)	30 (762)	30 (762)	83 (2108)	30 (762)	30 (762)	72-1/4 (1835)	24-1/8 (613)	25-1/2 (648)

* Includes piping connections

Table 36 Liebert XDV8 specifications

	XDV8BK [1] XDV8SK [1]	XDV8BT [1] XDV8ST [1]		XDV8BS [1] XDV8SS [1]
Models	**60 Hz**	**60 Hz**	**50 Hz**	**50 Hz**
Cooling Capacity	Nominal (92°F [33°C] EAT): 8kW / 2.3 Tons Maximum (95°F [35°C] EAT): 8.7kW / 2.5 Tons		Nominal (92°F [33°C] EAT): 7kW/ 2.0 Tons Maximum (103°F [39°C] EAT): 8.7kW/2.5Tons	
Conditions	Capacity rating is @ 55ºF (13ºC) Entering Fluid Temperature and 50ºF (10ºC) or lower dew point, rear air inlet.			
Electrical Requirements				
Input	120V model: 1ph-60 Hz	230V model: 1ph-60 Hz	230V model: 1ph-50 Hz	
Input power connections	2 power connections, each model			
Full Load Amps	120V model: 2.0A	230V model: 1.0A		
Power consumption, nominal, watts	180	190	190	190
Dimensions, in. (mm)				
Height – unit only	14 (355) not including pipe connections			
Height – including pipe connections	18-5/8 (473)			
Width	22-7/8 (581)			
Depth – Top	39-1/2 (1003)			
Depth – Bottom	29-5/8 (752)			
Weight, lb (kg)				
Unit only	77 (35)			
Shipping weight	125 (57)			
Installed, with refrigerant	79 (36)			
Number of Fans	2	2	2	2
Airflow, Nominal, ft^3/ min (m^3/ hr)	1000 (1699) with rear inlet. Bottom inlet airflow may be less, depending on restrictions inside cabinet		833 (1415) with rear inlet. Bottom inlet airflow may be less, depending on restrictions inside cabinet	
Audible noise	78 dBa sound power		73 dBa sound power	
Pipe Connections (without Liebert Flex Pipe)				
Refrigerant Supply from Liebert XDP/Liebert XDC	1/2" OD Cu, (optional 1/2" threaded coupler flex piping)			
Refrigerant Return to Liebert XDP/Liebert XDC	5/8" OD Cu, (optional 3/4" threaded coupler flex piping)			
Serviceable Parts	Fans and electrical components			
Cabinet Exterior Finish	Black, matte finish, heat-fused powder coat			
Options				
Smart Module control board (factory-installed)	Dry contact, 24VAC, 1A maximum			
Pre-Charged Refrigerant	R-134a refrigerant, one-shot connections			
Agency				
Approvals	CSA 60Hz		CSA 50Hz	CE 50Hz

1. Refer to **Figure 72** for complete part number.

Table 37 Liebert XDV10 specifications

Models	XDV10BK [1] XDV10SK [1] 60 Hz	XDV10BT [1] XDV10ST [1] 60 Hz	XDV10BT [1] XDV10ST [1] 50 Hz	XDV10BS [1] XDV10SS [1] 50 Hz
Cooling Capacity	Nominal (98ºF [37ºC] EAT: 10kW / 2.8 Tons Maximum (106ºF [41ºC] EAT): 11.7kW/3.3 Tons		Nominal (98ºF [37ºC] EAT): 8.3kW / 2.4 Tons Maximum (116ºF [47ºC] EAT): 11.7kW/3.3 Tons	
Conditions	Capacity Rating is @ 55ºF (13ºC) Entering Fluid Temperature and 50ºF (10ºC) or lower dew point, rear air inlet.			
Electrical Requirements				
Input	120V model: 1ph-60 Hz	230V model: 1ph-60 Hz	230V model: 1ph-50 Hz	
Input power connections	2 power connections, each model			
Full Load Amps	120V model: 2.0A	230V model: 1.0A		
Power consumption, nominal, watts	180	190	190	190
Dimensions, in. (mm)				
Height – unit only	14 (355) not including pipe connections			
Height – including hard pipe connections	18-5/8 (473)			
Height – including one-shot connections	19-5/8 (498)			
Width	22-7/8 (581)			
Depth – Top	39-1/2 (1003)			
Depth – Bottom	29-5/8 (752)			
Weight, lb (kg)				
Unit only	77 (35)			
Shipping weight	125 (57)			
Installed, with refrigerant	79 (36)			
Number of fans	2	2	2	2
Airflow, Nominal, ft^3/ min (m^3/ hr)	1000 (1699) with rear inlet. Bottom inlet airflow may be less, depending on restrictions inside cabinet		833 (1415) with rear inlet. Bottom inlet airflow may be less, depending on restrictions inside cabinet	
Audible noise	78 dBa sound power		73 dBa sound power	
Pipe Connections (without Liebert Flex Pipe)				
Refrigerant supply from Liebert XDP/ XDC	1/2" OD, Cu, (optional 1/2" threaded coupler flex piping)			
Refrigerant return to Liebert XDP/ XDC	5/8" OD, Cu, (optional 3/4" threaded coupler flex piping)			
Serviceable Parts	Fans and electrical components			
Cabinet Exterior Finish	Black, matte finish, heat-fused powder coat			
Options				
Smart Module control board (factory-installed)	Dry contact, 24VAC, 1A maximum			
Pre-Charged Refrigerant	R-134a refrigerant, one-shot connections			
Agency				
Approvals	CSA 60Hz		CSA 50Hz	CE 50Hz

1. Refer to **Figure 72** for complete part number.

Table 38 Liebert XDV dimensions—domestic and export

Model	Shipping Dimensions Length x Width x Height inches (mm)		Unit Dimensions Unpacked Length x Width x Height inches (mm)
	Domestic	Export	Unit Only
All Models	48 x 40 x 24-1/4 (1219 x 1016 x 616)	45-4/5 x 30-3/4 x 33 (1163 x 781 x 839mm)	39-1/2 x 22-7/8 x 14 (1003 x 581 x 356)

Figure 72 Liebert XDV model number nomenclature

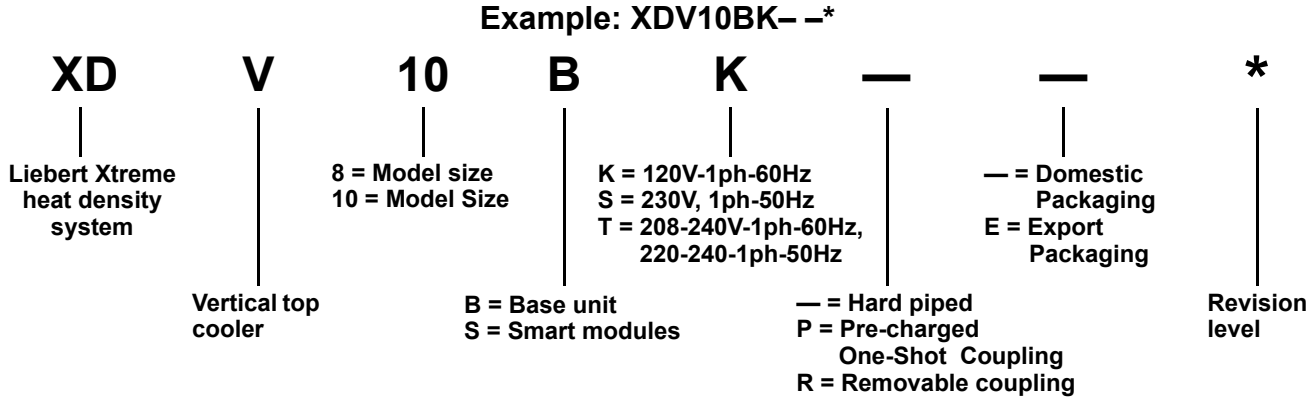


Table 39 Liebert XDC160 specifications

Models	XDC160 Air		XDC160 Water / Glycol
	XDC160AA	**XDC160AM**	**189192G3 (90-100°F) 189192G5 (65-85°F)**
Cooling Capacity, tons (kW)	46 (160)	37 (130)	See **Tables 40**, **41** and **42** for Water/Glycol performance data
Minimum Load	40% of system nominal capacity (64 kW for 60Hz unit)		
Electrical Requirements			
Input	460V-3ph-60Hz	380/415V-3ph-50Hz	460V-3ph-60Hz
Full Load Amps	79A		
Minimum supply wire sizing ampacity	84A		
Maximum fuse or circuit breaker size	100A		
Dimensions, inches (mm)			
Height - Main unit only	78 (1981)		
Height - Main unit only, as shipped	83 (2108)		
Width - Main unit	74 (1879)		
Depth - Main unit	34-5/8 (879)		
Height - Water/Glycol-Cooled Condenser Stand	N/A		24 (607)
Width - Water/Glycol-Cooled Condenser Stand	N/A		72 (1829)
Depth - Water/Glycol-Cooled Condenser Stand	N/A		33 (839)
Weight, lb (kg)			
Main unit only	1800 (817)		
Main unit only, as shipped	Domestic: 1945 (882); Export: 2093 (949)		
Water/Glycol-Cooled Condenser Stand	N/A		1075 (488)
Water/Glycol-Cooled Condenser Stand, as shipped	N/A		1150 (521)
Pipe Connections, inches, O.D., Cu			
Liebert XD Coolant supply to Liebert XD cooling modules	1-1/8		
Liebert XD Coolant return from Liebert XD cooling modules	2-1/8		
Liquid line, DX circuit	7/8		
Hot gas line, DX circuit	1-3/8		
Heat Rejection Equipment			
95°F ambient air cooled condenser	1-CDL830 or 2-CSL415		N/A
Number of XD Cooling Units Connected, Maximum (Minimum)			
Liebert XDCF10	16 (6)		
Liebert XDH20	8 (4)		
Liebert XDH32	5 (2)		
Liebert XDO16	10 (4)		
Liebert XDO20	8 (4)		
Liebert XDV8	20 (8)		
Liebert XDV10	16 (7)		
Cabinet Exterior Finish	Black, matte finish, heat-fused powder coat		
Maximum Ambient Operating Temperature °F (°C)	86 (30)		
Agency			
Approvals	CSA	CE	CSA

Table 40 Floor stand specifications—water-cooled Liebert XDC

	XDC160 Water Floor Stand - 60Hz				
	189192G5				189192G3
Entering Fluid Temp °F (°C)	65 (18)	70 (21)	75 (24)	85 (29)	95 (35)
Performance Data					
Cooling capacity, tons (kW)	46.1(162.3)	46.1(162.3)	46.1(162.3)	46.1(162.3)	44.5(156.5)
Flow, GPM	50	58	70	110	142
Pressure Drop, psi (Ft Water)	2.7 (6.2)	4.9 (11.3)	5.4 (12.5)	20.7 (47.8)	27.3 (63.1)
Heat Rejection Equipment					
Water regulating valve size	1"	1"	1"	1"	1"
Piping Connections					
Water / glycol supply and return lines	2-1/8"	2-1/8"	2-1/8"	2-1/8"	2-1/8"

Table 41 Floor stand specifications—Liebert XDC with 40% propylene glycol

	XDC160 Glycol Floor Stand - 60Hz - 40% PG 189192G3		
Outside Ambient °F (°C)	95 (35)	100 (38)	105 (41)
Max Entering Fluid Temp °F (°C)	110 (43)	110 (43)	110 (43)
Performance Data			
Cooling capacity, tons (kW)	42.5 (149.4)		
Total Heat Rejection, (kW)	192.6		
Flow, GPM	206		
Pressure Drop, psi (ft water)	37.2 (85.9)		
Heat Rejection Equipment			
Drycooler	DNT 940A		2 x DNT 880A*
Drycooler Pressure Drop, psi (ft water)	6.7 (15.5)		2.9 (6.6)
Glycol pump package - 10hp	9A31258G3		
Pump Control Package - 208V	9A34606G47		
Pump Control Package - 460V	9A32114G4		
Pump Total Head @ 204 GPM, ft water	145		
Water regulating valve size	1-1/4"		
Piping Connections			
Water / glycol supply and return lines	2-5/8"		

* When multiple drycoolers are used, ensure flow is balanced.

Table 42 Floor stand specifications—Liebert XDC with 40% ethylene glycol

	XDC160 Glycol Floor Stand - 60Hz - 40% EG 189192G3		
Outside Ambient °F (°C)	95 (35)	100 (38)	105 (41)
Max Entering Fluid Temp °F (°C)	110 (43)	110 (43)	110 (43)
Performance Data			
Cooling capacity, tons (kW)	42.5 (149.4)		
Total Heat Rejection, (kW)	192.6		
Flow, GPM	204		
Pressure Drop, psi (ft water)	35.9 (82.9)		
Heat Rejection Equipment			
Drycooler	DNT 940A		2 x DNT 880A*
Drycooler Pressure Drop, psi (ft water)	6.5 (15.1)		2.7 (6.3)
Glycol pump package - 10HP	9A31258G3		
Pump Control Package - 208V	9A34606G47		
Pump Control Package - 460V	9A32114G4		
Pump Total Head @ 204 GPM, ft water	145		
Water regulating valve size	1-1/4"		
Piping Connections			
Water / glycol supply and return lines	2-5/8"		

* When multiple drycoolers are used ensure flow is balanced.

Figure 73 Liebert XDC model number nomenclature

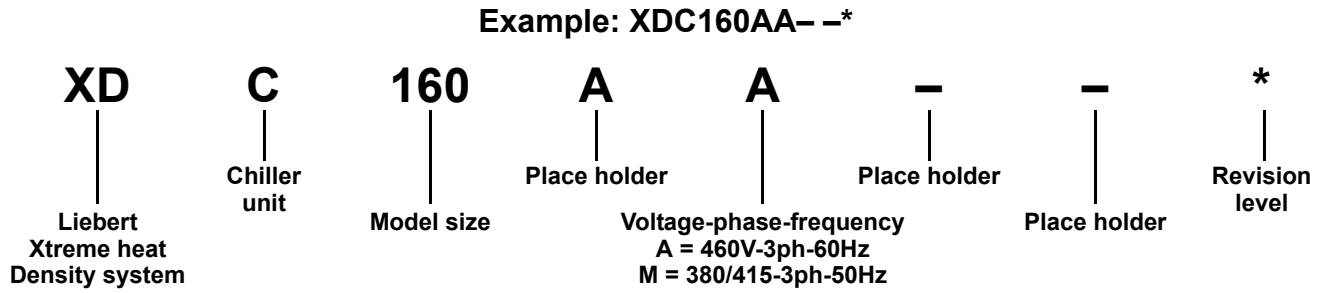
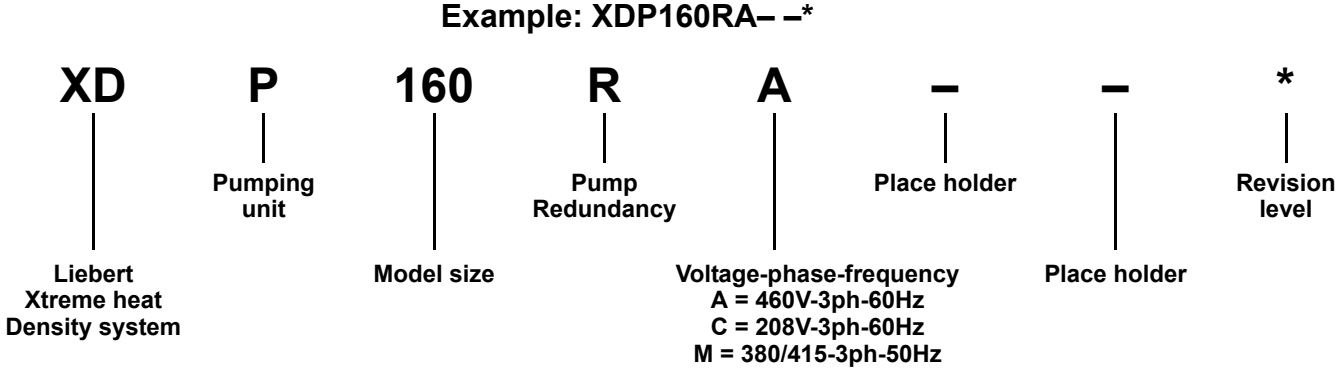


Table 43 Liebert XDP160 specifications

Models	**XDP160RC--3**	**XDP160RA--3**	**XDP160RM--3**
Cooling Capacity, Nominal	160kW / 46 Tons, 60Hz		140kW / 40 Tons, 50Hz
	Each capacity is based on 45ºF (7ºC) entering water temperature and 140gpm (530lpm) water flow rate. Capacity is reduced when glycol mixtures are used in place of 100% water.		
Minimum Load	30% of nominal system capacity or 48kW (163,800BTU/H)		
Electrical Requirements			
Input	208V/3ph/60Hz	460V/3/ph60Hz	380/415V/3ph/50Hz
Full Load Amps	4A	2.1A	2.3A
Dimensions, inches (mm)			
Height – Unit only	78 (1981)		
Height – As shipped	83 (2108)		
Width	38 (965)		
Depth	34 (864)		
Weight, lb (kg)			
Unit only	821 (372)		
Shipping weight	Domestic: 990 (449); Export: 1067 (484)		
Installed, with refrigerant and chilled water	1038 (471)		
Pipe Connections			
Refrigerant supply to Liebert XD cooling module	1-1/8" OD, Cu		
Refrigerant return from Liebert XD cooling module	2-1/8" OD, Cu		
Chilled water supply and return	2-5/8" OD, Cu		
Control valve	2-way, 2" nominal; 35 PSIG close-off pressure rating; 150 PSIG maximum allowable pressure		
Pressure Drop – Chilled Water Side	20 psig (137kPa, 1.38bar), with 140 gpm (530lpm) water flow rate, control valve fully open		
Temperature Rise – Chilled Water Side at rated flow, °F (°C)	8.0 (4.4)		6.9 (3.8)
Number of Liebert XD cooling units connected, maximum (minimum)			
Liebert XDCF10	16 (5)		
Liebert XDH20	8 (3)		
Liebert XDH32	5 (2)		
Liebert XDV8	20 (6)		
Liebert XDV10	16 (5)		
Liebert XDO16	10 (3)		
Liebert XDO20	8 (3)		
Cabinet Exterior Finish	Black, matte finish, heat-fused powder coat		
Operating Ambient Temperature, Maximum, °F (°C)	86 (30)		
Agency			
Approvals	CSA 60Hz		CE 50Hz

Figure 74 Liebert XDP model number nomenclature



Ensuring The High Availability Of Mission-Critical Data And Applications.

Emerson Network Power, the global leader in enabling business-critical continuity, ensures network resiliency and adaptability through a family of technologies—including Liebert power and cooling technologies—that protect and support business-critical systems. Liebert solutions employ an adaptive architecture that responds to changes in criticality, density and capacity. Enterprises benefit from greater IT system availability, operational flexibility and reduced capital equipment and operating costs.

Technical Support / Service
Web Site
www.liebert.com
Monitoring
800-222-5877
Liebert.monitoring@emerson.com
Outside the US: 614-841-6755
Single-Phase UPS
800-222-5877
upstech@emersonnetworkpower.com
Outside the US: 614-841-6755
Three-Phase UPS
800-543-2378
powertech@emersonnetworkpower.com
Environmental Systems
800-543-2778
Outside the United States
614-888-0246

Locations
United States
1050 Dearborn Drive
P.O. Box 29186
Columbus, OH 43229
Europe
Via Leonardo Da Vinci 8
Zona Industriale Tognana
35028 Piove Di Sacco (PD) Italy
+39 049 9719 111
Fax: +39 049 5841 257
Asia
7/F Dah Sing Financial Centre
108 Gloucester Road
Wanchai
Hong Kong
852 2572 2201
Fax: 852 2519 9210

SL-16655_REV09_7-09

Emerson Network Power.

The global leader in enabling *Business-Critical Continuity*.

- AC Power
- Connectivity
- DC Power
- Embedded Computing
- Embedded Power
- Monitoring
- Outside Plant
- Power Switching & Controls
- **Precision Cooling**
- Racks & Integrated Cabinets
- Services
- Surge Protection

EmersonNetworkPower.com