Precision Cooling
For *Business-Critical Continuity™*

Liebert® CRV™

Technical Data Manual—60Hz, Air-Cooled, Water/Glycol-Cooled, Chilled Water

EMERSON™
Network Power

MODEL NUMBER NOMENCLATURE - 25 DIGIT CONFIGURATION NUMBER

Model Number Part 1 *										Model Details											Model Number Part 2 *			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
C	R	0	2	0	R	A	1	C	7	S	D	1	8	1	1	E	L	1	0	P	A	*	*	*

Digits 1-2 - Unit Family

Liebert CRV = CR

Digits 3-5 - Nominal Capacity

DX = 020, 035

CW = 040

Digit 6

R = Row-Based, Horizontal Airflow

Digit 7 - System Type

A = Air Cooled

W = Water\Glycol Cooled

C = Chilled Water Cooled

Digit 8 - Fan Type

EC Plug Fans = 1

Digit 9 - Power Supply

A = 460V / 3ph / 60Hz (35kW and 40kW only)

C = 208V / 3ph / 60Hz

Digit 10 - Cooling System

2 =Two-Way Valve (CW Only)

3 = Three-Way Valve (CW Only)

7 = R-410A Digital Scroll Single Circuit (DX Only)

Digit 11 - Humidifier

0 = None

S = Steam Generating Canister

Digit 12 - Display Type

D = Liebert iCOM Control with Large Graphic Display

Digit 13 - Reheat

0 = None

1 = Electric Reheat

Digit 14 - Air Filter

8 = Merv 8 + Clogged Filter Alarm

9 = Merv 11 + Clogged Filter Alarm

Digit 15 - Water/Glycol Valve Type

1 = Two-Way Valve (W/G only) OR Default Air-Cooled Selection

7 = Three-Way Valve (W/G only)

H = Default CW Selection

Digit 16 - Unit Color

1 = Standard Color (Z-7021 Black)

2 = Non-Standard Color

Digit 17 - High-Voltage Options

L = No Dual-Float Condensate Pump (for CW units without humidifier)

5 = Dual-Float Condensate Pump (for CW units with or without humidifier)

A = No Dual-Float Condensate Pump (for DX units without humidifier)

E = Dual-Float Condensate Pump (for DX units with or without humidifier)

Digit 18 - Option Package

0 = None

H = Reheat and Humidifier Lockout

C = Reheat and Humidifier Lockout Additional Alarm Contact

Digit 19 - Liebert IntelliSlot® Housing

0 = No Cards

1 = One Web Card

2 = Two Web Cards

3 = One 485 Card

4 = Two 485 Cards

5 = One Web Card and One 485 Card

Digit 20 - Additional Sensors

0 = None

Digit 21 - Packaging

P = Domestic

S = Export (Seaworthy)

Digit 22 - Special Features

A = No SFAs, Standard Unit

X = SFA Included

Digits 23-25 - Factory Configuration Number

* The 14-digit model number consists of the first 10 digits and last four digits of the Configuration Number.

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1.0 PRODUCT DESCRIPTION

The Liebert CRV is a precision cooling unit located within a row of heat generating IT equipment racks. It provides all of the necessary functions of a precision air conditioner including cooling, humidification, dehumidification, air filtration and condensate management. The unit is to be applied in hot-aisle-cold-aisle configurations. Air enters this unit from the hot aisle, is filtered, cooled and conditioned, then expelled into the cold aisle through a supply air baffle.

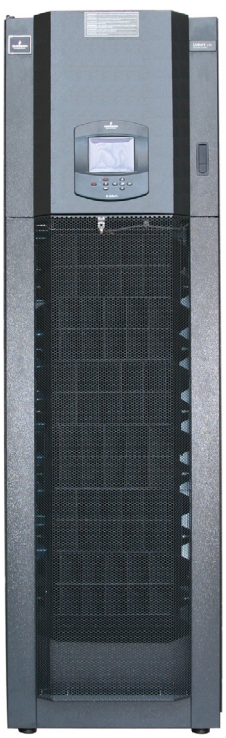
The Liebert CRV is optimized for maximum cooling capacity in a minimal footprint. The extremely energy efficient components of the system are managed by the Liebert iCOM control system. The control monitors the environment in real-time by locating sensors on the inlet of the racks the unit is cooling. This information allows the unit to optimize its operations for both performance and energy efficiency.

All operations and sensor data can be reported remotely via a variety of communication protocols, providing end users with a built-in mini-monitoring system. The supply air baffle allows the air leaving the cooling unit to be directed to the racks the Liebert CRV is conditioning; maximizing its effectiveness, reducing the chance for hot spots and improving the overall system efficiency. The angle and spacing of the baffle vanes have been optimized through CFD modeling, laboratory testing and real-world installations. All service and maintenance is performed through the front and rear of the unit, including all component replacement. All piping and electrical connections are made through the top or bottom of the unit.

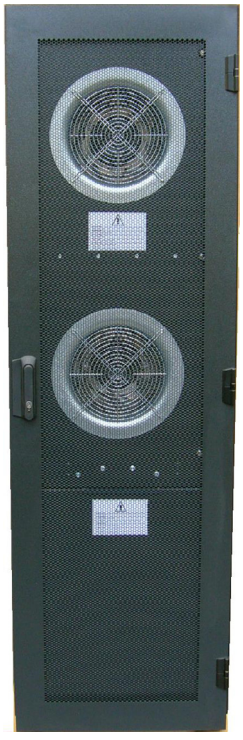
Table 1 Available unit configurations

Configuration	Nominal Size	Input Power (3ph, 60Hz)
Air-Cooled	20kW	208V
Water / Glycol Cooled		
Air-Cooled	35kW	208V 460V
Water / Glycol Cooled		
Chilled Water	40kW	208V 460V

Figure 1 Liebert CRV, front and rear views



Front



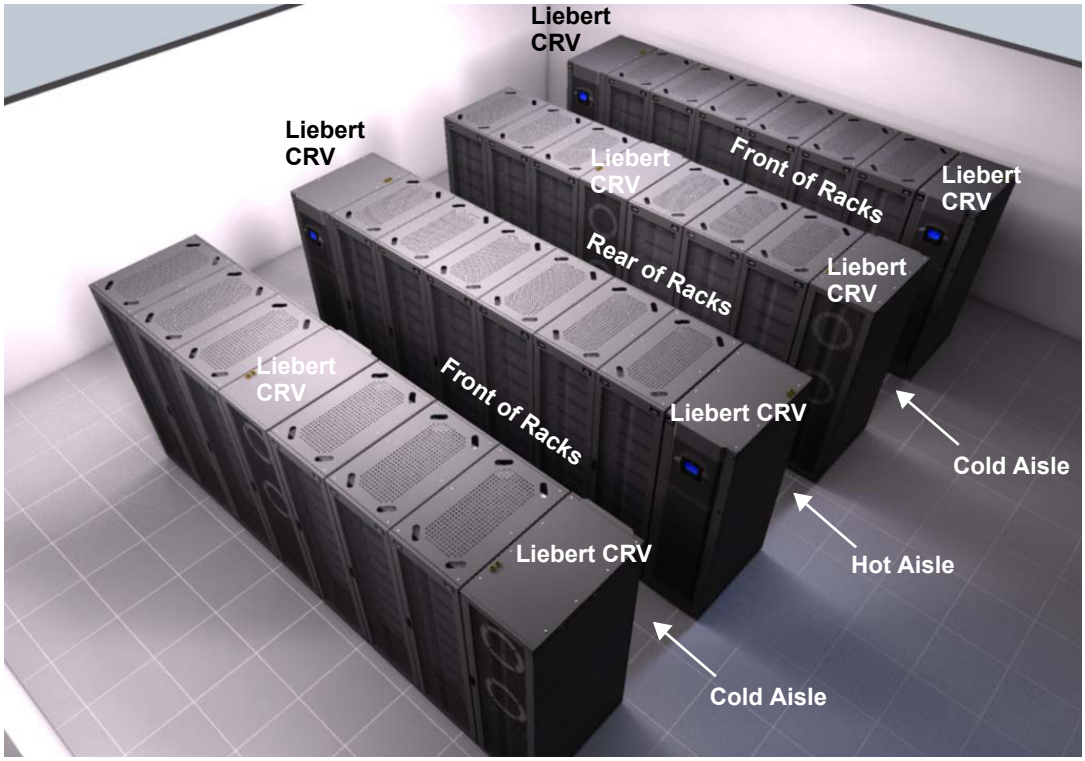
Rear

2.0 APPLICATION

2.1 Liebert CRV Intended Application

The Liebert CRV can be applied in virtually any application. Since the unit provides complete temperature and humidity control along with filtration, it can be deployed as the only cooling unit in smaller data centers and network closets. Larger data centers are able to benefit from its standard rack-sized footprint, deploying it as a supplemental spot cooler to address both hot spots and high density racks. The small footprint and variable cooling and airflow allow the unit to be initially oversized in anticipation of future IT expansion with minimal footprint or energy consumption penalties. The unit can be applied on both raised and non-raised floors, allowing it work with existing under floor and overhead cooling systems. It provides an excellent alternative for spaces that are unable to accommodate a Liebert XD system, or can be configured to support a Liebert XD installation. The unit is compatible with all forms of aisle containment, but the control algorithms have been optimized for Liebert SmartAisle cold aisle containment.

Figure 2 Example of high-density installation with alternating cold and hot aisles



2.2 Operating Limits

The Liebert CRV is designed to operate within the working ranges in **Table 2**. These limits refer to new units and those that have been correctly installed and serviced.

Table 2 Environmental limits—all models

		Minimum	Maximum
Unit Entering Air Conditions	Temperature	50°F (10°C)	105°F (40°C)
	Relative Humidity	15%	60%
Storage Conditions	Temperature	-4°F (-20°C)	122°F (50°C)
Power Supply Tolerances		Voltage ± 10%	
		Frequency ± 2Hz	

2.2.1 Operating Limits for Chilled Water and Water/Glycol-Cooled Units

Table 3 Operating limits for chilled water and water/glycol-cooled units

Models	Maximum Water Pressure, psi (kPa)	Maximum Close-Off Pressure, psi (kPa)	Minimum Entering Water Temperature, °F (°C)
CR020RW (water/glycol)	230 (1586)	43.5 (300)	55 (13)
CR035RW (water/glycol)	230 (1586)	43.5 (300)	
CR040RC (chilled water)	230 (1586)	25.4 (175)	

3.0 PLACING LIEBERT CRV UNITS IN ROWS OF RACKS FOR EFFICIENCY

This chapter provides examples of typical Liebert CRV installations. For best performance of the Liebert CRV, observe the following guidelines:

- Create a defined hot and cold aisle: eliminate gaps between server racks and utilize blanking plates
- Install the 2T rack temperature sensors on the front door of all equipment the Liebert CRV is protecting
- Use walls or opposing racks to minimize the width of the hot and cold aisles; target 2-6 feet.

For site specific recommendations on how to optimize your space for row based cooling, contact your local Emerson representative.

3.1 Row Placement

The Liebert CRV can be placed either at the end of a row or in between server racks. Locating a Liebert CRV at the end of a row helps to isolate the end of the cold aisle from the surrounding space; protecting it from hot air wrapping around the sides of the aisle. The 2T rack temperature sensors monitor for hot air wrapping over the top of the racks.

When deploying multiple Liebert CRVs it is recommended that units be installed at the end of rows with their baffles set to direct cold supply air toward the server equipment. Depending on row length, heat density and airflow requirements, additional cooling units can be installed throughout the row with their baffles set to direct supply air left and right as it leaves the unit.

Cooling unit location within a row becomes less critical when deployed in Liebert SmartAisle containment, but it is recommended that Liebert CRV(s) be evenly spaced in each row. Using room barriers, such as walls shown in **Figure 5**, can be very effective in simulating aisle containment.

Figure 3 One Liebert CRV, recommended placement

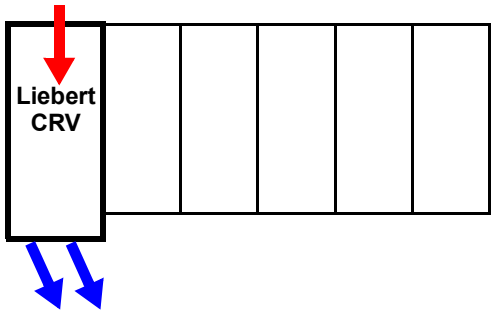


Figure 4 One Liebert CRV, alternate placement

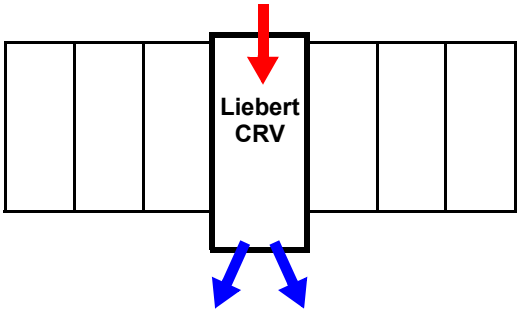


Figure 5 Simulated aisle containment using room barriers—single row

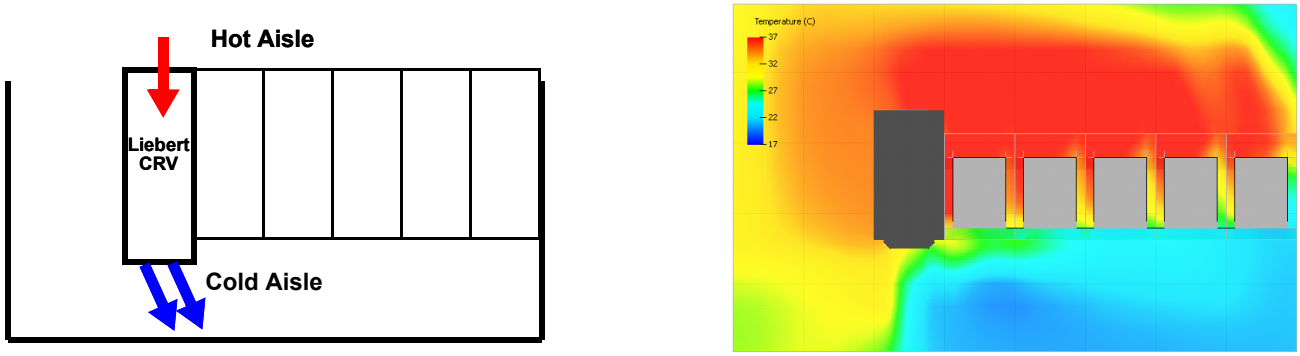
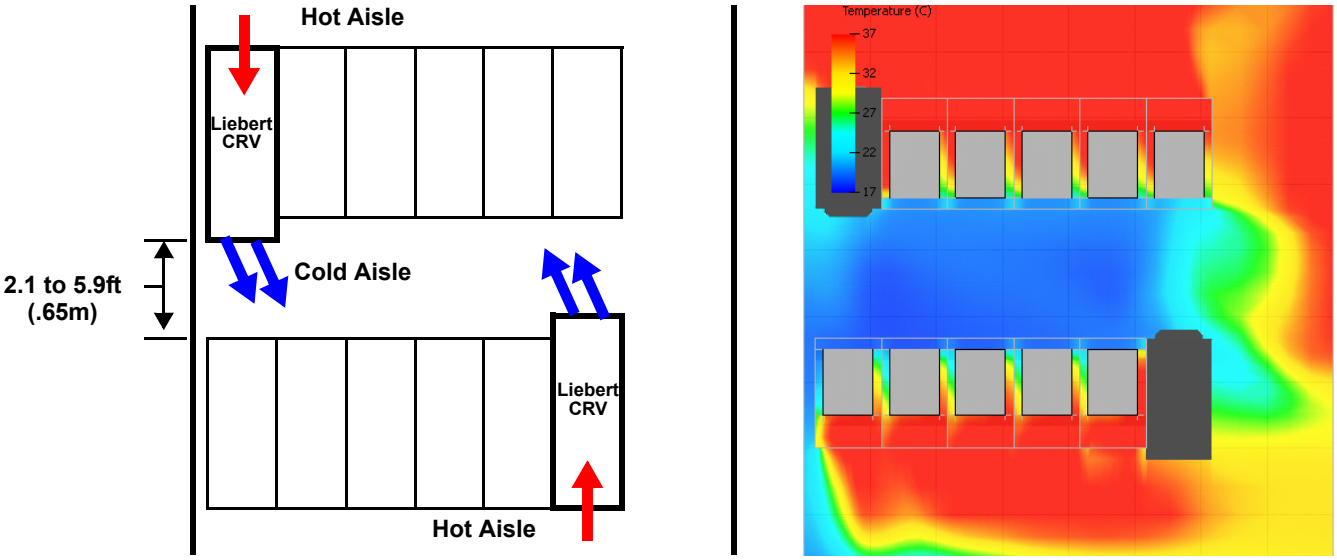


Figure 6 Simulated aisle containment using room barriers—multiple rows

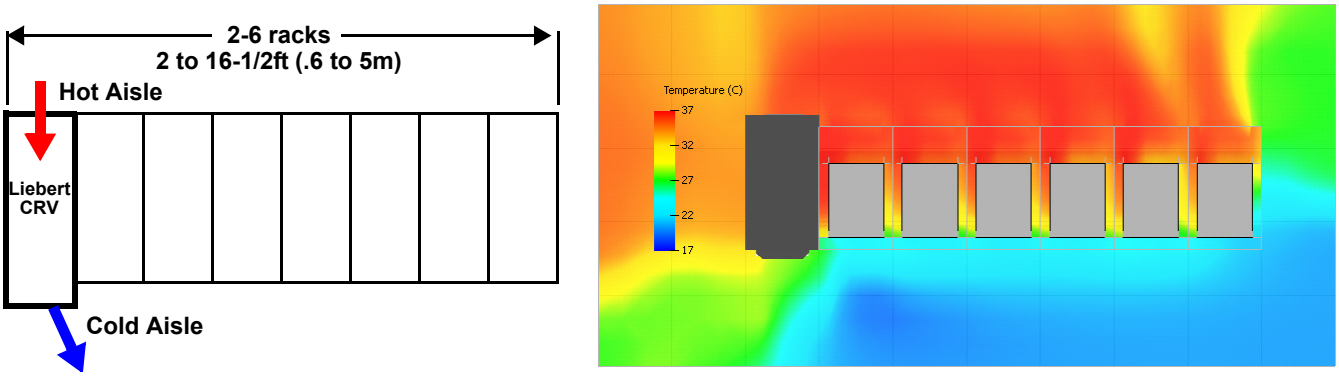


3.2 Number of Racks / Row Length

The number of racks the Liebert CRV can condition is dependent upon the heat load and airflow requirements of the equipment. It is recommended to oversize the Liebert CRV by approximately 20% to account for gaps where cold is lost through sever racks, obstructions (pillars, people, partially open rack doors) reducing air distribution efficiency, and error in estimating server equipment heat and airflow requirements. When deployed with Liebert SmartAisle cold aisle containment, the Liebert CRV can be more closely matched to the server equipment needs.

When the Liebert CRV is significantly oversized, the cooling unit is able to effectively distribute air 6 to 7 racks away. Initially over-sizing the unit provides for future datacenter flexibility with nearly no energy consumption or footprint penalty. The intelligent Liebert iCOM control and variable system components allow the unit to minimize its operations without sacrificing environmental control.

Figure 7 Number of racks, row length



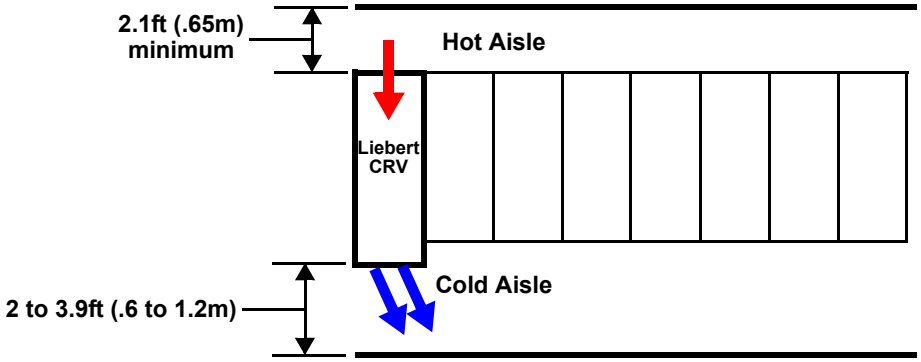
3.3 Placement in the Room

3.3.1 Depth of Hot Aisle-Cold Aisle

For optimal air distribution, use opposing racks or walls to clearly define the hot and cold aisles. This will help to create an efficient and effective air circulation path from the cooling unit, to the server racks, and back to the cooling unit. This helps to avoid cold air being lost to the room and prevents hot air from entering the cold aisle. The supply air baffle has been optimized for aisle spacing of 2 to 6 feet wide.

Liebert's SmartAisle, cold aisle containment system is recommended for maximum performance. While the Liebert CRV is compatible with all forms of aisle containment, its control algorithms have been optimized for partial and full cold aisle containment, allowing for increased operating efficiency and reducing the number of 2T rack sensors.

Figure 8 Depth of hot / cold aisles



3.4 Redundancy Arrangement

When laying out row based units for redundancy it is best to run all units at a lower operating level then to shutoff extra units. The units must be sufficiently sized to achieve the required cooling capacity if any of the other units fail. **Figure 9** shows an example of N+1 redundancy properly applied.

Figure 9 Example of an application with one row and N+1 redundancy—right side unit failed

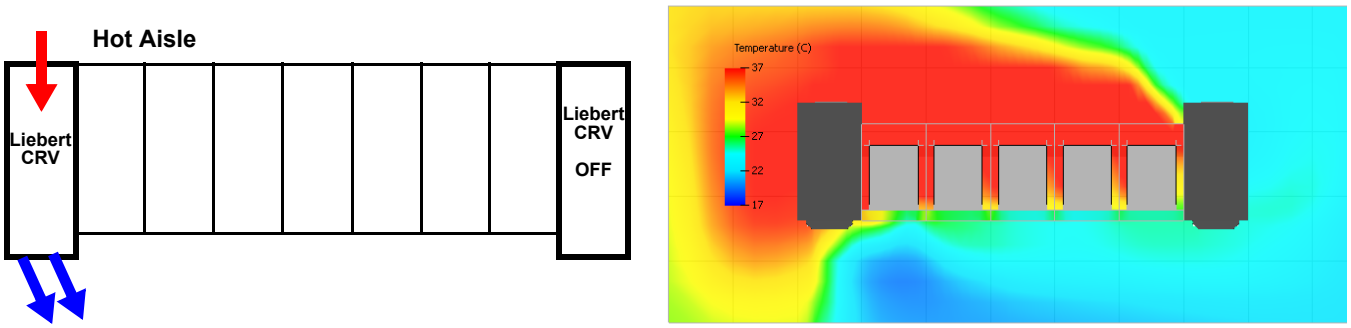
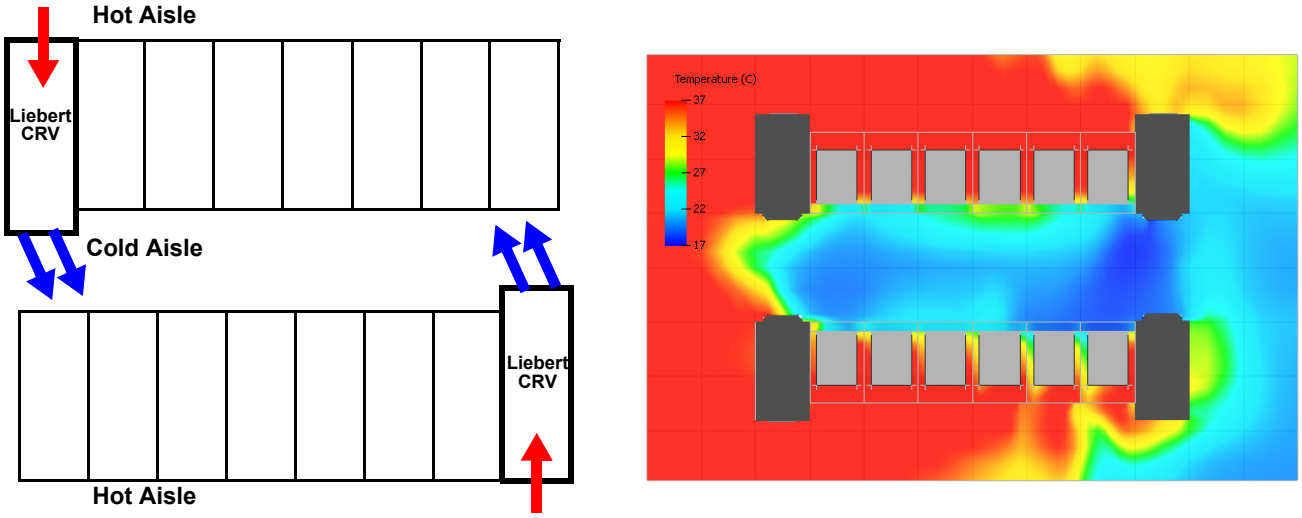


Figure 10 Example of an application with two rows and N+1 redundancy—unit at lower right failed



3.5 Liebert CRV Applied in Liebert SmartAisle Cold Aisle Containment

Using Liebert SmartAisle with the Liebert CRV is always recommended but not required. It is an excellent solution when attempting to cool widely varying heat loads, loads exceeding 10kW per rack, and when seeking the highest efficiency systems. For additional information about the Liebert SmartAisle, see the Liebert Web site: **www.Liebert.com**

Figure 11 Liebert CRV placement with Liebert SmartAisle cold aisle containment—Liebert CRVs in center of two rows

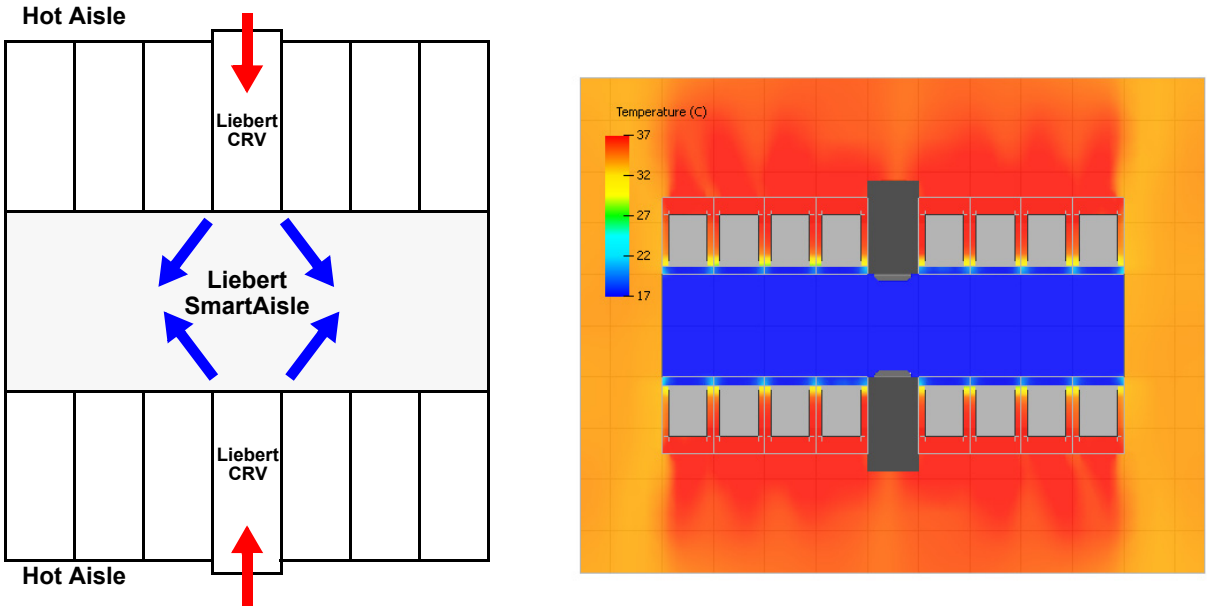
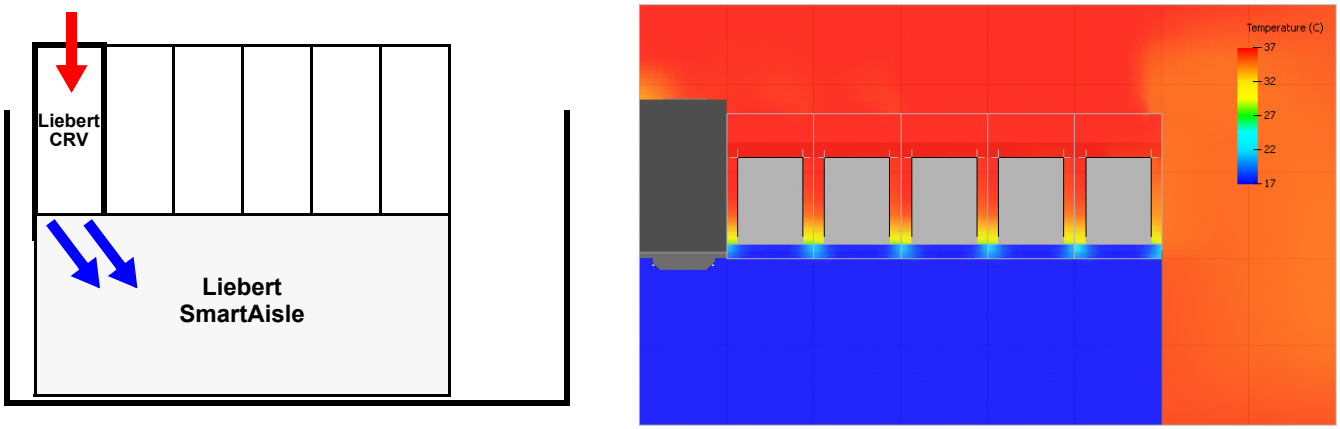


Figure 12 Liebert CRV placement with Liebert SmartAisle cold aisle containment—Liebert CRV at end of one row

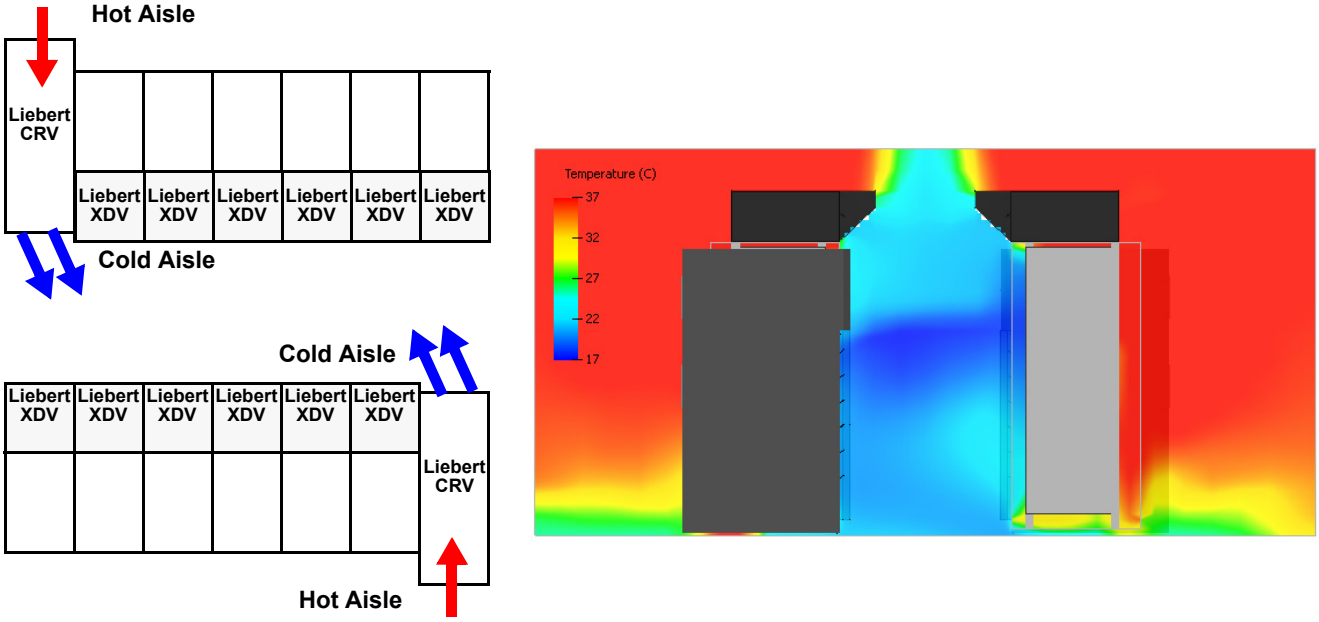


3.6 Liebert CRV and Liebert XD Systems

When larger spaces (approximately 20 racks or more) require high density cooling (greater than 8kW per rack), row-based Liebert CRVs can be used to the support Liebert Xtreme Density cooling systems. When used in conjunction, these systems are more efficient than row based units alone.

Figure 13 illustrates the layout of a typical installation with two rows of racks and Liebert XDV modules. Two Liebert CRV units are used to support the Liebert XD system and provide N+1 redundant humidity control.

Figure 13 Liebert CRV placement with Liebert XDVs



3.7 2T Rack Temperature Sensors

The 2T rack temperature sensors provide feedback to the cooling unit about the condition of the air entering the server racks. This information allows the Liebert CRV to ensure it is providing just enough cold air to each rack, virtually eliminating hotspots. Overcooling and excessive airflow are avoided, greatly reducing unnecessary energy consumption.

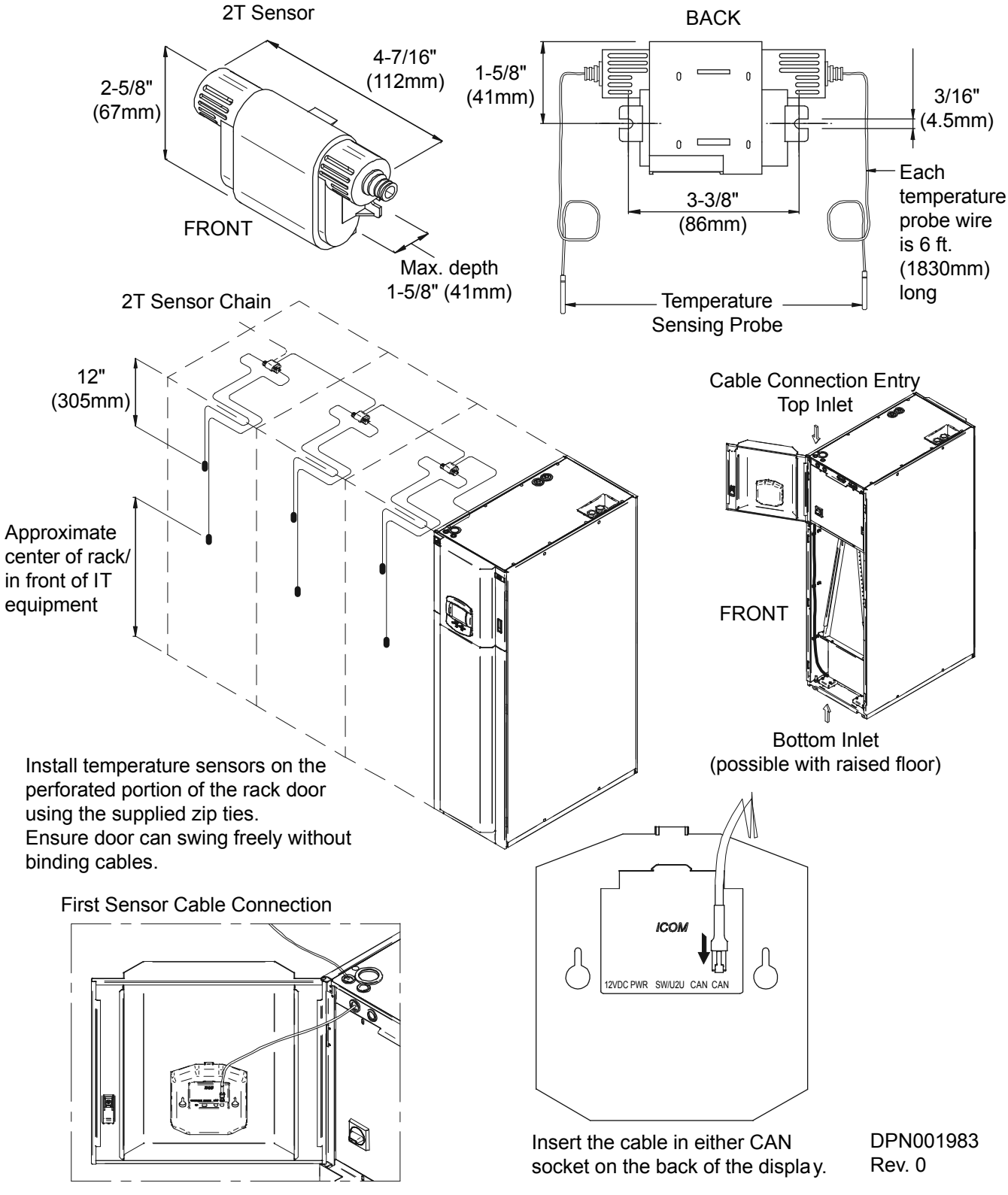
Each Liebert CRV includes three 2T rack temperature sensors to monitor three racks. A total of ten 2T temperature sensors can be connected to each cooling unit to monitor every rack a Liebert CRV is protecting. When multiple cooling units are connected in a Unit-to-Unit iCOM control network, all sensor data is shared to optimize their performance as a system.

While 2T rack sensor installation is not required, it is highly recommended. Each 2T sensor consists of two temperature probes for redundancy to be attached to the front door of the server racks. The sensor probes should be located at the highest part of the rack door while still in the supply airflow path of the servers.

A sensor network can be extended at any time by connecting additional 2T sensors to the last 2T sensor on the network. Sensors connect in a daisy chain fashion back to the cooling unit; individual wires from each sensor to the cooling unit are avoided.

2T rack sensors can also be initially installed on empty racks reserved for future growth with the control set to ignore these sensor readings. The extra 2T temperature sensor readings can also be shown on the local display and reported remotely for monitoring purposes only; not impacting unit operation. This function provides users with a built-in mini-monitoring system.

Figure 14 2T rack temperature sensor connections



DPN001983
Rev. 0

4.0 FEATURES

4.1 Standard Features—All Units (Air-Cooled, Water/Glycol and Chilled Water)

Fan

The unit is equipped with two plug fans: direct driven centrifugal fans with backward curved blades and Electronically Commutated DC motors; commonly referred to as EC plug fans. The fan speed is variable and automatically regulated by the Liebert iCOM control through all modes of operation. Each fan has a dedicated motor and speed controller which provides a level of redundancy. The fans push air through the coil and are located on the rear panel of the unit.

Supply Air Baffle

A field-adjustable, modular supply air baffle is located in the discharge air stream. It can be quickly and easily reconfigured to redirect airflow. The angles of the vanes have been optimized to effectively distribute air to heat generating equipment in a wide variety of applications.

Liebert iCOM Control System

The Liebert CRV is controlled by the Liebert iCOM Control System. The standard user interface is the Large Graphical Display (320x240 pixels, backlit) which presents system information and allows all parameters to be viewed and adjusted. It features push-button navigation, operational status LEDs and a 3-level password protection system. Unit-to-Unit communication with other Liebert CRVs and two Liebert IntelliSlot communication card housings are included as standard.

2T Rack Temperature Sensors

Consist of a vented case with two temperature probes. Three (3) 2T rack sensors are standard with each Liebert CRV. Up to ten (10) 2T housings (20 temperature probes) can be connected to a Liebert CRV. One (1) 2T housing and both sensor probes are to be attached to a rack the cooling unit is conditioning. The sensors provide real-time, direct feedback to the cooling unit to optimize the amount of cooling and airflow required; increasing energy efficiency and ensuring proper rack inlet air temperatures. The sensor data can also be reported to remote BMS and monitoring systems. The sensor network consists of one CAN wire leaving the cooling unit and connecting to a 2T sensor. Each remaining 2T sensor is connected to the previous sensor; often referred to as a daisy-chain configuration.

Remote Shutdown Terminal

Provides the customer with a location to remotely shut down the unit.

Common Alarm Contact

Provides the customer with a set of normally open (N.O.) contacts for remote indication of unit alarms.

Cabinet

The exterior steel panels are custom powder coated to protect against corrosion. The double wall constructed side panels separate the ½ inch, 2.0 lb/ft^3 insulation from the airstream. The unit is mounted on casters for quick installation and provided with levelling feet. The perforated inlet and outlet panels have 81% open area and the rear door utilizes a Knurr rack style handle and hinges.

Service Access

All service and maintenance is performed through the front and rear of the unit; including any component removal. No side access is required. All electrical and piping connections are made through the top and/or bottom of the unit. All units are provided with a Superior Service Access Panel to provide additional access.

Filter

The unit is equipped with two deep pleated 4 inch filters rated MERV8 following ASHRAE 52.2 (30% by ASHRAE 52.1), located within the cabinet and accessible from the rear of the unit. A filter clog alarm is included.

Locking Disconnect Switch

A moulded case circuit interrupter disrupts the flow of power to the unit. The electric panel high voltage compartment can only be accessed with the switch in the 'off' position. Conveniently located behind the Liebert iCOM display door for quick access.

4.2 Standard Features—Compressorized Units (Air-Cooled and Water/Glycol)

DX Cooling Coil

The evaporator coil has 7.25 ft^2 (0.674 m^2) face area, 4 or 5 rows deep. It is constructed of copper tubes and hydrophilic coated aluminum fins. The hydrophilic coating provides superior water carryover resistance. Two stainless steel condensate drain pans are provided.

Refrigeration System

Single refrigeration circuit includes a liquid line filter drier, a refrigerant sight glass with moisture indicator (air-cooled units only), an adjustable externally equalized expansion valve and a liquid line solenoid valve.

Compressor

The compressor is an R-410A scroll-type with variable capacity operation from 20-100%; commonly known as a digital scroll. Compressor solenoid valve unloads the compressor to provide variable capacity operation. The compressor has a suction gas cooled motor, vibration isolators, internal thermal overloads, manual reset high pressure switch, rotalock service valves, low pressure and high pressure transducer, crankcase heater, internal centrifugal oil pump and an operating speed of 3500 RPM @ 60Hz (2900RPM @ 50Hz).

Water/Glycol Condenser

Is an efficient stainless steel brazed-plate condenser. Waterside threaded connections are provided for convenience. Proper filtration must be field-supplied when used on open-loop water systems (cooling towers, etc). When operating on a closed-loop, to avoid undesired ice formation in the wintertime, it is advisable to use a water/glycol mixture.

Water/Glycol 2 or 3-Way Modulating Valve

A 3-way modulating valve controls the water/glycol flow passing through the brazed-plate condenser. The Liebert iCOM control manages the valve actuator movement in order to maintain the desired condensing temperature for various entering water temperatures. The maximum differential pressure across the closed valve is 43.5 PSI (300 kPa). Maximum system pressure is 230 PSI (1586 kPa).

4.3 Standard Features—Chilled Water Units

CW Cooling Coil

The evaporator coil has 7.25 ft^2 (0.674 m^2) face area, 6 rows deep. It is constructed of copper tubes and hydrophilic coated aluminum fins. The hydrophilic coating provides superior water carryover resistance. Two stainless steel condensate drain pans are provided.

Chilled Water System

The water circuit includes a 3-way modulating valve. The Liebert iCOM control positions the valve in response to room conditions. Cooling capacity will be controlled by bypassing chilled water around the coil.

Chilled Water 2 or 3-Way Modulating Valve

A 2-way modulating valve controls the chilled water flow passing through the cooling coil. The Liebert iCOM control manages the valve actuator movement in order to provide the desired amount of cooling for various entering water temperatures. Cooling capacity is regulated by varying the chilled water flow. The maximum differential pressure across the closed valve is 25.4 PSI (175 kPa). Maximum system pressure is 230 PSI (1586 kPa).

4.4 Optional Features—All Units (Air-Cooled, Water/Glycol and Chilled Water)

Dual-Float Condensate Pump

It has a capacity of 6 GPM (22.7 l/min) at 30ft (9 m) head. Pump is complete with integral primary and secondary float switches, pump, motor assembly and reservoir. The secondary float shall send a signal to the local alarm and shut down the unit upon high water condition.

Humidifier

A steam generating canister humidifier is factory-installed in the cooling unit and is operated by the Liebert iCOM control system. It is complete with disposable cylinder, all supply and drain valves, steam distributor and electronic controls. The need to change the canister is indicated on the Liebert iCOM display. The humidifier is designed to operate with water conductivity from 125-500 (50Hz) or 330-670 (60Hz) microS/cm. System automatically fills and drains as well as maintains the required water level based on conductivity. An air-gap within the humidifier assembly shall prevent backflow of the humidifier supply water. The humidifier is removable from the rear of the cabinet.

Electric Reheat

The electric reheat coils are low watt density, 304 stainless steel fin-tubular construction, protected by thermal safety switches and controlled in one stage.

Liebert IntelliSlot Web Card (IS-WEBL)

Provides 10/100 baseT Ethernet connectivity for unit monitoring and management. The supported management interfaces include: SNMP for Network Management Systems and HTTP for web page viewing.

Liebert IntelliSlot 485 Card (IS-485L)

Provides RS-485 Modbus network connectivity to Building Management Systems for unit monitoring and management.

Filter

The optional filters are two deep pleated 4 inch rated MERV11 following ASHRAE 52.2 (60-65% by ASHRAE 52.1), located within the cabinet and accessible from the rear of the unit. A filter clog alarm is included.

Reheat/Humidifier Lockout

Includes the necessary relays to disable the reheat and humidifier from an external 24 volt signal.

One Extra Common Alarm Contact

Provides the customer with a total of two sets of normally open (N.O.) contacts for remote indication of unit alarms.

Liebert Liqui-tect Sensor

Is a solid state water sensor that has no moving parts and is hermetically sealed to keep out dust and dirt. When the sensor detects the presence of moisture the alarm system is activated.

5.0 SPECIFICATIONS

Table 4 Air-cooled capacity data

	Cond. Temp. 120°F (48.9°C)	
	CR035RA	**CR020RA**
105°F DB, 71°F WB (40.6°C DB, 21.6°C WB) 17% RH		
Total BTU/H (kW)	137885 (40.4)	83960 (24.6)
Sensible BTU/H (kW)	137885 (40.4)	83960 (24.6)
100°F DB, 69.5°F WB (37.8°C DB, 20.8°C WB) 20% RH		
Total BTU/H (kW)	131401 (38.5)	79864 (23.4)
Sensible BTU/H (kW)	131401 (38.5)	79864 (23.4)
95°F DB, 67.9°F WB (35°C DB, 19.9°C WB) 23% RH		
Total BTU/H (kW)	125257 (36.7)	76110 (22.3)
Sensible BTU/H (kW)	125257 (36.7)	76110 (22.3
90°F DB, 66.2°F WB (32.2°C DB, 19.0°C WB) 27% RH		
Total BTU/H (kW)	120138 (35.2)	72356 (21.2)
Sensible BTU/H (kW)	120138 (35.2)	72356 (21.2)
85°F DB, 64.5°F WB (29.4°C DB, 18.1°C WB) 31% RH		
Total BTU/H (kW)	117066 (34.3)	68601 (20.1)
Sensible BTU/H (kW)	113994 (33.4)	68601 (20.1)
80°F DB, 62.8°F WB (26.7°C DB, 17.1°C WB) 37% RH		
Total BTU/H (kW)	113994 (33.4)	67919 (19.9)
Sensible BTU/H (kW)	103414 (30.3)	67919 (19.9)
80°F DB, 66.5°F WB (26.7°C DB, 19.2°C WB) 50% RH		
Total BTU/H (kW)	121503 (35.6)	72697 (21.3)
Sensible BTU/H (kW)	88738 (26)	59045 (17.3)
75°F DB, 62.5°F WB (23.9°C DB, 16.9°C WB) 50% RH		
Total BTU/H (kW)	113994 (33.4)	67919 (19.9)
Sensible BTU/H (kW)	87714 (25.7)	57338 (16.8)
75°F DB, 61°F WB (23.9°C DB, 16.1°C WB) 45% RH		
Total BTU/H (kW)	110581 (32.4)	66212 (19.4)
Sensible BTU/H (kW)	92492 (27.1)	60410 (17.7)
72°F DB, 60.1°F WB (22.2°C DB, 15.6°C WB) 50% RH		
Total BTU/H (kW)	108533 (31.8)	64847 (19)
Sensible BTU/H (kW)	86008 (25.2)	55973 (16.4)
72°F DB, 58.7°F WB (22.2°C DB, 14.8°C WB) 45% RH		
Total BTU/H (kW)	105462 (30.9)	63141 (18.5)
Sensible BTU/H (kW)	90103 (26.4)	59386 (17.4)

The net capacity data has fan motor heat factored in for all ratings.
Capacity data is factory-certified to be within 5% tolerance.
Data rated with standard filter.

Table 5 Water-cooled capacity data

	65°F (18.3°C) EWT - 105°F (40.6°C) Cond. Temp.		75°F (23.9°C) EWT - 105°F (40.6°C) Cond. Temp.		85°F (29.4°C) EWT - 110°F (43.3°C) Cond. Temp.	
	CR035RW	**CR020RW**	**CR035RW**	**CR020RW**	**CR035RW**	**CR020RW**
105°F DB, 71°F WB (40.6°C DB, 21.6°C WB) 17% RH						
Total BTU/H (kW)	146418 (42.9)	88738 (26)	146418 (42.9)	88738 (26)	144029 (42.2)	87032 (25.5)
Sensible BTU/H (kW)	146418 (42.9)	88738 (26)	146418 (42.9)	88738 (26)	144029 (42.2)	87032 (25.5)
Flow Rate, GPM (l/s)	10.60 (0.669)	6.47 (0.408)	16.64 (1.05)	10.11 (0.638)	23.51 (1.483)	14.20 (0.896)
Pressure Drop, ft water (kPa)	9.70 (29)	6.36 (19)	22.42 (67)	14.72 (44)	42.82 (128)	27.43 (82)
Heat rejection BTU/H (kW)	178159 (52.2)	108875 (31.9)	179183 (52.5)	108875 (31.9)	177817 (52.1)	108533 (31.8)
100°F DB, 69.5°F WB (37.8°C DB, 20.8°C WB) 20% RH						
Total BTU/H (kW)	139933 (41)	84642 (24.8)	139933 (41)	84642 (24.8)	137544 (40.3)	83277 (24.4)
Sensible BTU/H (kW)	139933 (41)	84642 (24.8)	139933 (41)	84642 (24.8)	137544 (40.3)	83277 (24.4)
Flow Rate, GPM (l/s)	10.19 (0.643)	6.20 (0.391)	15.95 (1.006)	9.67 (0.61)	22.48 (1.418)	13.55 (0.855)
Pressure Drop, ft water (kPa)	8.70 (26)	6.02 (18)	20.74 (62)	13.72 (41)	39.48 (118)	25.43 (76)
Heat rejection BTU/H (kW)	172015 (50.4)	104779 (30.7)	172015 (50.4)	104779 (30.7)	171333 (50.2)	104438 (30.6)
95°F DB, 67.9°F WB (35°C DB, 19.9°C WB) 23% RH						
Total BTU/H (kW)	133448 (39.1)	80888 (23.7)	133448 (39.1)	80888 (23.7)	131401 (38.5)	79182 (23.2)
Sensible BTU/H (kW)	133448 (39.1)	80888 (23.7)	133448 (39.1)	80888 (23.7)	131401 (38.5)	79182 (23.2)
Flow Rate, GPM (l/s)	9.78 (0.617)	5.93 (0.374)	15.26 (0.963)	9.24 (0.583)	21.46 (1.354)	12.90 (0.814)
Pressure Drop, ft water (kPa)	8.03 (24)	5.69 (17)	19.07 (57)	12.38 (37)	36.13 (108)	23.08 (69)
Heat rejection BTU/H (kW)	165531 (48.5)	100684 (29.5)	165531 (48.5)	100684 (29.5)	165189 (48.4)	100342 (29.4)
90°F DB, 66.2°F WB (32.2°C DB, 19.0°C WB) 27% RH						
Total BTU/H (kW)	135155 (39.6)	76793 (22.5)	135155 (39.6)	76793 (22.5)	127305 (37.3)	75427 (22.1)
Sensible BTU/H (kW)	131742 (38.6)	76793 (22.5)	131742 (38.6)	76793 (22.5)	125598 (36.8	75427 (22.1)
Flow Rate, GPM (l/s)	9.65 (0.609)	5.67 (0.358)	15.06 (0.95)	8.81 (0.556)	20.83 (1.314))	12.28 (0.775)
Pressure Drop, ft water (kPa)	8.03 (24)	5.02 (15)	18.40 (55)	11.37 (34)	34.12 (102)	20.74 (62)
Heat rejection BTU/H (kW)	163483 (47.9)	96588 (28.3)	163483 (47.9)	96588 (28.3)	161094 (47.2)	96247 (28.2)
85°F DB, 64.5°F WB (29.4°C DB, 18.1°C WB) 31% RH						
Total BTU/H (kW)	126622 (37.1)	76793 (22.5)	126622 (37.1)	76793 (22.5)	123892 (36.3)	74403 (21.8)
Sensible BTU/H (kW)	118772 (34.8)	73038 (21.4)	118772 (34.8)	73038 (21.4)	117407 (34.4)	74403 (21.8)
Flow Rate, GPM (l/s)	9.34 (0.589)	5.55 (0.35)	14.53 (0.917)	8.59 (0.542)	20.29 (1.28)	11.79 (0.744)
Pressure Drop, ft water (kPa)	7.36 (22)	5.02 (15)	17.06 (51)	11.04 (33)	32.45 (97)	19.40 (58)
Heat rejection BTU/H (kW)	158705 (46.5)	94540 (27.7)	158705 (46.5)	94540 (27.7)	157681 (46.2)	93175 (27.3)
80°F DB, 62.8°F WB (26.7°C DB, 17.1°C WB) 37% RH						
Total BTU/H (kW)	123209 (36.)1	73721 (21.6)	123209 (36.1)	73721 (21.6)	120479 (35.3)	71673 (21)
Sensible BTU/H (kW)	108192 (31.7)	69284 (20.3)	108192 (31.7)	69284 (20.3)	106827 (31.3)	68260 (20)
Flow Rate, GPM (l/s)	9.11 (0.575)	5.45 (0.344)	14.17 (0.894)	8.45 (0.533)	19.77 (1.247)	11.68 (0.737)
Pressure Drop, ft water (kPa)	7.36 (22)	4.68 (14)	16.39 (49)	10.37 (31)	30.78 (92)	19.07 (57)
Heat rejection BTU/H (kW)	155292 (45.5)	93175 (27.3)	155292 (45.5)	93175 (27.3)	154268 (45.2)	92492 (27.1)
80°F DB, 66.5°F WB (26.7°C DB, 19.2°C WB) 50% RH						
Total BTU/H (kW)	132766 (38.9)	78499 (23)	132766 (38.9)	78499 (23)	129353 (37.9)	76793 (22.5)
Sensible BTU/H (kW)	93858 (27.5)	59386 (17.4)	93858 (27.5)	59386 (17.4)	92492 (27.1)	58704 (17.2)
Flow Rate, GPM (l/s)	9.73 (0.614)	5.79 (0.365)	15.18 (0.958)	8.97 (0.566)	21.18 (1.336)	12.47 (0.787)
Pressure Drop, ft water (kPa)	8.03 (24)	5.35 (16)	18.73 (56)	11.71 (35)	35.13 (105)	21.41 (64)
Heat rejection BTU/H (kW)	164848 (48.3)	98294 (28.8)	164848 (48.3)	98294 (28.8)	163141 (47.8)	97612 (28.6)

Table 5 Water-cooled capacity data *(continued)*

	65°F (18.3°C) EWT - 105°F (40.6°C) Cond. Temp.		75°F (23.9°C) EWT - 105°F (40.6°C) Cond. Temp.		85°F (29.4°C) EWT - 110°F (43.3°C) Cond. Temp.	
	CR035RW	**CR020RW**	**CR035RW**	**CR020RW**	**CR035RW**	**CR020RW**
75°F DB, 62.5°F WB (23.9°C DB, 16.9°C WB) 50% RH						
Total BTU/H (kW)	123209 (36.1)	73721 (21.6)	123209 (36.1)	73721 (21.6)	120479 (35.3)	71673 (21)
Sensible BTU/H (kW)	92492 (27.1)	58021 (17)	92492 (27.1)	58021 (17)	91127 (26.7)	56997 (16.7)
Flow Rate, GPM (l/s)	9.11 (0.575)	5.47 (0.345)	14.19 (0.895)	8.46 (0.534)	19.77 (1.247)	11.68 (0.737)
Pressure Drop, ft water (kPa)	7.36 (22)	4.68 (14)	16.39 (49)	10.37 (31)	31.11 (93)	19.07 (57)
Heat rejection BTU/H (kW)	155292 (45.5)	93175 (27.3)	155292 (45.5)	93175 (27.3)	154609 (45.3)	92492 (27.1)
75°F DB, 61°F WB (23.9°C DB, 16.1°C WB) 45% RH						
Total BTU/H (kW)	119796 (35.1)	71332 (20.9)	119796 (35.1)	71332 (20.9)	117066 (34.3)	69967 (20.5)
Sensible BTU/H (kW)	96929 (28.4)	61434 (18)	96929 (28.4)	61434 (18)	95564 (28)	60751 (17.8)
Flow Rate, GPM (l/s)	8.89 (0.561)	5.33 (0.336)	13.81 (0.871)	8.23 (0.519)	19.24 (1.214)	11.40 (0.719)
Pressure Drop, ft water (kPa)	6.69 (20)	4.68 (14)	15.72 (47)	10.04 (30)	29.44 (88)	18.40 (55)
Heat rejection BTU/H (kW)	151879 (44.5)	91127 (26.7)	151879 (44.5)	91127 (26.7)	150855 (44.2)	90445 (26.5)
72°F DB, 60.1°F WB (22.2°C DB, 15.6°C WB) 50% RH						
Total BTU/H (kW)	117407 (34.4)	69967 (20.5)	117407 (34.4)	69967 (20.5)	114677 (33.6)	68260 (20)
Sensible BTU/H (kW)	90445 (26.5)	56997 (16.7)	90445 (26.5)	56997 (16.7)	89079 (26.1)	56315 (16.5)
Flow Rate, GPM (l/s)	8.75 (0.552)	5.23 (0.33)	13.55 (0.855)	8.07 (0.509)	18.86 (1.19)	11.16 (0.704)
Pressure Drop, ft water (kPa)	6.69 (20)	4.68 (14)	15.39 (46)	9.70 (29)	28.10 (84)	17.40 (52)
Heat rejection BTU/H (kW)	149489 (43.8)	89421 (26.2)	149489 (43.8)	89421 (26.2)	148466 (43.5)	89079 (26.1)
72°F DB, 58.7°F WB (22.2°C DB, 14.8°C WB) 45% RH						
Total BTU/H (kW)	113994 (33.4)	68260 (20)	113994 (33.4)	68260 (20)	111605 (32.7)	66554 (19.5)
Sensible BTU/H (kW)	94540 (27.7)	60069 (17.6)	94540 (27.7)	60069 (17.6)	93175 (27.3)	59386 (17.4)
Flow Rate, GPM (l/s)	8.54 (0.539)	5.10 (0.322)	13.24 (0.835)	7.86 (0.496)	1.84 (0.116)	10.87 (0.686)
Pressure Drop, ft water (kPa)	6.36 (19)	4.01 (12)	14.72 (44)	9.37 (28)	27.10 (81)	16.73 (50)
Heat rejection BTU/H (kW)	146076 (42.8)	87714 (25.7)	146076 (42.8)	87714 (25.7)	145394 (42.6)	87032 (25.5)

The net capacity data has fan motor heat factored in for all ratings.
Capacity data is factory-certified to be within 5% tolerance.
Data rated with standard filter.

Table 6 Glycol-cooled capacity data

	Glycol (30% Propylene) 110°F (43.3°C) EWT - 135°F (57.2°C) Cond. Temp.		Glycol (40% Propylene) 110°F (43.3°C) EWT - 135°F (57.2°C) Cond. Temp.	
	CR035RW	**CR020RW**	**CR035RW**	**CR020RW**
105°F DB, 71°F WB (40.6°C DB, 21.6°C WB) 17% RH				
Total BTU/H (kW)	130035 (38.1)	75769 (22.2)	130035 (38.1)	75769 (22.2)
Sensible BTU/H (kW)	130035 (38.1)	75769 (22.2)	130035 (38.1)	75769 (22.2)
Flow Rate, GPM (l/s)	24.60 (1.552)	14.38 (0.907)	26.64 (1.681)	15.58 (0.983)
Pressure Drop, ft water (kPa)	49.51 (148)	30.44 (91)	59.22 (177)	36.80 (110)
Heat rejection BTU/H (kW)	174063 (51)	103073 (30.2)	174063 (51)	103073 (30.2)
100°F DB, 69.5°F WB (37.8°C DB, 20.8°C WB) 20% RH				
Total BTU/H (kW)	123551 (36.2)	74745 (21.9)	123551 (36.2)	74745 (21.9)
Sensible BTU/H (kW)	123551 (36.2)	74745 (21.9)	123551 (36.2)	74745 (21.9)
Flow Rate, GPM (l/s)	23.57 (1.487)	14.20 (0.896)	25.50 (1.609)	15.39 (0.971)
Pressure Drop, ft water (kPa)	45.50 (136)	29.44 (88)	54.53 (163)	35.80 (107)
Heat rejection BTU/H (kW)	167920 (49.2)	102049 (29.9)	167920 (49.2)	102049 (29.9)
95°F DB, 67.9°F WB (35°C DB, 19.9°C WB) 23% RH				
Total BTU/H (kW)	117749 (34.5)	70990 (20.8)	117749 (34.5)	70990 (20.8)
Sensible BTU/H (kW)	117749 (34.5)	70990 (20.8)	117749 (34.5)	70990 (20.8)
Flow Rate, GPM (l/s)	22.54 (1.422)	13.55 (0.855)	24.39 (1.539)	14.68 (0.926)
Pressure Drop, ft water (kPa)	41.82 (125)	27.10 (81)	50.18 (150)	32.79 (98)
Heat rejection BTU/H (kW)	162118 (47.5)	98294 (28.8)	162118 (47.5)	98294 (28.8)
90°F DB, 66.2°F WB (32.2°C DB, 19.0°C WB) 27% RH				
Total BTU/H (kW)	111605 (32.7)	67236 (19.7)	111605 (32.7)	67236 (19.7)
Sensible BTU/H (kW)	111605 (32.7)	67236 (19.7)	111605 (32.7)	67236 (19.7)
Flow Rate, GPM (l/s)	21.54 (1.359)	12.92 (0.815)	23.30 (1.47)	13.98 (0.882)
Pressure Drop, ft water (kPa)	38.14 (114)	25.09 (75)	45.83 (137)	30.11 (90)
Heat rejection BTU/H (kW)	155974 (45.7)	94199 (27.6)	155974 (45.7)	94199 (27.6)
85°F DB, 64.5°F WB (29.4°C DB, 18.1°C WB) 31% RH				
Total BTU/H (kW)	109557 (32.1)	63823 (18.7)	109557 (32.1)	63823 (18.7)
Sensible BTU/H (kW)	109557 (32.1)	63823 (18.7)	109557 (32.1)	63823 (18.7)
Flow Rate, GPM (l/s)	20.61 (1.3	12.32 (0.777)	22.29 (1.406)	13.31 (0.84)
Pressure Drop, ft water (kPa)	35.13 (105)	22.75 (68)	42.15 (126)	27.43 (82)
Heat rejection BTU/H (kW)	150513 (44.1)	90786 (26.6)	150513 (44.1)	90786 (26.6)
80°F DB, 62.8°F WB (26.7°C DB, 17.1°C WB) 37% RH				
Total BTU/H (kW)	104438 (30.6)	63141 (18.5)	104438 (30.6)	63141 (18.5)
Sensible BTU/H (kW)	98977 (29)	61434 (18)	98977 (29)	61434 (18)
Flow Rate, GPM (l/s)	20.34 (1.283)	11.87 (0.749)	21.98 (1.387)	12.82 (0.809)
Pressure Drop, ft water (kPa)	34.46 (103)	21.08 (63)	40.82 (122)	25.76 (77)
Heat rejection BTU/H (kW)	148807 (43.6)	88055 (25.8)	148807 (43.6)	88055 (25.8)
80°F DB, 66.5°F WB (26.7°C DB, 19.2°C WB) 50% RH				
Total BTU/H (kW)	111605 (32.7)	66554 (19.5)	111605 (32.7)	66554 (19.5)
Sensible BTU/H (kW)	85325 (25)	54608 (16)	85325 (25)	54608 (16)
Flow Rate, GPM (l/s)	21.56 (1.36)	12.81 (0.808)	23.32 (1.471)	13.85 (0.874)
Pressure Drop, ft water (kPa)	38.47 (115)	24.42 (73)	45.83 (137)	29.44 (88)
Heat rejection BTU/H (kW)	156315 (45.8)	93516 (27.4)	156315 (45.8)	93516 (27.4)

Table 6 Glycol-cooled capacity data *(continued)*

	Glycol (30% Propylene) 110°F (43.3°C) EWT - 135°F (57.2°C) Cond. Temp.		Glycol (40% Propylene) 110°F (43.3°C) EWT - 135°F (57.2°C) Cond. Temp.	
	CR035RW	**CR020RW**	**CR035RW**	**CR020RW**
75°F DB, 62.5°F WB (23.9°C DB, 16.9°C WB) 50% RH				
Total BTU/H (kW)	104438 (30.6)	61775 (18.1)	104438 (30.6)	61775 (18.1)
Sensible BTU/H (kW)	83277 (24.4)	53243 (15.6)	83277 (24.4)	53243 (15.6)
Flow Rate, GPM (l/s)	20.34 (1.283)	11.98 (0.756)	21.98 (1.387)	12.93 (0.816)
Pressure Drop, ft water (kPa)	34.46 (103)	21.75 (65)	40.82 (122)	26.10 (78)
Heat rejection BTU/H (kW)	148807 (43.6)	88397 (25.9)	148807 (43.6)	88397 (25.9)
75°F DB, 61°F WB (23.9°C DB, 16.1°C WB) 45% RH				
Total BTU/H (kW)	101366 (29.7)	60069 (17.6)	101366 (29.7)	60069 (17.6)
Sensible BTU/H (kW)	88055 (25.8)	55973 (16.4)	88055 (25.8)	55973 (16.4)
Flow Rate, GPM (l/s)	19.86 (1.253)	11.67 (0.736)	21.45 (1.353)	12.60 (0.795)
Pressure Drop, ft water (kPa)	32.79 (98)	20.74 (62)	39.14 (117)	24.76 (74)
Heat rejection BTU/H (kW)	145735 (42.7)	86690 (25.4)	145735 (42.7)	86690 (25.4)
72°F DB, 60.1°F WB (22.2°C DB, 15.6°C WB) 50% RH				
Total BTU/H (kW)	99318 (29.1)	59386 (17.4)	99318 (29.1)	59386 (17.4)
Sensible BTU/H (kW)	81912 (24)	51878 (15.2)	81912 (24)	51878 (15.2)
Flow Rate, GPM (l/s)	19.53 (1.232)	11.54 (0.728)	21.08 (1.33)	12.46 (0.786)
Pressure Drop, ft water (kPa)	31.78 (95)	20.07 (60)	37.80 (113)	24.09 (72)
Heat rejection BTU/H (kW)	143687 (42.1)	86008 (25.2)	143687 (42.1)	86008 (25.2)
72°F DB, 58.7°F WB (22.2°C DB, 14.8°C WB) 45% RH				
Total BTU/H (kW)	96588 (28.3)	57680 (16.9)	96588 (28.3)	57680 (16.9)
Sensible BTU/H (kW)	86008 (25.2)	54949 (16.1)	86008 (25.2)	54949 (16.1)
Flow Rate, GPM (l/s)	19.05 (1.202)	11.27 (0.711)	20.57 (1.298)	12.16 (0.767)
Pressure Drop, ft water (kPa)	30.11 (90)	19.40 (58)	36.13 (108)	23.08 (69)
Heat rejection BTU/H (kW)	140957 (41.3)	84301 (24.7)	140957 (41.3)	84301 (24.7)

The net capacity data has fan motor heat factored in for all ratings.
Capacity data is factory-certified to be within 5% tolerance.
Data rated with standard filter.

Table 7 Physical data—air-cooled and water/glycol models

	35kW Models	20kW Models
Fan Data		
Total Airflow, CFM (m^3/h)	3260 (5540)	2454 (4170)
Total Fan Motor, hp (kW)	1.4 (1.06)	0.8 (0.6)
Number of Fans	2	
Evaporator Coil		
Face Area, $ft.^2$ (m^2)	7.26 (0.674)	
Rows	5	4
Face Velocity, FPM (m/s)	449 (2.28)	339 (1.72)
Electric Reheat 1 Stage		
Capacity, BTU/H (kW)	**460V:** 20,472 (6.0) **208V:** 16,719 (4.9)	
Steam Generating Humidifier		
Capacity, lb/hr (kg/hr)	5 (2.3)	
Capacity, kW	1.79	
Condensate Pump - Dual Float Type		
Capacity, GPM (l/m)	6 (22.7)	
Filter Section - Disposable Type		
MERV 8 - Standard Pleated Filter		
Quantity	2	
Nominal Size, in (mm)	31-1/2 x 17-1/2 x 4 (800 x 445 x 100)	
Effective Surface Area - ft^2 (m^2)	16.4 (1.52)	
MERV 11 - Optional Pleated Filter		
Quantity	2	
Nominal Size, in (mm)	31-1/2 x 17-1/2 x 4 (800 x 445 x 100)	
Effective Surface Area - ft^2 (m^2)	16.4 (1.52)	

Table 8 Capacities, chilled water models

	CR040RC			
	45°F (7.2°C) EWT, 10°F (5.6°C) Water Rise	**45°F (7.2°C) EWT, 14°F (7.7°C) Water Rise**	**48°F (8.9°C) EWT, 10°F (5.6°C) Water Rise**	**48°F (8.9°C) EWT, 14°F (7.7°C) Water Rise**
105ºF DB, 71ºF WB (40.6ºC DB, 21.6ºC WB) 17% RH				
Total BTU/H (kW)	169285 (49.6)	163824 (48)	160411 (47)	154950 (45.4)
Sensible BTU/H (kW)	169285 (49.6)	163824 (48)	160411 (47)	154950 (45.4)
Flow Rate, GPM (l/s)	33.44 (2.11)	23.62 (1.49)	31.70 (2)	22.35 (1.41)
Pressure Drop, ft water (kPa)	47.51 (142)	25.09 (75)	42.82 (128)	22.42 (67)
100ºF DB, 69.5ºF WB (37.8ºC DB, 20.8ºC WB) 20% RH				
Total BTU/H (kW)	155292 (45.5)	149489 (43.8)	146076 (42.8)	140616 (41.2)
Sensible BTU/H (kW)	155292 (45.5)	149489 (43.8)	146076 (42.8)	140616 (41.2)
Flow Rate, GPM (l/s)	30.75 (1.94)	21.56 (1.36)	29.01 (1.83)	20.29 (1.28)
Pressure Drop, ft water (kPa)	40.48 (121)	21.41 (64)	36.13 (108)	18.73 (56)
95ºF DB, 67.9ºF WB (35ºC DB, 19.9ºC WB) 23% RH				
Total BTU/H (kW)	140957 (41.3)	134814 (39.5)	131742 (38.6)	125598 (36.8)
Sensible BTU/H (kW)	140957 (41.3)	134814 (39.5)	131742 (38.6)	125598 (36.8)
Flow Rate, GPM (l/s)	27.90 (1.76)	19.50 (1.23)	25.99 (1.64)	18.07 (1.14)
Pressure Drop, ft water (kPa)	34.12 (102)	17.73 (53)	30.11 (90)	15.39 (46)
90ºF DB, 66.2ºF WB (32.2ºC DB, 19.0ºC WB) 27% RH				
Total BTU/H (kW)	126281 (37)	119796 (35.1)	117066 (34.3)	110581 (32.4)
Sensible BTU/H (kW)	126281 (37)	119796 (35.1)	117066 (34.3)	110581 (32.4)
Flow Rate, GPM (l/s)	25.04 (1.58)	17.28 (1.09)	23.14 (1.46)	16.01 (1.01)
Pressure Drop, ft water (kPa)	28.10 (84)	14.39 (43)	24.09 (72)	12.38 (37)
85ºF DB, 64.5ºF WB (29.4ºC DB, 18.1ºC WB) 31% RH				
Total BTU/H (kW)	111264 (32.6)	104438 (30.6)	102049 (29.9)	95223 (27.9)
Sensible BTU/H (kW)	111264 (32.6)	104438 (30.6)	102049 (29.9)	95223 (27.9)
Flow Rate, GPM (l/s)	22.03 (1.39)	15.06 (0.95)	20.29 (1.28)	13.63 (0.86)
Pressure Drop, ft water (kPa)	22.42 (67)	11.04 (33)	19.07 (57)	9.37 (28)
80ºF DB, 62.8ºF WB (26.7ºC DB, 17.1ºC WB) 37% RH				
Total BTU/H (kW)	96588 (28.3)	89421 (26.2)	87373 (25.6)	79864 (23.4)
Sensible BTU/H (kW)	96588 (28.3)	89421 (26.2)	87373 (25.6)	79864 (23.4)
Flow Rate, GPM (l/s)	19.18 (1.21)	12.84 (0.81)	17.28 (1.09)	11.57 (0.73)
Pressure Drop, ft water (kPa)	17.40 (52)	8.36 (25)	14.39 (43)	6.69 (20)
80°F DB, 66.5°F WB (26.7°C DB, 19.2°C WB) 50% RH				
Total BTU/H (kW)	121503 (35.6)	97953 (28.7)	100684 (29.5)	79864 (23.4)
Sensible BTU/H (kW)	91468 (26.8)	80547 (23.6)	82936 (24.3)	73721 (21.6)
Flow Rate, GPM (l/s)	24.09 (1.52)	14.11 (0.89)	19.97 (1.26)	11.57 (0.73)
Pressure Drop, ft water (kPa)	26.10 (78)	10.04 (30)	18.40 (55)	7.03 (21)
75° DB, 62.5°F WB (23.9°C DB, 16.9°C WB) 50% RH				
Total BTU/H (kW)	84301 (24.7)	73038 (21.4)	71673 (21)	62799 (18.4)
Sensible BTU/H (kW)	76451 (22.4)	73038 (21.4)	71673 (21)	62799 (18.4)
Flow Rate, GPM (l/s)	16.64 (1.05)	10.46 (0.66)	14.11 (0.89)	9.03 (0.57)
Pressure Drop, ft water (kPa)	13.38 (40)	6.02 (18)	10.04 (30)	4.35 (13)
75ºF DB, 61ºF WB (23.9ºC DB, 16.1ºC WB) 45% RH				
Total BTU/H (kW)	81229 (23.8)	73038 (21.4)	71673 (21)	62799 (18.4)
Sensible BTU/H (kW)	81229 (23.8)	73038 (21.4)	71673 (21)	62799 (18.4)
Flow Rate, GPM (l/s)	16.01 (1.01)	10.46 (0.66)	14.11 (0.89)	9.03 (0.57)
Pressure Drop, ft water (kPa)	12.71 (38)	6.02 (18)	10.04 (30)	4.35 (13)

Table 8 Capacities, chilled water models *(continued)*

	CR040RC			
	45°F (7.2°C) EWT, 10°F (5.6°C) Water Rise	**45°F (7.2°C) EWT, 14°F (7.7°C) Water Rise**	**48°F (8.9°C) EWT, 10°F (5.6°C) Water Rise**	**48°F (8.9°C) EWT, 14°F (7.7°C) Water Rise**
72°F DB, 60.1°F WB (22.2°C DB, 15.6°C WB) 50% RH				
Total BTU/H (kW)	71332 (20.9)	62458 (18.3)	61775 (18.1)	51536 (15.1)
Sensible BTU/H (kW)	71332 (20.9)	62458 (18.3)	61775 (18.1)	51536 (15.1)
Flow Rate, GPM (l/s)	14.11 (0.89)	9.03 (0.57)	12.20 (0.77)	7.45 (0.47)
Pressure Drop, ft water (kPa)	10.04 (30)	4.35 (13)	7.69 (23)	3.01 (9)
72°F DB, 58.7°F WB (22.2°C DB, 14.8°C WB) 45% RH				
Total BTU/H (kW)	71332 (20.9)	62117 (18.2)	61775 (18.1)	51536 (15.1)
Sensible BTU/H (kW)	71332 (20.9)	62117 (18.2)	61775 (18.1)	51536 (15.1)
Flow Rate, GPM (l/s)	14.11 (0.89)	9.03 (0.57)	12.20 (0.77)	7.45 (0.47)
Pressure Drop, ft water (kPa)	10.04 (30)	4.35 (13)	7.69 (23)	3.01 (9)

The net capacity data has fan motor heat factored in for all ratings.
Capacity data is factory-certified to be within 5% tolerance.
Data rated with standard filter.

Table 9 Physical data—chilled water models

	40kW Models (CR040RC)
Fan Data	
Total Airflow, CFM (m^3/h)	3325 (5650)
Total Fan Motor, hp (kW)	1.7 (1.26)
Number of Fans	2
Evaporator Coil	
Face Area, ft^2 (m^2)	7.26 (0.674)
Rows	6
Face Velocity, FPM (m/s)	459 (2.33)
Electric Reheat 1 Stage	
Capacity, BTU/H (kW)	**460V:** 20,472 (6.0) **208V:** 16,719 (4.9)
Steam Generating Humidifier	
Capacity, lb/hr (kg/hr)	5 (2.3)
kW	1.79
Condensate Pump - Dual Float type	
Capacity, GPM (l/m)	6 (22.7)
Filter Section - Disposable Type	
MERV 8 - Standard Pleated Filter	
Quantity	2
Nominal Size, in (mm)	31-1/2 x 17-1/2 x 4 (800 x 445 x 100)
Effective Surface Area, ft^2 (m^2)	16.4 (1.52)
MERV 11 - Optional Pleated Filter	
Quantity	2
Nominal Size, in (mm)	31-1/2 x 17-1/2 x 4 (800 x 445 x 100)
Effective Surface Area, ft^2 (m^2)	16.4 (1.52)

Table 10 Liebert CRV electrical data

	Air-Cooled Units			Water/ Glycol-Cooled Units			Chilled Water Units	
	CR035RA		CR020RA	CR035RW		CR020RW	CR040RC	
Voltage	460\3\60	208\3\60	208\3\60	460\3\60	208\3\60	208\3\60	460\3\60	208\3\60
Cooling with Dehumidifying, Condensate Pump, Reheat; With or Without Humidifier								
FLA	31.7	62.0	51.0	31.7	62.0	51.0	11.7	24.9
WSA	38.6	75.4	61.6	38.6	75.4	61.6	14.6	31.1
OPD	50	100	80	50	100	80	15.0	35
Cooling with Dehumidifying, Condensate Pump and Humidifier; NO Reheat								
FLA	27.9	53.8	42.8	27.9	53.8	42.8	7.9	16.7
WSA	32.9	63.1	49.3	32.9	63.1	49.3	9.9	20.9
OPD	50	100	70	50	100	70	15	25
Cooling with Dehumidifying and Condensate Pump; NO Reheat, NO humidifier								
FLA	24.2	45.4	34.4	24.2	45.4	34.4	4.2	8.3
WSA	29.2	54.7	40.9	29.2	54.7	40.9	4.6	9.1
OPD	45	90	60	45	90	60	15	15
Cooling with Dehumidifying and Reheat; NO Condensate Pump, NO humidifier								
FLA	30.5	59.7	48.7	30.5	59.7	48.7	10.5	22.6
WSA	37.4	73.1	59.3	37.4	73.1	59.3	13.1	28.3
OPD	50	100	80	50	100	80	15	30.0
Cooling with Dehumidifying, NO Condensate Pump, NO Reheat, NO Humidifier								
FLA	23.0	43.1	32.1	23.0	43.1	32.1	3.0	6.0
WSA	28.0	52.4	38.6	28.0	52.4	38.6	3.4	6.8
OPD	45	80	60	45	80	60	15	15

FLA = Full Load Amps; WSA = Wire Size Amps (Minimum Supply Circuit Ampacity); OPD = Maximum Overcurrent Protective Device
Electrical data for a unit does not change if dehumidifying is enabled or disabled

5.1 Sound Data

Tables 11, **12** and **13** show the sound pressure level in free field at 5ft. (1.5m) high and 6-1/2ft. (2m) in front of the air conditioner, with compressor and fan in operation.

Table 11 Sound data—CR020 air-cooled models

Model Fan Speed %	Airflow		Octave Band Frequency (Hz)										Sound Level dB(A)	Unit SPL suction (2m, f.f., dBA)
	SCFM	m³/h	Level	31.5	63	125	250	500	1000	2000	4000	8000		
100	2454	4170	PWL	73.8	69.4	71	77.3	75.9	74.2	73.5	68.2	59.2	79.6	69.2
75	2166	3680	PWL	71.2	66.8	68.4	74.7	73.3	71.6	70.9	65.6	56.6	77	66.9
55	1780	3025	PWL	67.6	63.2	64.8	71.1	69.7	68	67.3	62	53	73.4	63.9

Table 12 Sound data—CR035 air-cooled tested

Model Fan Speed %	Airflow		Octave Band Frequency (Hz)										Sound Level dB(A)	Unit SPL suction (2m, f.f., dBA)
	SCFM	m³/h	Level	31.5	63	125	250	500	1000	2000	4000	8000		
100	3260	5540	PWL	76	76.2	80.5	82.7	77.3	73.1	74.5	69	61.9	80.9	70
75	2708	4600	PWL	71.3	71.5	75.8	78	72.6	68.4	69.8	64.3	57.2	76.2	65.7
50	2048	3480	PWL	66.3	66.5	70.8	73	67.6	63.4	64.8	59.3	52.2	71.2	61.9

Table 13 Sound data—CR040 water-cooled models

Model Fan Speed %	Airflow		Octave Band Frequency (Hz)										Sound Level dB(A)	Unit SPL suction (2m, f.f., dBA)
	SCFM	m³/h	Level	31.5	63	125	250	500	1000	2000	4000	8000		
100	3325	5650	PWL	86.4	78.1	82.4	84.6	79.2	75	76.4	70.9	63.8	82.8	71.6
75	2708	4600	PWL	80.8	72.5	76.8	79	73.6	69.4	70.8	65.3	58.2	77.2	66
50	1972	3350	PWL	75.1	66.8	71.1	73.3	67.9	63.7	65.1	59.6	52.5	71.5	60.3

Level PWL sound power level

6.0 HEAT REJECTION

6.1 Liebert Condensers for Air-Cooled Liebert CRV Models

Liebert condensers are specifically designed to work with the Liebert CRV. The Variable Frequency Drive (VFD) models are designed for operation in outdoor ambient temperatures ranging from -20°F to 115°F (-29 to 46°C). The Lee-Temp models provide operation in colder outdoor environments ranging from -30°F to 115°F (-34 to 46°C).

Table 14 Air-cooled condenser matchups

Condenser Type	CRV 20kW Ambient, °F (°C)	CRV 35kW Ambient, °F (°C)	# Fans	R410A Models
VFD	95 (35)	—	1	TCSV28K-*
VFD	up to 115 (46)	95 (35)	2	TCSV60K-*
VFD	—	up to 115 (46)	3	TCSV90K-*
Lee-Temp	95 (35)	—	1	DCSL28K-*
Lee-Temp	up to 115 (46)	95 (35)	2	DCSL60K-*
Lee-Temp	—	up to 115 (46)	3	DCSL90K-*

* = A (460V / 3ph / 60Hz)–or–Y (208/230V / 3ph / 60Hz) –or– B (575V / 3ph / 60Hz)
B voltage is not available on VFD condensers

For all condenser safety, installation and operation information, see the Liebert Air Cooled, Direct Drive Condenser Installation, Operation and Maintenance Manual (SL-10066).

6.2 Refrigerant Planning Values

Planning for the refrigerant requirements of the completed system is the addition of the charges from Indoor Unit, Condenser (including Liebert Lee-Temp receiver, if used) and the interconnecting piping. **Tables 16** and **17** provide the approximate charge required for the condensers and the interconnecting piping. See indoor unit charge requirements in **Table 15**.

These values can be used for obtaining adequate refrigerant for the system, but should not be used for final charging. Consult indoor unit installation manual for charging procedures.

Table 15 R410A refrigerant and oil charge for air-cooled models

Model	Base Refrigerant Charge lb (kg)	Base Oil Charge *		Max. System Refrigerant Charge before Oil Addition, lb (kg)	Weight of Oil to Add for Every 10lb (4.5kg) of Refrigerant over Max System Charge, oz (kg)
		Initial Oil Charge oz (kg)	Max. Topping Up oz (kg)		
CR020RA	7 (3.2)	60 (1.68)	56 (1.57)	38 (17.1)	1.6 (.045)
CR035RA	10 (4.5)	110 (3.08)	106 (2.97)	28 (12.6)	4 (.113)

* The recommended oil is EMKARATE RL 32-3MA.

Table 16 R-410A refrigerant required, approximate

Single Circuit Model	VFD lb (kg)	Liebert Lee-Temp (inc. receiver) lb (kg)
28K	7 (3.2)	46 (20.9)
60K	16 (7.3)	84 (38.1)
90K	25 (11.3)	120 (54.4)

Table 17 Interconnecting piping refrigerant charge

External Pipe Diameter in (mm)	Gas R-410A, lb/feet (kg/m)	Liquid (+), at Different Condensing Temperatures - R-410A, lb/ft (kg/m)		
		95°F (35°C)	115°F (46°C)	135°F (57°C)
1/2" x 0.049 (12 x 1)	—	0.05 (0.08)	0.05 (0.07)	0.04 (0.07)
9/16" x 0.049 (14 x 1)	0.0084 (0.0124)	0.07 (0.11)	0.07 (0.11)	0.06 (0.10)
5/8" x 0.049 (16 x 1)	0.0114 (0.0169)	0.10 (0.16)	0.10 (0.14)	0.09 (0.13)
3/4" x 0.049 (18 x 1)	0.0149 (0.0221)	0.14 (0.20)	0.13 (0.19)	0.11 (0.17)
7/8" x 0.065 (22 x 1.25)	0.0232 (0.0346)	—	—	—
1-1/8" x 0.065 (28 x 1.5)	0.0392 (0.0584)	—	—	—

(+) Liquid pressure and density varies according to condensing temperature (see refrigerant tables).

Table 18 60Hz condenser data

Model #		28K			60K			90K		
# of Fans		1			2			3		
Input Voltage	ph	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD
VFD Controlled										
208/230	3	3.7	4.6	15	7.2	8.1	15	10.7	11.6	15
460		1.8	2.3	15	3.5	4.0	15	5.2	5.7	15
Liebert Lee-Temp Controlled/Fan-Cycling										
208/230	3	3.5	4.4	15	7.0	7.9	15	10.5	11.4	15
460		1.7	2.1	15	3.4	3.8	15	5.1	5.5	15
575		1.4	1.8	15	2.8	3.2	15	4.2	4.6	15

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

Table 19 Liebert Lee-Temp receiver electrical data, 50Hz and 60Hz

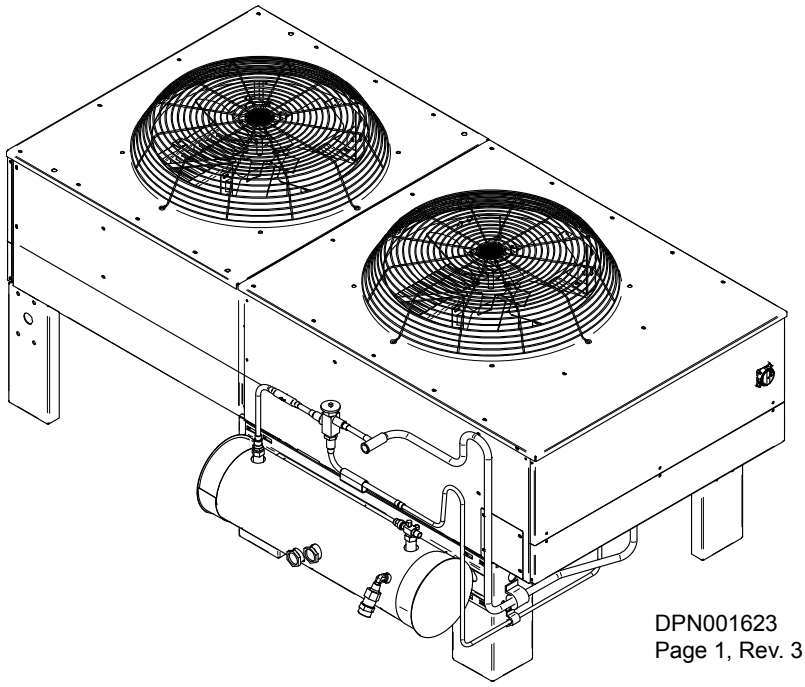
Rated Voltage - Single Phase	120		200/208/230	
Watts/Receiver	150	300	150	300
Full Load Amps	1.4	2.8	0.7	1.4
Wire Size Amps	1.8	3.5	0.9	1.8
Maximum Overcurrent Protection Device, Amps	15	15	15	15

NOTE

Liebert Lee-Temp condensers require a separate line voltage electrical supply for the heated receivers. See ***Table 19*** *for power requirements.*

6.3 Liebert Air-Cooled R-410A Lee-Temp Control Condensers

Figure 15 Liebert air-cooled R-410A Liebert Lee-Temp control condensers



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6.3.1 Standard Features (Source DPN001623, Pg. 1, Rev. 3)

Coil

Coil is constructed of copper tubes in a staggered tube pattern. Tubes are expanded into continuous, rippled or enhanced aluminum type fins. The fins have full depth fin collars completely covering the copper tubes which are connected to heavy wall type L headers. Inlet coil connector tubes pass through relieved holes in the tube sheet for maximum resistance to piping strain and vibration. Coils are factory leak tested at a minimum of 475 PSIG, dehydrated, then filled and sealed with a nitrogen holding charge for shipment..

Fan(s)

Blades are constructed of zinc plated steel or aluminum, with a diameter of 26 inches and secured to the fan shaft by a heavy duty hub with set screw. Fan guards are heavy gauge, close meshed, steel wire with corrosion resistant finish. Fans are factory balanced and tested before shipment.

Fan Motor(s)

Are provided with rain slingers, permanently lubricated bearings, and individual built-in overload protection. Motors are rigidly mounted on die-formed galvanized steel supports.

Head Pressure Control

A Liebert Lee-Temp control system is furnished for each circuit and consists of an insulated, heated receiver tank with sight glasses, pressure relief valve, rotalock valve, and head pressure operated 3-way valve for field-connection to air cooled condenser. This system allows operation at ambient conditions as low as -30°F (-34°C).

Housing

The condenser housing is constructed of bright aluminum sheet and divided into individual fan sections by full width baffles. Structural support members, including coil support frame, motor, and drive support, are galvanized steel for strength and corrosion resistance. Aluminum legs are provided with rigging holes for hoisting the unit into position.

Unit Disconnect Switch

A locking disconnect factory installed and wired in enclosed condenser control section.

Figure 16 Cabinet and anchor dimensional data, R-410A single-circuit Liebert Lee-Temp condensers

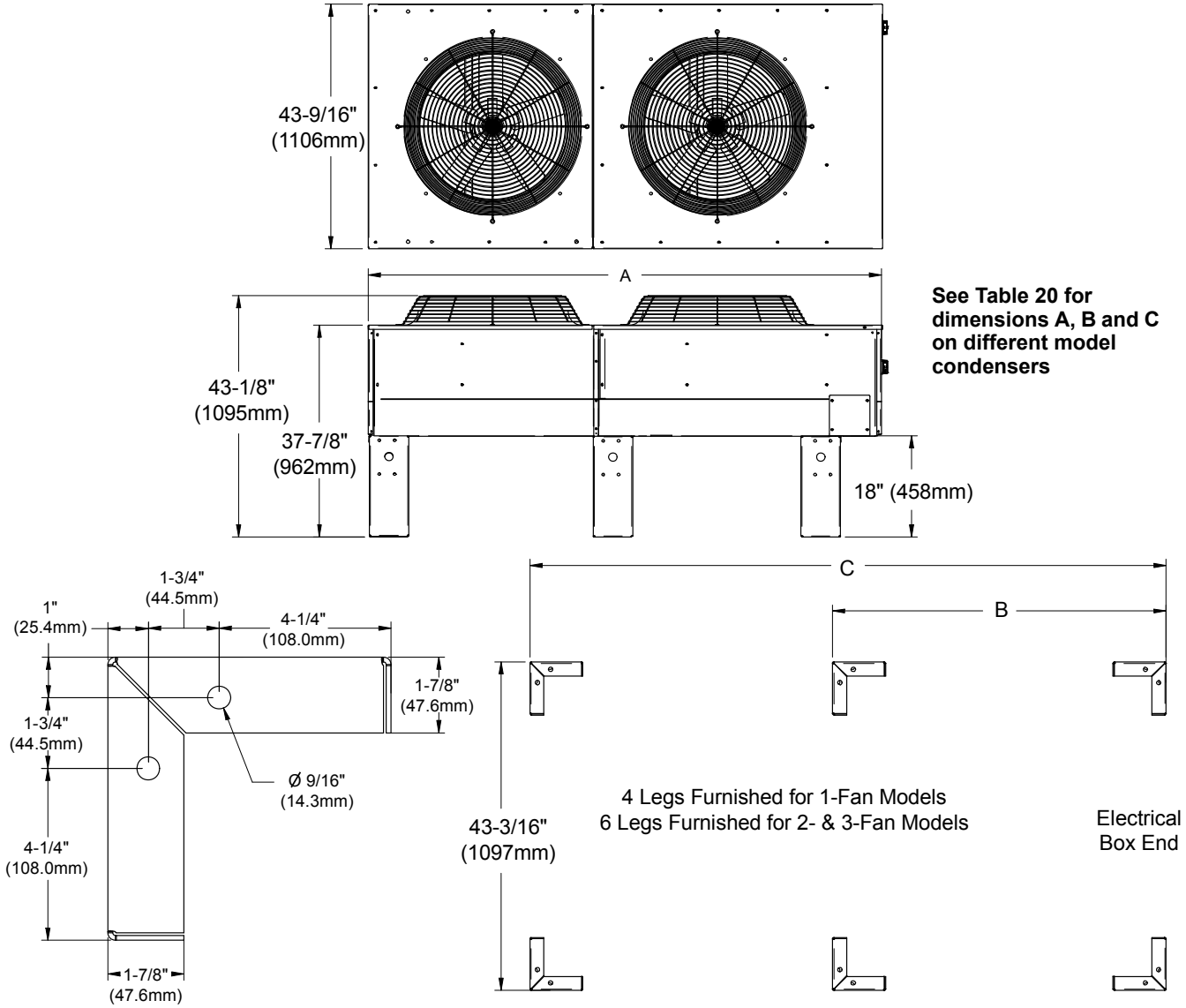


Table 20 Cabinet and anchor dimensions, R-410A, Liebert Lee-Temp control single circuit condensers 60Hz

Liebert Model No.	No. Fans	No. Legs	A	B	C	Net Weight
			in. (mm)	in. (mm)	in. (mm)	lb. (kg)
DCSL28K	1	4	51-1/2 (1308)	44 (1118)	—	325 (148)
DCSL60K	2	6	91-1/2 (2324)	44 (1118)	84 (2134)	475 (215)
DCSL90K	3	6	131-1/2 (3340)	44(1118)	124 (3150)	675 (306)

Source DPN001623, Rev. 3, Pg. 2

Figure 17 Piping, R-410A single-circuit Liebert Lee-Temp condensers

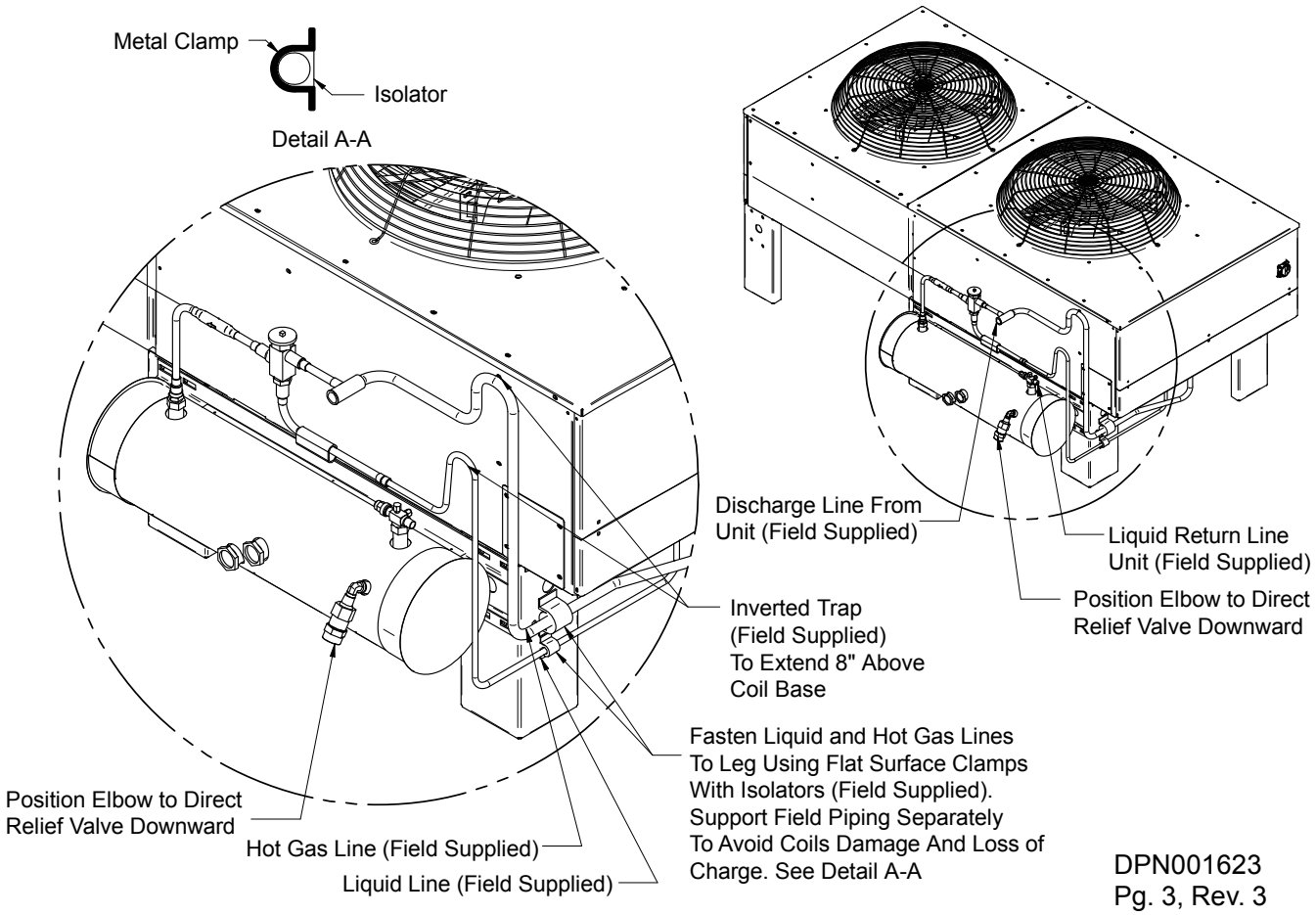


Table 21 Piping and refrigerant sizes for Liebert Lee-Temp condensers with R-410A

Condenser Piping Connection Sizes						
Condenser Connections, O.D., in.				Liebert Lee-Temp Connections, I.D., in.		
Condenser Model #	Hot Gas	Liquid	Liebert Lee-Temp Size, in. (mm)	Hot Gas Tee	Liquid To L-T Valve	Receiver Out
DCSL28K	1-1/8	7/8	9 x 36 (229 x 914)	1-1/8	5/8	5/8
DCSL60K	1-1/8	7/8	11 x 36 (279 x 914)	1-1/8	5/8	5/8
DCSL90K	1-1/8	7/8	11 x 48 (279 x 1219)	1-1/8	5/8	5/8

Source DPN001623, Rev. 3, Pg. 3

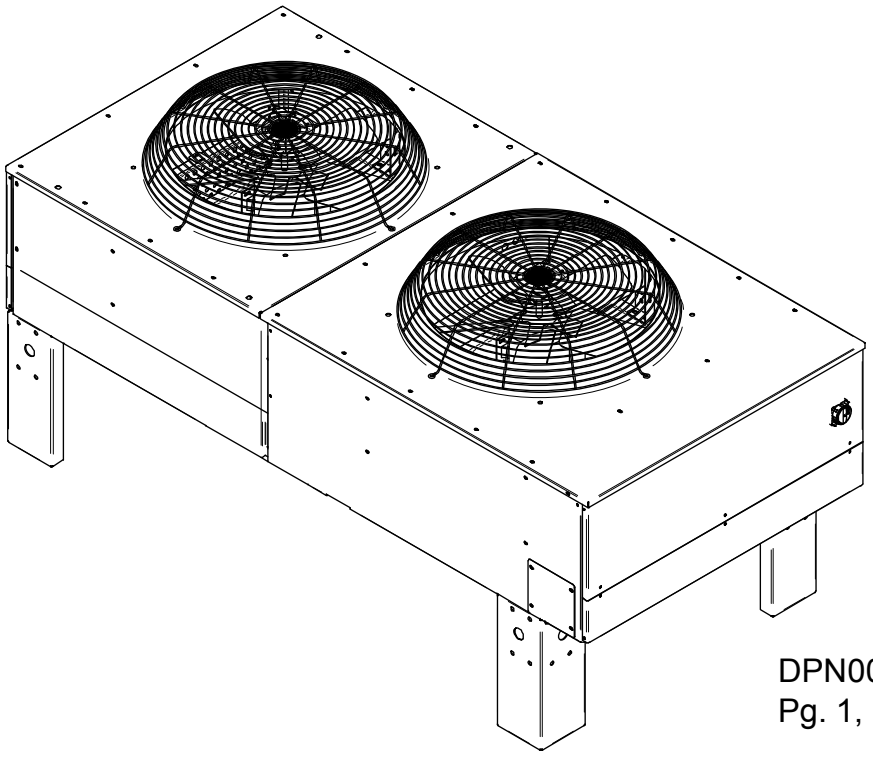
Table 22 Recommended refrigerant line sizes for Liebert Lee-Temp condensers with R-410A Cu, OD

Liebert CRV Model #	Total Equivalent Length, ft. (m)	Hot Gas Line, in. (mm)	Liquid Line, in. (mm)
CR020RA	50 (15.2)	3/4 (19.1)	5/8 (15.9)
	100 (30.5)	3/4 (19.1)	5/8 (15.9)
	150 (45.7)	3/4 (19.1)	5/8 (15.9)
CR035RA	50 (15.2)	7/8 (22.2)	3/4 (19.1)
	100 (30.5)	7/8 (22.2)	3/4 (19.1)
	150 (45.7)	7/8 (22.2)	3/4 (19.1)

Consult factory for proper line sizing for runs longer than 150 ft. (45.7m) equivalent length.
Source DPN001623, Rev. 3, Pg. 3

6.4 Liebert Air-Cooled R-410A VFD Control Condensers

Figure 18 Liebert air-cooled R-410A VFD control condensers



6.4.1 Standard Features (Source DPN001624, Pg. 1, Rev. 3)

Coil

The coil is constructed of copper tubes in a staggered tube pattern. Tubes are expanded into continuous, rippled or enhanced aluminum type fins. The fins have full depth fin collars completely covering the copper tubes which are connected to heavy wall type L headers. Inlet coil connector tubes pass through relieved holes in the tube sheet for maximum resistance to piping strain and vibration. Coils are factory leak tested at a minimum of 475 PSIG, dehydrated, then filled and sealed with a nitrogen holding charge for shipment.

Fans

Blades are constructed of zinc plated steel or aluminum with a diameter of 26 inches and secured to the fan shaft by a heavy duty hub with set screw. Fan guards are heavy gauge, close meshed, steel wire with corrosion resistant finish. Fans are factory balanced and tested before shipment.

Fan Motors

The variable speed fan motor is a specifically designed inverter duty motor with permanently lubricated ceramic bearings. The Liebert variable frequency drive (VFD) control system provides overload protection for the variable speed motor. Each ambient-temperature-controlled fan motor has built-in overload protection. All motors have rain slingers, permanently lubricated bearings and are rigidly mounted on die-formed galvanized steel supports.

Head Pressure Control

The Liebert VFD Condenser control system is complete with variable frequency drive (VFD), inverter duty fan motor operating from 0% to 100% motor RPM based on head pressure, refrigerant pressure transducers, ambient thermostat(s), ambient-temperature thermostat(s), motor overload protection, and electrical control circuit factory wired in the control panel. VFD control is always furnished on the fan adjacent to the connection end of the condenser which runs continuously with the compressors. Other condenser fans are controlled by ambient thermostats and are either “on” or “off”. This system allows for operation at ambient conditions as low as -20°F (-28.9°C).

Housing

The condenser housing is constructed of bright aluminum sheet and divided into individual fan sections by full width baffles. Structural support members, including coil support frame, motor, and drive support, are galvanized steel for strength and corrosion resistance. Aluminum legs are provided with rigging holes for hoisting the unit into position.

TVSS and Unit Disconnect Switch

Transient Voltage Surge Suppression and locking disconnect factory installed and wired in enclosed condenser control section.

Alarm Contacts

Normally open dry contacts provided for indication of VFD and TVSS alarm condition.

Figure 19 Cabinet and anchor dimensional data, R-410A VFD control condensers

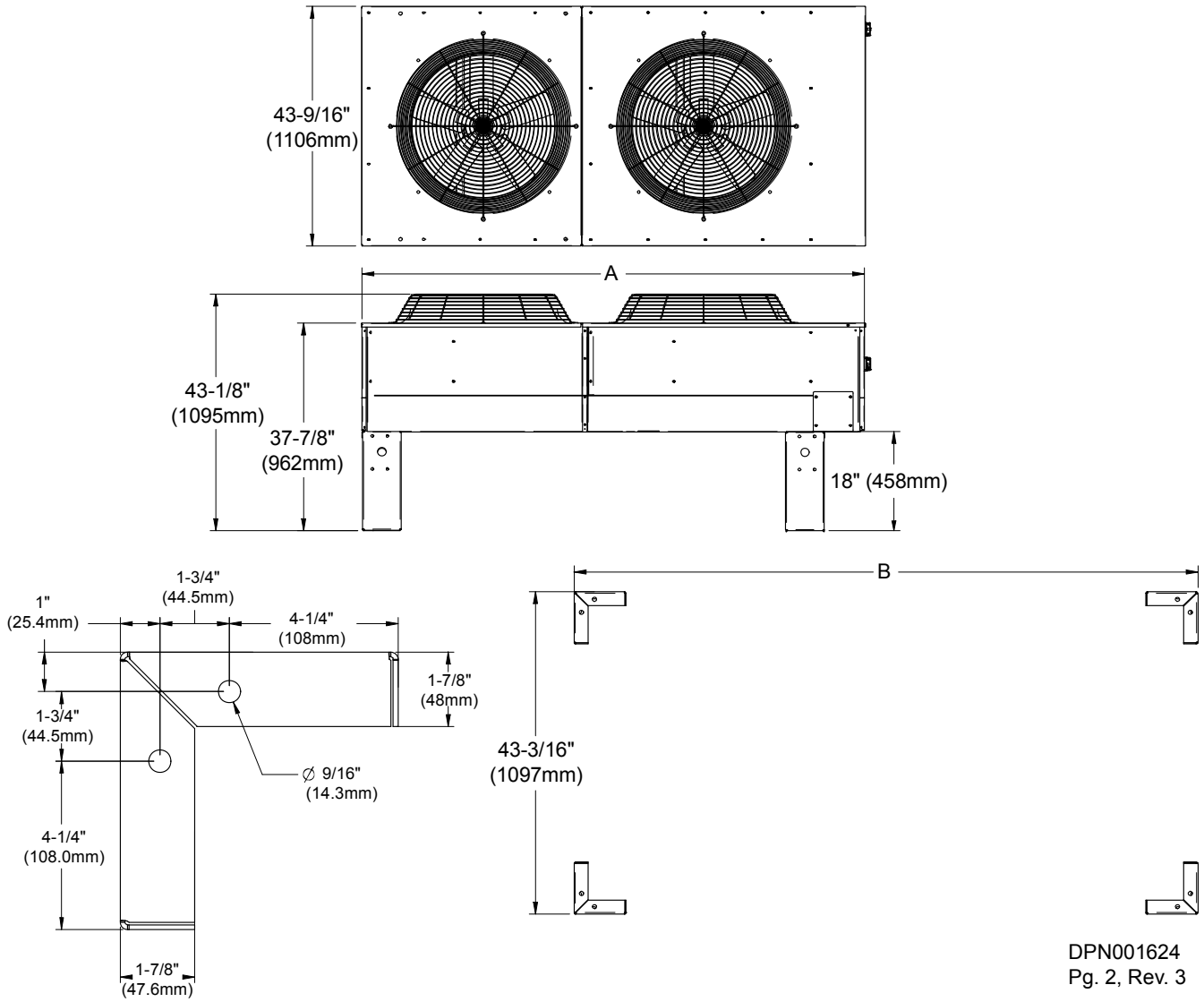


Table 23 Cabinet and anchor dimensions, R-410A, VFD control control single circuit condensers, 60Hz

Liebert Model No.	No. of Fans	A	B	Net Weight
		in. (mm)	in. (mm)	lb. (kg)
TCSV28K	1	51-1/2 (1308)	44 (1118)	325 (148)
TCSV60K	2	91-1/2 (2324)	84 (2134)	470 (213)
TCSV90K	3	131-1/2 (3340)	124 (3150)	670 (304)

Source DPN001624, Rev. 3, Pg. 2

Figure 20 Piping R-410A VFD control single circuit condensers

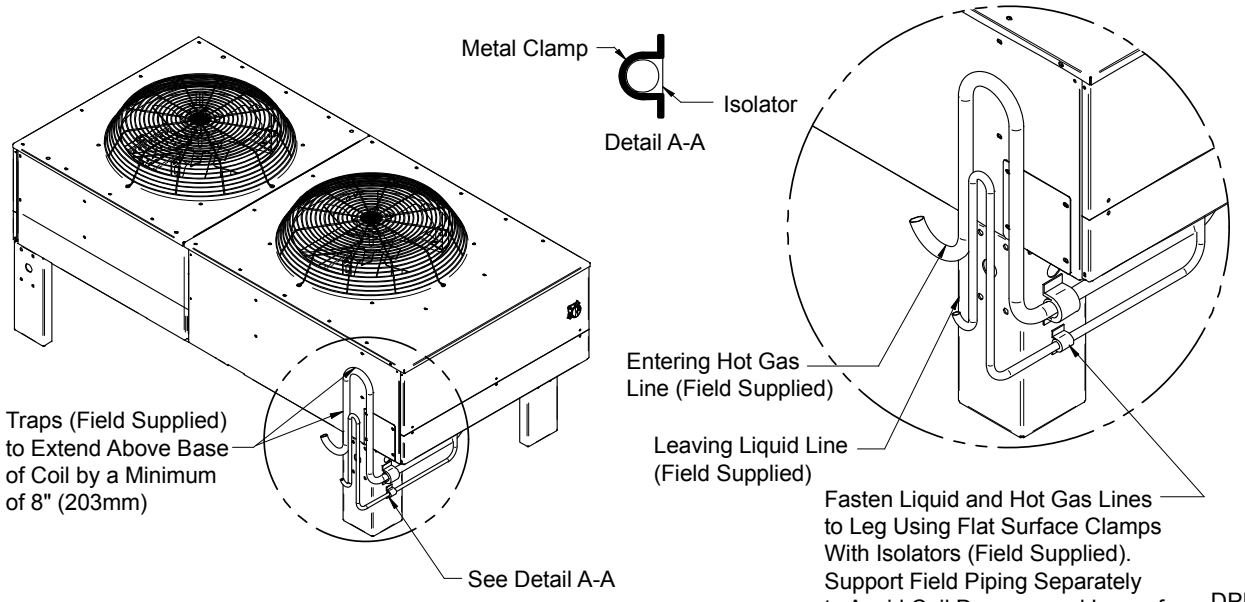


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Table 24 Piping and refrigerant sizes for Liebert air-cooled, VFD control condensers with R-410A

Condenser Piping Connection Sizes, Cu, O.D.		
Condenser Model #	**Entering Hot Gas Line, in. (mm)**	**Returning Liquid Line, in. (mm)**
TCSV28K	1-1/8 (28.6)	7/8 (22.2)
TCSV60K	1-1/8 (28.6)	7/8 (22.2)
TCSV90K	1-1/8 (28.6)	7/8 (22.2)

Source DPN001624, Rev. 3, Pg. 3

Table 25 Recommended refrigerant line sizes for Liebert air-cooled, VFD control condensers with R-410A, Cu, OD

Liebert CRV Model #	Total Equivalent Length, ft. (m)	Hot Gas Line, in. (m)	Liquid Line, in. (m)
CR020RA	50 (15.2)	3/4 (19.1)	5/8 (15.9)
	100 (30.5)	3/4 (19.1)	5/8 (15.9)
	150 (45.7)	3/4 (19.1)	5/8 (15.9)
CR035RA	50 (15.2)	7/8 (22.2)	3/4 (19.1)
	100 (30.5)	7/8 (22.2)	3/4 (19.1)
	150 (45.7)	7/8 (22.2)	3/4 (19.1)

Consult factory for proper line sizing for runs longer than 150 ft. (45.7m) equivalent length.
Source DPN001624, Rev. 3, Pg. 3

6.5 Liebert Drycoolers for Water/Glycol-Cooled Liebert CRVs

Liebert drycoolers are specifically designed to work with the Liebert CRV. The drycoolers provide glycol to the Liebert CRV's internal high efficiency brazed plate condenser to maintain proper condensing temperatures. Ethylene or Propylene glycol must be added to the water loop to prevent freezing during low outdoor temperatures. **Figure 21** shows the percentage of ethylene glycol that should be added based on the minimum outdoor temperature. If the Liebert CRV is attached to an open water loop (cooling tower, city water, etc.) a 16-20 mesh strainer is to be installed (not supplied by Liebert) upstream of the unit to prevent debris from entering the unit.

Table 26 Glycol-cooled drycooler matchups

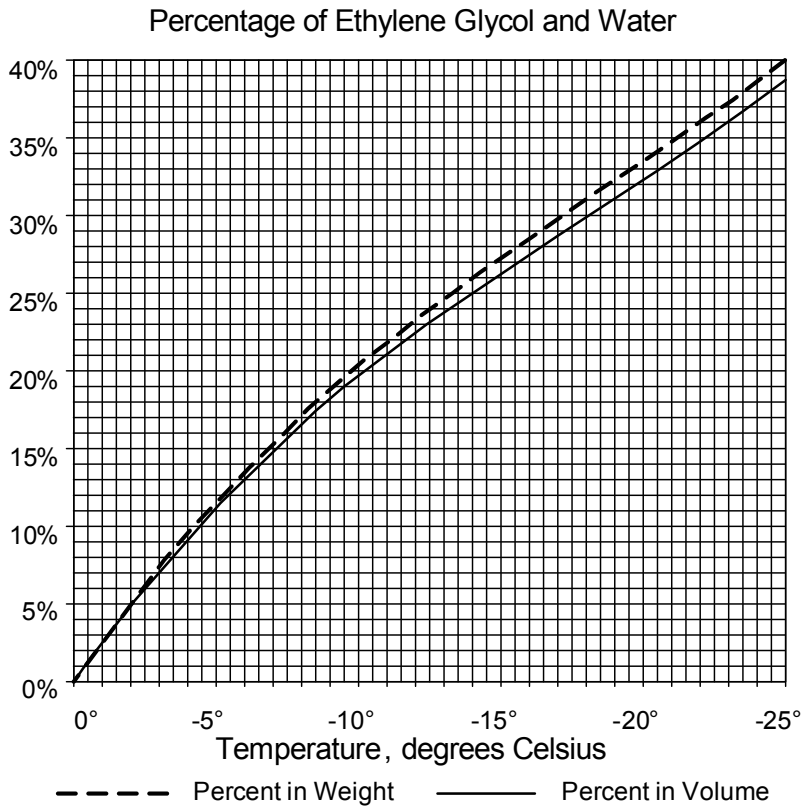
CRV Model	Outdoor Temperature, °F (°C)	# Fans	Models**	Suggested Pump HP***
20kW	95 (35)	2	DSO174*8	1.5
	100 (38)	2	DSO197*8	1.5
	105 (41)	3	DSO260*16	2
35kW	95 (35)	2	DSO225*16	2
	100 (38)	3	DSO350*16	2
	105 (41)	4	DSO491*16	3

* = A (460V / 3ph / 60Hz)–or–Y (208/230V / 3ph / 60Hz) –or– B (575V / 3ph / 60Hz)

** Matchups sized for 40% propylene glycol

*** Suggested pump selections provide at least 30ft H_2O head for piping losses

Figure 21 Percentage of ethylene glycol mixed with water



NOTICE

Risk of freezing fluid mixture. Can cause equipment damage.

The water supply/loop must be checked periodically for proper glycol mixture content. For safety, calculate the percentage for protection at least 9°F (5°C) below the minimum ambient design temperature.

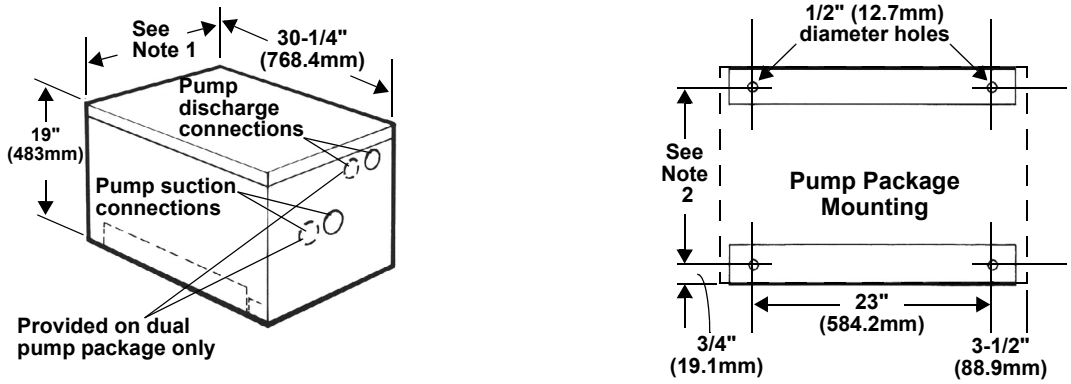
6.6 Drycooler General Data

Table 27 Drycooler electrical data

# of Fans	1				2				3				4				6				8			
Model #	33,69,92,109,112				139,174,197,225				260,310,350				352,419,466,491				620,650,700				790,880,940			
Pump Hp	ph	FLA	WSA	OPD	ph	FLA	WSA	OPD	ph	FLA	WSA	OPD	ph	FLA	WSA	OPD	ph	FLA	WSA	OPD	ph	FLA	WSA	OPD
208/230/60																								
0.75	1	12.4	14.3	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.75	3	7.0	7.9	15	3	10.5	11.4	15	3	14.0	14.9	15	3	17.5	18.4	20	3	24.5	25.4	25	3	31.5	32.4	35
1.5	3	10.1	11.8	15	3	13.6	15.3	20	3	17.1	18.8	25	3	20.6	22.3	25	3	27.6	29.3	35	3	34.6	36.3	40
2.0	3	11.0	12.9	20	3	14.5	16.4	20	3	18.0	19.9	25	3	21.5	23.4	30	3	28.5	30.4	35	3	35.5	37.4	40
3.0	3	14.1	16.8	25	3	17.6	20.3	30	3	21.1	23.8	30	3	24.6	27.3	35	3	31.6	34.3	40	3	38.6	41.3	50
5.0	3	20.2	24.4	40	3	23.7	27.9	40	3	27.2	31.4	45	3	30.7	34.9	50	3	37.7	41.9	50	3	44.7	48.9	60
7.5	3	27.7	33.8	50	3	31.2	37.3	60	3	34.7	40.8	60	3	38.2	44.3	60	3	45.2	51.3	70	3	52.2	58.3	80
10.0	3	34.3	42.0	70	3	37.8	45.5	70	3	41.3	49.0	70	3	44.8	52.5	80	3	51.8	59.5	90	3	58.8	66.5	90
15	3	49.7	61.3	100	3	53.2	64.8	110	3	56.7	68.3	110	3	60.2	71.8	110	3	67.2	78.8	110	3	74.2	85.8	125
460/3/60																								
0.75	3	3.3	3.7	15	3	5.0	5.4	15	3	6.7	7.1	15	3	8.4	8.8	15	3	11.8	12.2	15	3	15.2	15.6	20
1.5	3	4.7	5.5	15	3	6.4	7.2	15	3	8.1	8.9	15	3	9.8	10.6	15	3	13.2	14.0	15	3	16.6	17.4	20
2.0	3	5.1	6.0	15	3	6.8	7.7	15	3	8.5	9.4	15	3	10.2	11.1	15	3	13.6	14.5	15	3	17.0	17.9	20
3.0	3	6.5	7.7	15	3	8.2	9.4	15	3	9.9	11.1	15	3	11.6	12.8	15	3	15.0	16.2	20	3	18.4	19.6	20
5.0	3	9.3	11.2	15	3	11.0	12.9	20	3	12.7	14.6	20	3	14.4	16.3	20	3	17.8	19.7	25	3	21.2	23.1	30
7.5	3	12.7	15.5	25	3	14.4	17.2	25	3	16.1	18.9	25	3	17.8	20.6	30	3	21.2	24.0	30	3	24.6	27.4	35
10.0	3	15.7	19.2	30	3	17.4	20.9	30	3	19.1	22.6	35	3	20.8	24.3	35	3	24.2	27.7	40	3	27.6	31.1	45
15	3	22.7	28.0	45	3	24.4	29.7	50	3	26.1	31.4	50	3	27.8	33.1	50	3	31.2	36.5	50	3	34.6	39.9	60
575/3/60																								
0.75	3	2.7	3.1	15	3	4.1	4.5	15	3	5.5	5.9	15	3	6.9	7.3	15	3	9.7	10.1	15	3	12.5	12.9	15
1.5	3	3.8	4.4	15	3	5.2	5.8	15	3	6.6	7.2	15	3	8.0	8.6	15	3	10.8	11.4	15	3	13.6	14.2	15
2.0	3	4.1	4.8	15	3	5.5	6.2	15	3	6.9	7.6	15	3	8.3	9.0	15	3	11.1	11.8	15	3	13.9	14.6	15
3.0	3	5.3	6.3	15	3	6.7	7.7	15	3	8.1	9.1	15	3	9.5	10.5	15	3	12.3	13.3	15	3	15.1	16.1	20
5.0	3	7.5	9.0	15	3	8.9	10.4	15	3	10.3	11.8	15	3	11.7	13.2	15	3	14.5	16.0	20	3	17.3	18.8	20
7.5	3	10.4	12.7	20	3	11.8	14.1	20	3	13.2	15.5	20	3	14.6	16.9	25	3	17.4	19.7	25	3	20.2	22.5	30
10.0	3	12.4	15.2	25	3	13.8	16.6	25	3	15.2	18.0	25	3	16.6	19.4	30	3	19.4	22.2	30	3	22.2	25.0	35
15	3	18.4	22.7	35	3	19.8	24.1	40	3	21.2	25.5	40	3	22.6	26.9	40	3	25.4	29.7	45	3	28.2	32.5	45

6.7 Drycooler Pump Packages and Expansion Tank - Options

Figure 22 Drycooler pump package and pump mounting



Notes

1. Single pump packages are 17-1/4" (438.2mm) wide. Dual pump packages are 32-1/4" (819.2mm) wide.
2. Mounting holes are 15-11/32" (389.7mm) apart on single pump packages and 30-11/32" (770.7mm) apart on dual pump packages.
3. 7-1/2hp dimensions not shown—consult factory.

Expansion Tank- (P/N 1C16717P1)

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

This tank is sized for a typical "open" system with a fluid volume of less than 75 gal. (280l). When used in a "closed" system, volumes of up to 140 gal. (910l) can be accommodated. The use of a safety relief valve, field-supplied, is recommended for systems "closed" to atmospheric venting. Other piping accessories for filling, venting or adjusting the fluid in the system, are recommended, but not included.

Figure 23 Expansion tank

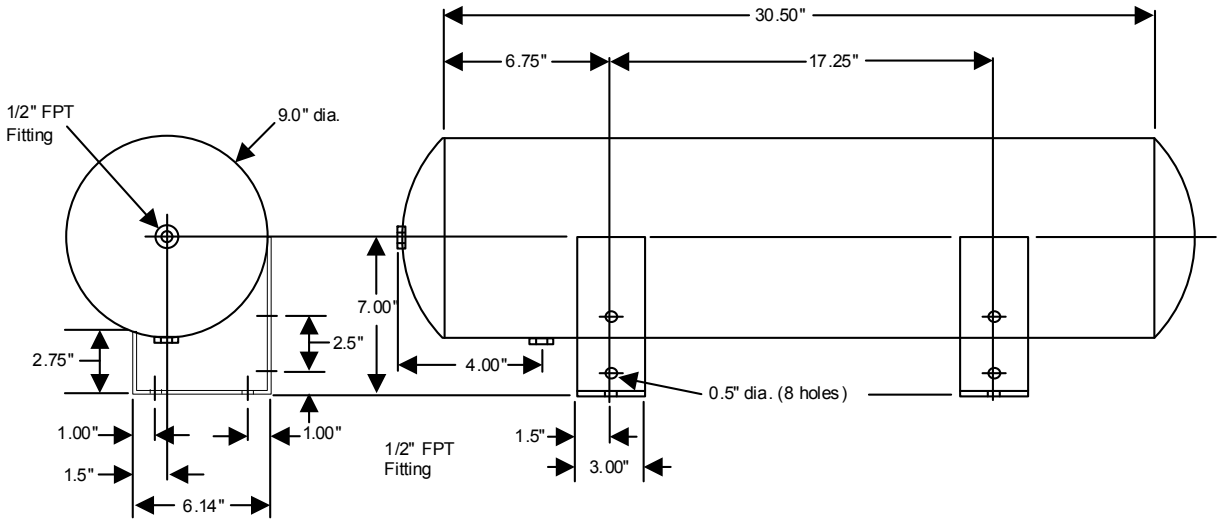
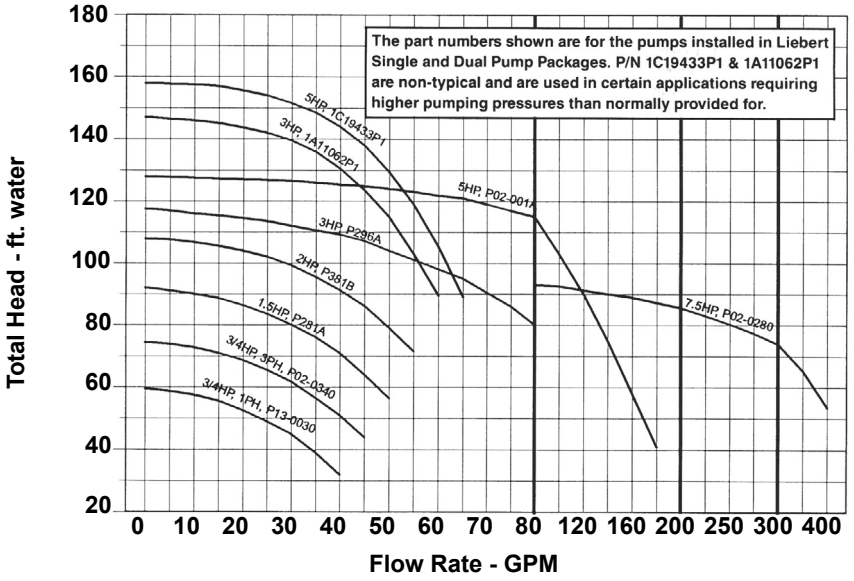


Table 28 Pump data

Pump Model	Connections		HP	Electric @ 60Hz				
	NPT Suction	Female Discharge		PH	208 FLA	230 FLA	460 FLA	575 FLA
3/4	1-1/4"	3/4"	3/4	1	7.6	6.9	N/A	N/A
3/4	1-1/4"	3/4"	3/4	3	3.5	3.2	1.6	1.3
1-1/2	1-1/4"	3/4"	1-1/2	3	6.6	6.0	3.0	2.4
2	1-1/4"	3/4"	2	3	7.5	6.8	3.4	2.7
3	1-1/2"	1"	3	3	10.6	9.6	4.8	3.9
5	1-1/2"	1-1/4"	5	3	16.7	15.2	7.6	6.1
7-1/2	3"	3"	7-1/2	3	24.2	22.0	11.0	9.0

To Calculate Total Pump and Drycooler Full Load Amps (FLA):
Total FLA = Pump FLA + Drycooler FLA
To Calculate Total Pump and Drycooler Wire Size Amps (WSA)
Total WSA = Largest Motor FLA x 1.25 + Sum of other Motor FLA values
To Calculate Total Pump and Drycooler Maximum Overcurrent Protective Device (OPD)
Total OPD = Largest Motor FLA x 4.0 + Sum of other Motor FLA values
Select standard fuse size (15A, 20A, 25A, 30A, etc.)

Figure 24 Pump curve, 60 Hz



6.8 Liebert Glycol-Cooled Direct Drive Drycoolers

6.8.1 Standard Features

Coil

Liebert manufactured coil is constructed of copper tubes in a staggered tube pattern. Tubes are expanded into continuous, rippled aluminum type fins. The fins have full depth fin collars completely covering the copper tubes which are connected to heavy wall type L headers. Inlet coil connector tubes pass through relieved holes in the tube sheet for maximum resistance to piping strain and vibration. Coils are factory leak tested at a minimum of 300 PSIG, dehydrated, then filled and sealed with a nitrogen holding charge for shipment.

Fan(s)

Blades are constructed of zinc-plated steel or aluminum with a diameter of 26 inches and secured to the fan shaft by a heavy duty hub with set screw. Fan guards are heavy gauge, close meshed, steel wire with corrosion resistant finish. Fans are factory balanced and tested before shipment.

Fan Motor(s)

Are provided with rain slingers, permanently lubricated bearings and individual built-in overload protection. Motors are rigidly mounted on die-formed galvanized steel supports.

Housing

The Drycooler housing is constructed of bright aluminum sheet and divided into individual fan sections by full width baffles. Structural support members, including coil support frame, motor, and drive support, are galvanized steel for strength and corrosion resistance. Aluminum legs are provided with rigging holes for hoisting the unit into position.

Fluid Temperature Control System (Fan Cycling)

Is complete with aquastats and electrical control circuit factory wired in the integral control panel. Aquastats cycle fans to maintain fluid temperature as outdoor air temperature changes. Head pressure is controlled by the fluid regulating valve in the Liebert indoor unit.

Unit Disconnect Switch

A locking disconnect factory installed and wired in enclosed control section (Standard with DSO, DDO Drycoolers).

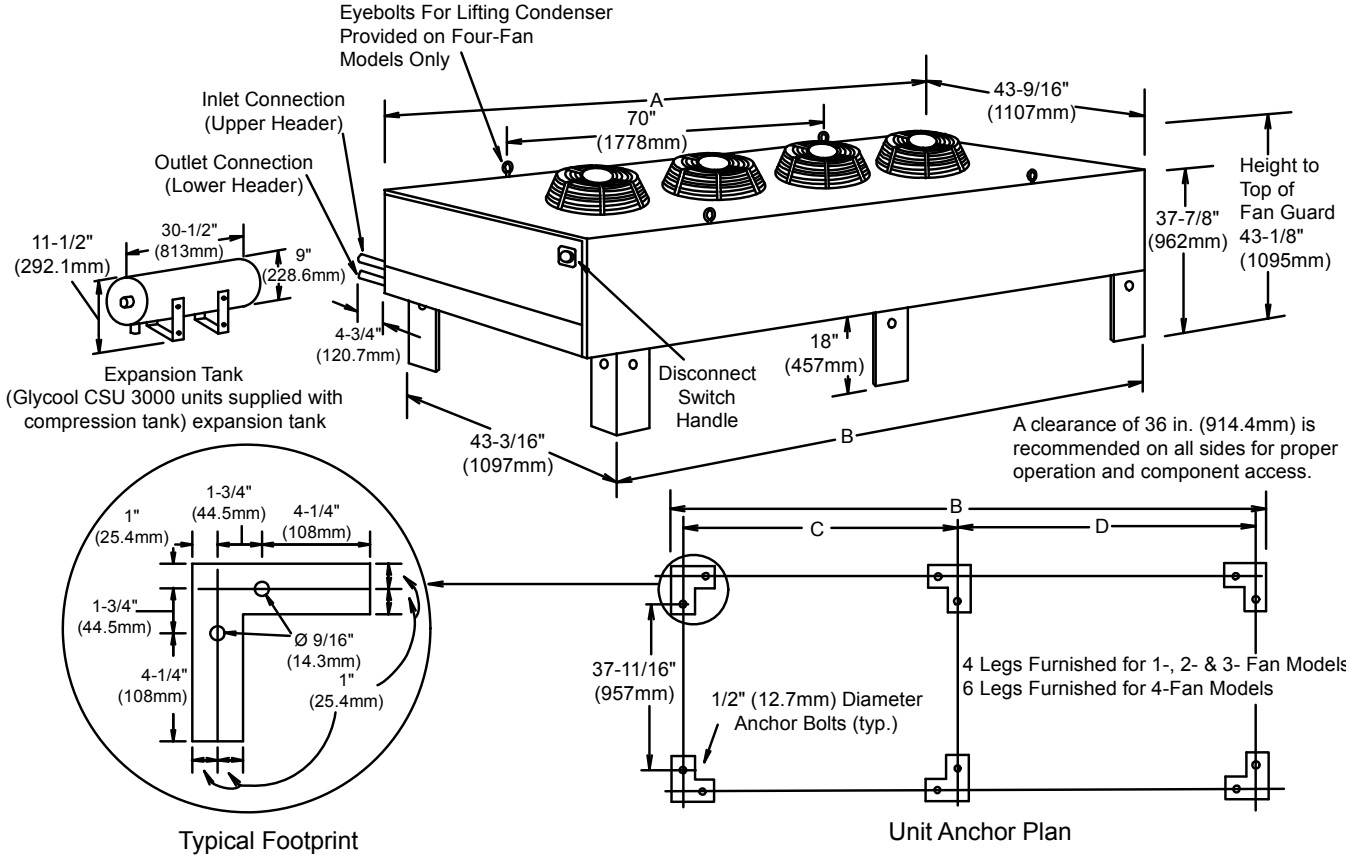
Pump Controls

Factory wired in the integral control panel. Single power feed to Drycooler supplies power to both Drycooler and pumps (electric service connection). Single pump (DSO) and dual pump (DDO) control options are available.

DDO

Drycooler keeps one pump in active mode and the other in standby mode. Switchover between pumps activated by factory-supplied pump selector switch or by contact closure on field-installed flow switch.

Figure 25 Cabinet and anchor dimensional data for direct drive drycoolers



1. All drycooler fan motors are 3/4hp.
2. DSO model prefix indicates that the control section in the drycooler includes controls for a single pump package.
   DDO model prefix indicates that the control section in the drycooler includes controls for a dual pump package.
   DSF model prefix indicates that the control section in the drycooler includes controls for a single pump package on a fan speed control drycooler.
3. DNT prefix indicates a single circuit with fan cycling but no pump controls.
4. DNC prefix indicates a single circuit with no fan or pump controls.

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Model # Note 2, 3, 4	# of Fans	A in (mm)	B in (mm)	C in (mm)	D in (mm)	CFM (l/s) 60Hz Note 1	CFM (l/s) 50Hz Note 1	Internal Vol gal. (L)	Net Weight lb. (kg)
-033	1	51-1/2 (1308)	44 (1118)	42 (1067)	—	7200 (3398)	6000 (2932)	1.2 (4.6)	390 (177)
-069	1	51-1/2 (1308)	44 (1118)	42 (1067)	—	6866 (3240)	5722 (2700)	2.4 (9.2)	410 (186)
-092	1	51-1/2 (1308)	44 (1118)	42 (1067)	—	6633 (3130)	5527 (2609)	3.7 (13.9)	430 (195)
-109	1	51-1/2 (1308)	44 (1118)	42 (1067)	—	6322 (2984)	5268 (2486)	4.9 (18.6)	450 (204)
-112	1	51-1/2 (1308)	44 (1118)	42 (1067)	—	6088 (2873)	5074 (2394)	5.8 (22.0)	470 (213)
-139	2	91-1/2 (2324)	84 (2134)	82 (2083)	—	13732 (6481)	11443 (5401)	4.8 (18.2)	565 (256)
-174	2	91-1/2 (2324)	84 (2134)	82 (2083)	—	13265 (6261)	11054 (5217)	6.9 (26.2)	605 (274)
-197	2	91-1/2 (2324)	84 (2134)	82 (2083)	—	12645 (5968)	10535 (4973)	9 (34)	645 (293)
-225	2	91-1/2 (2324)	84 (2134)	82 (2083)	—	12177 (5748)	10147 (4789)	11.1 (42.1)	685 (310)
-260	3	131-1/2 (3340)	124 (3150)	122 (3099)	—	19898 (9392)	16582 (7827)	10.0 (37.8)	826 (375)
-310	3	131-1/2 (3340)	124 (3150)	122 (3099)	—	18965 (8951)	15804 (7459)	13.1 (49.6)	886 (402)
-350	3	131-1/2 (3340)	124 (3150)	122 (3099)	—	17398 (8212)	14499 (6843)	19.4 (73.3)	946 (429)
-352	4	171-1/2 (4356)	164 (4166)	82 (2083)	80 (2032)	24800 (11705)	20667 (9755)	13.1 (49.6)	1040 (471)
-419	4	171-1/2 (4356)	164 (4166)	82 (2083)	80 (2032)	23650 (11163)	19708 (9302)	17.4 (65.9)	1120 (508)
-466	4	171-1/2 (4356)	164 (4166)	82 (2083)	80 (2032)	22770 (10747)	18975 (8956)	22.0 (83.3)	1150 (522)
-491	4	171-1/2 (4356)	164 (4166)	82 (2083)	80 (2032)	21700 (10242)	18083 (8535)	26.3 (99.6)	1200 (544)

Source DPN000274, Rev. 1

Table 29 Piping, direct drive drycoolers, O.D., Cu

Drycooler Model #	Number of Coil Circuits	Inlet & Outlet Pipe Diameter (Inches)
-33	4*	1-3/8
-69	4, 8*	1-3/8
-092	6, 12*, 16	1-5/8
-109	8	1-3/8
-109	16*	2-1/8
-112	8	1-3/8
-112	16*, 26	2-1/8
-139	8, 16*	2-1/8
-174	16*, 24	2-1/8
-197	16*, 32	2-1/8
-225	16, 26*	2-1/8
-260	16, 24*	2-1/8
-310	16, 32*	2-1/8
-350	16, 32*	2-1/8
-350	48	2-5/8
-352	16, 24*	2-1/8
-419	16, 32*	2-1/8
-466	26	2-1/8
-466	40*	2-5/8
-491	16	2-1/8
-491	32, 48*	2-5/8

* Standard Circuiting

\- For model prefix designation, refer to Cabinet & Anchor Dimensional Data page.

Source: DPN000275, Rev. 2

7.0 INSTALLATION DRAWINGS

Figure 26 Raised-floor cutouts for bottom-entry piping and electrical connections

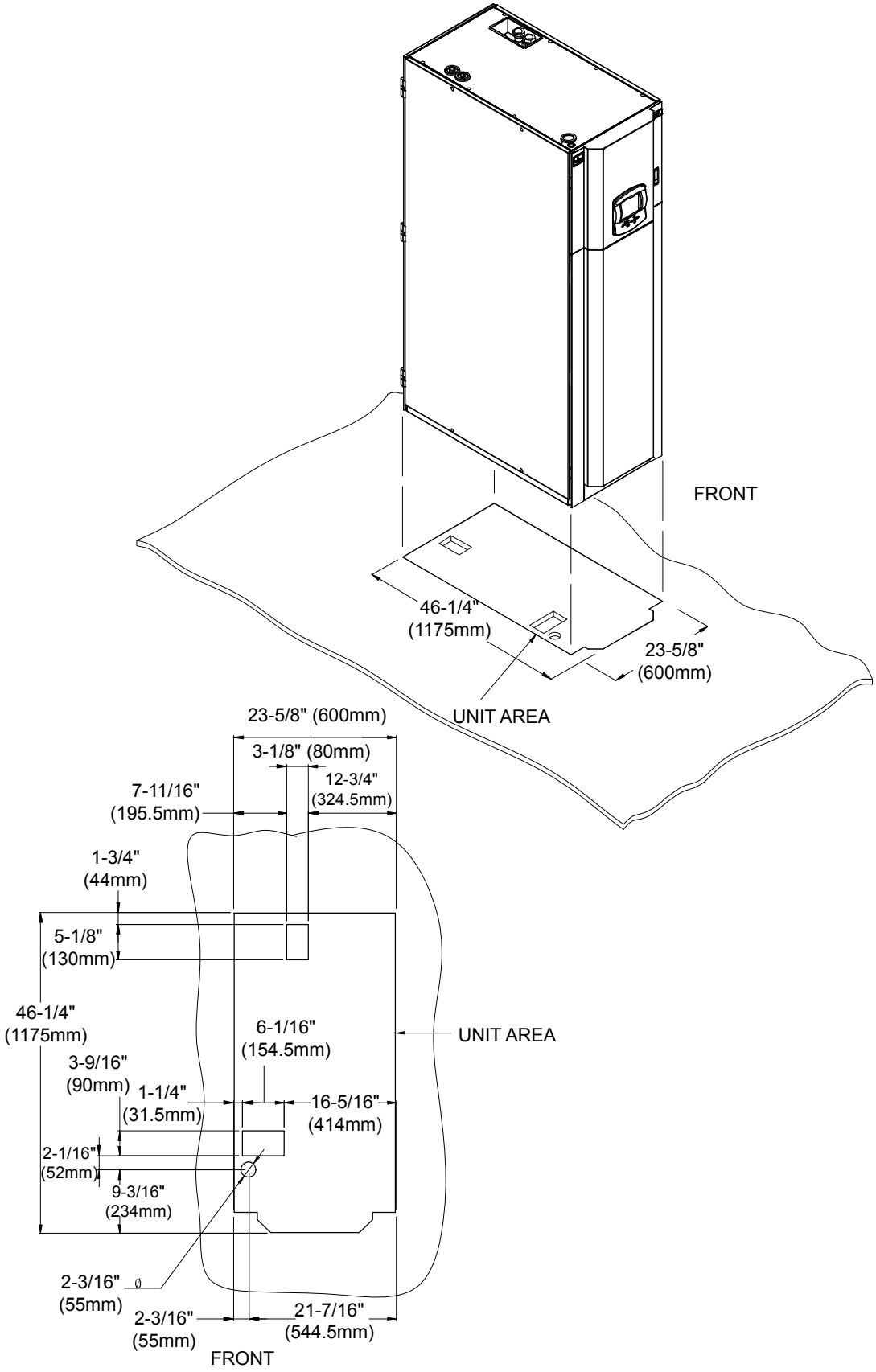


Figure 27 Airbleeding valve position CW

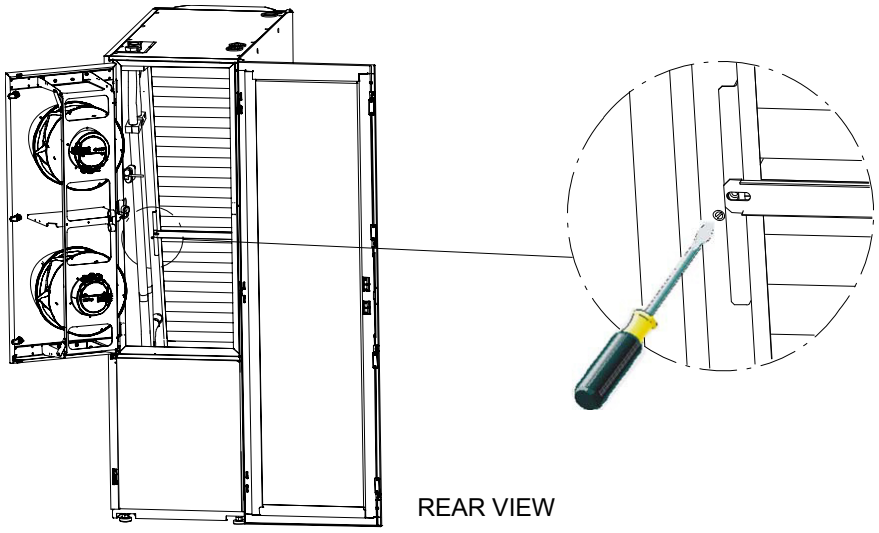
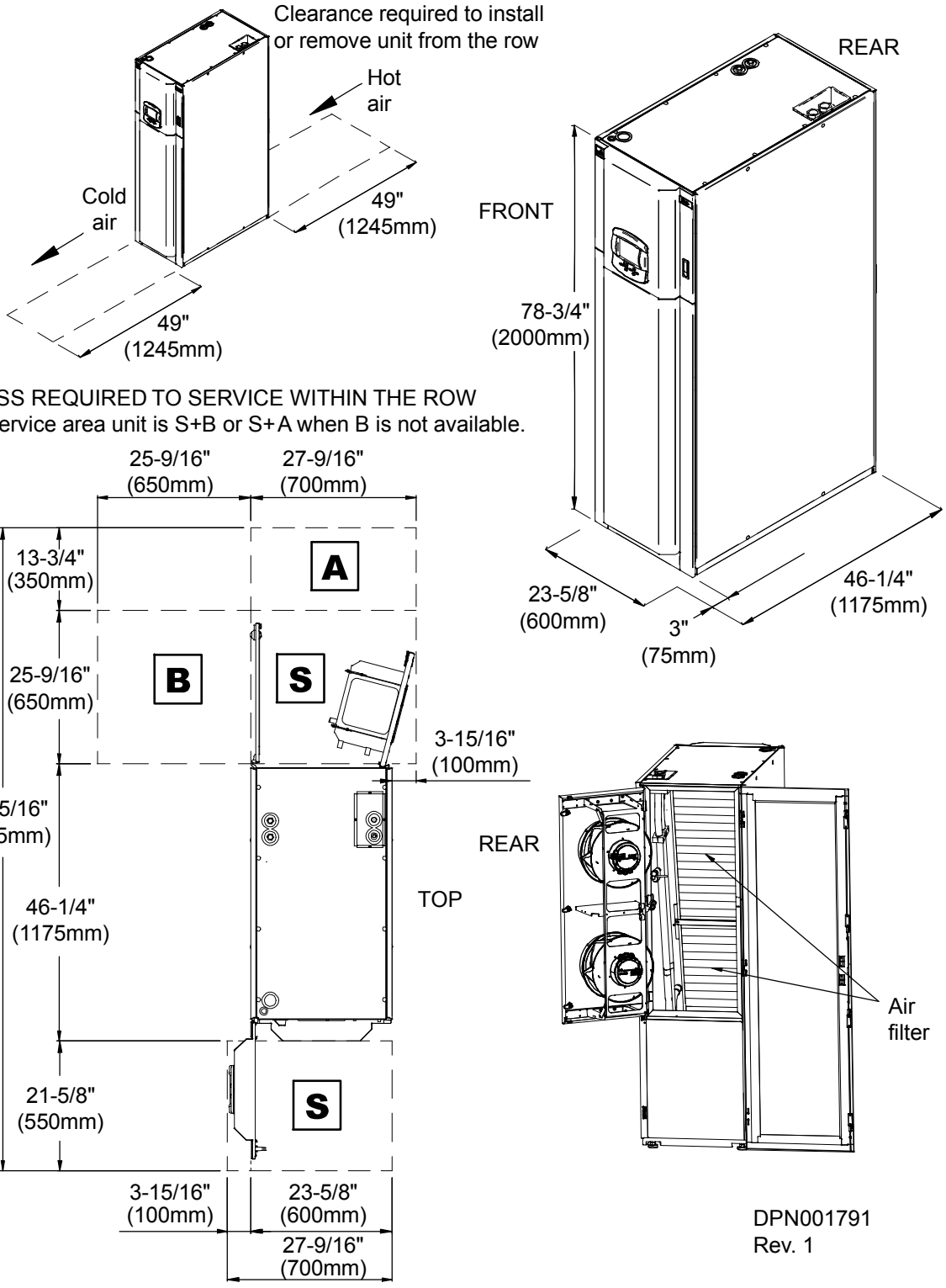


Figure 28 Cabinet and floor planning dimensional data—air, water and glycol models



Model No.	Dry Weight ± 5% (lb / kg)	
	Air Cooled	Water/Glycol
CR035R	805 (365)	849 (385)
CR020R	739 (335)	772 (350)
CR040R	Chilled Water	
	728 (330)	

Source DPN001791, Rev. 1

Figure 29 Piping and electrical connections, air-cooled models

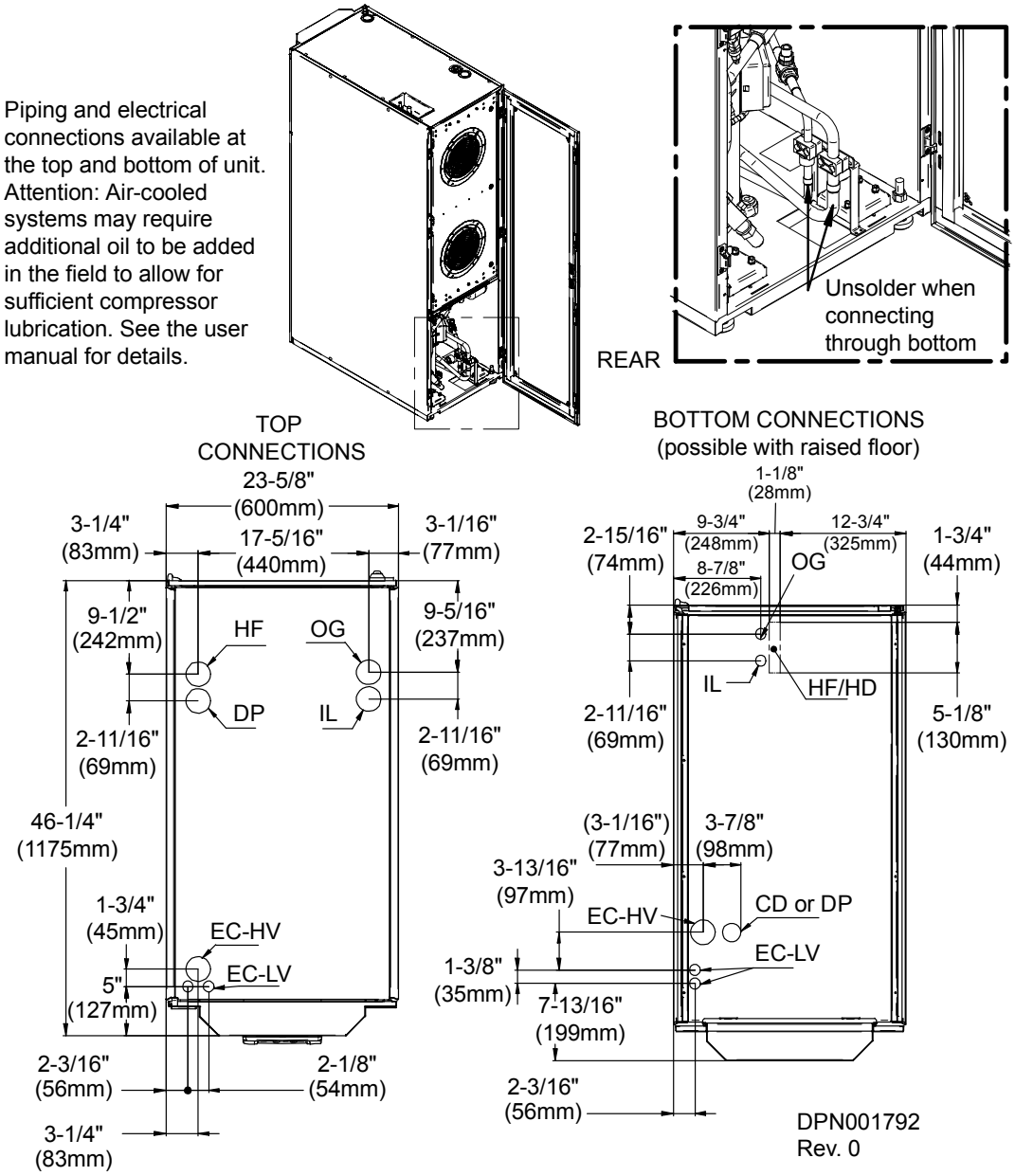


Table 30 Unit connections, air-cooled models

Unit Connections		CR20A (60Hz)	CR35A (60Hz)
IL	Refrigerant liquid line inlet	OD 1/2" Cu Sweat	OD 5/8" Cu Sweat
OG	Refrigerant gas line outlet	OD 5/8" Cu Sweat	OD 7/8" Cu Sweat
CD	Condensate drain.	1" MPT	
HF	Humidifier feed	1/2" FPT for top connection 1/4" compression for bottom connection	
HD	Humidifier drain	1" MPT	
DP	Pump drain	1/2" FPT	
EC-HV	Electrical supply-high voltage	Combination hole knockout diameter 35, 44.5 and 63.5mm (1-3/8", 1-3/4" and 2-1/2")	
EC-LV	Electrical supply-low voltage	Hole diameter 22 (7/8") typical 2 places	

* With pump, CD is connected with HD. See DP.

Source DPN001792, Rev. 0

Figure 30 Piping and electrical connections, water/glycol-cooled models

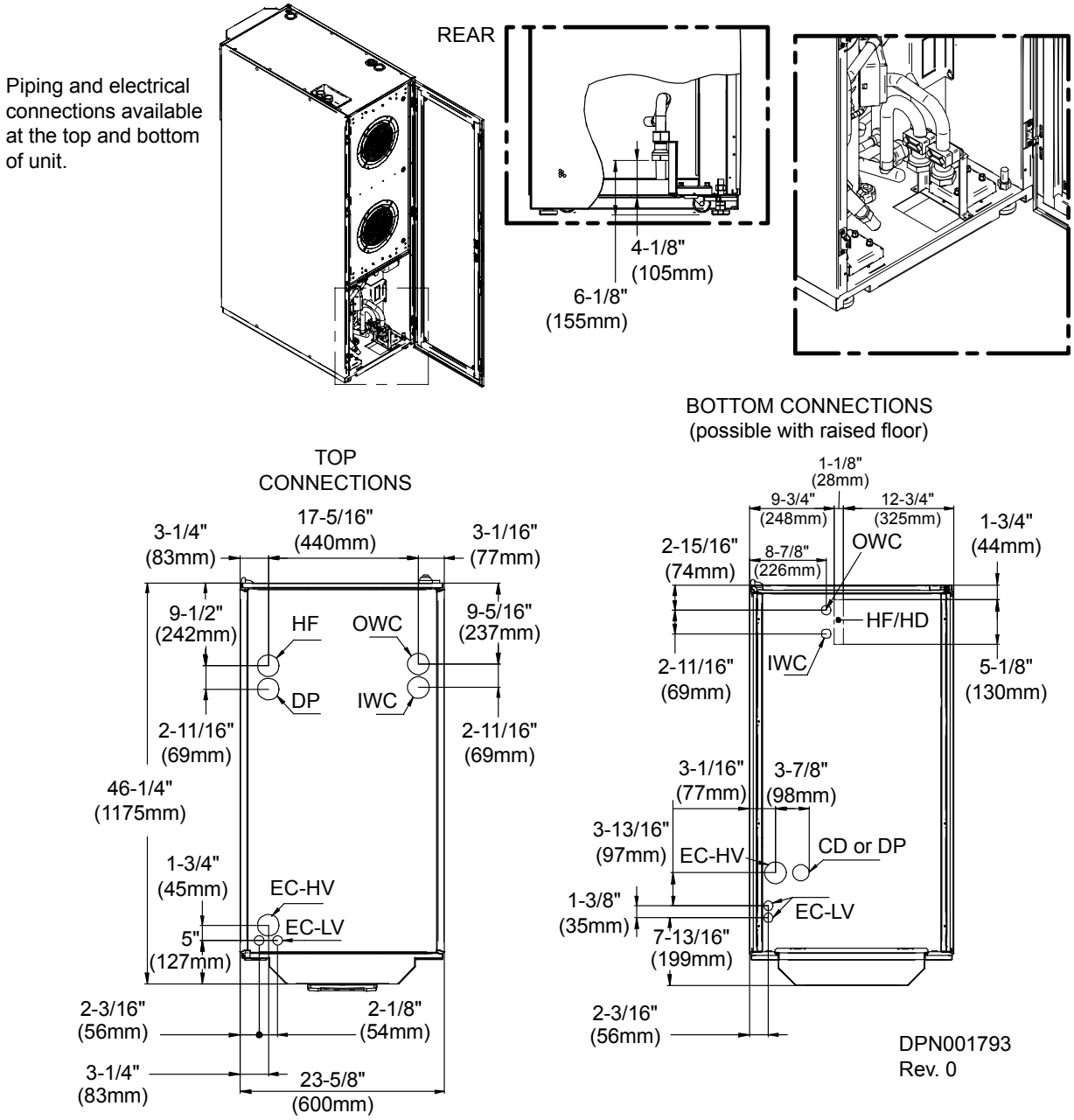


Table 31 Unit connections, water/glycol-cooled models

Unit Connections		CR20W	CR35W
IWC [1]	Water to condenser inlet (*)	1-1/4" FPT	1-1/4" FPT
CD [2]	Condensate drain	1" MPT	
HF	Humidifier Feed	1/2" FPT for top connection 1/4" compression for bottom	
HD [2]	Humidifier Drain	1" MPT	
DP	Pump Drain	1/2" FPT	
EC-HV	Electrical Supply-High Voltage	Combination hole knockout diameter 35, 44.5 and 63.5mm (1-3/8", 1-3/4" and 2-1/2")	
EC-LV	Electrical Supply-Low Voltage	Hole diameter 22mm (7/8") Typical 2 Places	

1. Install a 16-20 mesh strainer on the glycol/water supply to prevent particles from entering the heat exchanger.
2. With pump, CD is connected with HD. See DP.

Source DPN001793, Rev. 0

Figure 31 Piping and electrical connections, chilled water models

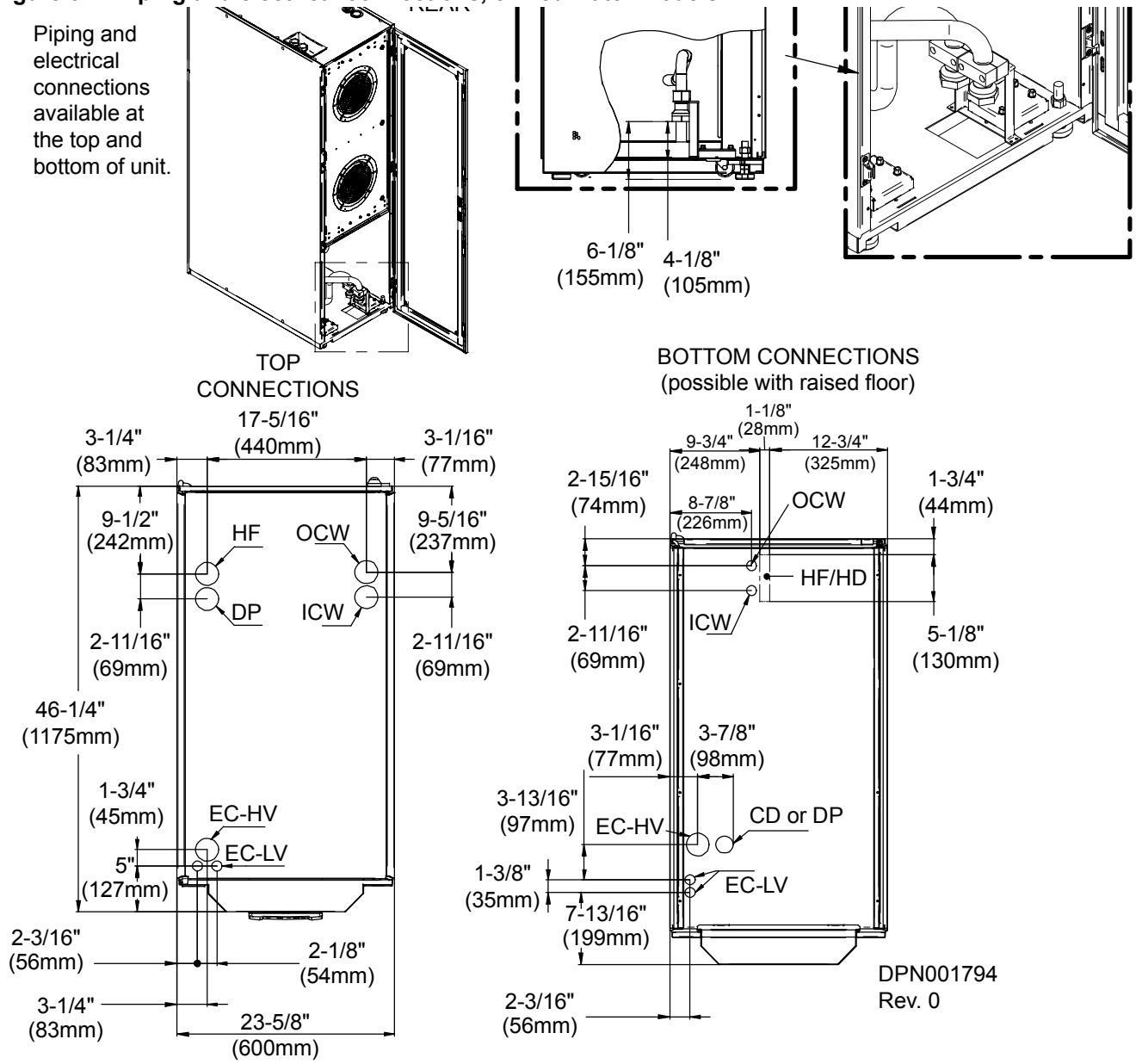


Table 32 Unit connections, chilled water models

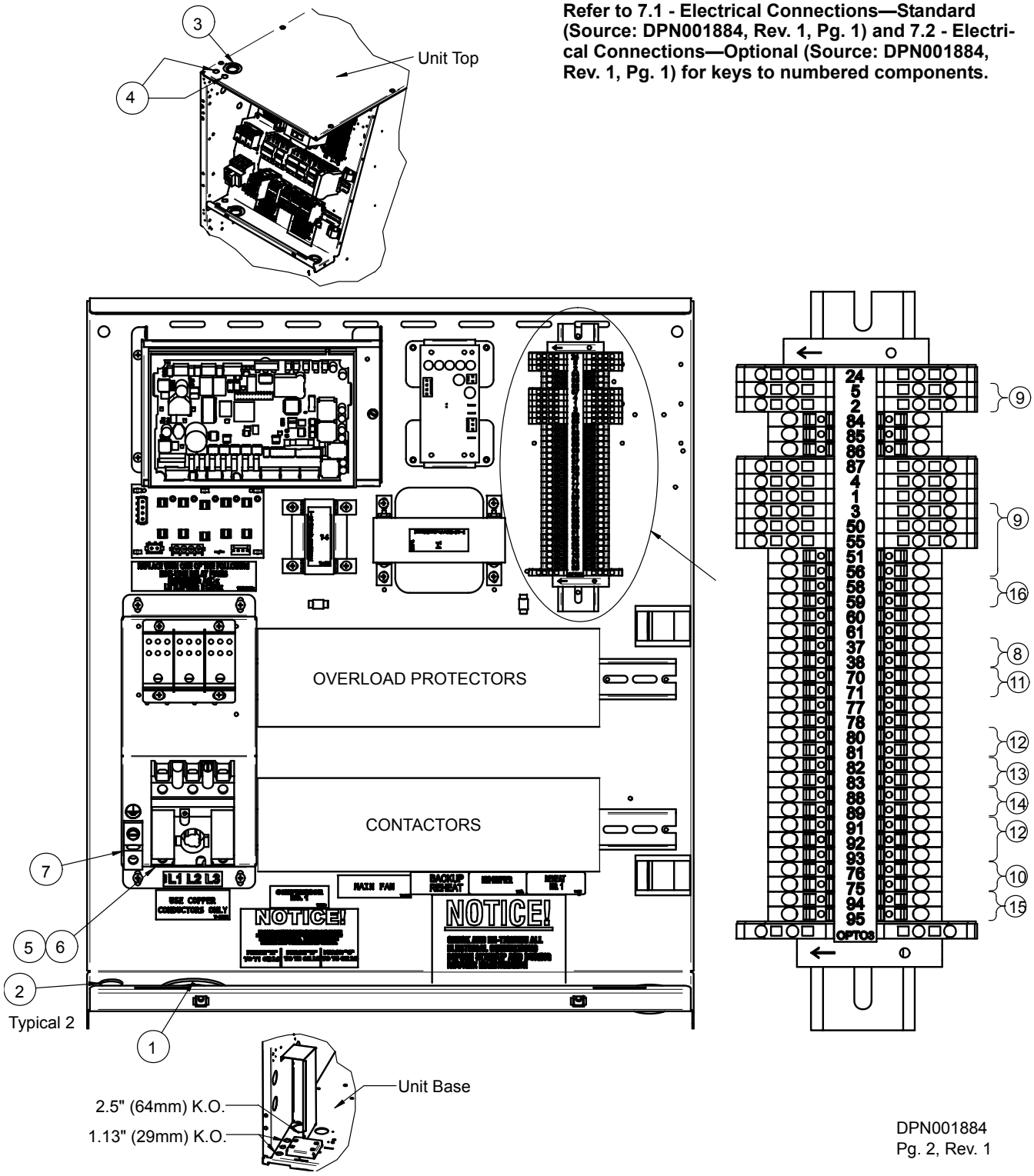
Unit Connections		CR40C
ICW	Chilled water inlet	1-1/4" FPT
OCW	Chilled water outlet	1-1/4" FPT
CD *	Condensate drain	1" MPT
HF	Humidifier feed	1/2" FPT for top connection, 1/4" compression for bottom connection
HD *	Humidifier drain	1" MPT
DP	Pump drain (optional)	1/2" FPT
EC-HV	Electrical supply-high voltage	Combination Hole Knockout Diameter: 1-3/8", 1-3/4" and 2-1/2" (35, 44.5 and 63.5mm)
EC-LV	Electrical supply-low voltage	Hole Diameter: 7/8" (22); Typical 2 places

* With pump, CD is connected with HD. See DP.

Source DPN001794, Rev. 0

Figure 32 Electrical field-connection locations

Refer to 7.1 - Electrical Connections—Standard (Source: DPN001884, Rev. 1, Pg. 1) and 7.2 - Electrical Connections—Optional (Source: DPN001884, Rev. 1, Pg. 1) for keys to numbered components.



DPN001884
Pg. 2, Rev. 1

7.1 Electrical Connections—Standard (Source: DPN001884, Rev. 1, Pg. 1)

1. **High-voltage entrance through the bottom of the electric panel**—1.38" (34.9mm), 1.75" (44.5mm) & 2.50" (64mm) diameter concentric knockout.
2. **Low-voltage entrance through the bottom of the electric panel**—Quantity (2) 1.125" (28mm) diameter knockouts.
3. **High-voltage entrance through the top of the unit**—1.38" (34.9mm), 1.75" (44.5mm) & 2.50" (64mm) diameter concentric knockout.
4. **Low-voltage entrance through the top of the unit**—Quantity (2) 1.125" (28mm) diameter knockouts.
5. **Three-phase electrical service**—Connect to terminals on disconnect switch. Three-phase service not by Liebert.
6. **Factory-installed locking disconnect switch**
7. **Earth ground**—Terminal for field-supplied earth grounding wire.
8. **Remote unit shutdown**—Replace existing jumper between terminals 37 & 38 with field-supplied, normally closed switch having a minimum 75VA, 24VAC rating. Use field-supplied Class 1 wiring.
9. **Customer alarm inputs**—Terminals for field-supplied, normally closed contacts, having a minimum 75VA, 24VAC rating, between terminals 3 & 50, 2 & 51, 5 & 55, or 3 & 56. Use field-supplied Class 1 wiring.
10. **Common alarm**—On any alarm, normally open dry contact is closed across terminals 75 & 76 for remote indication. 1 AMP, 24VAC maximum load. Use Class 1, field-supplied wiring.
11. **Heat rejection interlock**—On any call for compressor operation, normally open dry contact is closed across terminals 70 & 71 to heat rejection equipment. 1 AMP, 24VAC maximum load. Use Class 1, field-supplied wiring.

7.2 Electrical Connections—Optional (Source: DPN001884, Rev. 1, Pg. 1)

12. **Smoke sensor alarm**—Factory-wired dry contacts from smoke sensor are 91-common, 92-NO, and 93-NC. Supervised contacts, 80 & 81, open on sensor trouble indication. This smoke sensor is not intended to function as, or replace, any room smoke detection system that may be required by local or national codes. 1 AMP, 24VAC maximum load. Use Class 1, field-supplied wiring.
13. **Reheat and humidifier lockout**—Remote 24VAC required at terminals 82 & 83 for lockout of reheat and humidifier.
14. **Condensate alarm (with condensate pump option)**—On pump high water indication, normally open dry contact is closed across terminals 88 & 89 for remote indication. 1 AMP, 24VAC maximum load. Use Class 1 field supplied wiring.
15. **Common Alarm**—On any alarm, one additional normally open dry contact is closed across terminals 94 & 95 for remote indication. 1 AMP, 24VAC maximum load. Use Class 1, field-supplied wiring.
16. **Liebert Liqui-tect shutdown and dry contact**—On Liebert Liqui-tect activation, normally open dry contact is closed across terminals 58 & 59 for remote indication (Liebert Liqui-tect sensor ordered separately). 1 AMP, 24VAC maximum load. Use Class 1, field-supplied wiring.

NOTE

Refer to specification sheet for total unit full load amps, wire size amps and max overcurrent protective device size.

Figure 33 Liebert IntelliSlot cable connection routing

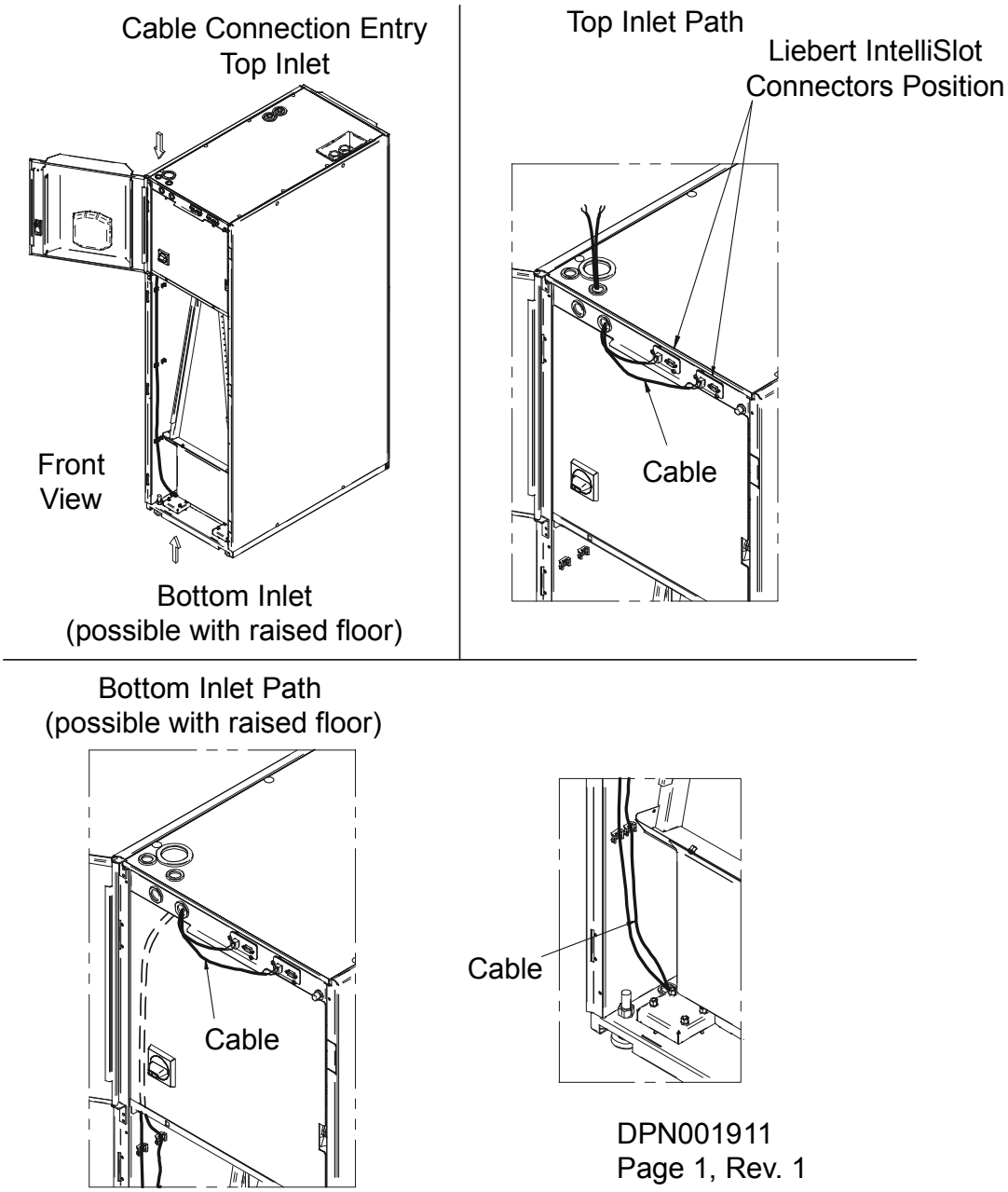


Figure 34 General arrangement diagram—air-cooled models

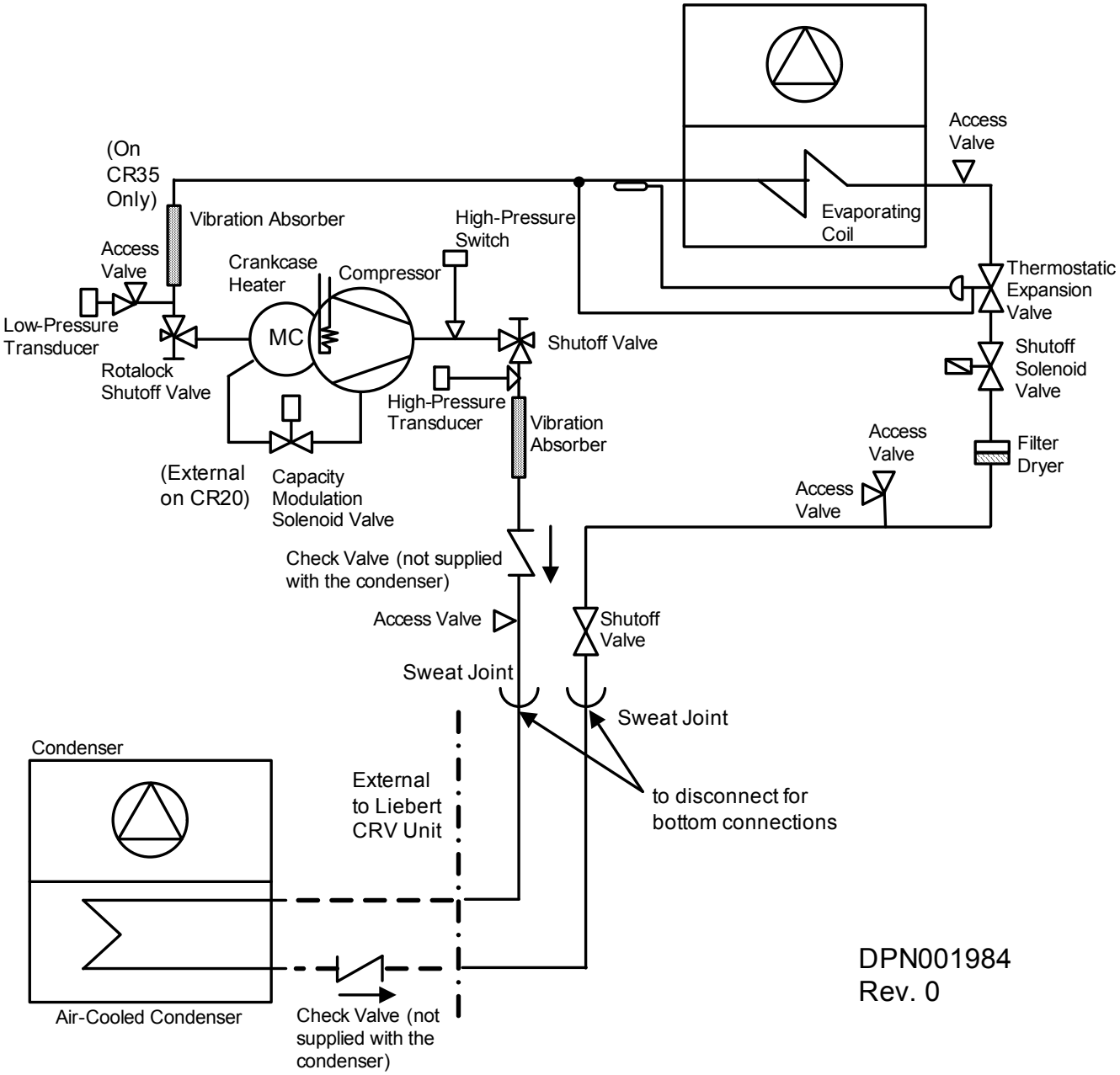


Figure 35 General arrangement diagram—water/glycol models

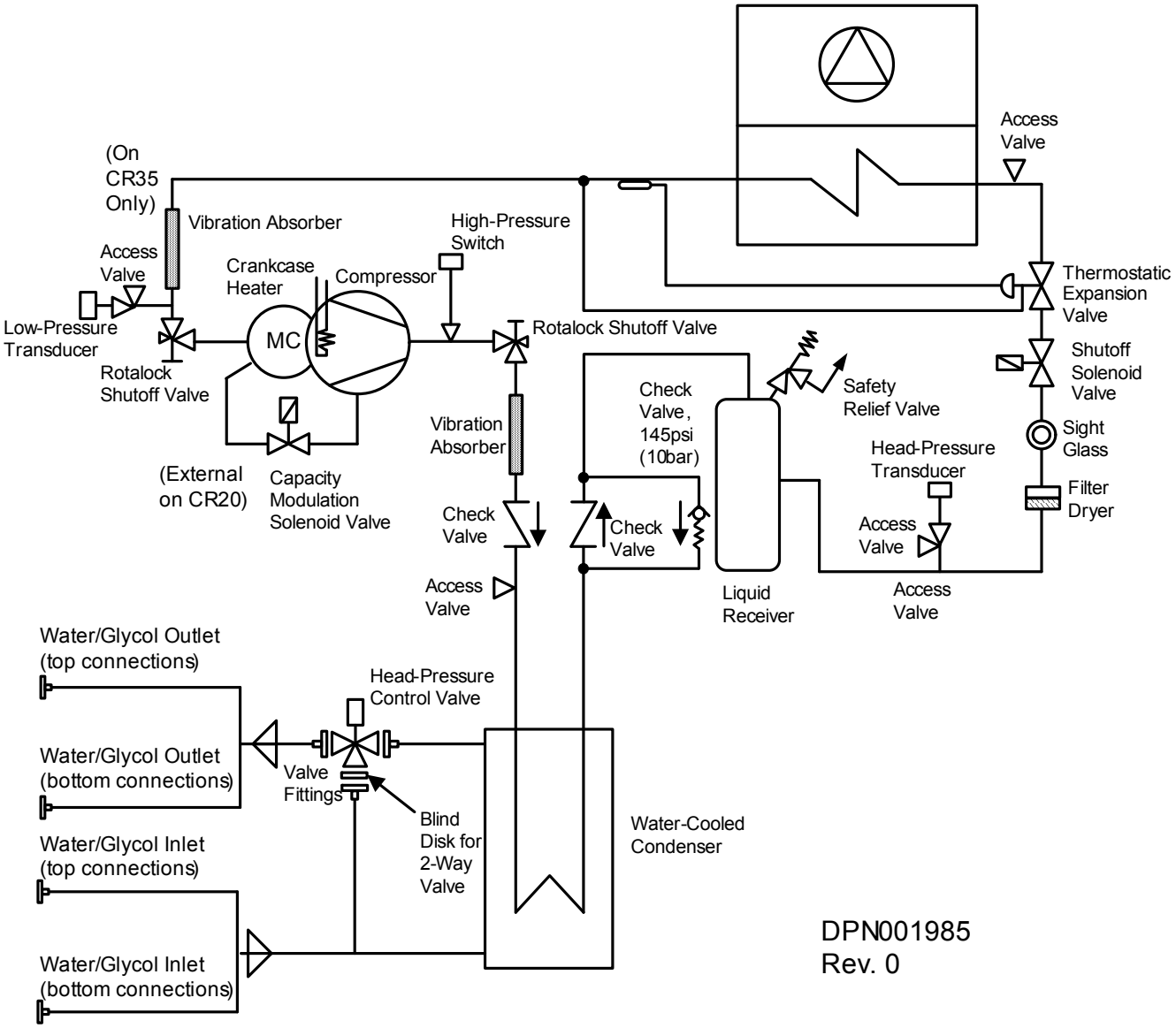
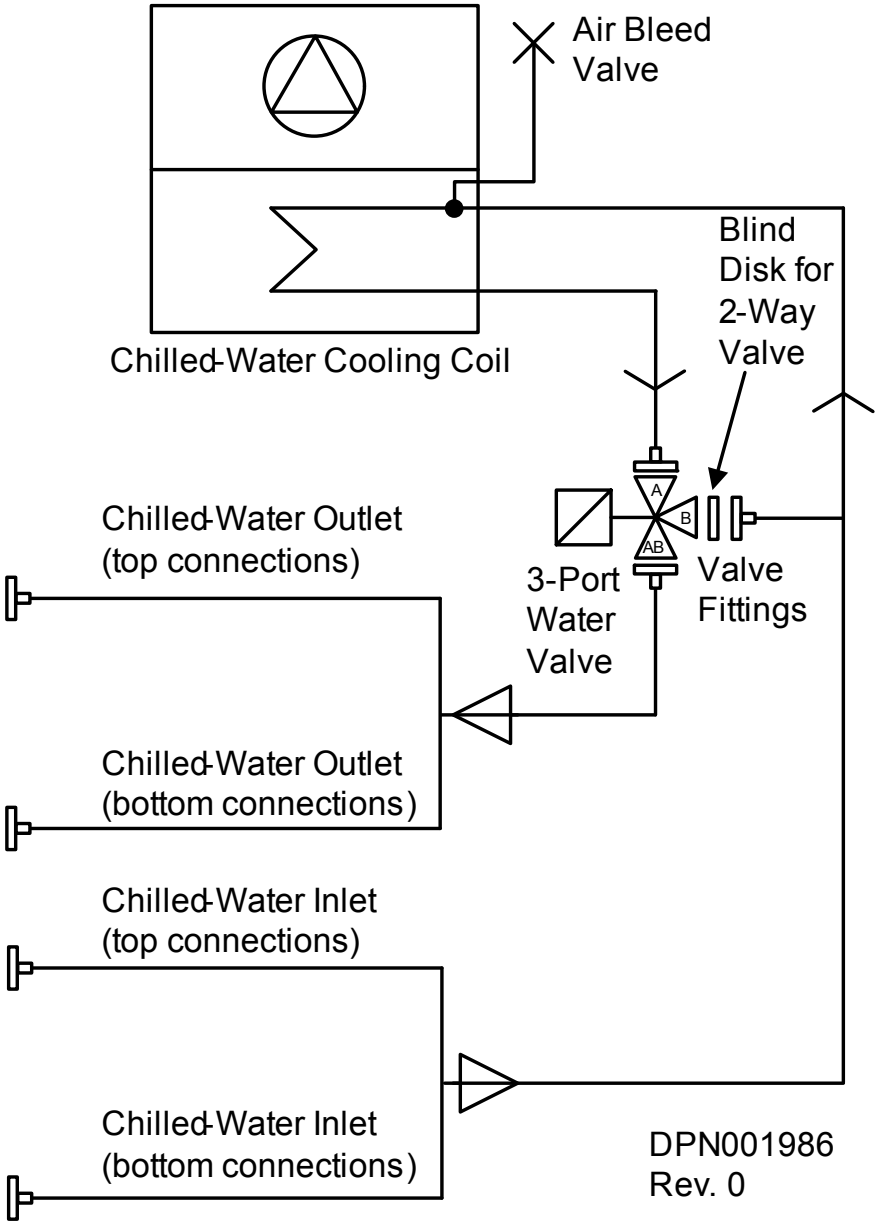


Figure 36 General arrangement diagram—chilled water models



8.0 GUIDE SPECIFICATIONS

1.0 GENERAL

1.1 Summary

These specifications describe requirements for a mission critical environmental control system. The system shall be designed to control temperature and humidity conditions in rooms containing electronic equipment, with good insulation and vapor barrier. The manufacturer shall design and furnish all equipment to be fully compatible with the heat dissipation requirements of the room.

1.2 Design Requirements

The precision environmental control system shall be a Liebert self-contained factory assembled unit with horizontal airflow delivery. The system shall have a total cooling capacity of ___ BTU/HR (___ kW) with a sensible cooling capacity of ___ BTU/HR (___ kW) based on an entering air temperature of ___°F (___°C) dry bulb and ___°F (___°C) wet bulb. The EC plug fans shall be collectively ___ HP (___ kW), capable of handling ___ CFM (___ CMH). The unit is to be supplied with ___ volt 3 phase 60 Hz electrical service. Net capacities shall include losses due to fan motor heat. Standard 60 Hz units shall be CSA (NRTL-C) certified.

1.3 Submittals

Submittals shall be provided with the proposal and shall include: Single-Line Diagrams; Dimensional, Electrical, and Capacity Data; Piping and Electrical Connection Drawings.

2.0 PRODUCT

2.1 Cooling System

2.1.1 Air-Cooled Refrigeration System

2.1.1.1 Refrigeration System

Single refrigeration circuit shall include a liquid line filter drier, a refrigerant sight glass with moisture indicator, an adjustable externally equalized expansion valve, and a liquid line solenoid valve. The indoor evaporator refrigerant piping shall be spun shut with a nitrogen holding charge. Field relief of the Schrader valve shall indicate a leak-free system.

2.1.1.2 Evaporator Coil

The direct expansion tilted slab cooling coil shall have 7.25 $ft.^2$ (0.674 m^2) face area, 4 or 5 rows deep. It is constructed of copper tubes and hydrophilic coated aluminum fins. The hydrophilic coating provides superior water carryover resistance. Two stainless steel condensate drain pans are provided.

2.1.1.3 Compressor

The compressor shall be scroll-type with variable capacity operation from 20-100%; commonly known as a Digital Scroll. Compressor solenoid valve shall unload the compressor to provide variable capacity operation. The compressor shall have a suction gas cooled motor, vibration isolators, internal thermal overloads, manual reset high pressure switch, rotalock service valves, low pressure and high pressure transducer, crankcase heater, internal centrifugal oil pump, and an operating speed of 3500 RPM at 60Hz. Compressor shall be located outside the airstream and shall be removable and serviceable from the rear of the unit.

2.1.1.4 R410A Refrigerant

The system shall be designed for use with R410A refrigerant, which meets the EPA clean air act for phase-out of HCFC refrigerants.

2.1.2 Water / Glycol Cooled Refrigeration System

2.1.2.1 Refrigeration System

Single refrigeration circuit shall include a liquid line filter drier, an adjustable externally equalized expansion valve, and a liquid line solenoid valve. The water/glycol circuit shall be equipped with a brazed-plate heat exchanger having a total pressure drop of ___ ft. (___ kPa) of water at a flow rate of ___ GPM (___ l/s) with ___°F (___°C) entering water/glycol temperature. The water piping shall be threaded closed with a nitrogen holding charge. Field relief of the Schrader valve shall indicate a leak-free system.

2.1.2.2 Evaporator Coil

The direct expansion tilted slab cooling coil shall have 7.25 ft.^{2} (0.674 m^2) face area, 4 or 5 rows deep. It is constructed of copper tubes and hydrophilic coated aluminum fins. The hydrophilic coating provides superior water carryover resistance. Two stainless steel condensate drain pans are provided.

2.1.2.3 Compressor

The compressor shall be scroll-type with variable capacity operation from 20-100%; commonly known as a Digital Scroll. Compressor solenoid valve shall unload the compressor to provide variable capacity operation. The compressor shall have a suction gas cooled motor, vibration isolators, internal thermal overloads, manual reset high pressure switch, rotalock service valves, low pressure and high pressure transducer, crankcase heater, internal centrifugal oil pump, and an operating speed of 3500 RPM at 60Hz. Compressor shall be located outside the airstream and shall be removable and serviceable from the rear of the unit.

2.1.2.4 R410A Refrigerant

The system shall be designed for use with R410A refrigerant, which meets the EPA clean air act for phase-out of HCFC refrigerants.

2.1.2.5 Modulating Valve

A (2-way) (3-way) modulating valve shall control the water/glycol flow passing through the brazed-plate condenser. The iCOM control shall manage the valve actuator movement in order to maintain the desired condensing temperature for various entering water temperatures. The maximum differential pressure across the closed valve shall be 43.5 PSI (300 kPa). Maximum system pressure shall be 230 PSI (1586 kPa).

2.1.2.6 Brazed-Plate Heat Exchanger

The heat exchanger shall be a brazed-plate type. The primary side shall be piped to a chilled water source, and the secondary side shall be connected to the refrigeration system. A strainer is to be installed upstream of the Liebert CRV, on the primary (building) chilled water side.

2.1.3 Chilled Water System

2.1.3.1 Chilled Water System

The water circuit shall be designed to distribute water into the entire coil face area. The coil shall be supplied with ___°F (___°C) entering water temperature, with a ___°F (___°C) temperature rise. The coil shall require ___ GPM (___ l/s) of chilled water and the pressure drop shall not exceed ___ PSI (___ kPa).

2.1.3.2 Evaporator Coil

The chilled water tilted slab cooling coil shall be 7.25 ft.^{2} (0.674 m^2) face area, 6 rows deep. It is constructed of copper tubes and hydrophilic coated aluminum fins. The hydrophilic coating provides superior water carryover resistance. Two stainless steel condensate drain pans shall be provided. The water circuit shall be threaded shut with a nitrogen holding charge. Field relief of the Schrader valve shall indicate a leak-free system.

2.1.3.3 Modulating Valve

A (2-way) (3-way) modulating valve controls the chilled water flow passing through the cooling coil. The iCOM control manages the valve actuator movement in order to provide the desired amount of cooling for various entering water temperatures. Cooling capacity is regulated by varying the chilled water flow. The maximum differential pressure across the closed valve is 25.4 PSI (175 kPa). Maximum system pressure is 230PSI (1586 kPa).

2.2 Fan Section

The unit shall be equipped with two plug fans: direct driven centrifugal fans with backward curved blades and Electronically Commutated DC motors; commonly referred to as EC plug fans. The fan speed shall be variable and automatically regulated by the iCOM control through all modes of operation. Each fan has a dedicated motor and speed controller which provides a level of redundancy. Both impellers shall be made of steel and balanced. The EC plug fans shall be collectively ___ HP (___ kW), capable of handling ___ CFM (___ CMH). Mounted on the rear fan door, the entire fan assembly shall be cable of swinging out of the unit for accessibility. The fans shall be located to blow air through the filters and titled slab-coil to ensure even air distribution and maximum coil performance.

2.3 Cabinet Construction and Accessibility

2.3.1 Cabinet Construction

The exterior panels shall be 20 gauge steel and powder coated with ___ color paint to protect against corrosion. The double wall constructed side panels separate the 1/2-inch, 2.0 lb./ft.^{3} insulation from the airstream and increase unit rigidity. The unit shall be mounted on casters for quick installation and provided with leveling feet. The perforated inlet and outlet panels shall have 81% open area. The rear door shall utilize Knürr rack style handle and hinges to mirror the appearance of neighboring server racks.

2.3.2 Serviceability

The cabinet shall be designed so all components are easily accessible for service and maintenance. The Superior Service Access Panel shall provide additional access to the top of the system components. Side access is not required.

The variable speed EC plug fans shall be mounted on the rear fan door, to provide access to all sides when swung out of the unit. Units with a compressor, dual-float condensate pump, and canister humidifier shall be mounted near the edge of the unit.

2.3.3 Supply Air Baffle System

A field adjustable, modular supply air baffle shall be located in the discharge air stream on the front of the cabinet. The modular baffle segments shall be easily reconfigurable to redirect airflow.

2.4 Locking Disconnect Switch

A manual disconnect switch shall be mounted in the electrical panel and be capable of disrupting the flow of power to the unit. The electric panel compartment can only be accessed with the switch in the “off” position. It shall be conveniently located behind the iCOM display door for quick access.

2.5 Filtration

The filter channel shall be an integral part of the system, located within the cabinet and serviceable from the rear. The filters shall be deep pleated 4" thick with an ASHRAE 52.2 MERV8 rating (30% ASHRAE 52.1) or ASHRAE 52.2 MERV11 rating (60-65% ASHRAE 52.1). A filter clog alarm shall be included.

2.5.1 Extra Filter Set (Optional)

___ extra set(s) of filters shall be provided per system.

2.6 Electric Reheat (Optional)

The low-watt density, 304/304, stainless steel, finned-tubular electric reheat coils shall be capable of maintaining room dry bulb conditions when the system is calling for dehumidification. The reheat section shall include UL/CSA recognized safety switches to protect the system from overheating. The capacity of the reheat coils shall be ___ BTU/HR (___ kW) controlled in one stage. The reheat elements shall be accessible from the front of the cabinet.

2.7 Steam Generating Canister Humidifier (Optional)

A canister-type steam generating humidifier shall be factory-installed in the cooling unit and operated by the iCOM control system. It is complete with disposable cylinder, all supply and drain valves, steam distributor and electronic controls. The need to change the canister is indicated on the iCOM display. The humidifier is designed to operate with water conductivity from 330-670 (60Hz) microS/cm. System shall automatically fill and drain as well as maintain the required water level based on conductivity. An air-gap within the humidifier assembly shall prevent backflow of the humidifier supply water. The humidifier capacity shall be ___lb./hr (___ kg/hr). The humidifier canister shall be removable from the rear of the cabinet.

2.8 Dual-Float Condensate Pump (Optional)

The condensate pump shall have a minimum capacity of 6 GPM (22.7 l/min) at 30 ft. (9 m) head. Pump is complete with integral primary and secondary float switches, pump, motor assembly and reservoir. The secondary float shall send a signal to the local alarm and shut down the unit upon high water condition.

2.9 Liebert iCOM® Microprocessor Control With Large Graphic Display

The Liebert CRV shall be controlled by the Liebert iCOM Control System. The standard user interface is the Large Graphical Display (320x240 pixels, backlit) which presents system information and allows all parameters to be viewed and adjusted. It features push-button navigation, operational status LEDs, and a 3-level password protection system. Unit-to-Unit communication with other Liebert CRVs and two IntelliSlot communication card housings shall be included as standard.

The Liebert iCOM unit control shall be factory-set for Intelligent Control which uses "fuzzy logic" and "expert systems" methods. The Liebert iCOM control processor shall be microprocessor based with a 320x240 dot matrix graphic front monitor display panel and control keys for user inputs mounted in an ergonomic, aesthetically pleasing housing.

Proportional and Tunable PI shall also be user selectable options. Internal unit component control shall include the following:

- **Compressor Short Cycle Control** - Prevents compressor short-cycling and needless compressor wear.
- **System Auto Restart** - The auto restart feature will automatically restart the system after a power failure. Time delay is programmable.
- **Sequential Load Activation** - On initial startup or restart after power failure, each operational load is sequenced with a minimum of one second delay to minimize total inrush current.
- **Econ-O-Coil Flush Cycles** - Econ-O-Coils are flushed periodically to prevent a buildup of contaminants.
- **Predictive Dew Point Control** - Calculates the moisture content in the room and prevents unnecessary humidification and dehumidification cycles by responding to changes in dew point temperature.

The Liebert iCOM control shall be compatible with all Liebert remote monitoring and control devices. Options are available for BMS interface via MODbus, Jbus, BACNet, Profibus and SNMP.

The Liebert iCOM control processor shall be microprocessor based dot matrix graphic front monitor display and control keys for user inputs mounted in an ergonomic, aesthetically pleasing housing.

The display and housing shall be viewable while the unit panels are open or closed. The controls shall be menu driven. The display shall be organized into three main sections: User Menus, Service Menus and Advanced Menus. The system shall display user menus for: active alarms, event log, graphic data, unit view/status overview (including the monitoring of room conditions, operational status in % of each function, date and time), total run hours, various sensors, display setup and service contacts. A password shall be required to make system changes within the service menus. Service menus shall include: setpoints, standby settings (lead/lag), timers/sleep mode, alarm setup, sensor calibration, maintenance/wellness settings, options setup, system/network setup, auxiliary boards and diagnostics/service mode. A password shall be required to access the advanced menus, which include the factory settings and password menus.

The **User Menus** shall be defined as follows:

- **Active Alarms:** Unit memory shall hold the 200 most recent alarms with time and date stamp for each alarm.
- **Event Log:** Unit memory shall hold the 400 most recent events with ID number, time and date stamp for each event.
- **Graphic Data View:** Eight graphic records shall be available: return air temperature, return air humidity, supply air temperature, outdoor temperature and four custom graphs.
- **Unit View - Status Overview:** Simple or Graphical "Unit View" summary displays shall include temperature and humidity values, active functions (and percent of operation) and any alarms of the host unit.
- **Total Run Hours:** Menu shall display accumulative component operating hours for major components including compressors, fan motor, humidifier and reheat.
- **Various Sensors:** Menu shall allow setup and display of optional custom sensors. The control shall include 3 standard remote sensors, expandable to a total of 10 remote rack sensors. Each units remote sensors must be selectable to use the average of all 10 sensor readings or use the maximum actual temperature value.

- **Display Setup:** Customer shall pre-select the desired grouping of display languages at the time of the order from the following choices:
  - Group 1: English, French, Italian, Spanish, German
  - Group 2: English, Russian, Greek
  - Group 3: English, Japanese, Chinese, Arabic
- **Service Contacts**: Menu shall allow display of local service contact name and phone number.

The **Service Menus** shall be defined as follows:

- **Setpoints:** Menu shall allow setpoints within the following ranges:
  - Temperature Setpoint 65-85ºF (18-29ºC)*
  - Temperature Sensitivity +1-10ºF (0.6-5.6ºC)
  - Humidity Setpoint 20-80% RH*
  - Humidity Sensitivity 1-30% RH
  - High Temperature Alarm 35-90ºF (2-32ºC)
  - Low Temperature Alarm 35-90ºF (2-32ºC)
  - High Humidity Alarm 15-85% RH
  - Low Humidity Alarm 15-85% RH

  * The microprocessor may be set within these ranges, however, the unit may not be able to control to extreme combinations of temperature and humidity.
- **Standby Settings/Lead-Lag:** Menu shall allow planned rotation or emergency rotation of operating and standby units.
- **Timers/Sleep Mode:** Menu shall allow various customer settings for turning on/off unit.
- **Alarm Setup:** Menu shall allow customer settings for alarm notification (audible/local/remote). The following alarms shall be available:
  - High Temperature
  - Low Temperature
  - High Humidity
  - Low Humidity
  - Compressor Overload (Optional)
  - Main Fan Overload (Optional)
  - Humidifier Problem
  - High Head Pressure
  - Change Filter
  - Fan Failure
  - Low Suction Pressure
  - Unit Off
- **Audible Alarm:** The audible alarm shall annunciate any alarm that is enabled by the operator.
- **Common Alarm:** A programmable common alarm shall be provided to interface user selected alarms with a remote alarm device.
- **Remote Monitoring:** All alarms shall be communicated to the Liebert monitoring system with the following information: Date and time of occurrence, unit number and present temperature and humidity.
- **Sensor Calibration:** Menu shall allow unit sensors to be calibrated with external sensors.
- **Maintenance/Wellness Settings:** Menu shall allow reporting of potential component problems before they occur.
- **Options Setup:** Menu shall provide operation settings for the installed components.
- **System/Network Setup:** Menu shall allow Unit-to-Unit (U2U) communication and setup for teamwork modes of operation (up to 32 units).
- **Teamwork Modes of Operation:** Saves energy by preventing operation of units in opposite modes multiple units.
- **Auxiliary Boards:** Menu shall allow setup of optional expansion boards.

- **Diagnostics/Service Mode:** The Liebert iCOM control shall be provided with self-diagnostics to aid in troubleshooting.

  The microcontroller board shall be diagnosed and reported as pass/not pass. Control inputs shall be indicated as on or off at the front display. Control outputs shall be able to be turned on or off from the front display without using jumpers or a service terminal. Each control output shall be indicated by an LED on a circuit board.

Advanced Menus

- **Factory Settings:** Configuration settings shall be factory-set based on the pre-defined component operation.
- **Change Passwords:** Menu shall allow new passwords to be set or changed.
- **System View - Status Overview:** "System View" shall display a summary of operation for the total number of operating units within a Unit-to-Unit (U2U) configuration.
- **Spare Parts List:** Menu shall include a list of critical spare parts, their quantity and part numbers.
- **Unit Diary:** Menu shall include a free field area within the unit memory where unit history may be stored for reference.

2.10 Rack Temperature Sensors

The Liebert CRV shall be provided with three 2T rack temperature sensors which consist of a vented case with two temperature probes. The sensors shall provide real-time, direct feedback to the cooling unit to optimize the amount of cooling and airflow provided. The sensor data shall be available to remote BMS and monitoring systems. The sensor network shall consists of one CAN wire leaving the cooling unit and connecting to a 2T sensor. Each remaining 2T sensor is connected to the previous sensor.

2.10.1 Additional Rack Temperature Sensor(s) (Optional)

___ additional 2T rack temperature sensors shall be provided.

2.10.2 Additional CAN Cables for Rack Sensors (Optional)

___ additional ___ feet long CAN cables shall be provided.

2.11 Liebert vNSA™ (Optional)

The Liebert vNSA shall include a (8) (16) port network switch and 120V power supply inside a steel box secured with a key lock. (A Large iCOM graphic display is mounted on the front panel.)

2.12 Liebert iCOM Wall Mount Large Graphic Display (Optional)

The Liebert iCOM Large Graphic Display Kit shall include an ergonomic, aesthetically pleasing housing, a 320x240 dot matrix graphic display and a 120V power supply. The Wall Mount Large Graphic Display shall be used to allow remote location of a "System View" display and all features of the Large Graphic User, Service and Advanced menus for use with Liebert iCOM-controlled products connected for Unit-to-Unit (U2U) communications.

2.13 Communication Interfaces

2.13.1 Remote Shutdown Terminal

The remote shutdown terminal shall provide the customer with a location to remotely shut down the unit.

2.13.2 Common Alarm Contact

The common alarm contact shall provide the customer with a set of normally open (n/o) contacts for remote indication of unit alarms.

2.13.3 Reheat / Humidifier Lockout (Optional)

The reheat and humidifier lockout shall include the necessary relays to disable the reheat and humidifier from an external 24 volt signal.

2.13.4 One (1) Extra Common Alarm Contact (Optional)

The extra common alarm contact shall provides the customer with one additional contact (total of two sets) of normally open (n/o) contacts for remote indication of unit alarms.

2.13.5 Liebert IntelliSlot® Web Card (optional)

The Liebert IntelliSlot Web Card shall provide 10/100 baseT Ethernet connectivity for unit monitoring and management. The supported management interfaces include: SNMP for Network Management Systems and HTTP for Web page viewing.

2.13.6 Liebert IntelliSlot 485 Card (Optional)

The Liebert IntelliSlot 485 Card shall provide RS-485 Modbus network connectivity to Building Management Systems for unit monitoring and management.

2.14 Liebert Liqui-tect® Sensor (Optional)

A total of ___ (quantity) solid state water sensor(s) with no moving parts and is hermetically sealed to keep out dust and dirt shall be provided. When the sensor detects the presence of moisture the alarm system is activated.

2.15 Heat Rejection

2.15.1 Air-Cooled Condenser

The Emerson-manufactured outdoor air-cooled condenser shall be the low profile, multiple direct drive, propeller fan type. The condenser shall balance the heat rejection of the compressor at ___°F (___°C) ambient. The condenser shall be constructed of aluminum and contain a copper tube, aluminum fin coil arranged for vertical air discharge.

2.15.1.1 Variable Frequency Drive Control

The winter control system for the air-cooled condenser shall be Liebert VFD Control. The control system shall include a variable frequency drive, inverter duty fan motor operating from 0% to 100% motor RPM based on head pressure, refrigerant pressure transducers, ambient-temperature thermostat(s), motor overload protection and electrical control circuit, factory- wired in the control panel. VFD control shall be furnished on the fan adjacent to the connection end of the condenser, which runs continuously with the compressors. The variable speed fan motor shall be an inverter duty motor with permanently lubricated ceramic bearings. The Liebert variable frequency drive control system shall provide overload protection for the variable speed motor.

Each ambient-temperature-controlled On/Off fan motor shall have built-in overload protection. The transducer shall automatically sense the highest head pressure of either operating compressor and control the variable speed fan on the air-cooled condenser to properly maintain the head pressure. Transient Voltage Surge Suppression and locking disconnect is standard and shall be factory-installed and wired in the enclosed condenser electrical panel section. The VFD control system shall provide positive startup and operation in ambient temperature as low as -20°F (-28.9°C). The air-cooled condenser shall have a ___ volt, three phase, 60Hz power supply.

2.15.1.2 Liebert Lee-Temp System

The winter control system for the air-cooled condenser shall be Liebert Lee-Temp. The Liebert Lee-Temp system shall allow startup and positive head pressure control with ambient temperatures as low as -30°F (-34.4°C). The Liebert Lee-Temp package shall include the following components for each refrigeration circuit: insulated receiver, pressure relief valve, head pressure three-way control valve and rotalock valve for isolating the refrigerant charge. The Liebert Lee-Temp receiver shall be factory-insulated and mounted ready for the field connection to the air-cooled condenser. A disconnect switch shall be factory-mounted and wired to the condenser control panel, accessible from the exterior. The Liebert Lee-Temp (150) (300) Watt heater shall require a separate power supply of (120) (230) volt, single phase.

2.15.2 Drycooler

The Liebert drycooler is a low-profile, direct-drive propeller fan-type air-cooled fluid cooling unit. The drycooler shall be constructed with an aluminum cabinet and a copper-tube aluminum fin coil. All electrical connections and controls are enclosed in an integral, weatherproof section of the drycooler. The drycooler shall be designed for ___°F (___°C) ambient.

2.15.2.1 Fan Cycling Control

Two or more thermostats shall be employed on drycoolers with two or more fans to cycle fans or groups of fans in response to leaving fluid temperatures. The thermostat setpoints shall be listed on the factory-supplied schematic.

2.15.2.2 Pump Controls

Single Pump Option - Pump controls for a single glycol pump up to 7.5 hp shall be incorporated into the same integral electrical panel as the drycooler fan controls and may include fuses or circuit breakers as required for the pump motor. Pump voltage, phase and frequency shall be same as drycooler voltage, phase and frequency.

Dual Pump Option - Pump controls for a dual glycol pump system shall operate one pump as primary and the second pump shall operate as a standby pump. Pump controls shall be incorporated into the same integral electrical panel controlling drycooler fans. A field-supplied flow switch shall sense loss of flow and switch to the standby pump for continuous system operation. An internal switch shall allow manual selection of the primary (lead) pump.

2.15.2.3 Pump Package

2.15.2.3.1 Single Pump Package

This system shall be provided with a centrifugal pump mounted in a weatherproof and vented enclosure. The pump shall be rated for ___ GPM (___ l/m) at ___ ft. (___ kPa) of head and operate on ___ volt, 3-phase, ___ Hz.

2.15.2.3.1 Dual Pump Package

The dual pump package shall include pumps, enclosure, and field-mounted flow switch. The standby pump shall automatically start up on failure of the lead pump by drycooler pump controls or by a separate factory-wired control box and shall include a lead/ lag switch for the pumps. Each pump shall be rated for ___ GPM (___ l/s) at ___ ft. (___ kPa) of head.

3.0 EXECUTION

3.1 Installation of Precision Cooling Units

3.1.1 General

Install precision cooling units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

3.1.2 Electrical Wiring

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

3.1.3 Piping Connections

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

3.2 Field Quality Control

Start up mainframe coolant units in accordance with manufacturer's startup instructions. Test controls and demonstrate compliance with requirements.

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

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

3.2.1 Supply and Drain Water Piping

Connect water supply and drains to air conditioning unit. Provide pitch and trap as manufacturer's instructions and local codes require.

3.2 Field Quality Control

Start up environmental control units in accordance with manufacturer's startup instructions. Test controls and demonstrate compliance with requirements.

Notes

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

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