Liebert® CRV™ Thermal Management System

System Design Manual—60Hz, 600mm Wide, Air-Cooled, Water/Glycol-Cooled, Chilled Water Units; 300mm Wide, Chilled Water Units

EMERSON™
Network Power

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MODEL NUMBER NOMENCLATURE - 25 DIGIT CONFIGURATION NUMBER [1]

Model # Part 1										Model Details											Model # 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, kW

DX = 019 (300mm [12" wide]), 020, 035 (600mm [24"] wide), 2000mm [78.75in.] height)

CW = 040 (600mm [24in.] wide, 2000mm height)

Digit 6 - Row-Based, Unit Depth

R = 1100mm (43.4in)

2 = 1200mm (47.25 in) (available on 300mm [12in.] chilled water models only)

Digit 7 - System Type

A = Air Cooled

W = Water/Glycol Cooled

C = Chilled Water Cooled

Digit 8 - Fan Type

1 = Variable Speed EC fans

Digit 9 - Power Supply

A = 460V / 3ph / 60Hz

C = 208V / 3ph / 60Hz

P = 208/230V / 1ph / 60Hz (Control transformer can be tapped to provide 240V / 1ph / 60Hz)

Y = 208/230 3ph 60Hz

Digit 10 - Cooling System

600mm (24in.) wide series:

2 = Two-Way Valve (CW, 600mm [24in.] models only)

3 = Three-Way Valve (CW, 600mm [24in.] models only)

7 = R-410A digital scroll (DX only)
300mm (12in.) wide series: Includes three-way valve, field-adjustable to two-way

9 = Top and bottom CW connections

Digit 11 - Humidifier

0 = None

S = Steam Generating Canister (600mm [24in.] models only)

Digit 12 - Display Type

D = Liebert iCOM® Control with Large Graphic Display

Digit 13 - Reheat

0 = None

1 = Electric Reheat (600mm [24in.] models only)

Digit 14 - Air Filter

8 = 4" MERV 8 + Clogged Filter Alarm (600mm [24in.] models only

9 = 4" MERV 11 + Clogged Filter Alarm (600mm [24in.] models) only

C = 1/2" MERV 1 and Clog Filter Alarm (300mm [12in.] models only)

A = 2" MERV 8 (300mm [12in.] DX models only)

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 condensate pump (for units without humidifier), 5k SCCR CW

A = NO condensate pup (for units without humidifier)

E = Dual-float condensate pump (for units with or without humidifier)

5 = Dual-float condensate pump (for units with or without humidifier), 5k SCCR CW

M = NO dual-float condensate pump (for units without humidifier), 65k SCCR, 600 series only

P = Dual-float condensate Pump (for units with or without humidifier), 65k SCCR, 600 series only

Digit 18 - Option Package (600 Series Only)

0 = None

H = Reheat and Humidifier Lockout

C = Reheat and Humidifier Lockout Additional Alarm Contact

D = Low Sound Package (DX units only)

L = Low Sound Package and Reheat and Humidifier Lockout and Additional Alarm Contact (DX units only)

Digit 19 - Liebert IntelliSlot® Housing

0 = No Cards

U = (1) Liebert IntelliSlot IS-UNITY-DP Card

C = (1) Liebert SiteLink-E® Card

6 = (1) Liebert IntelliSlot IS-UNITY-DP Card and (1) Liebert SiteLink-E® Card

7= (2) Liebert IntelliSlot IS-UNITY-DP Cards

Digit 20 - Future Options

0 = None

Digit 21 - Packaging

P = Domestic

S = Export (Seaworthy)

Digit 22 - Special Features

A = No SFAs, Standard Unit

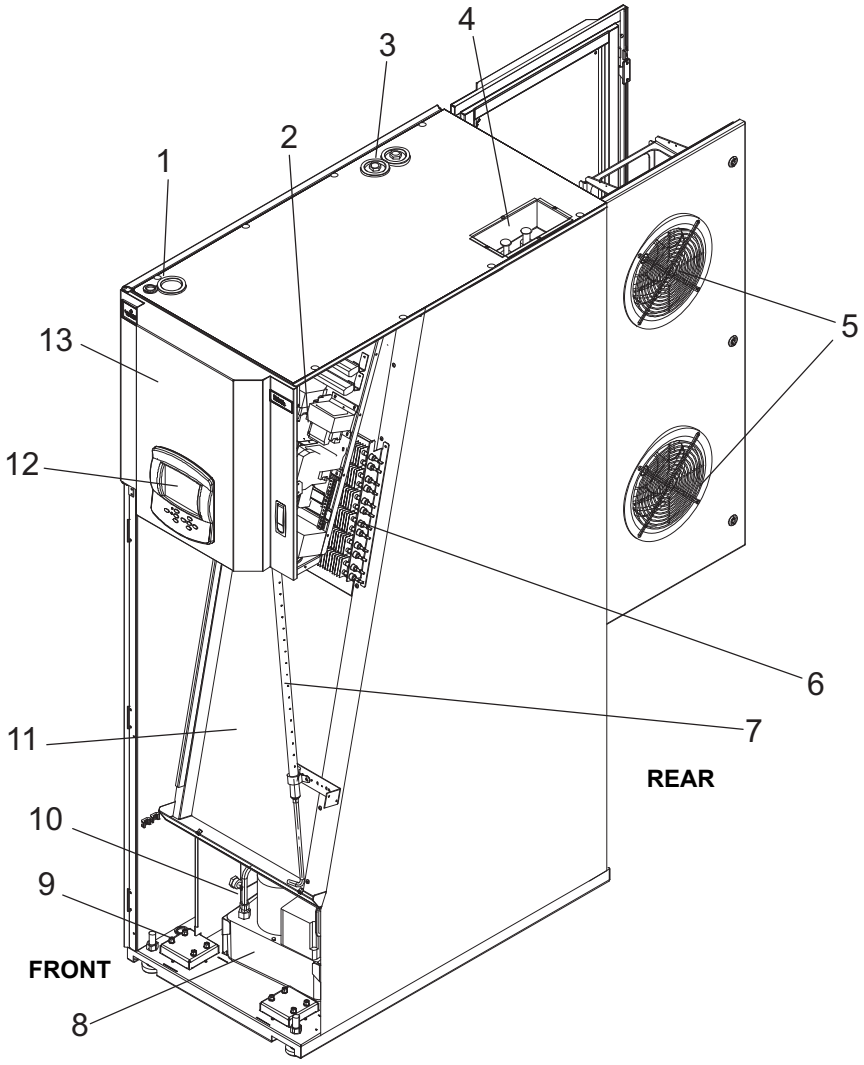
X = SFA Included

Digits 23-25 - Factory Configuration Number

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

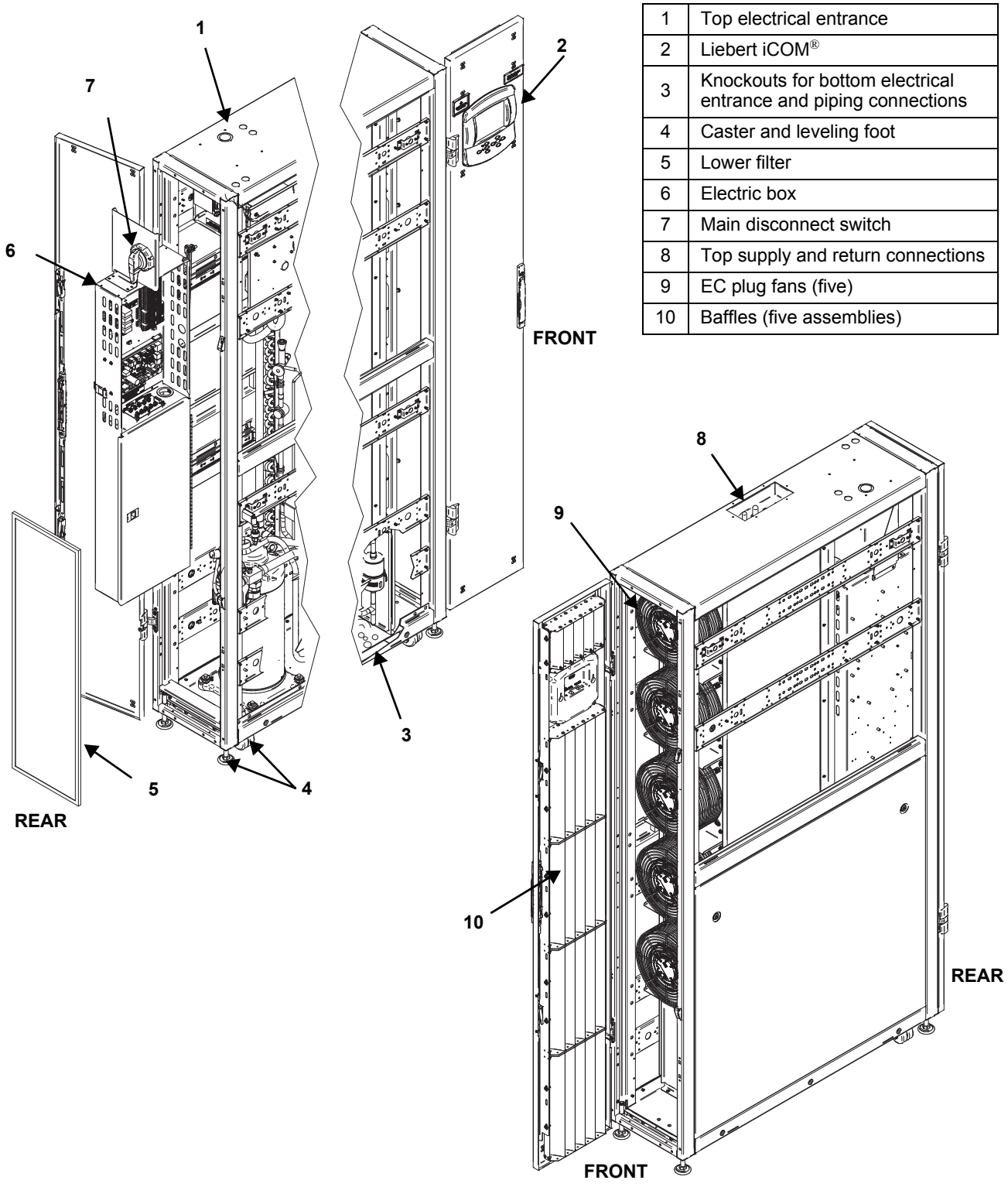
1.0 LIEBERT CRV COMPONENT LOCATION

Figure 1 Component location, common components—All models



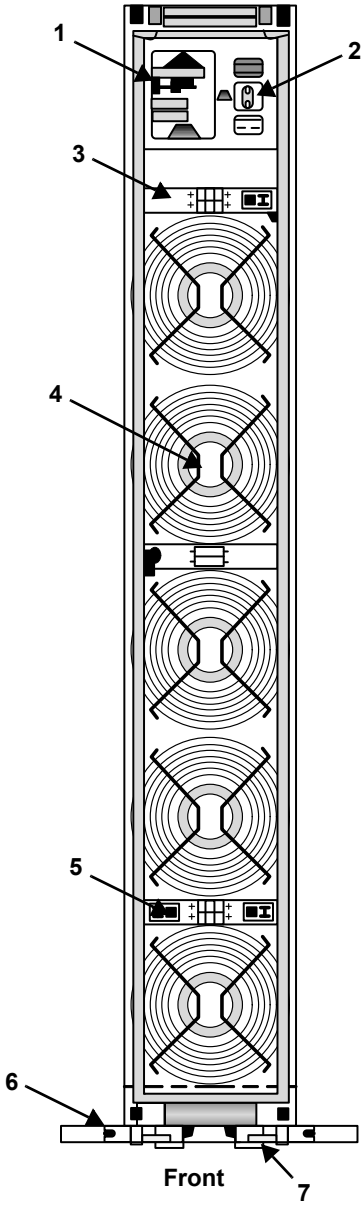
1	Top electrical entrance
2	Electric box
3	Top humidifier water supply, condensate pump drain
4	Supply and Return Connections
5	EC plug fans
6	Electric heaters
7	Humidifier distributor
8	Condensate pump
9	Bottom electrical entrance
10	Bottom condensate pump drain
11	Evaporator / CW coil
12	Liebert iCOM®
13	Serial tag (inside door)

Figure 2 Component location—Liebert 300mm (12in.) CR019 DX units

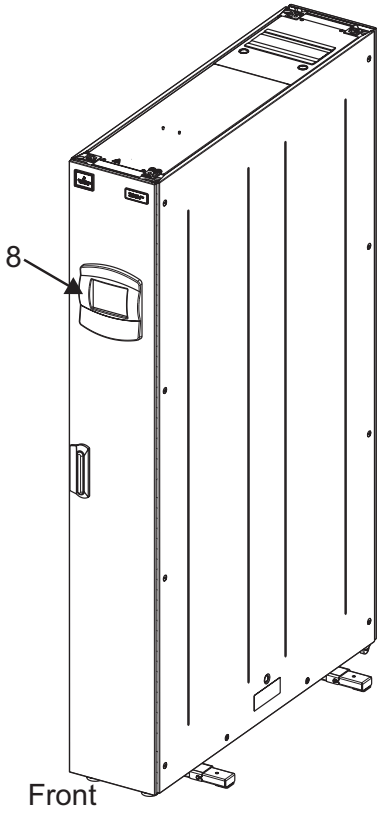


1	Top electrical entrance
2	Liebert iCOM®
3	Knockouts for bottom electrical entrance and piping connections
4	Caster and leveling foot
5	Lower filter
6	Electric box
7	Main disconnect switch
8	Top supply and return connections
9	EC plug fans (five)
10	Baffles (five assemblies)

Figure 3 Component location—Liebert CR030, CR034 chilled water units



1	Unit Tag
2	Main Switch
3	Fan Group 1 MCB
4	Fan (5 or 6 depending on cooling capacity - see unit code)
5	Fan Group 2 MCB
6	Stabilizer Bar
7	Casters and Leveling Feet
8	Liebert iCOM®



2.0 PRODUCT DESCRIPTION/CONFIGURATIONS

The Liebert CRV is a Thermal Management unit for location within a row of heat-generating IT equipment racks. The 300 series and 600 series provide all the necessary functions of a Thermal Management unit, including cooling, dehumidification, air filtration and condensate management. The 600 series is also capable of humidification.

The Liebert CRV 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.

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 with 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 rack temperature monitoring system. The supply air baffle on the 600 series 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 Unit configurations

Series	Width	Configuration	Nominal Cooling Capacity, kW	Input Power 60Hz
600	24in. (600mm)	Air-Cooled	20	208V - 3ph 460V - 3ph
		Water / Glycol Cooled		
		Air-Cooled	35	
		Water / Glycol Cooled		
		Chilled Water	40	
300	12in. (300mm)	Air-Cooled	19	208/230 - 1ph
		Chilled Water	30	208/230* - 1ph
			34	

* Control transformer can be re-tapped to provide 240V - 1ph - 60Hz

Figure 4 Liebert CRV, front and rear views

Front **Rear**

600mm (24 inch) DX and CW Models

Front **Rear**

300mm (12 inch) DX Models

Front **Rear**

Liebert CRV 300mm (12 inch) CW Models

3.0 AIR-COOLED SYSTEMS

3.1 Capacity and Physical Data—Air-Cooled Systems

Table 2 Performance data—600mm (24 inch) units

Return Air Temperature	Standard 95°F (35°C) Ambient Condenser			
	CR020RA		CR035RA	
	Liebert Fin and Tube Condenser	Liebert MC™ Condenser	Liebert Fin and Tube Condenser	Liebert MC™ Condenser
105°F DB, 71°F WB (40.6°C DB, 21.6°C WB) 17% RH				
Total kBTU/H (kW)	87.2 (25.5)	90.7 (26.6)	142.8 (41.8)	141.3 (41.4)
Sensible kBTU/H (kW	87.2 (25.5)	90.7 (26.6)	142.8 (41.8)	141.3 (41.4)
100°F DB, 69.5°F WB (37.8°C DB, 20.8°C WB) 20% RH				
Total kBTU/H (kW)	83.5 (24.5)	86.8 (25.4)	136.9 (40.1)	135.5 (39.7)
Sensible kBTU/H (kW	83.5 (24.5)	86.8 (25.4)	136.9 (40.1)	135.5 (39.7)
95°F DB, 67.9°F WB (35°C DB, 19.9°C WB) 23% RH				
Total kBTU/H (kW)	79.8 (23.4)	82.9 (24.3)	131.7 (38.6)	130.1 (38.1)
Sensible kBTU/H (kW	79.8 (23.4)	82.9 (24.3)	130.0 (38.1)	129 (37.8)
90°F DB, 66.2°F WB (32.2°C DB, 19.0°C WB) 27% RH				
Total kBTU/H (kW)	76.1 (22.3)	79.1 (23.2)	127.5 (37.4)	125.9 (36.9)
Sensible kBTU/H (kW	76.1 (22.3)	79.1 (23.2)	121.3 (35.5)	120.5 (35.3)
85°F DB, 64.5°F WB (29.4°C DB, 18.1°C WB) 31% RH				
Total kBTU/H (kW)	72.8 (21.3)	76.1 (22.3)	123.8 (36.3)	122.2 (35.8)
Sensible kBTU/H (kW	71.9 (21.1)	73.8 (21.6)	112.0 (32.8)	111.2 (32.6)
80°F DB, 62.8°F WB (26.7°C DB, 17.1°C WB) 37% RH				
Total kBTU/H (kW)	70.5 (20.7)	73.8 (21.6)	120.3 (35.2)	118.8 (34.8)
Sensible kBTU/H (kW	65.5 (19.2)	67.1 (19.7)	102.3 (30.0)	101.5 (29.7)

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

Table 3 Physical data—600mm (24in.) air-cooled systems

Parameter	CR020RA	CR035RA
Fan Data		
Total Airflow, CFM (m^3/h)	2454 (4170)	3260 (5540)
Total Fan Motor, hp (kW)	0.8 (0.6)	1.4 (1.06)
Number of Fans	2	
Evaporator Coil		
Face Area, ft^2 (m^2)	7.26 (0.674)	
Rows	4	5
Face Velocity, FPM (m/s)	339 (1.72)	449 (2.28)
Electric Reheat Single Stage		
Capacity, BTU/H (kW)	**460V:** 20,472 (6.0) **208V:** 16,719 (4.9)	
Steam Generating Humidifier		
Capacity, lb/hr (kg/hr)	5.0 (2.3)	
Capacity, kW	1.79	
Condensate Pump - Dual Float Type		
Capacity, GPM (l/m)	6.0 (22.7)	
Filter Section - Disposable Type		
	MERV 8 - Standard Pleated Filter	
Number	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 4 Performance data—300mm (12 inch) units

	Standard 95°F (35°C) Ambient Condenser
	CR019RA
Return Air Temperature	MC Condenser
105°F DB, 71°F WB (40.6°C DB, 21.6°C WB) 17% RH	
Total, kBTU/H (kW)	86.1 (25.2)
Sensible, kBTU/H (kW)	86.1 (25.2)
100°F DB, 69.5°F WB (37.8°C DB, 20.8°C WB) 20% RH	
Total, kBTU/H (kW)	82.6 (24.2)
Sensible, kBTU/H (kW)	82.6 (24.2)
95°F DB, 67.9°F WB (35°C DB, 19.9°C WB) 23% RH	
Total, kBTU/H (kW)	79.7 (23.3)
Sensible, kBTU/H (kW)	78.1 (22.9)
90°F DB, 66.2°F WB (32.2°C DB, 19.0°C WB) 27% RH	
Total, kBTU/H (kW)	77.3 (22.7)
Sensible, kBTU/H (kW)	72.8 (21.3)
85°F DB, 64.5°F WB (29.4°C DB, 18.1°C WB) 31% RH	
Total, kBTU/H (kW)	75.2 (22)
Sensible, kBTU/H (kW)	67.1 (19.7)
80°F DB, 62.8°F WB (26.7°C DB, 17.1°C WB) 37% RH	
Total, kBTU/H (kW)	73.1 (21.4)
Sensible, kBTU/H (kW)	61.2 (17.9)

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

Table 5 Physical data—300mm (12in.) wide models

System	19kW Model
	DX
Fan Data	
Total Airflow, CFM (m^3/h)	2306 (3918)
Total Fan Motor, hp (kW)	0.65 (0.48)
Number of Fans	5
Evaporator Coil	
Face Area, ft^2 (m^2)	6.25 (0.58)
Rows	3
Face Velocity, FPM (m/s)	369 (1.87)
Condensate Pump - Dual Float Type	
Capacity, GPM (l/m)	208V condensate pump rated for 0.77GPM at 13 ft. (2.9l/m at 3.9m) of total head pressure 230V condensate pump rated for 0.92GPM at 13 ft. (3.5l/m at 3.9m) of total head pressure
Filter Section—MERV 1, Washable Type	
Quantity	2
Nominal Size, in (mm)	35.5 x 10.8 x 0.4 (902 x 274 x 10)
Effective Surface Area, ft^2 (m^2)	2.3 (0.21)

3.2 Operating Limits—Air-Cooled Systems

The Liebert CRV is designed to operate within the working ranges in **Table 6**. These limits refer to new units and those that have been correctly installed and serviced.

Table 6 Environmental limits—all models

Parameter		Design Condition	
		Minimum	Maximum
Unit Entering Air Conditions	Temperature	75°F (23.9°C)	110°F(43.3°C)
	Relative Humidity	15%	60%
Storage Conditions	Temperature	-4°F (-20°C)	122°F (50°C)
Power Supply Tolerances		Voltage ± 10%	
		Frequency ±2Hz	

3.3 Electrical Data—Air-Cooled Models

Table 7 Electrical data—Air-Cooled, 600mm (24in.) models

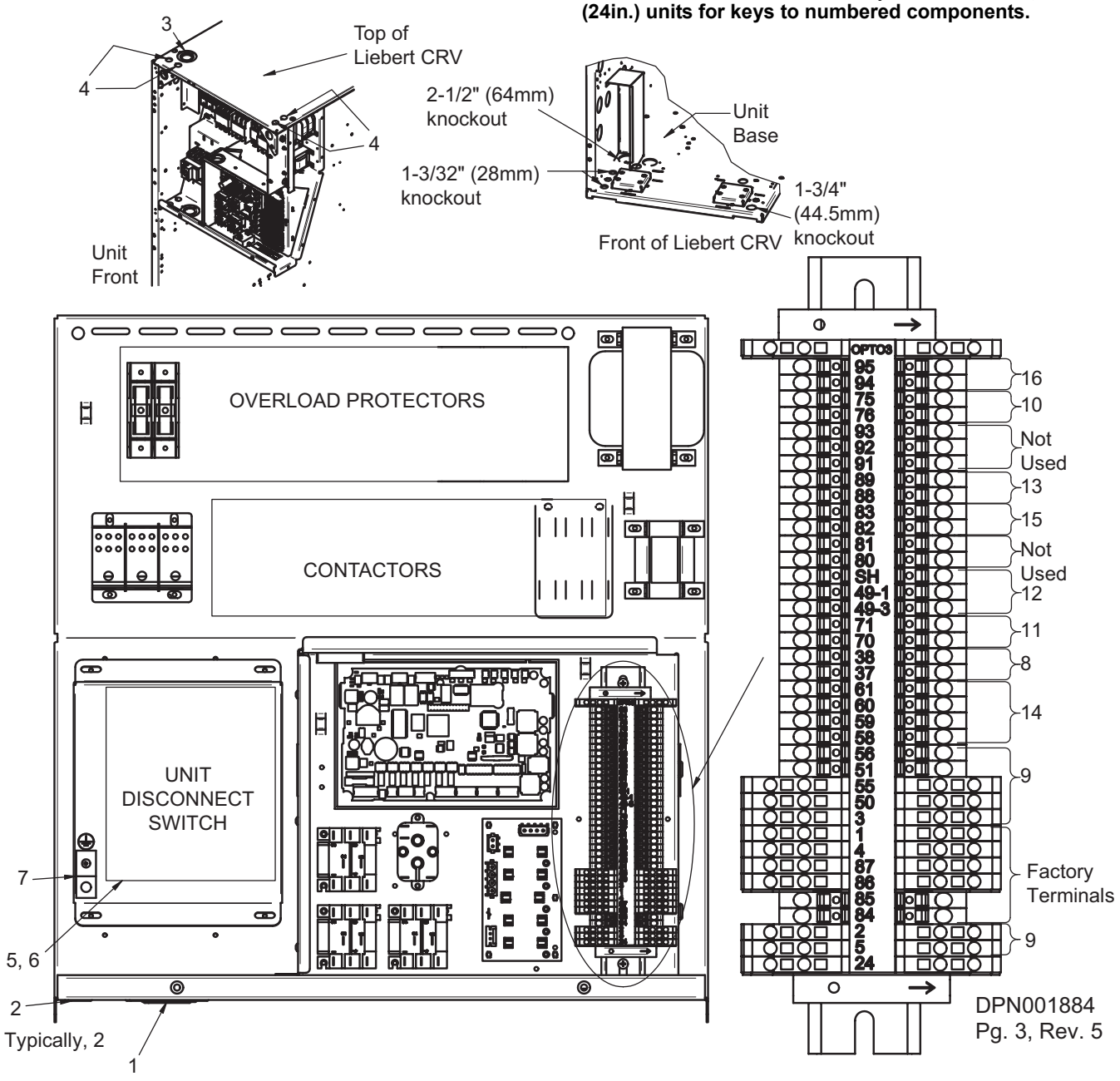
Voltage	CR035RA		CR020RA	
	460/3/60	208/3/60	460/3/60	208/3/60
Dehumidification, With or Without Humidifier, Reheat, Condensate Pump				
FLA	32.2	62.0	24.2	50.8
WSA	39.1	75.4	29.2	61.4
OPD	50	100	35	80
Dehumidification and Humidifier; NO Reheat, Condensate Pump				
FLA	28.4	53.8	20.4	42.6
WSA	33.4	63.1	23.5	49.1
OPD	50	100	35	70
Dehumidification and Condensate Pump; NO Reheat, NO Humidifier				
FLA	24.7	45.4	16.7	34.2
WSA	29.7	54.7	19.8	40.7
OPD	45	90	30	60
Dehumidification and Reheat; NO Humidifier, NO Condensate Pump				
FLA	31.0	59.7	23.0	48.5
WSA	37.9	73.1	28.0	59.1
OPD	50	100	35	80
Dehumidification; NO Humidifier, NO Reheat, NO Condensate Pump				
FLA	23.5	43.1	15.5	31.9
WSA	28.5	52.4	18.6	38.4
OPD	45	80	30	60

Table 8 Electrical data—Air-Cooled, 300mm (12in.) models

Voltage	CR019
	208-230/3/60
With Condensate Pump	
FLA	33.9
WSA	40.4
OPD	60
Without Condensate Pump	
FLA	32.9
WSA	39.4
OPD	60

Figure 5 Electrical field-connection locations—600mm (24in.) units

Refer to 3.4 - Electrical Connections—Standard Features, 600mm (24in.) units and 3.5 - Electrical Connections—Optional Features, 600mm (24in.) units for keys to numbered components.



3.4 Electrical Connections—Standard Features, 600mm (24in.) units

Source: DPN001884, Revision 5, Pg. 1

1. **High-voltage connection through the bottom of the electric panel**—1-3/8" (34.9mm), 1-3/4" (44.5mm) and 2-1/2" (64mm) diameter concentric knockout.
2. **Low-voltage connection through the bottom of the electric panel**—Two knockouts, each 7/8" (22mm) diameter.
3. **High-voltage connection through the top of the unit**—1-3/8" (34.9mm), 1-3/4" (44.5mm) and 2-1/2" (64mm) diameter concentric knockout.
4. **Low-voltage connection through the top of the unit**—Four knockouts, each 7/8" (22mm) diameter.
5. **Three-phase electrical service**—Connect to terminals on disconnect switch. Three-phase service not by Emerson. Refer to **7.6.3 - Important Note for 460V-Rated Liebert CRV Units (CR******A)**.
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 and 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 and 50, Terminals 2 and 51, Terminals 5 and 55, or Terminals 3 and 56. Use field-supplied Class 1 wiring. Terminal 3 and 56 are used for humidifier alarm when a humidifier is installed. The remaining terminals are available for customer alarm inputs, such as smoke sensors and building fire alarms.
10. **Common alarm**—On any alarm, normally open dry contact is closed across Terminals 75 and 76 for remote indication. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
11. **Heat rejection interlock**—On any call for compressor operation, normally open dry contact is closed across Terminals 70 and 71 to heat rejection equipment. 1A, 24VAC maximum load. Use field-supplied, Class 1 wiring.
12. **CANbus Connector**—Terminal block with Terminals 49-1 (CAN-H) and 49-3 (CAN-L) + SH (shield connection). The terminals are used to connect the CANbus communication cable (provided by others) from the indoor unit to the Liebert MC, Premium model.

    CANbus Cable—CANbus cable provided by others to connect to the outdoor condenser. Cable must meet the following specifications:
    - Conductors: 22-18AWG stranded tinned copper
    - Twisted Pair (minimum 8 twists per foot)
    - Braided shield or foil shield with drain wire
    - Low Capacitance: 15pf/ft or less
    - UL approved temperature rated to 75°C
    - UL approved voltage rated to 300V
    - UV- and moisture-resistant if not provided in conduit
    - Plenum rated: NEC type CMP (if required by national or local codes)

3.5 Electrical Connections—Optional Features, 600mm (24in.) units

Source: DPN001884, Revision 5, Pg. 1

13. **Condensate pump high water alarm (available when optional pump is installed)**—On pump high-water indication, normally open dry contact is closed across Terminals 88 and 89 for remote indication. 1A, 24VAC maximum load. Use field-supplied, Class 1 wiring.
14. **Liebert Liqui-tect® shutdown and dry contact (available when optional Liebert Liqui-tect sensor is installed)**—On Liebert Liqui-tect activation, normally open dry contact is closed across Terminals 58 and 59 for remote indication. The Liebert Liqui-tect sensor notifies the Liebert iCOM® of indication through Terminals 60 and 61. 1A, 24VAC maximum load. Use Class 1, field-supplied wiring.
15. **Reheat and humidifier lockout**—Remote 24VAC required at Terminals 82 and 83 for lockout of reheat and humidifier.
16. **Additional Common Alarm**—On any alarm, one additional normally open dry contact is closed across Terminals 94 and 95 for remote indication. 1A, 24VAC maximum load. Use Class 1, field-supplied wiring.

NOTE

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

NOTICE

Risk of improper input power. Can cause equipment damage.

The electronically commutated motors included in the Liebert CRV unit —included in 480V CR035 and CR040 units—are suitable for connection to an electrical service providing input power to the unit with 300V or less line-to-ground potential only.

Acceptable unit input electrical service for 460V (480V) nominal units:

- 480V wye with solidly grounded neutral and 277V line-to-ground

Unacceptable unit input electrical service for 460V (480V) nominal units:

- Wye with high resistance (or impedance) ground
- Delta without ground or with floating ground
- Delta with corner ground
- Delta with grounded center tap

3.6 Electrical Field Connections—Standard Features, 300mm (12in.) DX Models

Source: DPN002810, Revision 1

1. **High-Voltage Connection Through the Rear of the Switch Box**—1-1/8" (28.6mm) and 1-3/4" (44.5mm) diameter concentric knockout.
2. **Low-Voltage Connection Through the Bottom of the Unit**—Quantity of two 7/8" (22mm) diameter knockouts, not shown; see **Figure 14**.
3. **High-Voltage Connection Through the Top of the Unit**—1-1/4" (32mm) and 1-3/4" (44.5mm) diameter concentric knockout, not shown; see **Figure 14**.
4. **Low-Voltage Connection Through the Top of the Unit**—Two knockouts, 7/8" (22mm) diameter, not shown; see **Figure 14**.
5. **Three-Phase Electrical Service**—Connect to terminals on disconnect switch. Three-phase service not by Emerson. (Refer to serial tag for total unit full load amps, wire size amps and maximum overcurrent protective device size. Refer to **NOTICE on page 13** for information about electrical service.)
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 and 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 and 50, 2 and 51, 5 and 55 or 3 and 56. Use field-supplied Class 1 wiring. Terminals 5 & 55 not available when optional Condensate Pump is installed. The terminals in **Figure 6** indicated as not used are available for customer alarm inputs.
10.) **Common Alarm**—On any alarm, normally open dry contact is closed across Terminals 75 and 76 for remote indication. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
11. **Heat Rejection Interlock**—On any call for compressor operation, normally open dry contact is closed across Terminals 70 and 71 to heat rejection equipment. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
12. **CANbus Connector**—Terminal block with Terminals 49-1 (CAN-H) and 49-3 (CAN-L) + SH (shield connection). The terminals are used to connect the CANbus communication cable (provided by others) from the indoor unit to the Liebert MC Condenser-Premium Model.

    CANbus Cable—CANbus cable provided by others to connect to the outdoor condenser. Cable must have the following specifications:
    a. Conductors—22-18AWG stranded, tinned copper
    b. Twisted pair (minimum eight twists per foot [305mm])
    c. Braided shield or foil shield with drain wire
    d. Low capacitance—15pf/ft or less
    e. UL-approved temperature rated to 167°F (75°C)
    f. UL-approved voltage rated to 300V
    g. UV- and moisture-resistant if not provided in conduit
    h. Plenum rated—NEC type CMP (if required by national or local codes)

3.6.1 Electrical Field Connections—Optional Features, 300mm (12in.) DX Models

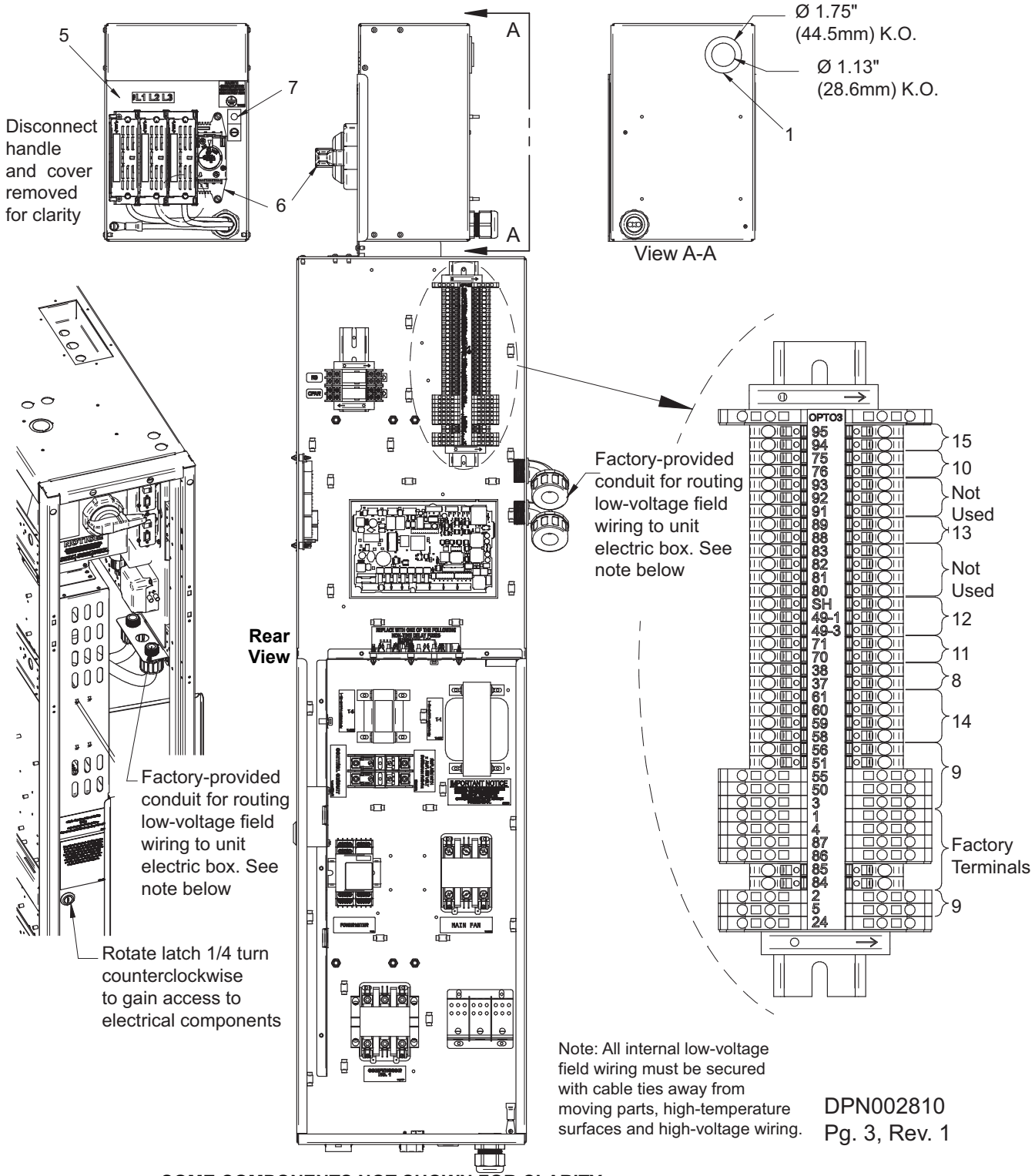
Source: DPN002810, Rev. 1

13. **Condensate Pump High Water Alarm** (available when optional pump is installed)—On pump high water indication, normally open dry contact is closed across Terminals 88 and 89 for remote indication. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
14. **Liebert Liqui-tect® Shutdown and Dry Contact** (available when optional Liebert Liqui-tect sensor is installed)—On Liebert Liqui-tect activation, normally open dry contact is closed across Terminals 58 and 59 for remote indication. The Liebert Liqui-tect sensor notifies Liebert iCOM® of indication through Terminals 60 and 61. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
15. **Additional Common Alarm**—On any alarm, one additional normally open dry contact is closed across Terminals 94 and 95 for remote indication. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.

Figure 6 Electrical field connections—300mm (12in.) DX models

Refer to 3.6 - Electrical Field Connections—Standard Features, 300mm (12in.) DX Models and 3.6.1 - Electrical Field Connections—Optional Features, 300mm (12in.) DX Models for keys to numbered components.

See Figure 7 for low-voltage field wiring routing into the unit



SOME COMPONENTS NOT SHOWN FOR CLARITY
General wire routing paths shown. Wiring must be run in conduit and must be inside the Liebert CRV frame and panels. Attach conduit to the inside of the rails with cable ties.

Control wiring must be run in separate conduit from power wiring. For top entry routing, see Figure 9; for bottom entry, see Figure 10.

Figure 7 Low-voltage field wiring routing into the unit—300mm (12in.) DX

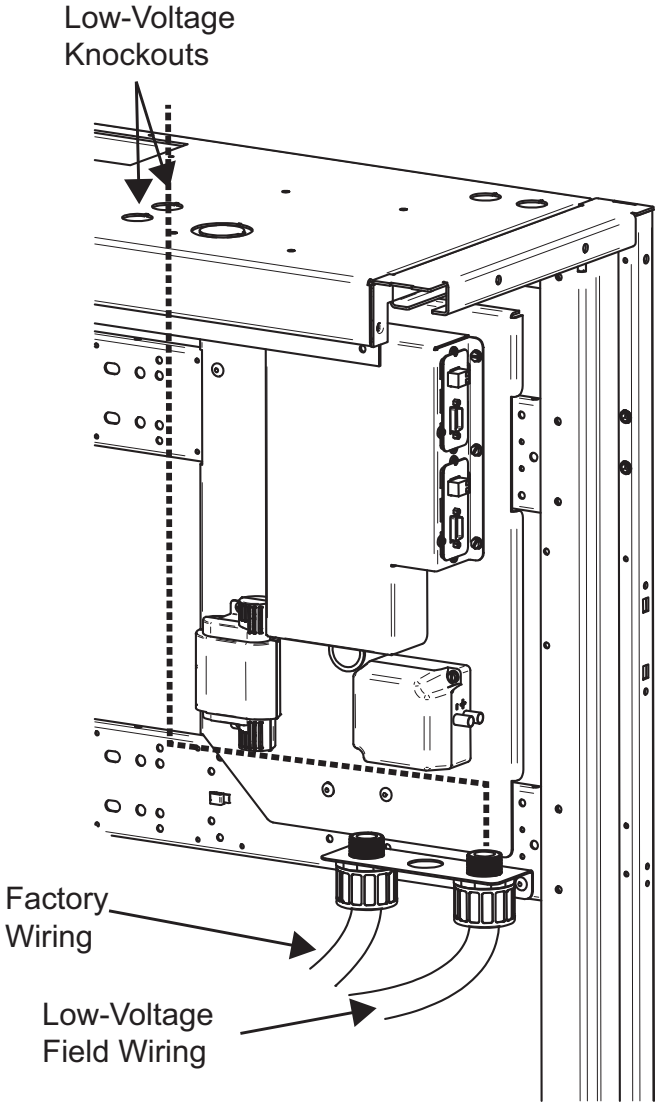
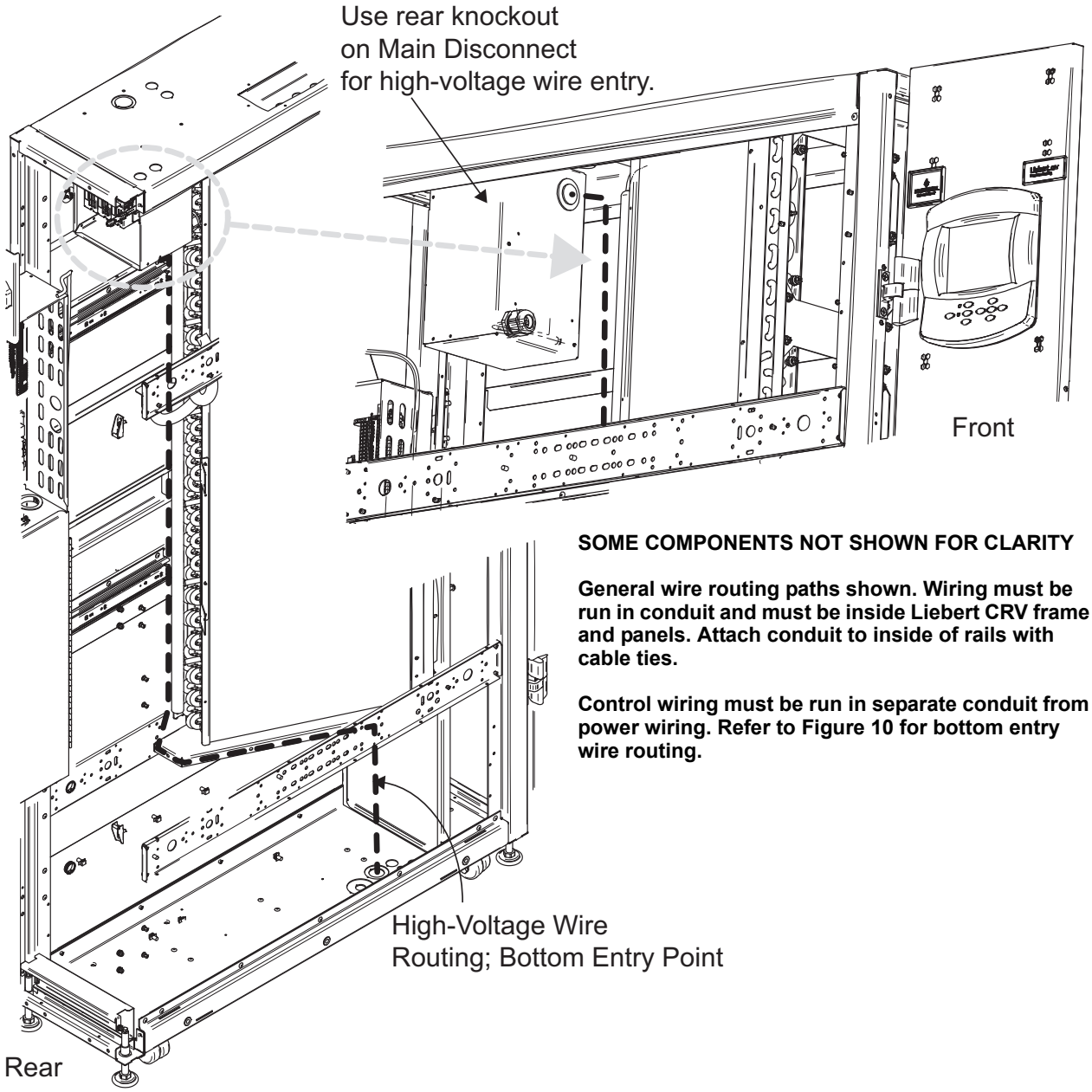


Figure 8 Power cable routing—Bottom entry, 300mm (12in.) DX models



SOME COMPONENTS NOT SHOWN FOR CLARITY

General wire routing paths shown. Wiring must be run in conduit and must be inside Liebert CRV frame and panels. Attach conduit to inside of rails with cable ties.

Control wiring must be run in separate conduit from power wiring. Refer to Figure 10 for bottom entry wire routing.

Figure 9 Liebert IntelliSlot cable routing—Top entry, 300mm (12in.) DX models

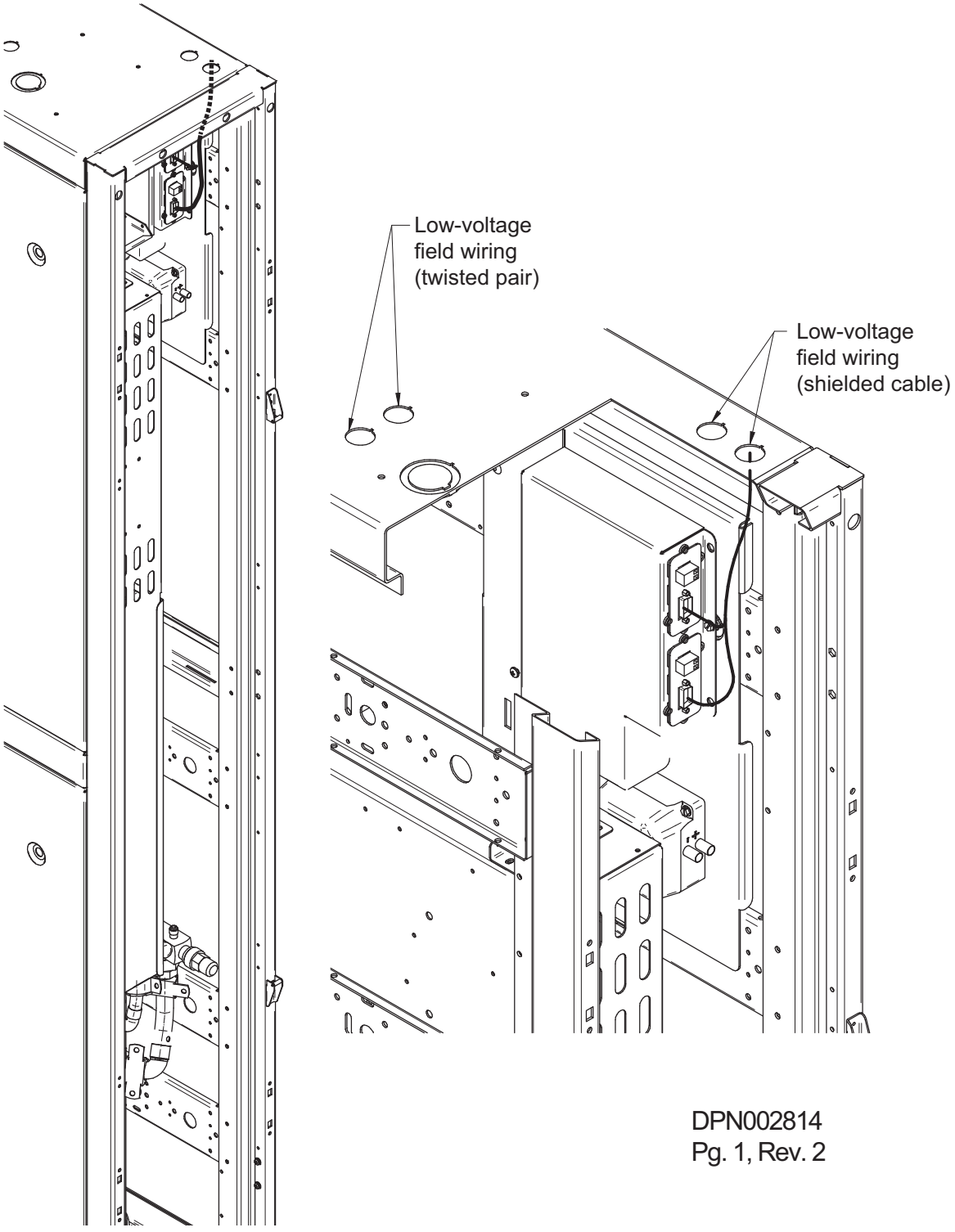
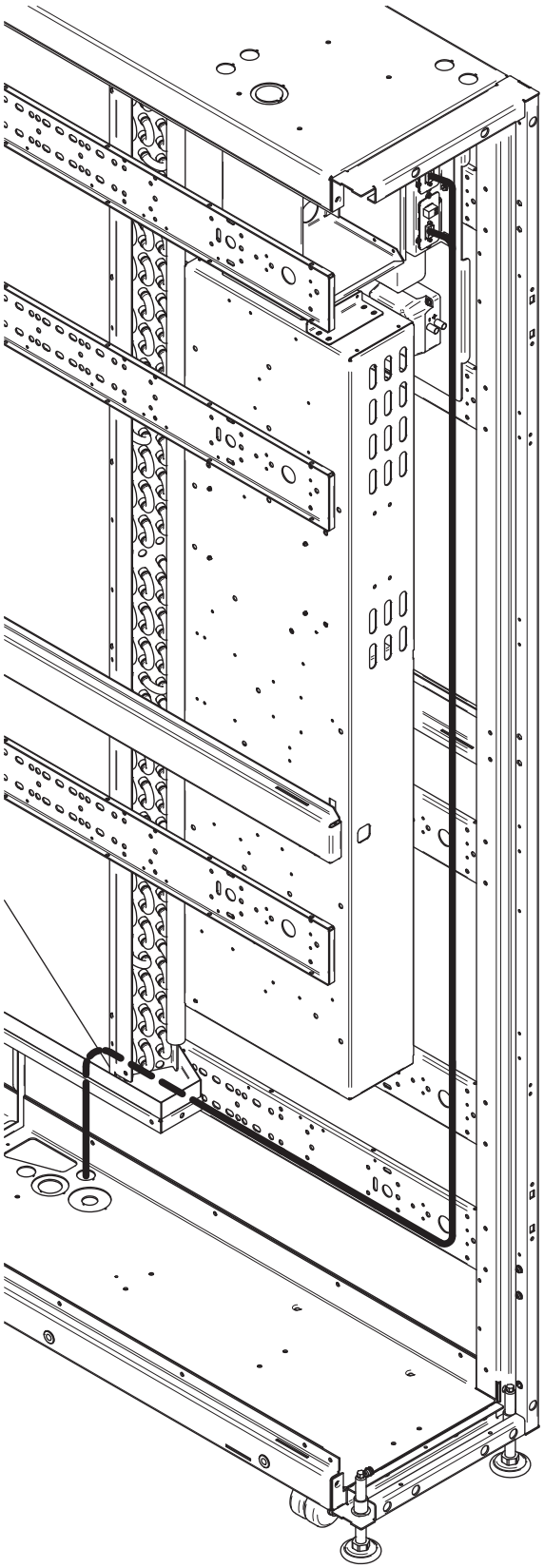


Figure 10 Liebert IntelliSlot® cable routing—Bottom entry, 300mm (12in.) DX models

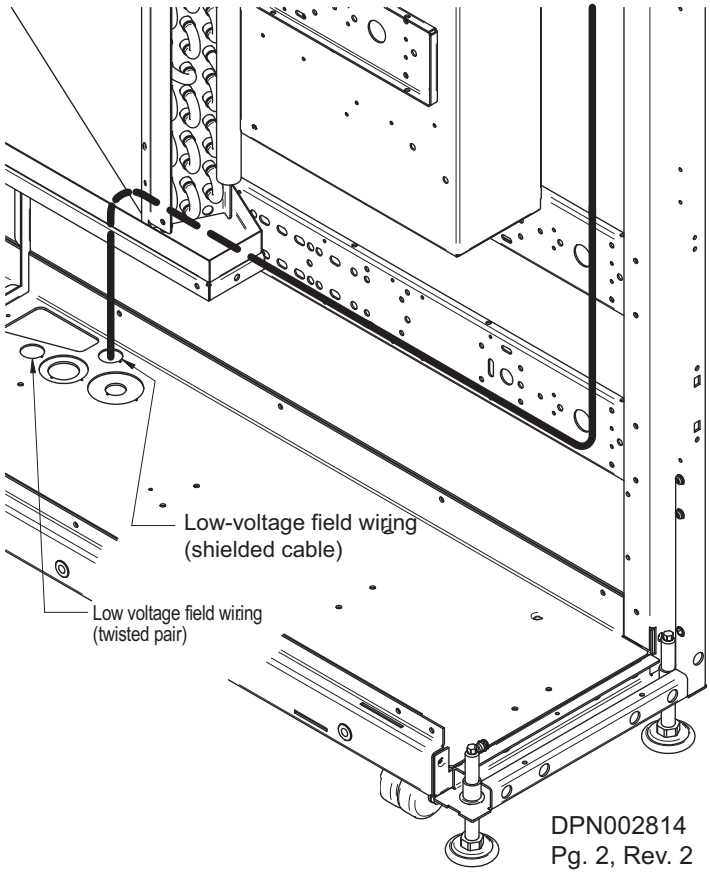


SOME COMPONENTS NOT SHOWN FOR CLARITY

General wire routing paths shown. Wiring must be run in conduit and must be inside Liebert CRV frame and panels. Attach conduit to inside of rails with cable ties.

Shielded cable may be used. If not, control wiring must be run in separate conduit from power wiring.

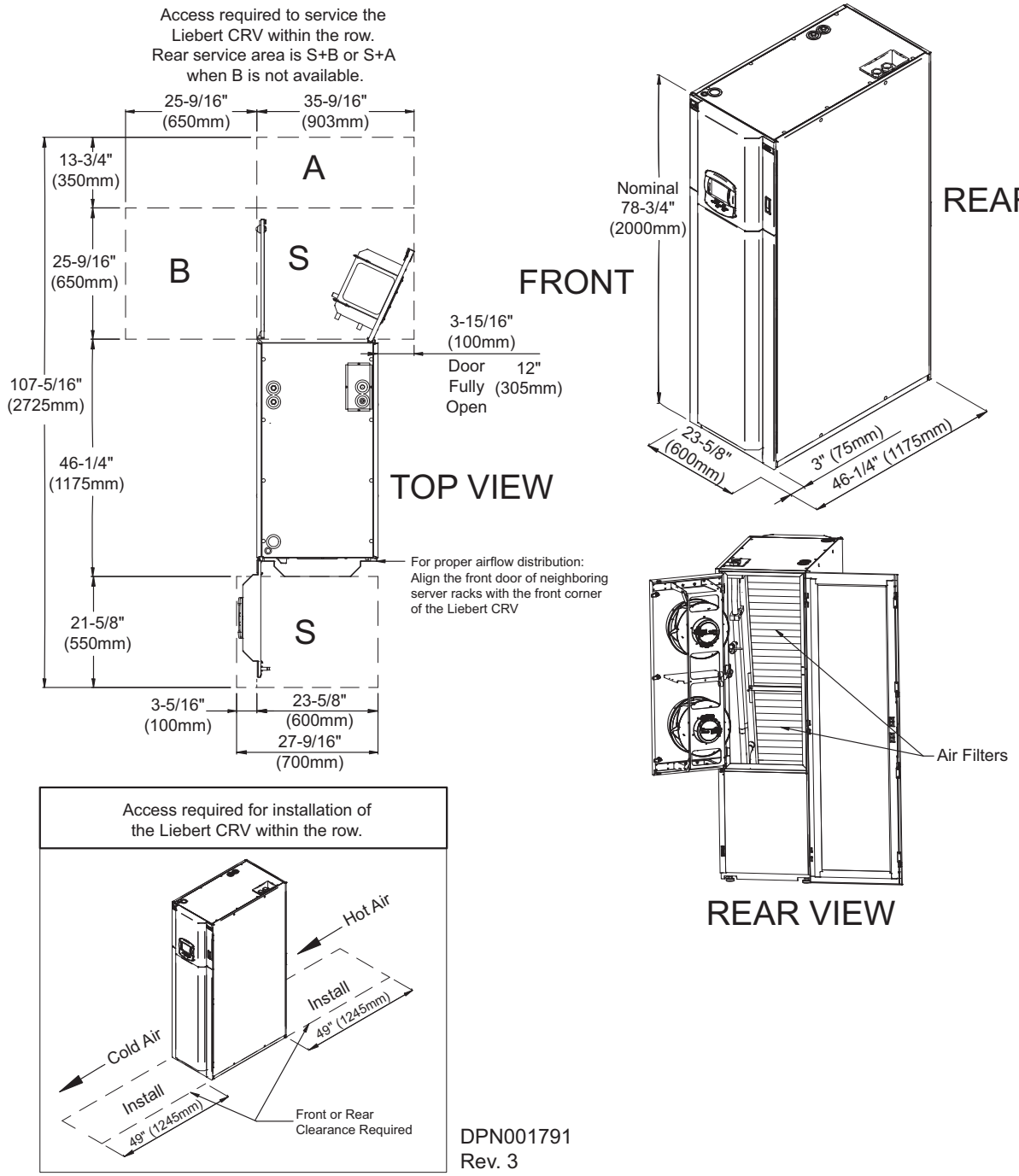
Secure the control wiring or conduit to the bottom edge of the rail with cable ties. Route the shielded cable up toward the Liebert IntelliSlot bays and fasten to the side rails as needed.



DPN002814
Pg. 2, Rev. 2

3.7 Dimensions—Air-Cooled Systems

Figure 11 Cabinet and floor planning dimensions—Air-cooled, 600mm (24in.) wide models

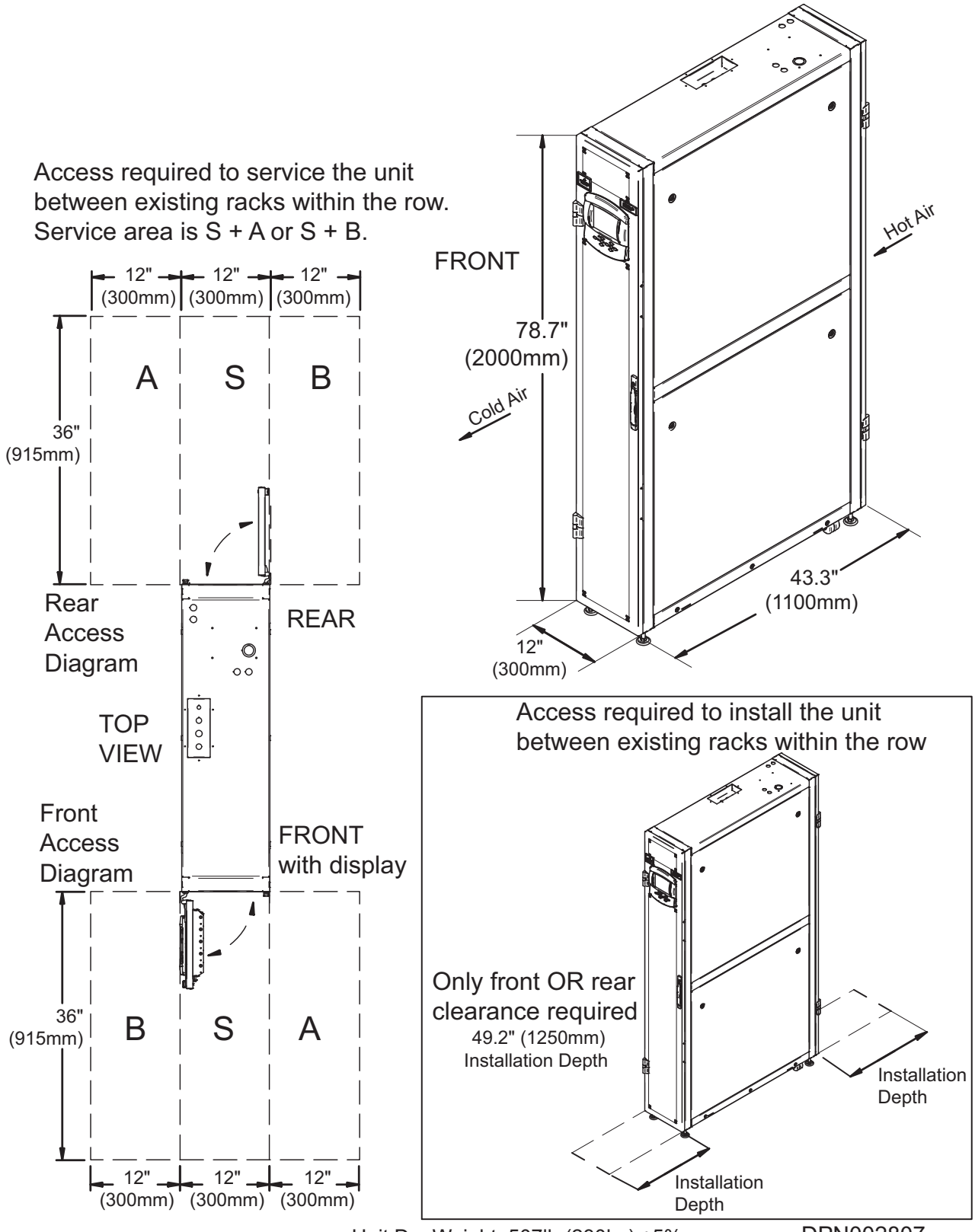


DPN001791
Rev. 3

Model No.	Dry Weight, ± 5% lb (kg) Air Cooled
CR020R	739 (335)
CR035R	805 (365)

Source DPN001791, Rev. 3

Figure 12 Cabinet and floor planning dimensions—Air-cooled, 300mm (12in.) wide models

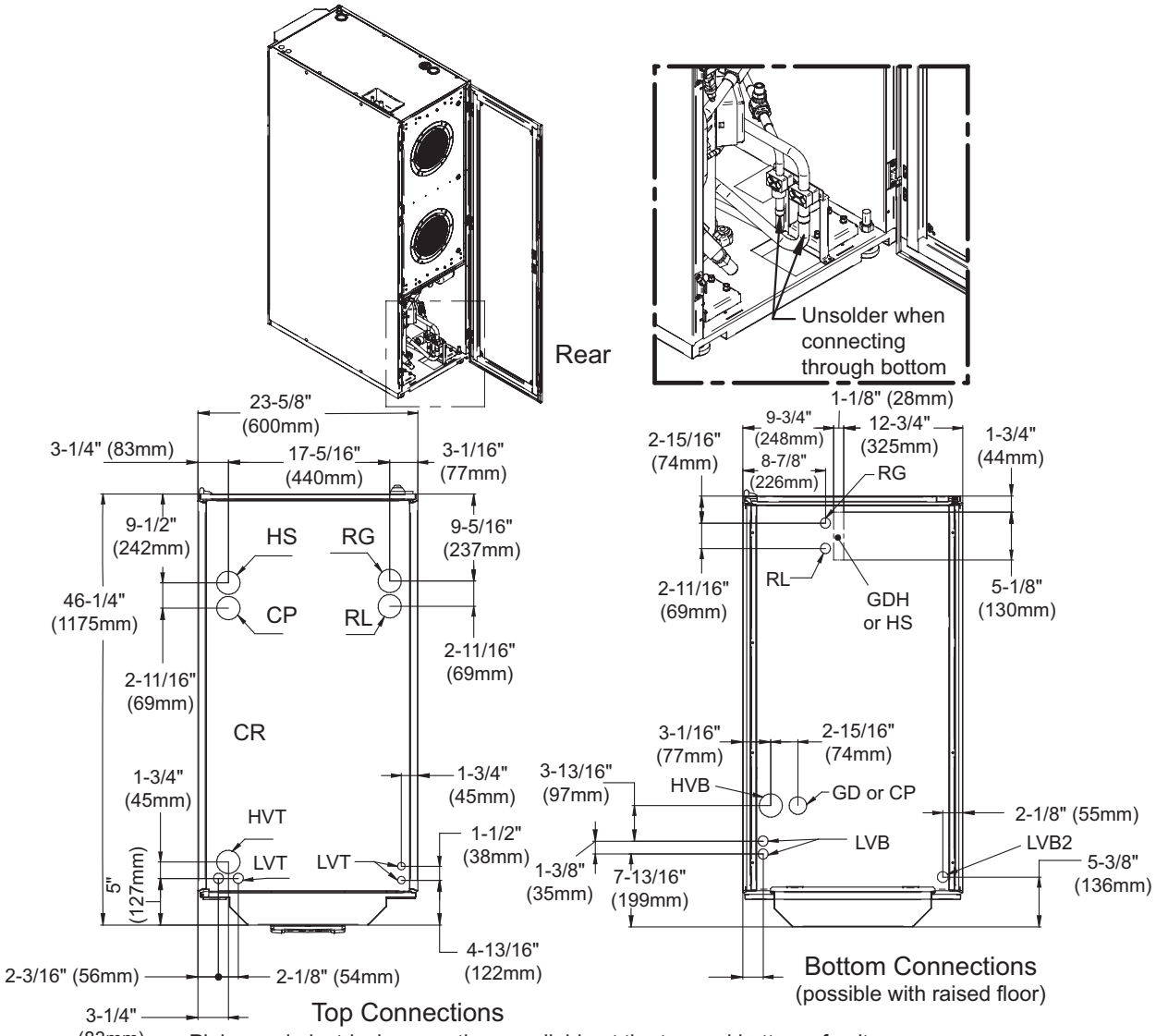


Unit Dry Weight: 507lb (230kg) ±5%

DPN002807
Rev. 0

3.8 Piping—Air-Cooled Systems

Figure 13 Primary connection locations, air-cooled models, 600mm (24in.), digital scroll with EC fans



Piping and electrical connections available at the top and bottom of unit. Air-cooled systems may require oil to be added in the field to allow sufficient compressor lubrication.

DPN001792
Rev. 2

Table 9 Unit connections, air-cooled models

Unit Connections		CR20A	CR35A
RL	Refrigerant Liquid Line Inlet	1/2" O.D. Copper Sweat	5/8" O.D. Copper Sweat
RG	Refrigerant Gas Line Outlet	5/8" O.D. Copper Sweat	7/8" O.D. Cu Sweat
GD	Gravity Coil Pan Drain	1" MPT	
GDH	Gravity Humidifier Drain	N/A	
CP	Condensate Pump	1/2" FPT	
HS	Humidifier Supply	1/2" FPT (top connection), 1/4" Compression Fitting (bottom connection)	
HVT	High-Voltage Top Connection	Combination Knockout Hole Diameter 35mm (1-3/8"), 44.5mm (1-3/4") and 63.5mm (2-1/2")	
HVB	High-Voltage Bottom Entrance (feed through the base of the unit)	Knockout Hole Diameter 63.5mm (2-1/2")	
LVT	Low Voltage Top Connection	Knockout Hole Diameter 22mm (7/8") 4 places	
LVB	Low Voltage Bottom Entrance (feed through the base of the unit)	Knockout Hole Diameter 27.8mm (1-3/32") 2 places	
LVB2	Low Voltage Bottom Entrance (feed through the base of the unit)	Hole Diameter 44.5mm (1-3/4") 1 place	

Source DPN001792, Rev. 2

Figure 14 Connections—air-cooled 300mm (12in.) models

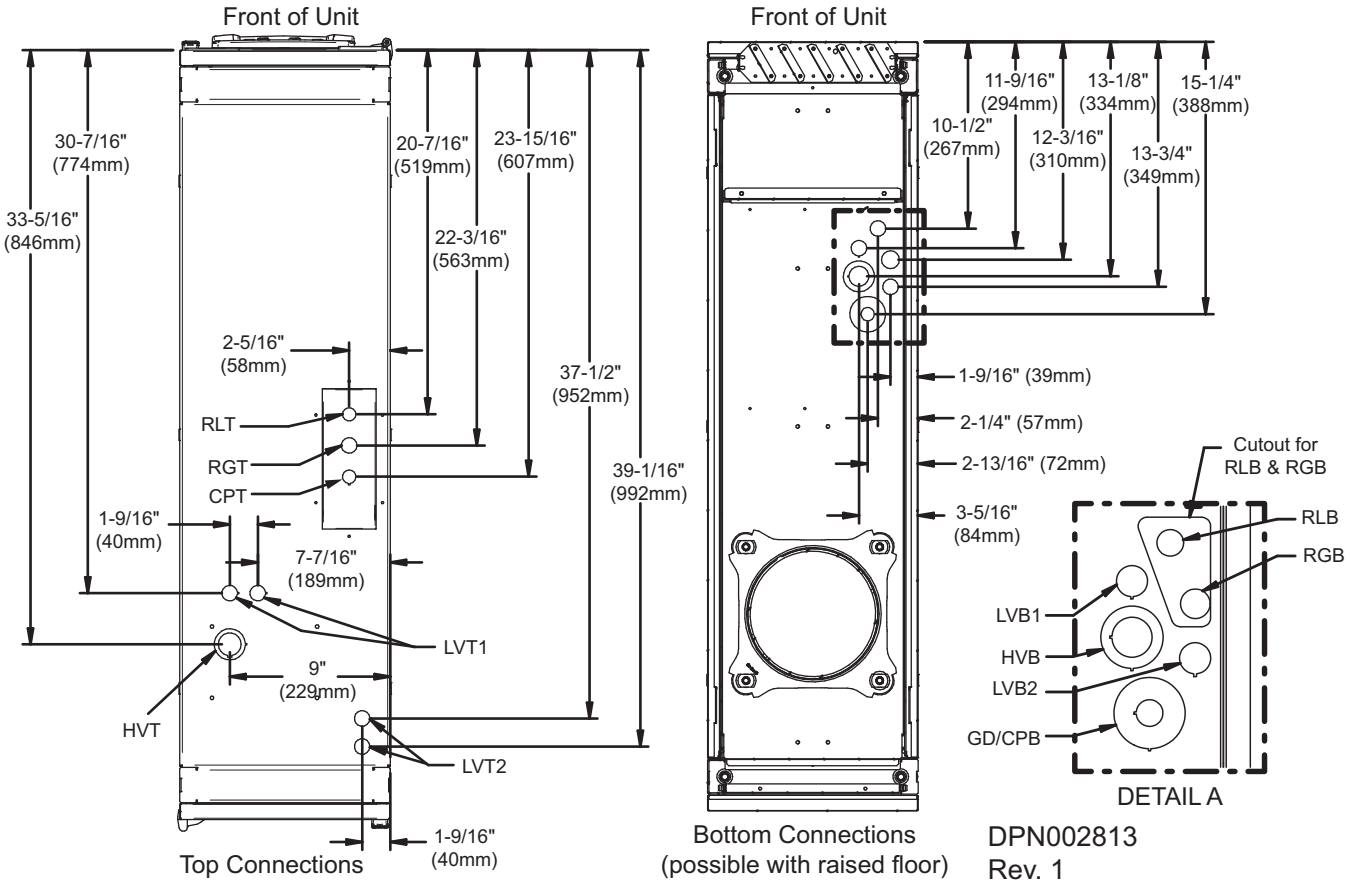


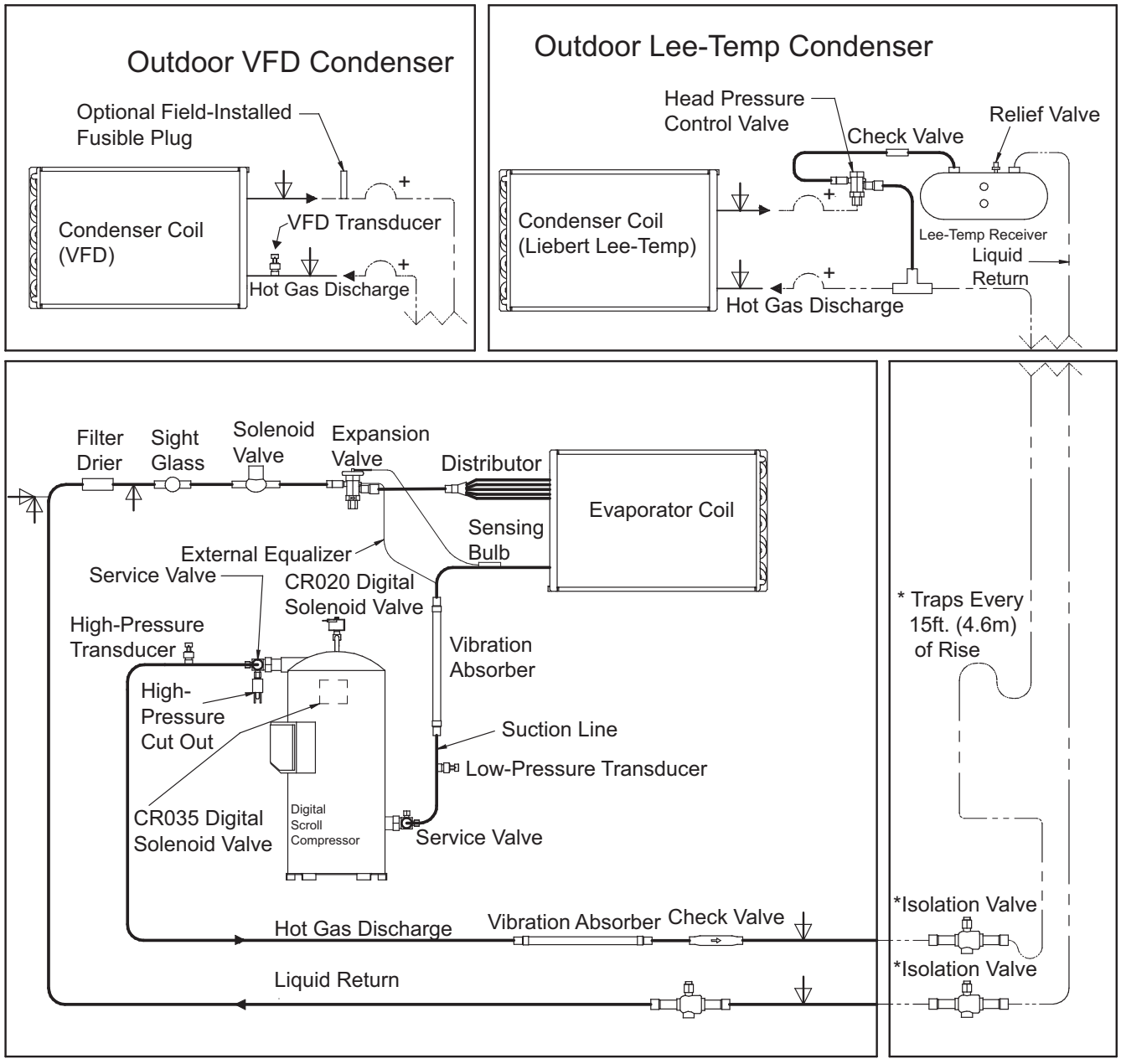
Table 10 Key to unit connections in Figure 14

Top Connection	Description	Dimensions Top Connection	Bottom Connection	Description	Dimensions Bottom Connection
RLT	Refrigerant Liquid Line Inlet	1/2" O.D. Copper Sweat	RLB	Refrigerant Liquid Line Inlet	1/2" O.D. Copper Sweat
RGT	Refrigerant Gas Line Outlet	5/8" O.D. Copper Sweat	RGB	Refrigerant Gas Line Outlet	5/8" O.D. Copper Sweat
CPT	Condensate Pump	Knockout 19mm (3/4")	GD	Gravity Coil Pan Drain	Knockout 3/4" (19mm) and 2" (51mm)
HVT	High Voltage Top Connection	Combination Knockout 32mm (1-1/4") and 44mm (1-3/4")	CPB	Condensate Pump	
			HVB	High Voltage Bottom Entrance (feed through unit's base)	Combination Knockout 1-1/8" (29mm) and 1-3/4" (44mm)
LVT1	Low Voltage Top Connection	Knockout Hole Diameter, 2 places, 22mm (7/8")	LVB1	Low Voltage Bottom Connection	Knockout Hole Diameter 22mm (7/8")
LVT2	Low Voltage Top Connection	Knockout Hole Diameter, 2 places, 22mm (7/8")	LVB2	Low Voltage Bottom Connection	Knockout Hole Diameter 7/8" (22mm)

Source: DPN002813, Rev. 1

Figure 15 General arrangement diagram, fin and tube condenser with and without Liebert Lee-Temp—Air-cooled 600mm (24 in.) Liebert CRV models

Refer to 4.1 - Liebert MC Condenser Selections—600mm (24in.) and 300mm (12in.)CRV Units and 4.8 - Liebert Fin/Tube Condenser Selections—600mm (24in.) Units for details.



Factory Refrigerant Piping

Field Piping

Service / Schrader (Access) Connection No Valve Core

Service / Schrader (Access) Connection With Valve Core

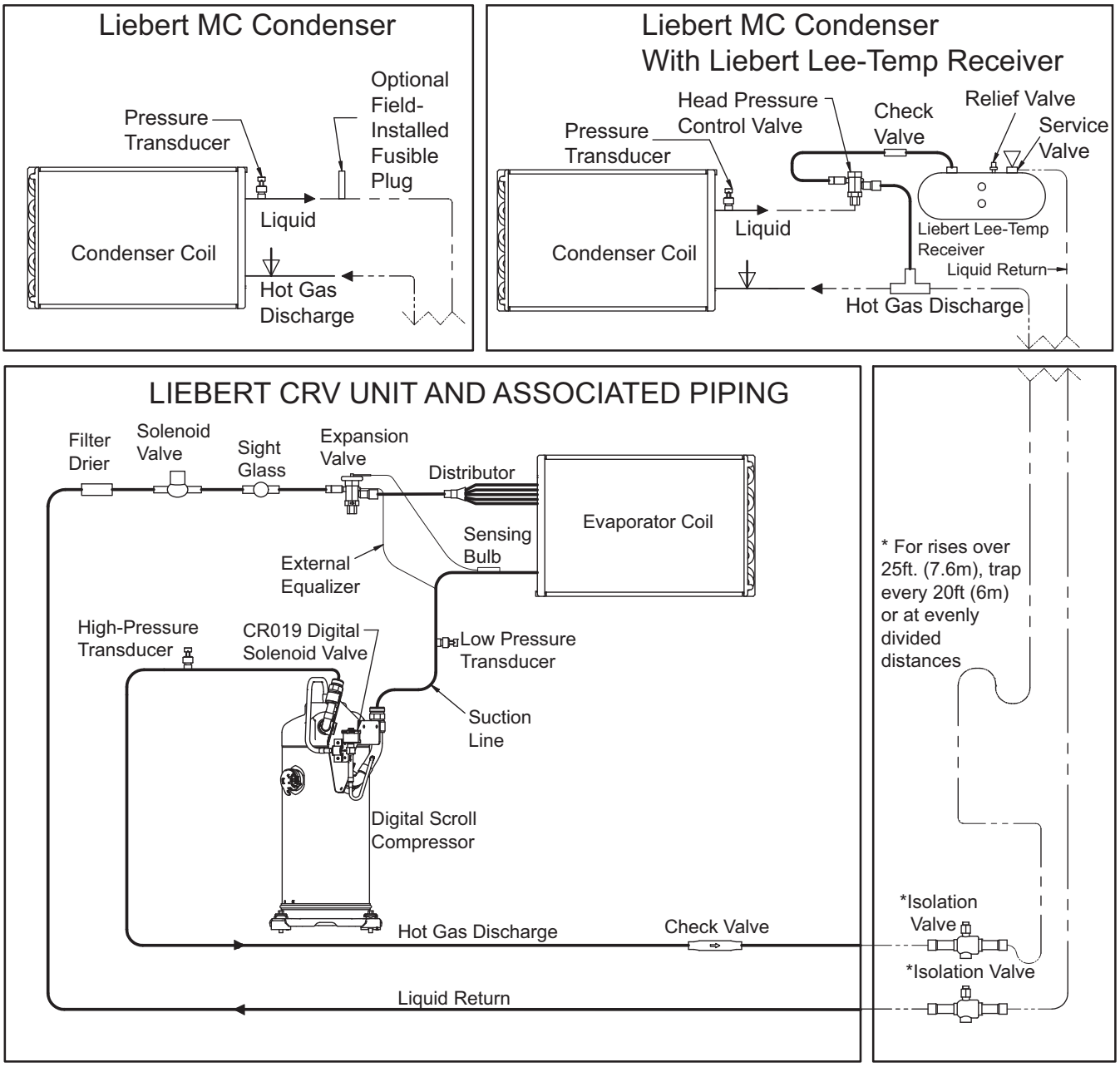
1. Schematic representation shown. Do not use for specific connection locations.
2. One or more additional pressure relief valves are required downstream of any and all field-installed isolation. Do not isolate any refrigerant circuits from overpressurization protection.

* Components are not supplied by Liebert but are recommended for proper circuit operation and maintenance. Should be located near the indoor Liebert CRV unit.

\+ Inverted Trap on Discharge and Liquid Lines to extend above the base of the coil by a minimum of 7-1/2" (190mm).

DPN001984
Rev. 4

Figure 16 General arrangement, Liebert MC condenser with and without Liebert Lee-Temp—Air-cooled 300mm (12in.) units



Factory Refrigerant Piping

Field Piping

Service / Schrader (Access) Connection With Valve Core

NOTES:

1. Schematic representation shown. Do not use for specific connection locations.
2. One or more additional pressure relief valves are required downstream of any and all field-installed isolation. Do not isolate any refrigerant circuits from overpressurization protection.
3. Refer to outdoor condenser documents above for proper trap placement.

* Components are not supplied by Emerson, but are recommended for proper circuit operation and maintenance. Isolation valves should be located near the indoor Liebert CRV unit.

DPN002808
Rev. 1

3.9 Sound Data—Air-Cooled Systems

Tables 11 and **12** 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. The sound data is without the Low Sound Package compressor jacket and sound-deadening panel insulation installed.

Sound power is an absolute measurement that can be used for comparisons when all sound measurement parameters match exactly.

Table 11 Sound data—Model CR020RA, 600mm (24in.) air-cooled

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

Table 12 Sound data—Model CR035RA, 600mm (24in.) air-cooled

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

3.10 Standard Features—600mm (24in.) Air-Cooled Systems

Source: DPN001904, Revision 2

Fan—The unit is equipped with two plug fans: direct-drive 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 that provide 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 three-level password protection system. Unit-to-Unit communication with other Liebert CRV's 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 2T rack sensors are standard with each Liebert CRV. Up to ten 2T housings (20 temperature probes) can be connected to a Liebert CRV. One 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 side panels separate the half-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 Knürr 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, four-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 molded case circuit interrupter disrupts the flow of power to the unit. The electric panel high-voltage compartment can be accessed only with the switch in the Off position. The switch is located behind the Liebert iCOM display door for quick access.

65,000A Short Circuit Current Rating (SCCR)—The electrical panel provides a 65k amp SCCR.

Direct Expansion (DX) Cooling Coil—The evaporator coil has 7.25 ft^2 (0.674 m^2) face area, four or five 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, 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. The 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).

3.11 Optional Features—600mm (24in.) Air-Cooled Systems

Source: DPN001907, Revision 3

Dual-Float Condensate Pump—It has a capacity of 6 GPM (22.7 l/m) at 30ft. (9m) 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 back- flow 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.

Low Noise Package—The Low Noise Package reduces the level of sound emitted from the compressor. The package consists of a 3/8 inch closed-cell polymeric 4.5 – 8.5 lb/ft^3 density compressor sound jacket that encloses the compressor. Additional half-inch closed cell polymeric 3 - 8 lb/ft^3 density sound deadening material is affixed to the underside of the superior service access panel located above the compressor and attached to the inner side of the compressor compartment panels that face the hot and cold aisles. All sound deadening material is non-shedding and is outside of the airstream.

Liebert IntelliSlot® Unity-DP—Provides ground fault isolated connectivity for unit monitoring and management. Supported management interfaces include:

- Emerson Protocol for Trellis™, Liebert SiteScan™ and Liebert Nform™
- Embedded LIFE™ Technology for Remote Service Delivery
- SNMP (v1/v2c/v3) for Network Management Systems
- HTTP/HTTPS for Web page viewing
- SMTP for e-mail
- SMS for mobile messaging
- Modbus RTU—Modbus Remote Terminal Unit (RTU) communication protocol for Building Management Systems over an RS-485 serial network (also called Modbus RTU RS-485)
- Modbus TCP—Modbus Transmission Control Protocol for Building Management Systems over an Internet or LAN network
- BACnet IP—BACnet over Internet Protocol for Building Management Systems over a Internet or LAN network
- BACnet MSTP—BACnet Master-Slave/Token-Passing (MSTP) communication protocol over an RS-485 serial network (also called BACnet MSTP RS-485)

Liebert IntelliSlot SiteLink-E® CARD (IS-485EXI)—Provides ground fault isolated connection to a Liebert SiteLink-E for monitoring and management. Compatible with Liebert SiteScan® Web 4.0 or newer version.

Filter—The optional filters are two deep-pleated, four-inch filters 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 24V signal.

One (1) 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—This solid-state water sensor has no moving parts and is hermetically sealed to keep out dust and dirt. The alarm system is activated when the sensor detects the presence of moisture.

3.12 Standard Features—300mm (12in.) Air-Cooled Systems

Source: DPN002811, Revision 1

DX Cooling Coil—The evaporator coil has 6.46 ft^2 (0.60 m^2) face area, three rows deep. It is constructed of copper tubes and hydrophilic coated aluminium fins. The hydrophilic coating provides superior water carryover resistance. A stainless steel condensate drain pan is provided.

Refrigeration System—Single refrigeration circuit includes a liquid line filter dryer, a refrigerant sight glass with moisture indicator, an adjustable externally equalized expansion valve and a liquid line solenoid valve.

Compressor—The compressor is an R-410A scroll-type compressor with variable capacity operation from 20-100%; commonly known as a digital scroll. The 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.

Fans—The unit is equipped with five plug fans: direct driven centrifugal fans with backward curved blades and electronically commutated motors, commonly referred to as EC plug fans. The fan speed is variable and automatically regulated by the Liebert iCOM through all modes of operation. Each fan has a dedicated motor and integrated speed controller, which provides a level of redundancy. The fans pull air through the coil and are located in the front of the unit.

Supply Air Baffle—Field-adjustable, modular supply air baffles are located in the discharge air stream. They can be quickly and easily reconfigured to redirect airflow. The angles of the vanes have been optimized to distribute air effectively to heat generating equipment in a wide variety of applications.

Liebert iCOM Control System—The Liebert CRV is controlled by the Liebert iCOM. 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 three-level password protection system. Unit-to-Unit communication with other Liebert CRV's and two Liebert IntelliSlot® communication card housings are included as standard.

2T Rack Temperature Sensors—The 2T sensors consist of a vented case with two temperature probes. Three 2T rack sensors are standard with each Liebert CRV. Up to ten 2T housings (20 temperature probes) can be connected to a Liebert CRV 300mm unit. One 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 building management system 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 in a daisy-chain configuration.

Remote Shutdown Terminal—Provides the customer with a remote location to 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 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 front and rear doors have handles 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.

Filter—The unit is equipped with two 1/2 inch filters rated MERV1 (based on ASHRAE 52.2-2007), located within the cabinet and accessible from the rear of the unit. A filter clog alarm is included.

Locking Disconnect Switch—A molded 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 rear door for quick access.

65,000A Short Circuit Current Rating (SCCR)— The electrical panel provides a 65k amp SCCR.

3.13 Optional Features—300mm (12in.) Air-Cooled Systems

Source: DPN002812, Revision 1

Dual-float Condensate Pump—Capacity of 45 GPH (171 l/hr) at 13ft (4m) head. Pump is complete with integral primary and secondary float switches, pump, motor assembly and reservoir. The secondary float signals the local alarm and shuts down the unit upon high water condition.

Liebert IntelliSlot® Sitelink-E® Card (IS-485EXI)—Provides ground fault isolated connection to a Liebert SiteLink-E for monitoring and management. Compatible with Liebert SiteScan® Web 4.0 or newer version.

Liebert IntelliSlot® Unity™ Card (IS-UNITY-DP)—Provides ground fault isolated RS-485 Modbus, BACnet IP and Modbus IP network connectivity to Building Management Systems for unit monitoring and management. Also, provides ground fault isolated 10/100 baseT Ethernet connectivity for unit monitoring and management. The supported management interfaces include: SNMP for Network Management Systems, HTTP for web page viewing, SMTP for email and SMS for mobile messaging. This card can support dual IP and 485 protocols simultaneous.

Filter—The optional filters are two deep pleated 2 inch rated MERV8 (based on ASHRAE 52.2-2007) located within the cabinet and accessible from the rear of the unit. A filter clog alarm is included.

One (1) Extra Common Alarm Contact—Provides a total of two sets of normally open contacts for remote indication of unit alarms.

Liebert Liqui-tect® Sensor—A solid-state water sensor that has no moving parts and is hermetically sealed to keep out dust and dirt. The alarm system is activated when the sensor detects moisture.

4.0 HEAT REJECTION—LIEBERT MC™ AND FIN/TUBE CONDENSERS

All Liebert condensers are designed to work with the Liebert CRV.

4.1 Liebert MC Condenser Selections—600mm (24in.) and 300mm (12in.)CRV Units

For best performance, lowest sound and most energy-efficient operation, Emerson recommends matching a Liebert CRV 20kW or 35kW air-cooled unit with a Liebert MC condenser. The Liebert MC provides greater heat rejection and lower condensing temperatures than the legacy fin-tube condenser match-ups shown below.

Table 13 Traditional open room 95°F (35°C)/23RH return air conditions

Indoor Model	Unit Width	Outdoor Design Ambient Temperature, °F (°C)					
		95 (35)	100 (38)	105 (41)	110 (43)	115 (46)	120 (49)
CR019R*	300mm (12")	MCS028E1	MCM040E1	MCM040E1	MCM040E1	MCL055E1	MCL055E1
CR020A	600mm (24")						
CR035A		MCM040E1	MCL055E1	MCL055E1	MCM080E1	MCM080E1	MCM080E1

* 300mm (12") DX model

Table 14 Traditional open room 95°F (35°C)/23RH return air conditions, Liebert QuietLine™ operation

Indoor Model	Unit Width	Outdoor Design Ambient Temperature, °F (°C)					
		95 (35)	100 (38)	105 (41)	110 (43)	115 (46)	120 (49)
CR019R*	300mm (12")	MCS028E1	MCM040E1	MCL055E1	MCL055E1	MCM080E1	—
CR020A	600mm (24")						—
CR035A		MCL055E1	MCL055E1	MCM080E1	MCM080E1	MCL110E1	—

* 300mm (12") DX model

4.2 Dimensions and Weights—Liebert MC Condensers

Table 15 Condenser net weights, shipping weights, dimensions and volume, approximate

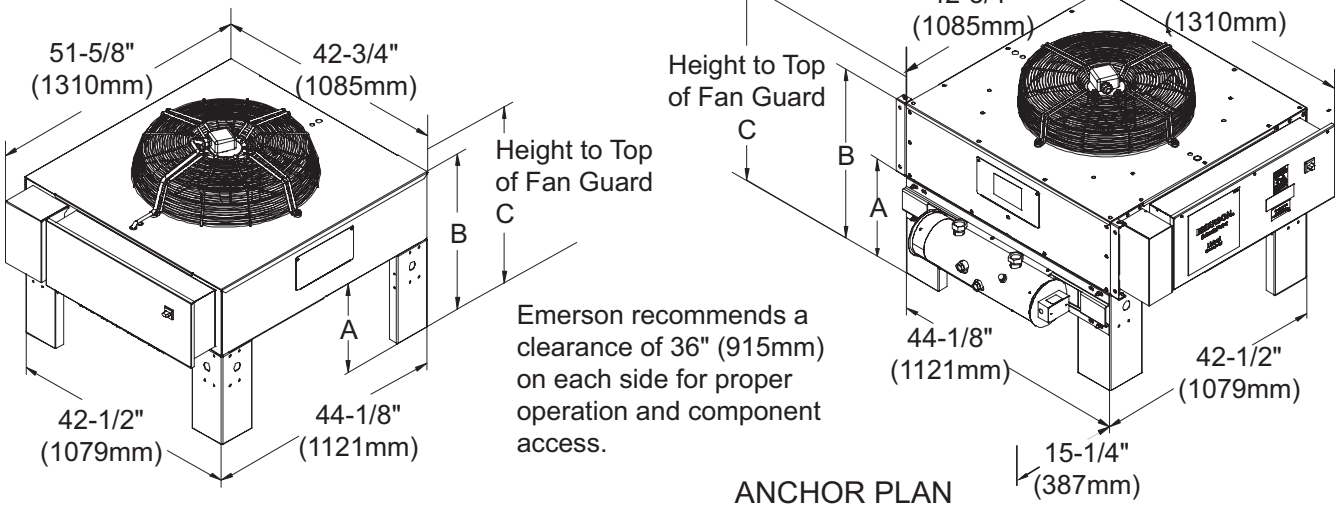
Model #	Number of Fans	Condenser Net Weight lb (kg)	Domestic Packaging			Export Packaging		
			Packaged Weight lb (kg)	Dimensions (LxWxH) in. (cm)	Volume ft^3 (m^3)	Packaged Weight lb (kg)	Dimensions (LxWxH) in. (cm)	Volume ft^3 (m^3)
MCS028	1	154 (70)	335 (152)	76x36x63 (193x91x160)	100 (2.8)	455 (206)	77x37x64 (196x94x163)	106 (3.0)
MCM040	1	231 (105)	410 (186)	76x36x63 (193x91x160)	100 (2.8)	535 (243)	77x37x64 (196x94x163)	106 (3.0)
MCM080	2	441 (200)	750 (340)	136x36x63 (345x91x160)	179 (5.0)	945 (429)	137x37x64 (348x94x163)	188 (5.3)
MCL055	1	344 (156)	525 (238)	76x36x63 (193x91x160)	100 (2.8)	645 (293)	77x37x64 (196x94x163)	106 (3.0)
MCL110	2	602 (273)	910 (413)	136x36x63 (345x91x160)	179 (5.0)	1110 (503)	137x37x64 (348x94x163)	188 (5.3)

Weights are based on units with EC fans, units with AC fans may be slightly less.
Net and packaged weights will increase with factory options: legs taller than 18", coated coils and seismic options. Field-installed receivers also add to net weights. Consult factory for additional information. See **Table 16** for weight added by longer legs.

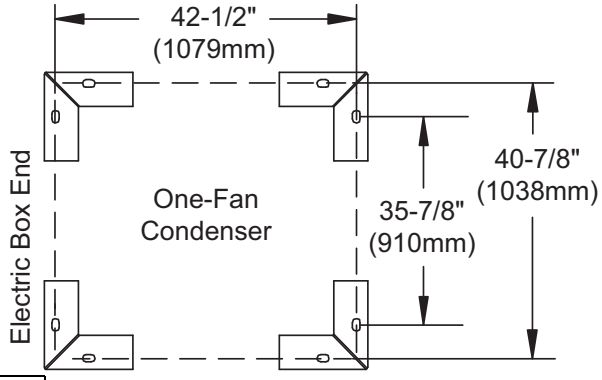
Table 16 Condenser net weight addition—taller legs

Leg Height In. (mm)	Additional Weight by Condenser Model, lb. (kg)				
	MCS028	MCM040	MCM080	MCL055	MCL110
36 (914)	120	120	139	127	148
48 (1219)	151	151	171	159	179
60 (1524)	183	183	202	190	210

Figure 17 Condenser planning dimensional data—MCS028



ANCHOR PLAN



See Figure 20 for typical footprint dimensions.

DPN002372 Rev. 3

DPN002373 Rev. 4

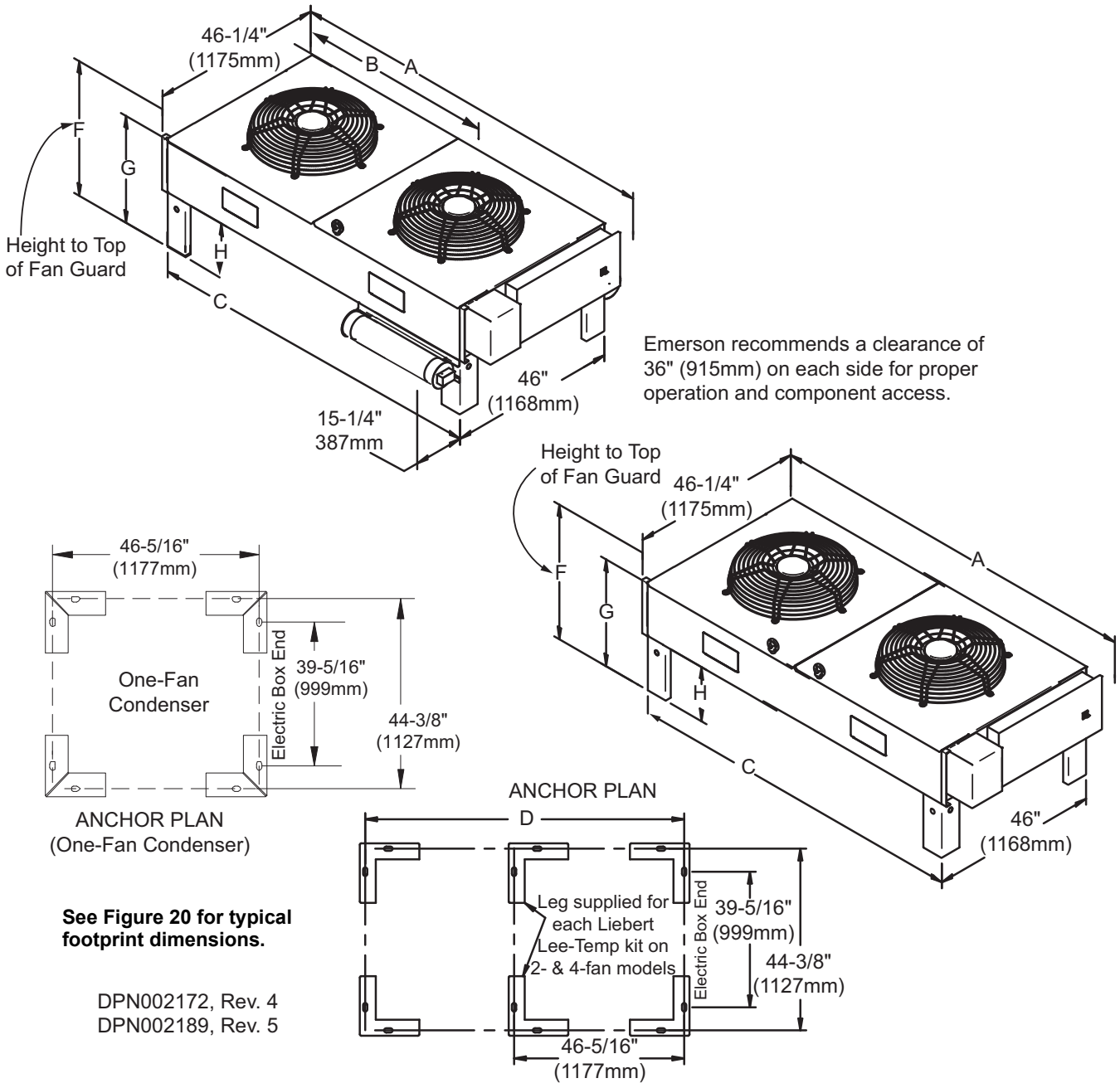
Dimensions		
Leg Height A *, In. (mm)	**B In. (mm)**	**C In. (mm)**
18 (457)	31-5/8 (803)	39-5/8 (1006
36 (914)	49-5/8 (1260)	57-5/8 (1464)
48 (1219)	61-5/8 (1565)	69-5/8 (1768)
60 (1524)	73-5/8 (1870)	81-5/8 (2073)

* 18" legs standard for all models. Cross-bracing is required for legs longer than 18" (457mm). Number varies according to model and options.

See **Tables 15** and **16** for weights, including added weight for legs of various lengths.

Source: DPN002372, Rev. 2; DPN002373, Rev. 3

Figure 18 Condenser planning dimensional data—MCM040, MCM080



See Figure 20 for typical footprint dimensions.

DPN002172, Rev. 4
DPN002189, Rev. 5

Liebert Model	# of Fans	Dimensions						Leg Height
		A in. (mm)	B in. (mm)	C in. (mm)	D in. (mm)	F in. (mm)	G in. (mm)	H* in. (mm)
MCM040	1	57-3/16 (1453)	—	48 (1219)	46-5/16 (1177)	39-5/8 (1006)	31-5/8 (803)	18 (457)
MCM080	2	105-1/4 (2674)	—	96-1/16 (2440)	94-7/16 (2398)	57-5/8 (1464)	49-5/8 (1260)	36 (914)
								48 (1219)
								60 (1524)

* 18" legs standard for all models. Cross-bracing is required for legs longer than 18" (457mm); number varies according to model and options.

See **Tables 15** and **16** for weights, including added weight for legs of various lengths.

Source: DPN002172, Rev. 4; DPN002189, Rev. 5

Figure 19 Condenser planning dimensional data—MCL055, MCL110

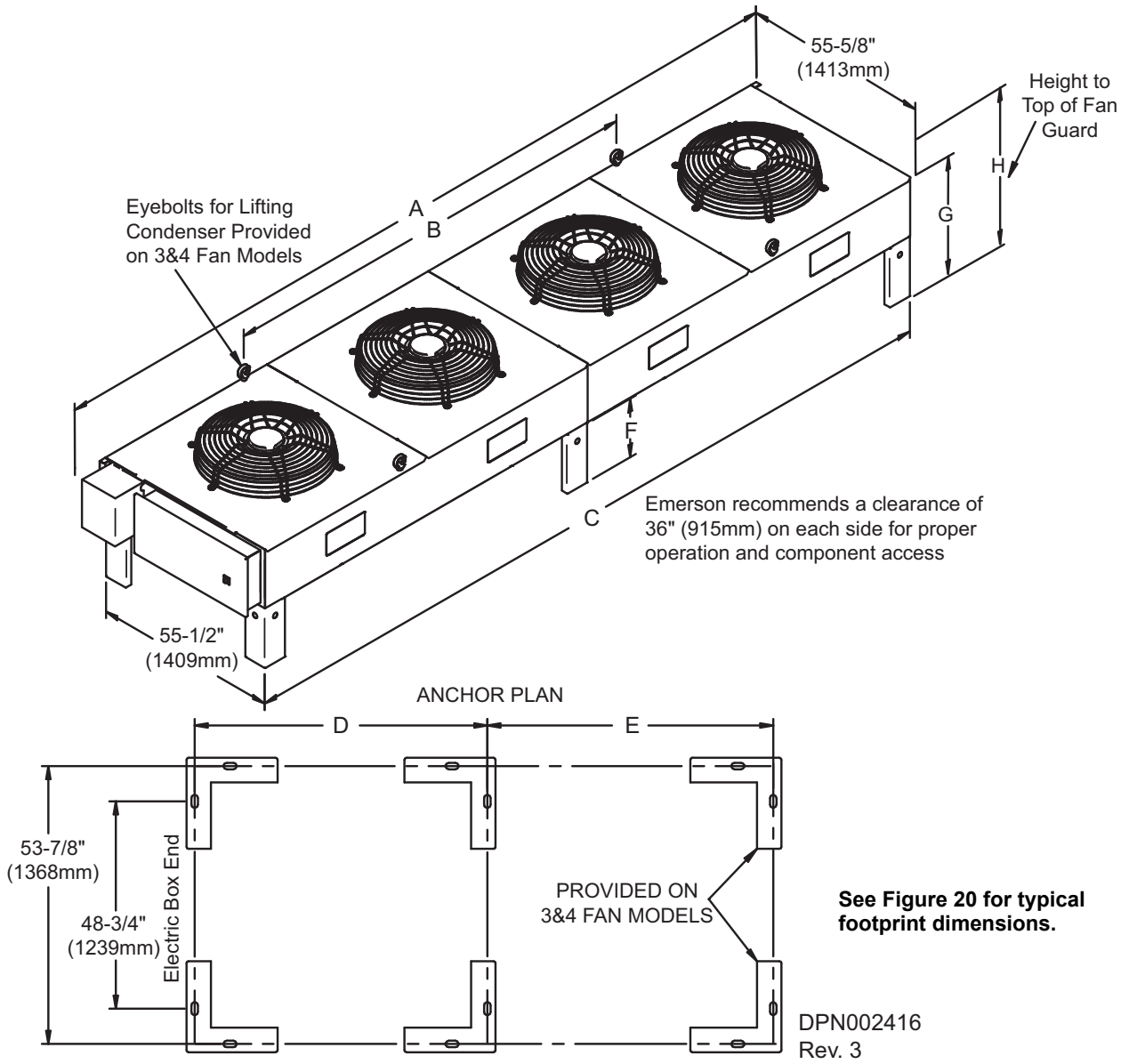
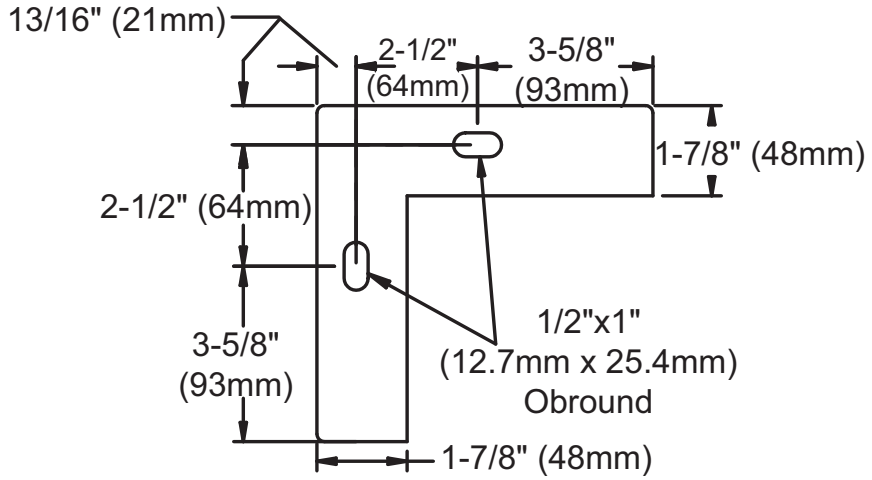


Table 17 Cabinet and anchor dimensions, MCL110, MCL165 and MCL220

Liebert Model #	# of Fans	Dimensions, In. (mm)					Leg Height F *	G	H	Condenser Net Weight lb. (kg)
		A	B	C	D	E				
MCL055	1	68 (1727	—	56 (1423)	54-3/8 (1381)	—	18 (457)	35-7/8 (911)	43-5/8 (1108)	344 (156)
MCL110	2	124-1/8 (3152)	—	112-1/8 (2848)	110-1/2 (2806)	—	36 (914)	53- 7/8 (1368)	61-5/8 (1565)	602 (273)

Source: DPN002416, Rev. 3

Figure 20 Typical footprint dimensions, all units



4.3 Electrical Data—Liebert MC™ Condensers

Table 18 Electrical data, three-phase, 60Hz condenser, Premium Version (EC control)

Model #	Number of Fans	Power Requirements								
		FLA			WSA			OPD		
		208/230V	380/415V	460V	208/230V	380/415V	460V	208/230V	380/415V	460V
MCS028	1	3.0	1.4	1.4	3.8	1.8	1.8	15	15	15
MCM040	1	2.3	1.4	1.4	3.2	1.9	1.9	15	15	15
MCM080	2	4.6	2.8	2.8	5.5	3.3	3.3	15	15	15
MCL055	1	5.7	2.8	2.8	7.1	3.5	3.5	15	15	15
MCL110	2	11.4	5.6	5.6	12.8	6.3	6.3	15	15	15

1. FLA = Full Load Amps; WSA = Wire Size Amps; OPD = Maximum Overcurrent Protection Device.
2. 208V–460V premium models must be connected to Wye 3-phase systems.

Table 19 Electrical data—Liebert Lee-Temp receiver, 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 18*** *for power requirements.*

4.4 Electrical Field Connections—Liebert MC Condensers

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

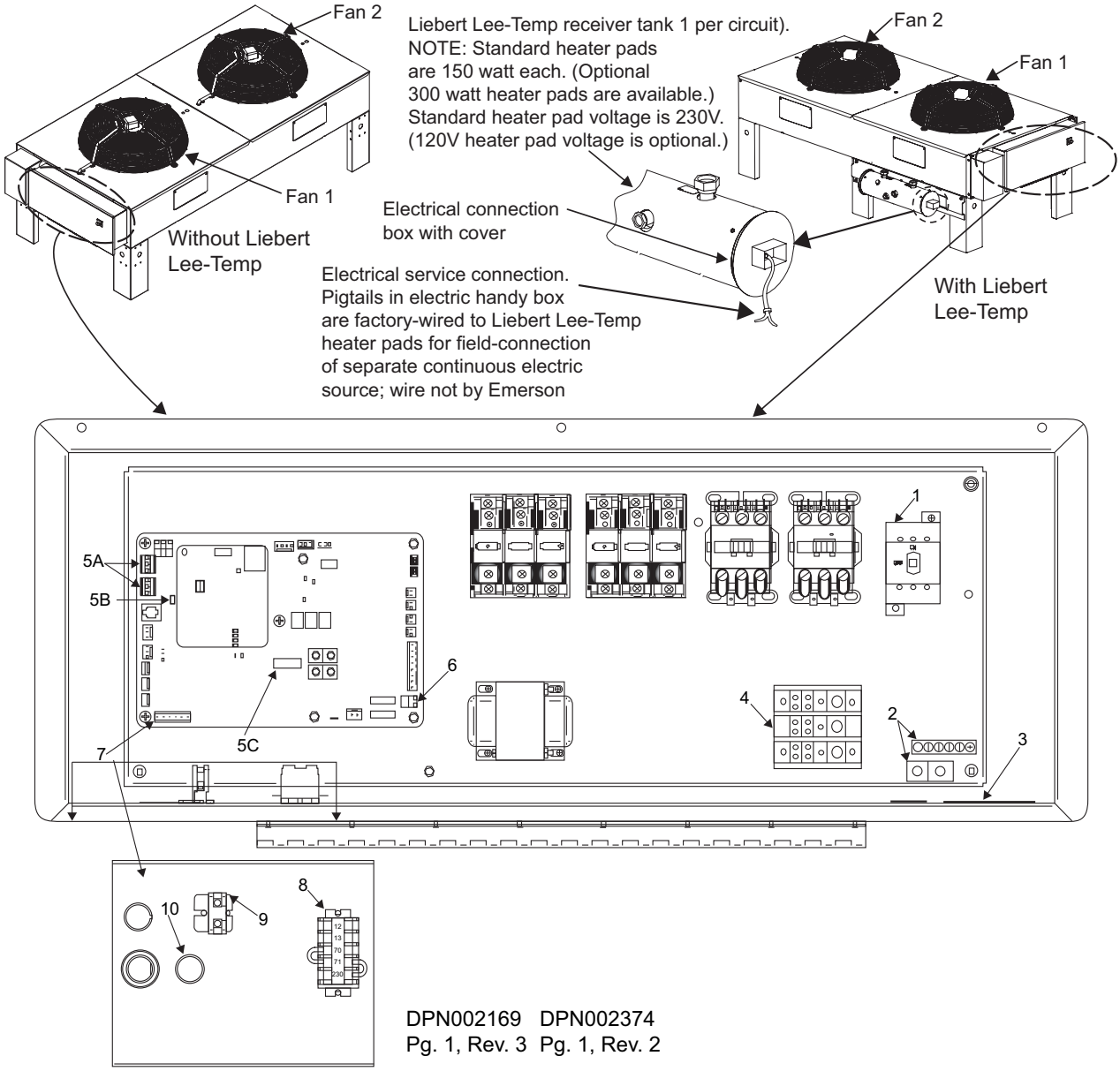
Line voltage electrical service is required for all condensers at the location of the condenser. The voltage supply to the condenser may not be the same voltage supply as required by the indoor unit. Consider using UPS equipment on both data center cooling units and Liebert MC condensers to maintain uninterrupted cooling capability. Refer to the unit's serial tag for specific condenser electrical requirements. A unit disconnect is standard. However, a site disconnect may be required per local code to isolate the unit for maintenance. Route the supply power to the site disconnect switch and then to the unit. Route the conduit to the knockout provided in the bottom right end of the electrical control enclosure. Connect the earth ground wire lead to the marked earth ground connection terminal provided near the factory-installed disconnect switch (see **Figure 21**).

NOTE

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

4.4.1 Electrical Field Connection Descriptions, Liebert MC Condensers

Figure 21 Typical connections, Premium Efficiency Control

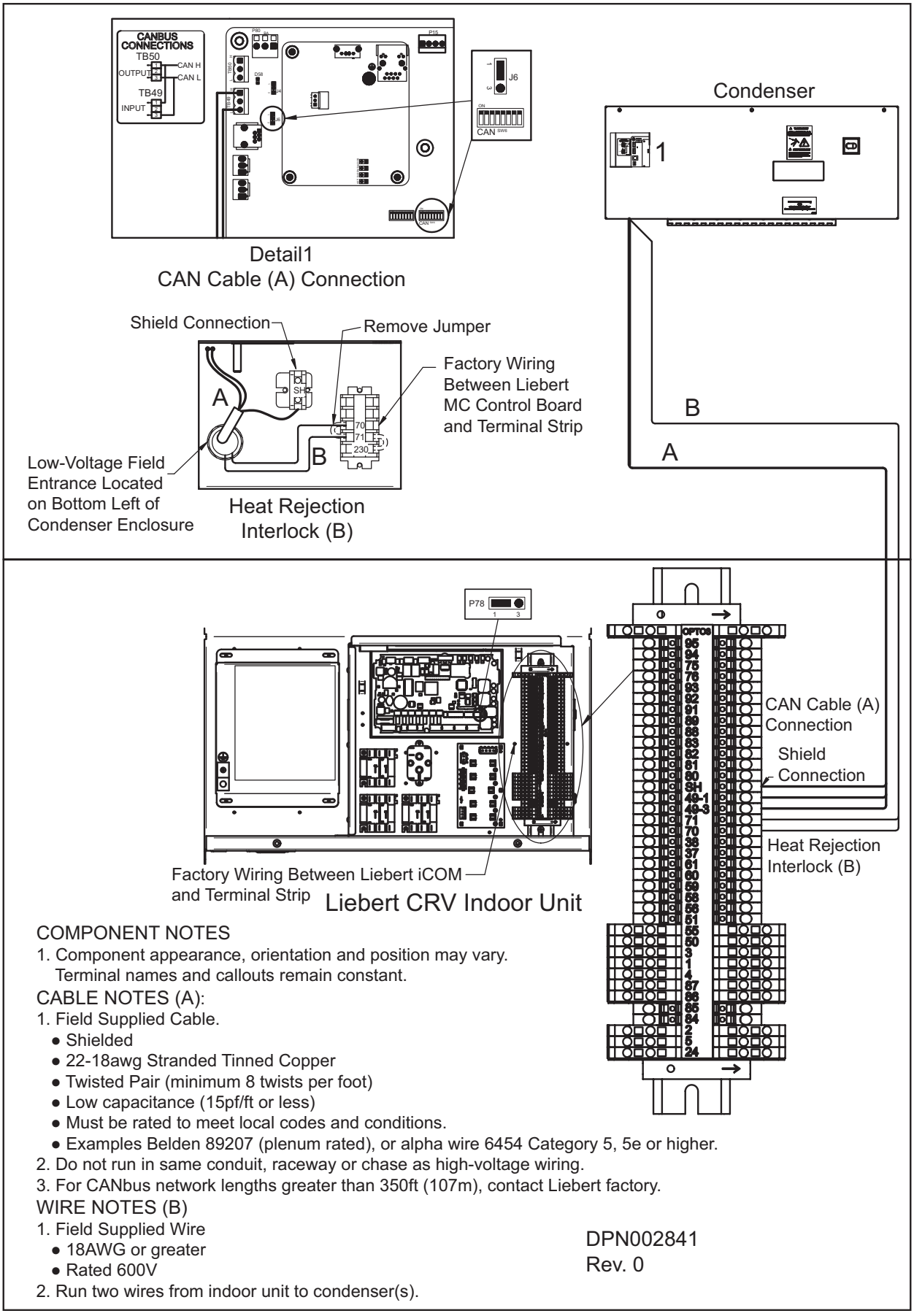


Key Electrical Details—Typical Connections, Premium Efficiency Control

Source: DPN002169, Rev. 3

1. **Three-phase electrical service**—Terminals are on top of disconnect switch for one-fan and two-fan units. Terminals are on bottom of disconnect switch for three-fan and four-fan units. Three-phase service not by Emerson. See **Note 5**.
2. **Earth ground**—Field lug terminal for earth ground connection. Ground terminal strip for fan motor ground connection.
3. **Primary high voltage entrance**—Three 7/8" (22.2mm) diameter knockouts located at the bottom of the enclosure.
4. **SPD field connection terminals**—High-voltage surge protection device (SPD) terminals. SPD is an optional device.
5. **CANbus terminal connections**—Field terminals for CANbus cable connection (see **Figures 21** and **22**).
   - 5A is the CANbus connectors.
     - TB49-1 is the input terminal for CANbus high.
     - TB49-3 is the input terminal for CANbus low.
     - TB50-1 is output terminal for CANbus high.
     - TB50-3 is the output terminal for CANbus low.
     - Each CANbus cable shield is connected to terminal "SH", **Item 9**.
   - 5B is the "END OF LINE" jumper.
   - 5C is the CANbus "DEVICE ADDRESS DIP SWITCH". CANbus cable not by Emerson. See **Note 2**.
6. **Remote unit shutdown**—Replace existing jumper between terminals TB38-1 and TB38-2 with field supplied normally closed switch having a minimum 75VA 24VAC rating. Use field-supplied Class 1 wiring.
7. **Alarm terminal connections**
   a. Common Alarm Relay indicates when any type of alarm occurs. TB74-1 is common, TB74-2 is normally open and TB74-3 is normally closed. 1 Amp 24VAC is the maximum load. Use field-supplied Class 1 wiring.
   b. Shutdown Alarm Relay indicates when condenser loses power, or when a critical alarm has occurred that shuts down the condenser unit. TB74-4 is common; TB74-5 is normally open; and TB74-6 is normally closed. 1 Amp 24VAC is the maximum load. Use field-supplied Class 1 wiring.
8. **Indoor unit interlock and SPD alarm terminals**
   a. On any call for compressor operation, normally open contact is closed across Terminals 70 and 71 for Circuit 1, and normally open contact is closed across Terminals 70 and 230 for Circuit 2 from indoor room unit.
   b. During SPD alarm, normally open contact is closed across Terminals 12 & 13. SPD is an optional device.
9. **CANbus shield terminal**—Terminal for field shield connection of the CANbus field-supplied cables. The shield of CANbus field-supplied cables must not be connected to ground.
10. **Primary low voltage entrance**—One 7/8" (22.2mm) diameter knockout that is free for customer low-voltage wiring.

Figure 22 CANbus communication connection Liebert CRV 600mm (24 in.) and Liebert MC (premium) unit



COMPONENT NOTES

1. Component appearance, orientation and position may vary. Terminal names and callouts remain constant.

CABLE NOTES (A):

1. Field Supplied Cable.
   - Shielded
   - 22-18awg Stranded Tinned Copper
   - Twisted Pair (minimum 8 twists per foot)
   - Low capacitance (15pf/ft or less)
   - Must be rated to meet local codes and conditions.
   - Examples Belden 89207 (plenum rated), or alpha wire 6454 Category 5, 5e or higher.
2. Do not run in same conduit, raceway or chase as high-voltage wiring.
3. For CANbus network lengths greater than 350ft (107m), contact Liebert factory.

WIRE NOTES (B)

1. Field Supplied Wire
   - 18AWG or greater
   - Rated 600V
2. Run two wires from indoor unit to condenser(s).

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Notes to Liebert MC Condensers Electrical Field Connections

1. Refer to specification sheet for unit voltage rating, full load amp and wire size amp ratings.
2. The CANbus wiring is field-supplied and must be:
   - shielded
   - 22-18AWG stranded tinned copper,
   - twisted pair (minimum 8 twists per foot),
   - low capacitance (15pf/ft or less),
   - plenum rated (NEC type CMP) if required by local codes,
   - UV and moisture resistant or run within conduit once in an outdoor environment, and
   - must be temperature- and voltage-rated for conditions present.

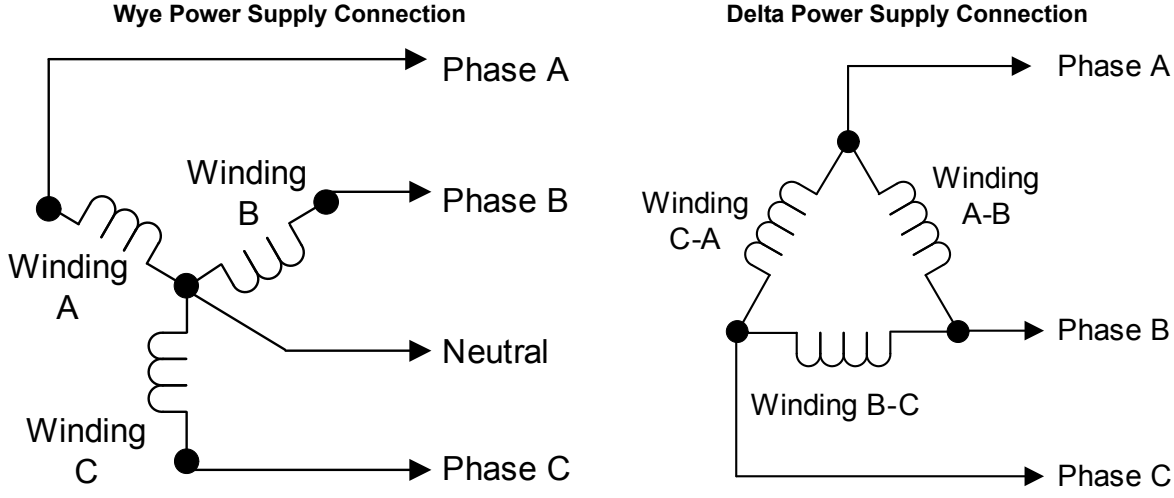
   Examples: Belden part number 89207 (plenum rated) or Alpha Wire part number 6454 (UV resistant outdoor rated) Category 5, 5e or higher.
3. Do not run the CANbus cable in the same conduit, raceway or chase as high voltage.
4. For CANbus network lengths greater than 350ft(107m), contact Liebert factory.
5. All wiring must be sized and selected for insulation case per NEC and other local codes.
6. The electronically commutated (EC) motors included in the micro-channel condenser units are suitable for connection to power supplies with a solidly grounded neutral. (Some platforms can accept power supplies listed under **Item b** below. Contact the factory for more information.)
   a. Acceptable power supplies for 208 to 480V nominal units
   - 208V wye with solidly grounded neutral and 120V line to ground;
   - 380V wye with solidly grounded neutral and 220V line to ground;
   - 480V wye with solidly grounded neutral and 277V line to ground.

   b. Non-acceptable power supplies for 208V to 480V nominal units
   - wye with high resistance (or impedance) ground;
   - delta without ground or with floating ground;
   - delta with corner ground; or
   - delta with grounded center tap.

4.4.2 Wye vs. Delta Connection Power Supply—MCM and MCL Models with EC Fans

Condensers can operate on Wye or Delta connection power supply.

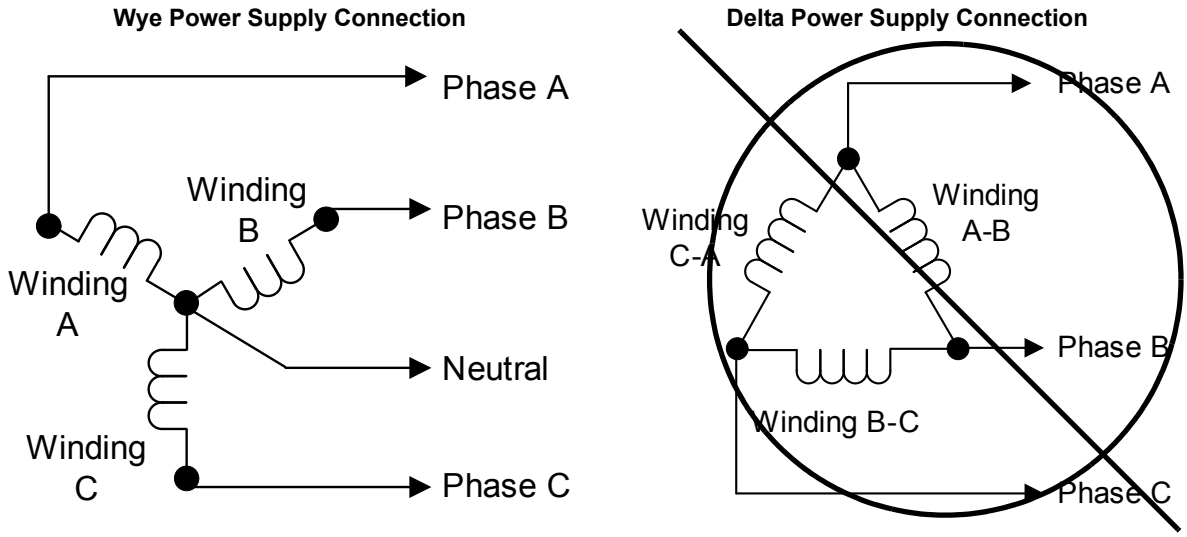
Figure 23 Wye and Delta power supply connection diagram



4.4.3 Wye vs. Delta Connection Power Supply—Small Platform Condenser (MCS0286) with Premium EC Control

The Liebert MC Condenser Small Platform (MCS028) with Premium EC Control is designed to operate with Wye-connected power. It will NOT operate properly with Delta-connected power.

Figure 24 Wye and Delta power supply connection diagram



Acceptable Power Supplies—208V to 480V Nominal Units - Small Platform Condenser (MCS028) with Premium EC Control

- 208V wye with solidly grounded neutral and 120V line-to-ground
- 380V wye with solidly grounded neutral and 220V line-to-ground
- 480V wye with solidly grounded neutral and 277V line-to-ground

Unacceptable Power Supplies—208V to 480V Nominal Units - Only Small Platform Condenser (MCS028) with Premium EC Control

- Wye with high-resistance (or impedance) ground
- Delta without ground or with floating ground
- Delta with corner ground
- Delta with grounded center tap

NOTE

The Liebert MCS028 Premium EC Fan Model will not operate properly with Delta-connected power. A field-supplied isolation transformer or other power solutions will be needed to for proper condenser function.

4.5 Piping—Liebert MC Condensers

4.6 Piping Guidelines

Indoor units and condensers both ship with holding charges of inert gas. Do not vent the condenser until all refrigerant piping is in place, ready for connection to indoor unit and condenser.

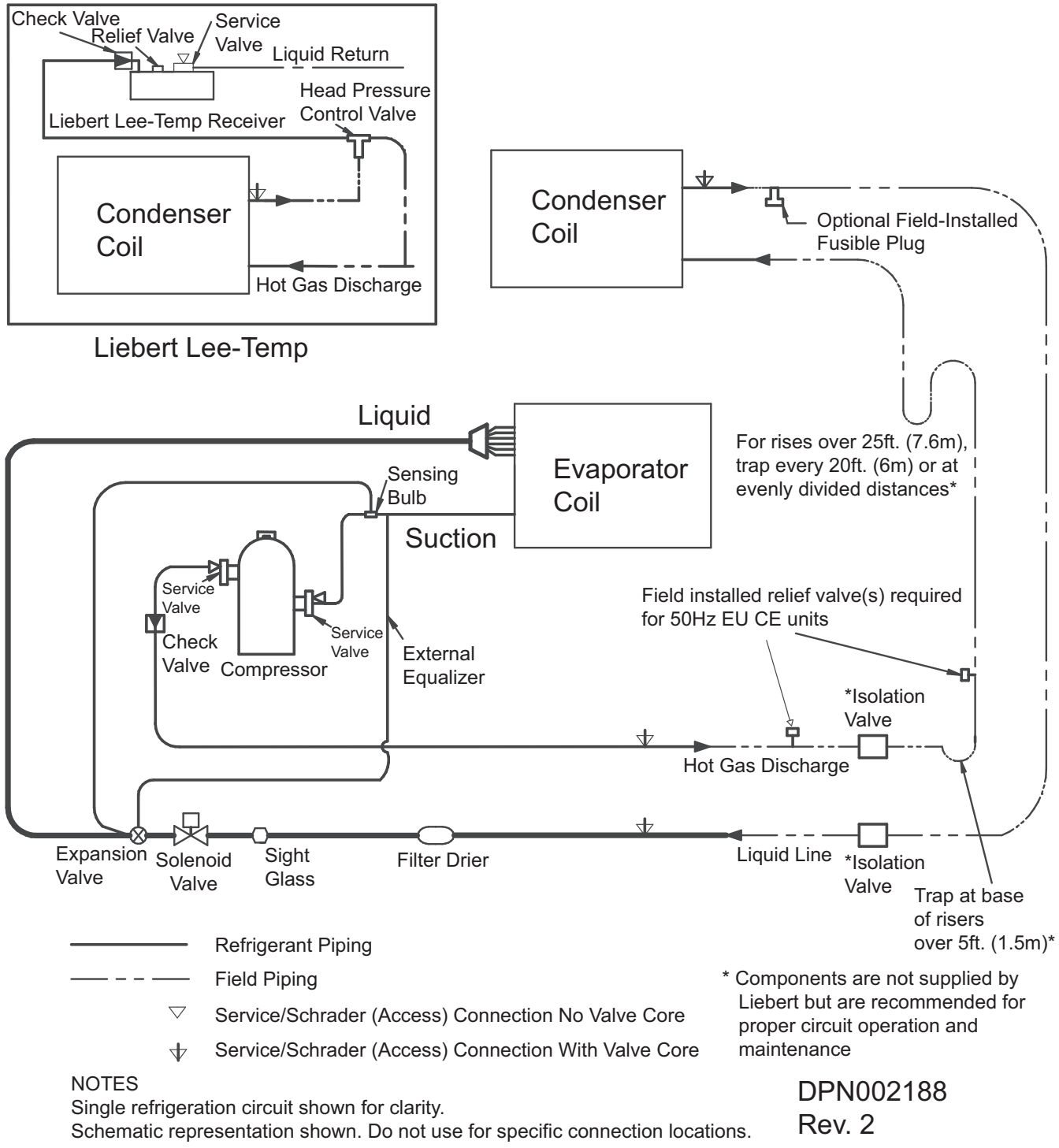
- Use copper piping with a brazing alloy with a minimum temperature of 1350°F (732°C), such as Sil-Fos. Avoid soft solders such as 50/50 or 95/5.
- Use a flow of dry nitrogen through the piping during brazing to prevent formation of copper oxide scale inside the piping. When copper is heated in the presence of air, copper oxide forms. POE oil will dissolve these oxides from inside the copper pipes and deposit them throughout the system, clogging filter driers and affecting other system components.
- A pure dry nitrogen flow of 1-3 ft^3/min (0.5-1.5 l/s) inside the pipe during brazing is sufficient to displace the air. Control the flow using a suitable metering device.
- Ensure that the tubing surfaces to be brazed are clean and that the ends of the tubes have been carefully reamed to remove any burrs.
- Ensure that all loose material has been cleaned from inside the tubing before brazing.
- Protect all refrigerant line components within 18" (460mm) of the brazing site by wrapping them with wet cloth or suitable heat sink compound.
- Isolate piping from building using vibration isolating supports.
- Refer to the indoor unit's user manual for appropriate piping sizes.
- Install traps on the hot gas (discharge) lines at the bottom of any rise over 5 feet high. If the rise exceeds 25 feet (7.5m), then install a trap in 20 foot (6m) increments or evenly divided.
- Pitch horizontal hot gas piping down at a minimum rate of 1/2" per 10 ft. (42mm per 10m) so that gravity will aid in moving oil in the direction of refrigerant/oil flow.
- Consult factory if Liebert Lee-Temp™ condenser is below the evaporator or if a condenser not equipped with Liebert Lee-Temp is more than 15 ft (4.6m) below the evaporator.
- Consult factory if piping run exceeds 150 feet (46m) equivalent length on traditional DX units.
- Consult factory if piping run exceeds 300 feet (91m) actual length, or 450 feet (137m) equivalent length on units installed with Liebert EconoPhase™ units.
- Record linear length of liquid and discharge line required from the indoor unit to the condenser accurately for calculating refrigerant requirements.
- Keep piping clean and dry, especially on units with POE oil (R407C, R410A or R22 refrigerant).
- Avoid piping runs through noise-sensitive areas.
- Do not run piping directly in front of indoor unit discharge airstream.
- Refrigerant oil – do not mix oil types or viscosities. Consult indoor unit for refrigerant type and oil requirements.

NOTE

Failure to use compressor oils recommended by compressor manufacturer will void compressor warranty. Consult Emerson or the compressor manufacturer for further recommendations or if you have questions about compressor oils.

Refer to ASHRAE Refrigeration Handbook for general good practices for refrigeration piping. The Liebert indoor cooling unit has a factory-installed high-pressure safety switch in the high side refrigerant circuit. A pressure relief valve is provided with Liebert Lee-Temp™ receivers. A fusible plug is factory installed in the Liebert DSE™ receivers. Consult local building codes to determine if condensers without receivers will require field-provided pressure relief devices. A fusible plug kit is available for field installation.

Figure 25 Liebert MC piping schematic with and without Liebert Lee-Temp



4.7 Field Piping Guidelines Liebert MC Condensers

One discharge line and one liquid line must be field-installed for each circuit of the indoor unit and the outdoor condenser(s). Dual circuit condensers are available for most dual circuit indoor unit applications. Refer to **Figures 25**, through **27** for additional field-installed piping needed at the condenser. This piping is needed for proper system performance and for installation/interconnecting receivers and head pressure control valves for Liebert Lee-Temp™ systems.

NOTE

Keep the evaporator unit and condenser closed with their factory charge of inert gas while all field piping is installed. Keep the field piping clean and dry during installation, and do not allow it to stand open to the atmosphere.

When all the field interconnecting piping is in place, vent the condenser's inert gas charge and connect to the field piping. Finally, vent the evaporator unit's charge of inert gas and make its piping connection last.

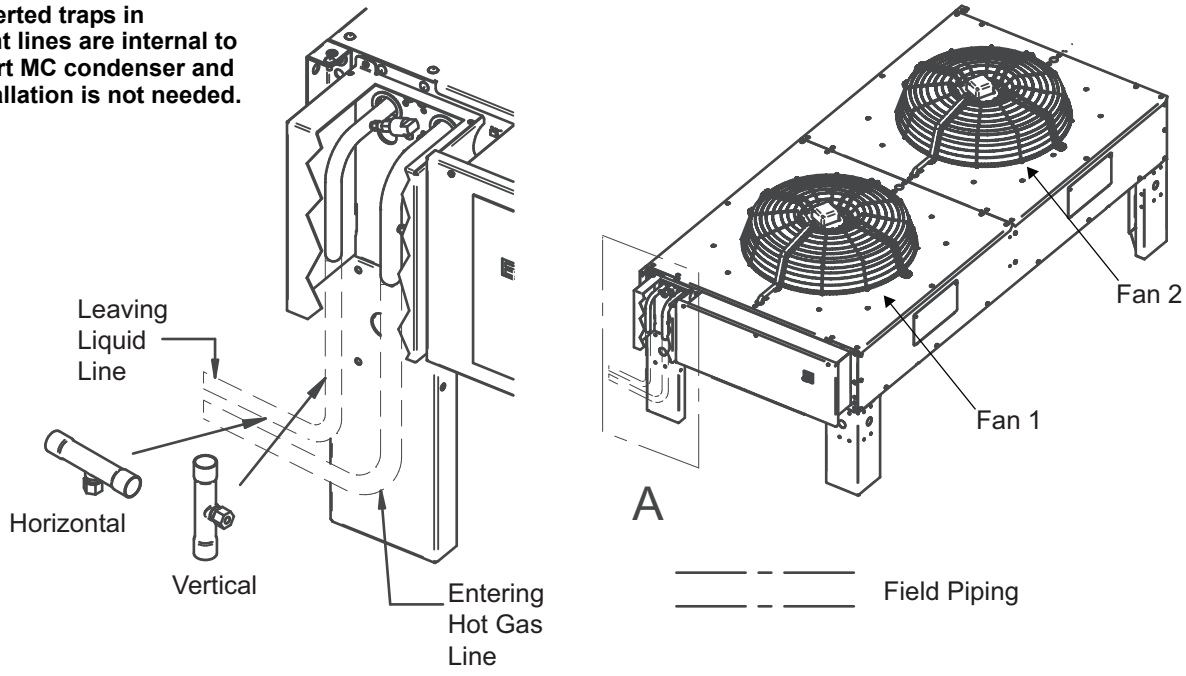
Keep accurate length measurements of field piping for estimating system charge.

Follow all proper brazing practices, including a dry nitrogen purge to maintain system cleanliness.

The condenser connection pipes must be wrapped with a wet cloth to keep the pressure and temperature sensors cool during any brazing.

Figure 26 Liebert MC Condenser piping—Single-circuit units

Note: Inverted traps in refrigerant lines are internal to the Liebert MC condenser and field-installation is not needed.



Optional fusible plug service kit to be brazed into the liquid line(s) in either the vertical or horizontal position (where required). Vertical position is preferred; horizontal position is optional.

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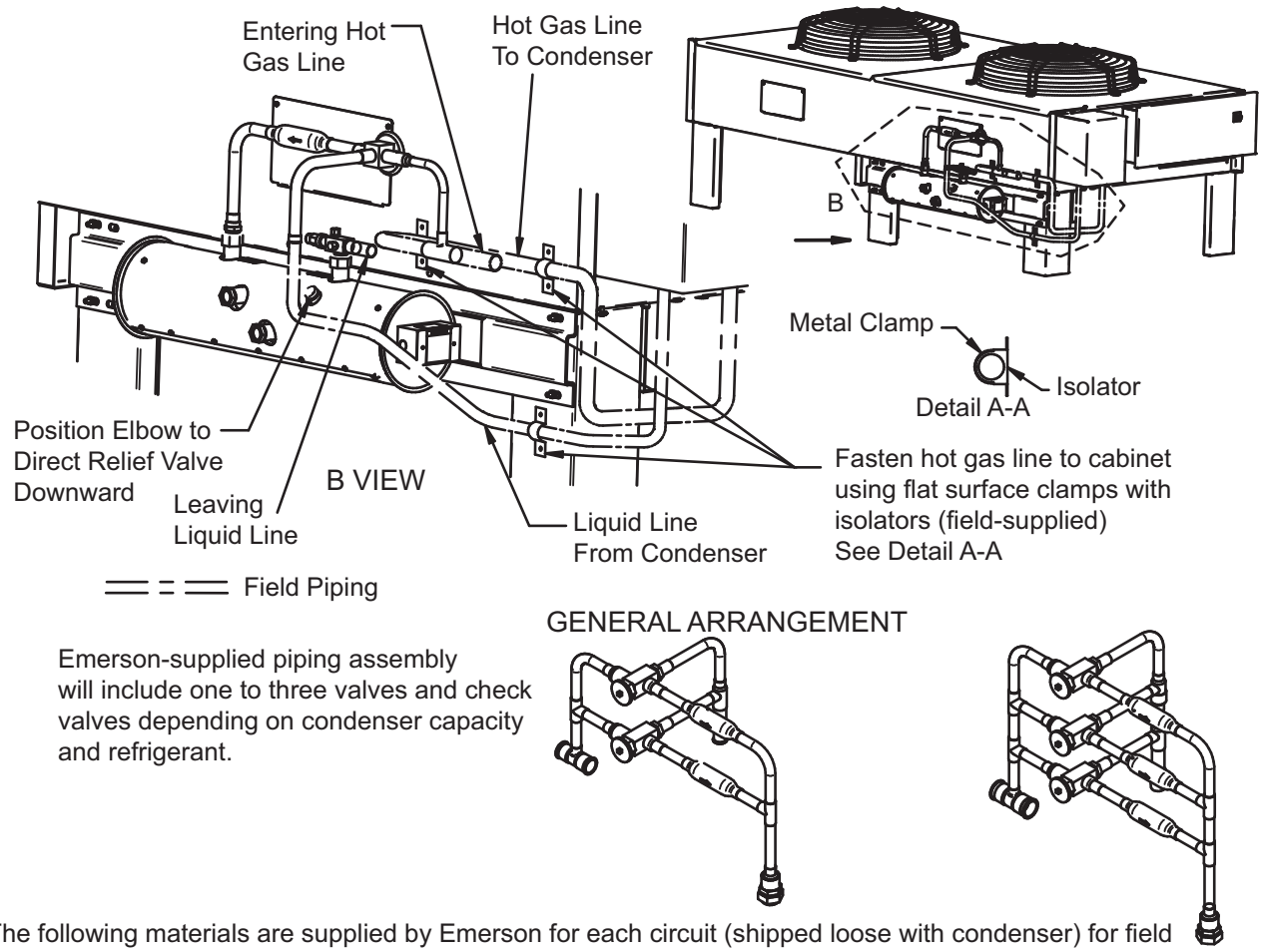
Table 20 Liebert MC single-circuit piping sizes

Model No.	Number of Fans	Connection Sizes, OD, In	
		Hot Gas Line	Liquid Line
MCS028	1	7/8	5/8
MCM040	1	7/8	5/8
MCM080	2	1-1/8	7/8
MCL055	1	1-1/8	7/8
MCL110	2	1-3/8	1-1/8

Source: DPN002166, Rev. 1

Figure 27 Condenser piping for single-circuit Liebert MC condensers (with Liebert Lee-Temp)



1.The following materials are supplied by Emerson for each circuit (shipped loose with condenser) for field installation: insulated Liebert Lee-Temp storage tank with sight glasses, head pressure control valve, check valve, rotalock valve and pressure relief valve. All other piping to be supplied and installed by others.
2. Consult factory for proper line sizing for runs longer than 150ft.(45.7m) equivalent length.

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Table 21 Condenser piping connection sizes—Single-circuit condensers with Liebert Lee-Temp

	Condenser Connections, OD.In		Liebert Lee-Temp Connections		
Model #	Hot Gas	Liquid	Hot Gas Tee IDS In.	Liquid Line to Lee-Temp Valve ODS, In.	Receiver Out IDS In.
MCS028	7/8	5/8	7/8	5/8	5/8
MCM040	7/8	5/8	7/8	5/8	5/8
MCM080	1-1/8	7/8	1-1/8	7/8	1-1/8
MCL055	1-1/8	7/8	1-1/8	7/8	7/8
MCL110	1-3/8	1-1/8	1-3/8	1-1/8	1-1/8

Source: DPN002167, Rev. 3

Table 22 Recommended refrigerant line sizes for Liebert MC condensers with R-410A, with and without Liebert Lee-Temp, 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)
	300 (91.4)	7/8 (22.2) [2]	3/4 (19.1)
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)
	300 (91.4)	1-1/8 (28.6) [2]	7/8 (22.2)

1. Consult factory for proper line sizing for runs longer than 300 ft. (91.4m) equivalent length.
2. Must downsize vertical riser one trade size (1-1/8" to 7/8" or 7/8" to 3/4").
3. Source DPN001624, Rev. 7, Pg. 3

4.8 Liebert Fin/Tube Condenser Selections—600mm (24in.) Units

4.8.1 Variable Frequency Drive Fin/Tube Condensers with/without Liebert Lee-Temp™

The fin/tube condensers are designed for operation in outdoor ambient temperatures ranging from -20°F to 115°F (-29 to 46°C). The Liebert Lee-Temp models provide operation in colder outdoor environments ranging from -30°F to 115°F (-34 to 46°C).

Table 23 Traditional open room return air conditions

Model No.	Unit Width	Ambient Temperature Selection			
		95°F (35°C) Standard Selection		100°F - 115° (38°C-46°C)	
		VFD Units	Units with Liebert Lee-Temp	VFD Units	Units with Liebert Lee-Temp
CR020A	600mm (24")	TCSV28K TCSV60K	DCSL28K DCSL60K	TCSV60K TCSV90K	DCSL60K DCSL90K
CR035A					

4.9 Dimensions and Weights—Liebert Fin/Tube Condensers

Figure 28 Cabinet and anchor dimensions, R-410A single-circuit Liebert Lee-Temp™ condensers

See Table 24 for dimensions A, B and C on different model condensers

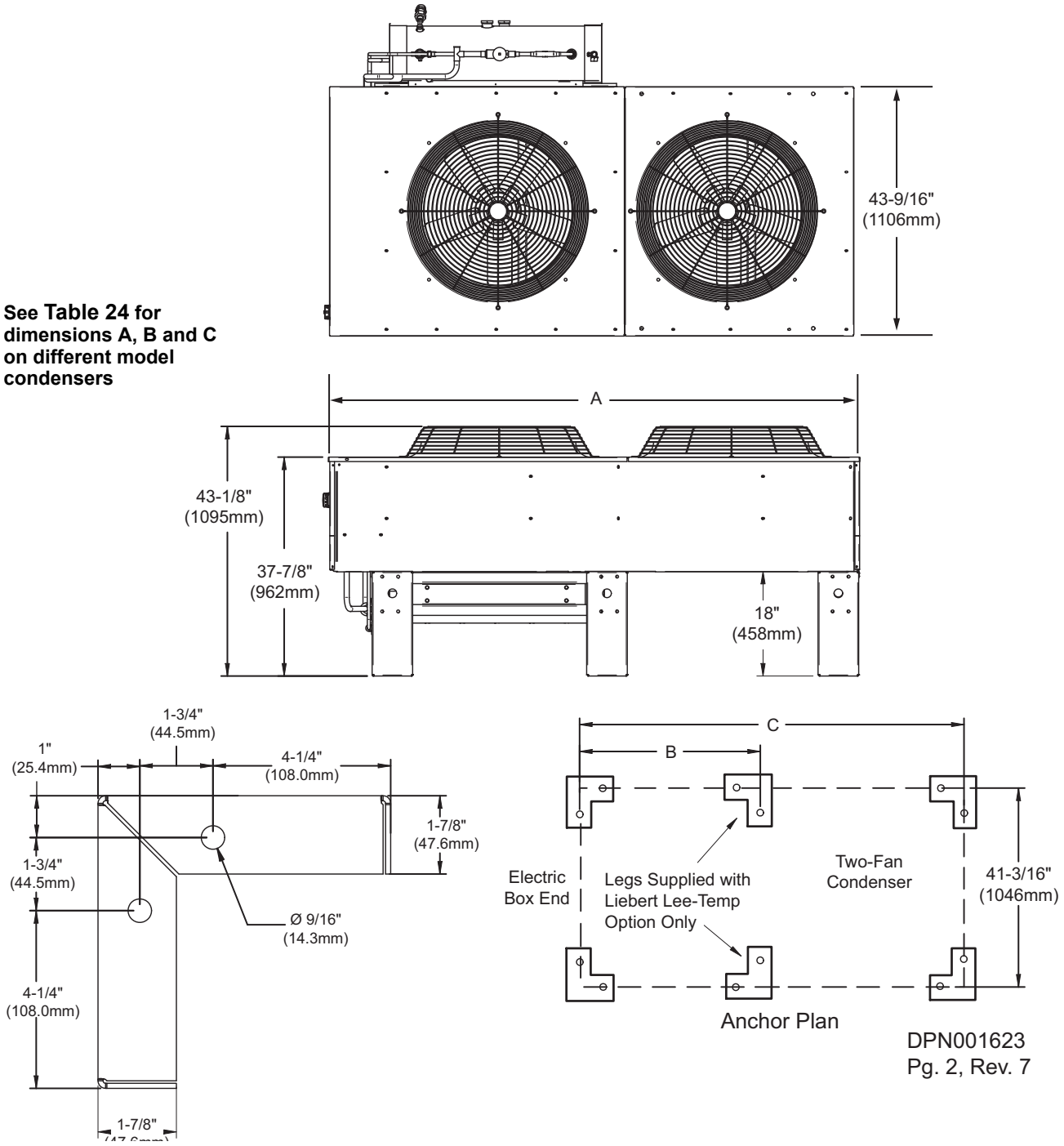


Table 24 Cabinet and anchor dimensions, R-410A, Liebert Lee-Temp control single circuit condensers, 60Hz

Model No.	# of Fans	# of Legs	A in. (mm)	B in. (mm)	C in. (mm)	Net Weight lb. (kg)
DCSL28K	1	4	51-1/2 (1308)	42 (1067)	—	325 (147)
DCSL60K	2	6	91-1/2 (2324)	42 (1067)	82 (2083)	475 (215)
DCSL90K	3	6	131-1/2 (3340)	42 (1067)	124 (3150)	675 (306)

Source DPN001623, Rev. 7, Pg. 2

Figure 29 Cabinet and anchor dimensions, R-410A VFD control fin/tube condensers

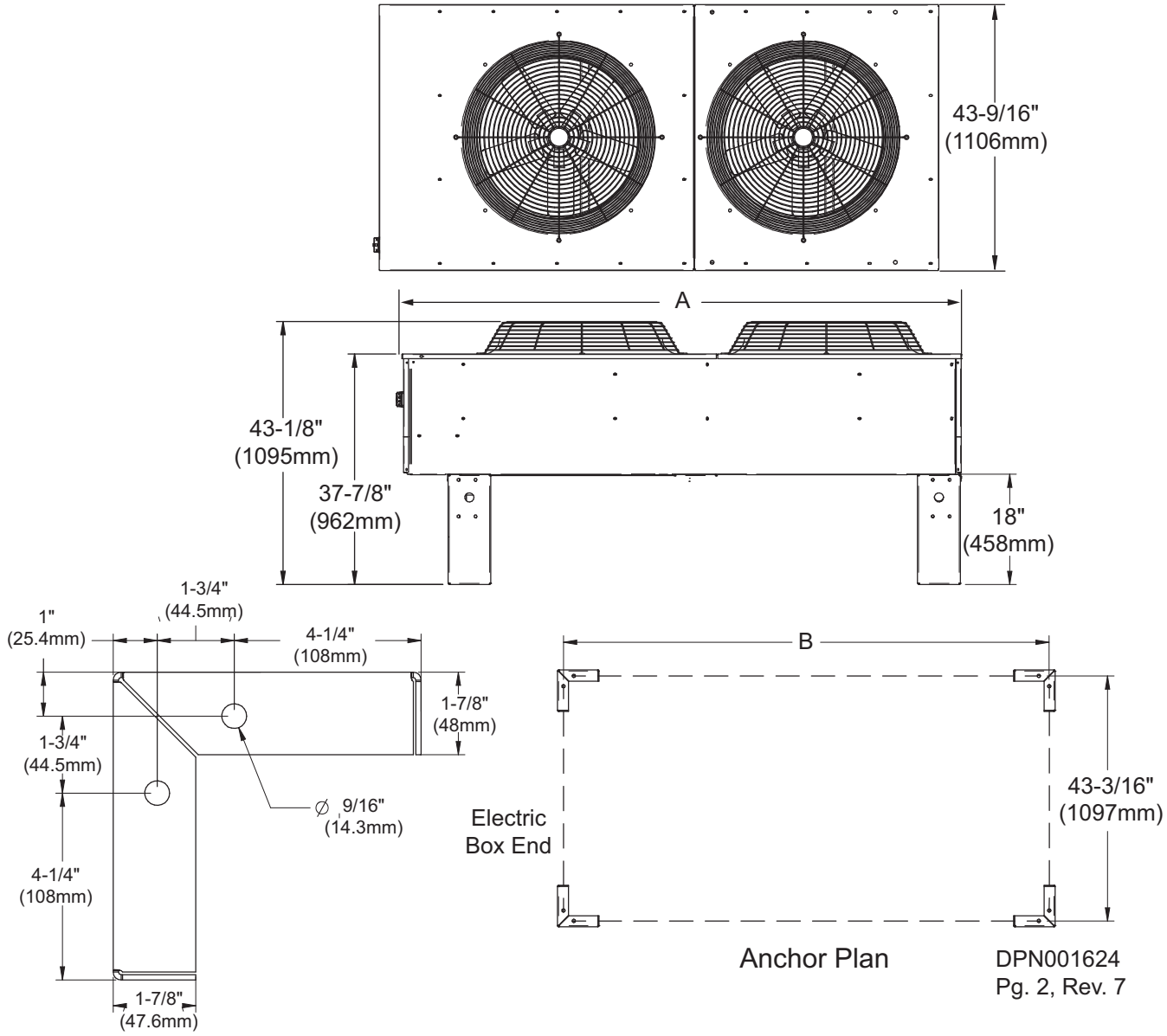


Table 25 Cabinet and anchor dimensions, R-410A, VFD control single circuit fin/tube condensers, 60Hz

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. 7, Pg. 2

4.10 Electrical Field Connections Fin/Tube

Table 26 Electrical data—60Hz fin/tube condenser

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

Figure 30 Electrical field connections, R410A VFD fin/tube condensers

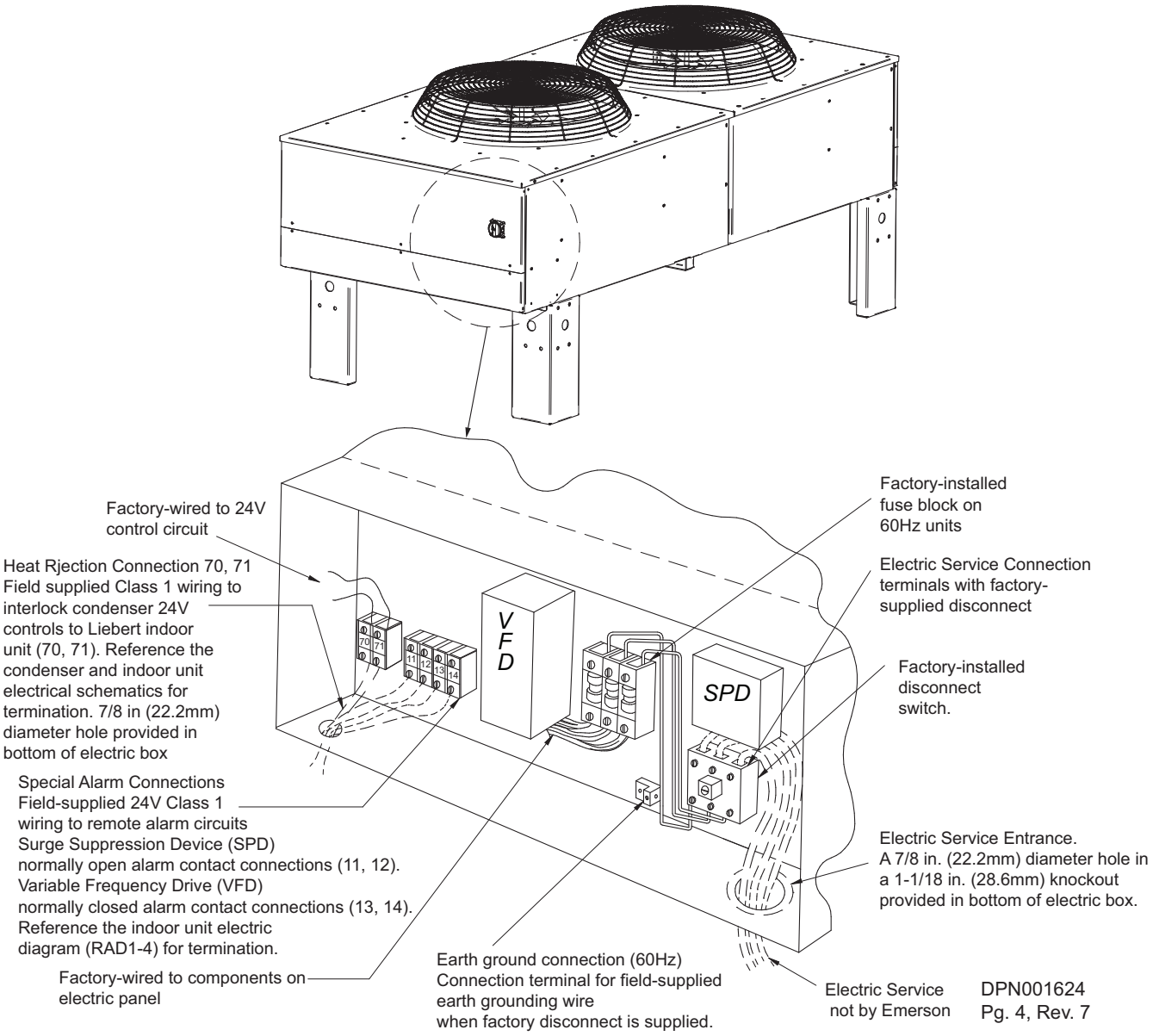
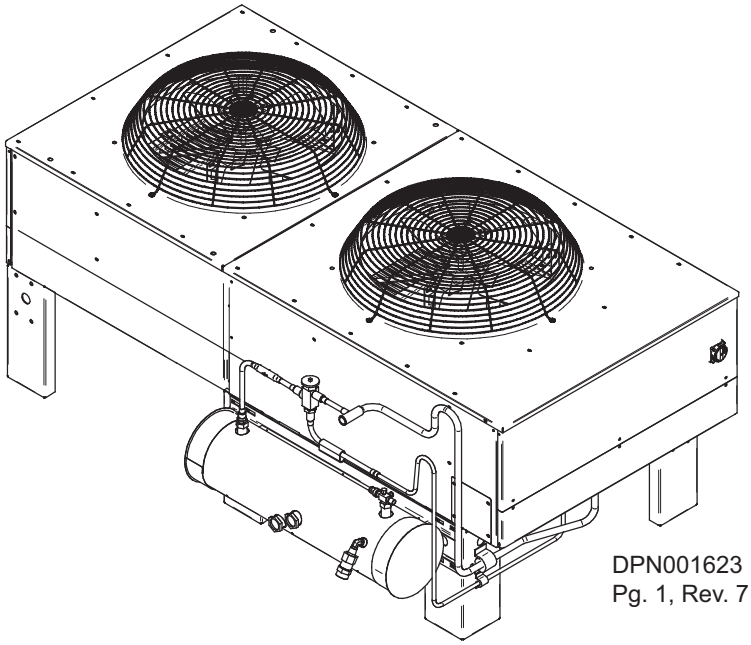


Figure 31 Liebert air-cooled R-410A Liebert Lee-Temp™ control fin/tube condensers



4.10.1 Features—Liebert Air Cooled R-410A Fin/Tube Condensers with Liebert Lee-Temp Condensers

Source DPN001623, Pg. 1, Rev. 7

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 an inert gas holding charge for shipment.

Fan(s)—Blades are constructed of aluminum, with a diameter of 26 inches (660.4mm) and secured to the fan shaft by a heavy duty painted steel 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)—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, roto lock valve, and head pressure operated three-way valve for field-connection to air cooled condenser. This system allows operation at ambient conditions as low as -30°F (-34°C).

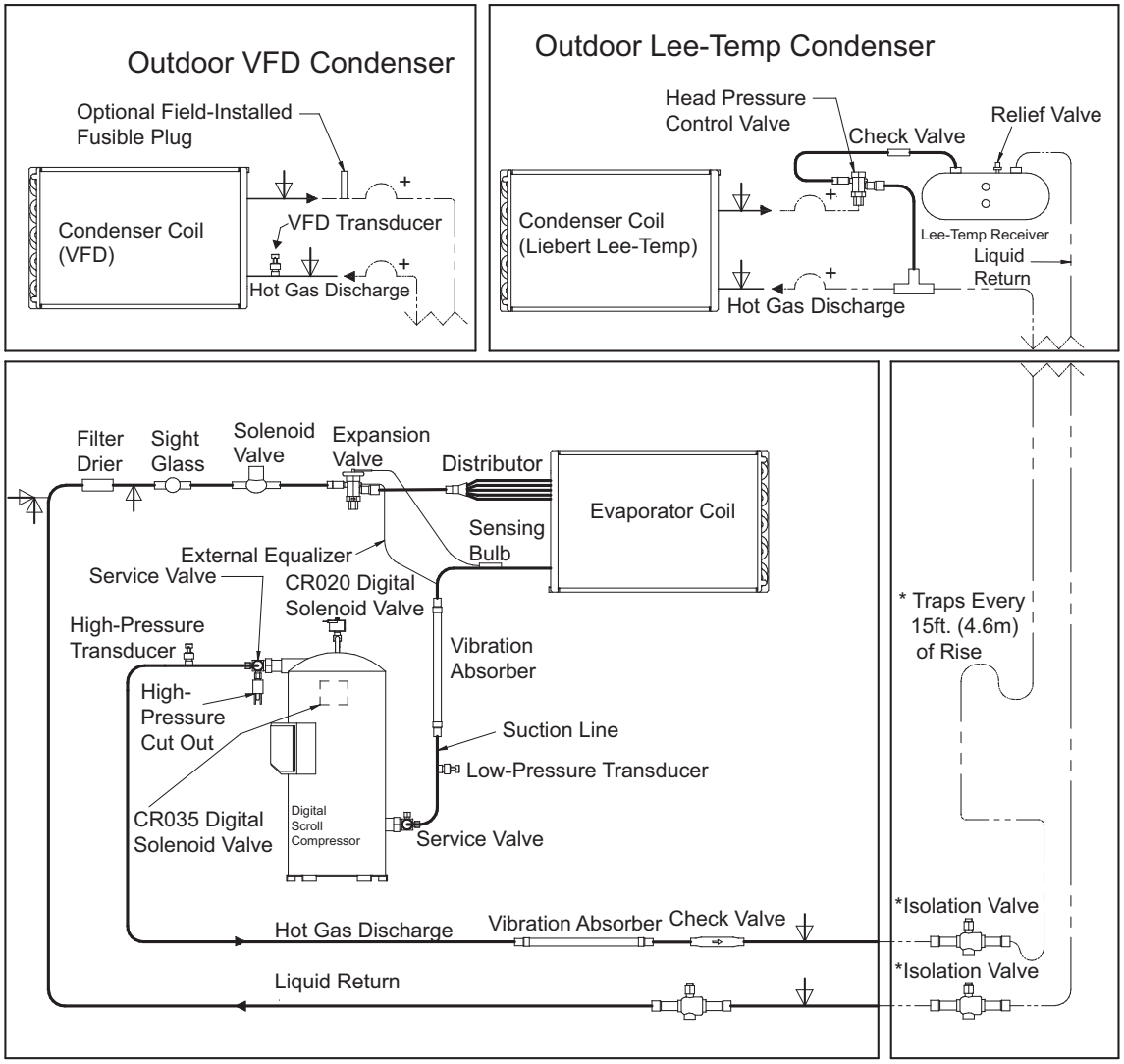
Housing—The condenser housing is constructed of bright aluminum sheet and divided into individual fan sections by full width baffles. Structural support members, including coil support frame, motor, and drive support, are galvanized steel for strength and corrosion resistance. Aluminum legs are provided with rigging holes For Hoisting The Unit Into Position.

Unit Disconnect Switch—A locking disconnect factory-installed and wired in enclosed condenser control section.

Electrical Controls—Electrical controls, overload protection devices and service connection terminals are provided and factory-wired inside the integral NEMA 3R electrical panel section of the housing. Only supply wiring and indoor unit interlock wiring are required at condenser installation.

4.11 Piping—Liebert Fin/Tube Condensers

Figure 32 General arrangement diagram fin/tube condensers—600mm (24 in.) air-cooled models with and without Liebert Lee-Temp™



Factory Refrigerant Piping
Field Piping
Service / Schrader (Access) Connection No Valve Core
Service / Schrader (Access) Connection With Valve Core

1. Schematic representation shown. Do not use for specific connection locations.
2. One or more additional pressure relief valves are required downstream of any and all field-installed isolation. Do not isolate any refrigerant circuits from overpressurization protection.

* Components are not supplied by Liebert but are recommended for proper circuit operation and maintenance. Should be located near the indoor Liebert CRV unit.

\+ Inverted Trap on Discharge and Liquid Lines to extend above the base of the coil by a minimum of 7-1/2" (190mm).

DPN001984
Rev. 4

Figure 33 Piping R-410A VFD control single circuit fin/tube condensers

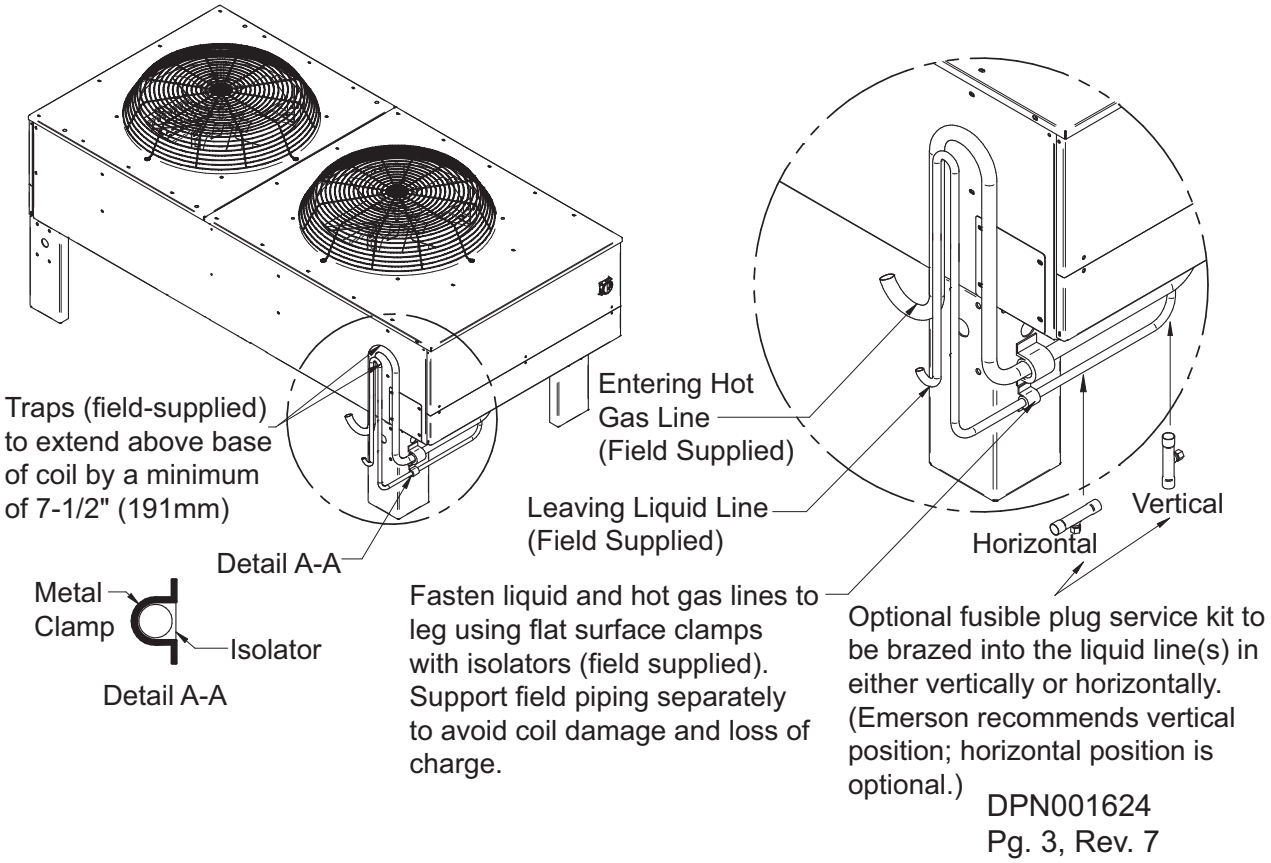


Table 27 Piping and refrigerant sizes for Liebert air-cooled, VFD control fin/tube single-circuit condensers with R-410A

Condenser Piping Connection Sizes, Cu, O.D.			
Condenser Model #	Entering Hot Gas Line, in. (mm)	Returning Liquid Line, in. (mm)	Weight, lb. (kg)
TCSV28K	1-1/8 (28.6)	7/8 (22.2)	325 (147.4)
TCSV60K	1-1/8 (28.6)	7/8 (22.2)	475 (215.5)
TCSV90K	1-1/8 (28.6)	7/8 (22.2)	675 (306.2)

Interconnection piping (field-supplied and installed) required. Configure piping for parallel refrigerant flow between condenser sections.
Source DPN001624, Rev. 7, Pg. 3

Table 28 Recommended refrigerant line sizes for Liebert air-cooled, VFD control fin/tube condensers with R-410A, with and without Liebert Lee-Temp, 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)
	300 (91.4)	7/8 (22.2) [2]	3/4 (19.1)
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)
	300 (91.4)	1-1/8 (28.6) [2]	7/8 (22.2)

1. Consult factory for proper line sizing for runs longer than 300 ft. (91.4m) equivalent length.
2. Must downsize vertical riser one trade size (1-1/8" to 7/8" or 7/8" to 3/4").
3. Source DPN001624, Rev. 7, Pg. 3

Figure 34 Fin/tube condenser piping, R-410A single-circuit with Liebert Lee-Temp

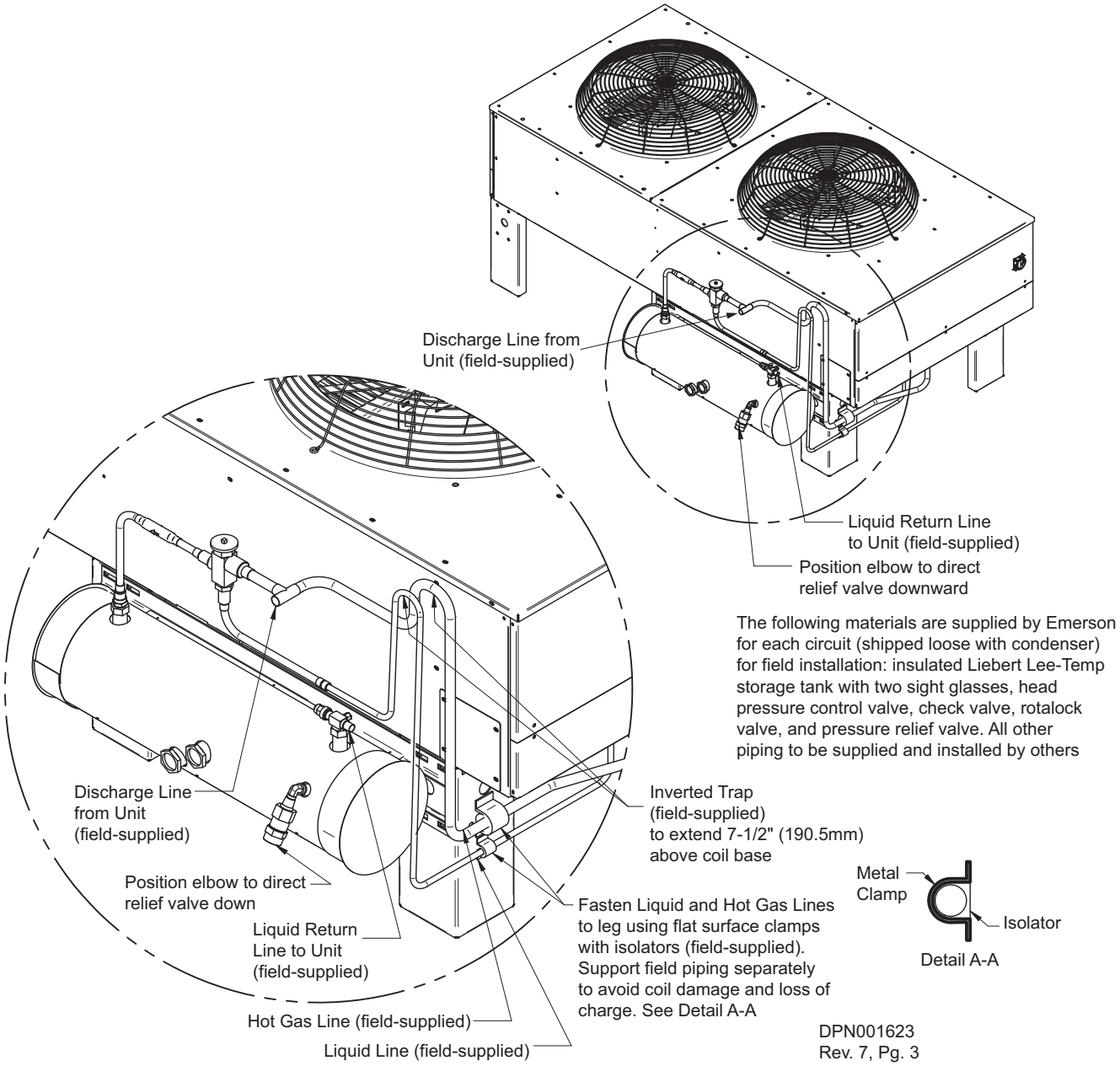


Table 29 Piping and refrigerant sizes for Liebert Lee-Temp condensers with R-410A

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	7/8
DCSL60K	1-1/8	7/8	11 x 36 (279 x 914)	1-1/8	5/8	7/8
DCSL90K	1-1/8	7/8	11 x 48 (279 x 1219)	1-1/8	5/8	7/8

Source DPN001623, Rev. 7, Pg. 3

4.12 Liebert Air-Cooled R-410A VFD Control Fin/Tube Condensers Features

4.12.1 Features—Liebert Air-Cooled R-410A VFD Control Fin/Tube Condensers

Source DPN001624, Pg. 1, Rev. 7

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 an inert gas holding charge for shipment.

Fans—Blades are constructed of zinc-plated steel or aluminum with a diameter of 26 inches (660.4mm) 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-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.

SPD and Unit Disconnect Switch—Surge Protection Device and locking disconnect factory-installed and wired in enclosed condenser control section.

Alarm Contacts—Normally open dry contacts provided for indication of VFD and SPD alarm condition.

4.12.2 Optional Features—Liebert Air-Cooled R-410A VFD Control Fin/Tube Condensers

Fusible Plug Service Kit

Provides compliance for local codes requiring fusible-plug-type pressure relief devices. Shipped loose for field-installation on each liquid line.

5.0 LIEBERT CRV WATER/GLYCOL SYSTEMS

5.1 CAPACITY AND PHYSICAL DATA—600MM (24IN.) MODELS

Table 30 Performance data—Water-cooled, 600mm (24in.) Model CR020RW

Return Air Temperature	83°F (28.33°C) EWT - 95°F (35°C) LWT	85°F (29.4°C) EWT - 110°F (43.3°C) Cond. Temp.
105°F DB, 71°F WB (40.6°C DB, 21.6°C WB) 17% RH		
Total, kBTU/H (kW)	28.0 (95.7)	27.6 (94.1)
Sensible, kBTU/H (kW)	28.0 (95.7)	27.6 (94.1)
Flow Rate, GPM (l/s)	19.0 (1.2)	14.2 (0.9)
Pressure Drop, ft water (kPa)	45.9 (137.1)	26.3 (78.5)
Heat Rejection, kBTU/H (kW)	113.6 (33.3)	113 (33.1)
100°F DB, 69.5°F WB (37.8°C DB, 20.8°C WB) 20% RH		
Total, kBTU/H (kW)	91.5 (26.8)	90.0 (26.4)
Sensible, kBTU/H (kW)	91.5 (26.8)	90.0 (26.4)
Flow Rate, GPM (l/s)	18.2 (1.15)	13.6 (0.85)
Pressure Drop, ft water (kPa)	42.5 (126.9)	24 (71.9)
Heat Rejection, kBTU/H (kW)	109.3 (26.8)	108.8 (31.9)
95°F DB, 67.9°F WB (35°C DB, 19.9°C WB) 23% RH		
Total, kBTU/H (kW)	87.6 (25.7)	86.0 (25.2)
Sensible, kBTU/H (kW)	87.2 (25.6)	85.9 (25.2)
Flow Rate, GPM (l/s)	17.6 (1.11)	12.9 (0.81)
Pressure Drop, ft water (kPa)	39.7 (118.7)	21.9 (65.5)
Heat Rejection, kBTU/H (kW)	105.2 (25.7)	104.6 (30.6)
90°F DB, 66.2°F WB (32.2°C DB, 19.0°C WB) 27% RH		
Total, kBTU/H (kW)	84.7 (24.8)	82.8 (24.3)
Sensible, kBTU/H (kW)	81.5 (23.9)	80.5 (23.6)
Flow Rate, GPM (l/s)	17.1 (1.08)	12.3 (0.77)
Pressure Drop, ft water (kPa)	37.6 (112.4)	20.0 (59.7)
Heat Rejection, kBTU/H (kW)	102.2 (24.8)	101.3 (29.7)
85°F DB, 64.5°F WB (29.4°C DB, 18.1°C WB) 31% RH		
Total, kBTU/H (kW)	82.2 (24.1)	80.3 (23.5)
Sensible, kBTU/H (kW)	75.1 (22.0)	74.2 (21.8)
Flow Rate, GPM (l/s)	16.6 (1.05)	11.8 (0.74)
Pressure Drop, ft water (kPa)	35.5 (106.2)	18.5 (55.3)
Heat Rejection, kBTU/H (kW)	99.6 (24.1)	98.7 (28.9)
80°F DB, 62.8°F WB (26.7°C DB, 17.1°C WB) 37% RH		
Total, kBTU/H (kW)	79.8 (23.4)	78.0 (22.9)
Sensible, kBTU/H (kW)	68.6 (20.1)	67.7 (19.8)
Flow Rate, GPM (l/s)	16.2 (1.03)	11.7 (0.74)
Pressure Drop, ft water (kPa)	34.0 (101.7)	18.2 (54.4)
Heat Rejection, kBTU/H (kW)	97.1 (23.4)	96.3 (28.2)
80°F DB, 66.5°F WB (26.7°C DB, 19.2°C WB) 50% RH		
Total, kBTU/H (kW)	85.1 (24.9)	83.1 (24.4)
Sensible, kBTU/H (kW)	60.5 (17.7)	59.7 (17.5)
Flow Rate, GPM (l/s)	17.1 (1.08)	12.5 (0.79)
Pressure Drop, ft water (kPa)	37.6 (112.4)	20.6 (61.5)
Heat Rejection, kBTU/H (kW)	102.9 (30.1)	101.6 (29.8)

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

Table 31 Performance data—Water-cooled, 600mm (24in.) Model CR035RW

Return Air Temperature	83°F (28.33°C) EWT - 95°F (35°C) LWT	85°F (29.4°C) EWT - 110°F(43.3°C) Cond. Temp.
105°F DB, 71°F WB (40.6°C DB, 21.6°C WB) 17% RH		
Total, kBTU/H (kW)	152.3 (44.6)	150.3 (44.0)
Sensible, kBTU/H (kW)	152.3 (44.6)	150.3 (44)
Flow Rate, GPM (l/s)	30.1 (1.9)	23.5 (1.48)
Pressure Drop, ft water (kPa)	66.8 (199.6)	41.2 (123.2)
Heat Rejection, kBTU/H (kW)	180.2 (52.8)	179.6 (52.6)
100°F DB, 69.5°F WB (37.8°C DB, 20.8°C WB) 20% RH		
Total, kBTU/H (kW)	147.2 (43.1)	144.7 (42.4)
Sensible, kBTU/H (kW)	144.5 (42.3)	143.1 (41.9)
Flow Rate, GPM (l/s)	29.2 (1.85)	22.5 (1.42)
Pressure Drop, ft water (kPa)	63.1 (188.5)	37.8 (113)
Heat Rejection, kBTU/H (kW)	175.0 (51.3)	174.1 (51)
95°F DB, 67.9°F WB (35°C DB, 19.9°C WB) 23% RH		
Total, kBTU/H (kW)	142.9 (41.9)	140.2 (41.1)
Sensible, kBTU/H (kW)	135.6 (39.8)	134.4 (39.4)
Flow Rate, GPM (l/s)	29.8 (1.8)	21.5 (1.35)
Pressure Drop, ft water (kPa)	60.0 (179.2)	34.6 (103.3)
Heat Rejection, kBTU/H (kW)	170.7 (50)	169.5 (49.7)
90°F DB, 66.2°F WB (32.2°C DB, 19.0°C WB) 27% RH		
Total, kBTU/H (kW)	138.7 (40.7)	135.9 (39.8)
Sensible, kBTU/H (kW)	126.6 (37.1)	125.3 (36.7)
Flow Rate, GPM (l/s)	27.8 (1.75)	20.3 (1.28)
Pressure Drop, ft water (kPa)	56.9 (170.2)	31.1 (92.9)
Heat Rejection, kBTU/H (kW)	166.5 (48.8)	165.3 (48.4)
85°F DB, 64.5°F WB (29.4°C DB, 18.1°C WB) 31% RH		
Total, kBTU/H (kW)	134.8 (39.5)	132.1 (38.7)
Sensible, kBTU/H (kW)	117.3 (34.4)	116.1 (34)
Flow Rate, GPM (l/s)	27.1 (1.71)	20.3 (1.28)
Pressure Drop, ft water (kPa)	54.5 (162.9)	31.0 (92.8)
Heat Rejection, kBTU/H (kW)	162.5 (47.6)	161.5 (47.3)
80°F DB, 62.8°F WB (26.7°C DB, 17.1°C WB) 37% RH		
Total, kBTU/H (kW)	130.9 (38.4)	128.4 (37.6)
Sensible, kBTU/H (kW)	107.7 (31.6)	106.5 (31.2)
Flow Rate, GPM (l/s)	26.0 (1.64)	19.8 (1.25)
Pressure Drop, ft water (kPa)	50.2 (150)	29.5 (88.3)
Heat Rejection, kBTU/H (kW)	158.6 (46.5)	157.6 (46.2)
80°F DB, 66.5°F WB (26.7°C DB, 19.2°C WB) 50% RH		
Total, kBTU/H (kW)	139.5 (40.9)	136.8 (40.1)
Sensible, kBTU/H (kW)	95.8 (28.1)	94.6 (27.7)
Flow Rate, GPM (l/s)	28.0 (1.77)	21.2 (1.34)
Pressure Drop, ft water (kPa)	57.9 (173.2)	33.7 (100.8)
Heat Rejection, kBTU/H (kW)	167.3 (49.0)	166.1 (48.7)

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

Table 32 Performance data—GLYCOOL-cooled, 600mm (24in.) models CR035RW and CR020RW

Return Air Temperature	Glycol (40% Propylene) 104°F (43.3°C) EWT - 115°F (46.1°C) LWT	
	CR035RW	CR020RW
105°F DB, 71°F WB (40.6°C DB, 21.6°C WB)17% RH		
Total, kBTU/H (kW)	141.4 (41.4)	88.3 (25.9)
Sensible, kBTU/H (kW)	141.4 (41.4)	88.3 (25.9)
Flow Rate, GPM (l/s)	34.4 (2.17)	21.8 (1.37)
Pressure Drop, ft water (kPa)	98.2 (293.6)	67.6 (202.2)
Heat rejection, kBTU/H (kW)	177.3 (52.0)	111.0 (32.6)
100°F DB, 69.5°F WB (37.8°C DB, 20.8°C WB)20% RH		
Total, kBTU/H (kW)	135.5 (39.7)	84.4 (24.7)
Sensible, kBTU/H (kW)	135.5 (39.7)	84.4 (24.7)
Flow Rate, GPM (l/s)	33.5 (2.11)	21.0 (1.32)
Pressure Drop, ft water (kPa)	93.4 (279.2)	63.2 (189.0)
Heat rejection, kBTU/H (kW)	171.2 (50.2)	107.0 (31.4)
95°F DB, 67.9°F WB (35°C DB, 19.9°C WB)23% RH		
Total, kBTU/H (kW)	129.9 (38.0)	80.5 (23.6)
Sensible, kBTU/H (kW)	128.9 (37.7)	80.5 (23.6)
Flow Rate, GPM (l/s)	32.4 (2.04)	20.1 (1.27)
Pressure Drop, ft water (kPa)	87.4 (261.3)	58.3 (174.2)
Heat rejection, kBTU/H (kW)	165.5 (48.5)	102.9 (30.2)
90°F DB, 66.2°F WB (32.2°C DB, 19.0°C WB)27% RH		
Total, kBTU/H (kW)	125.7 (36.8)	76.7 (22.5)
Sensible, kBTU/H (kW)	120.5 (35.3)	76.6 (22.5)
Flow Rate, GPM (l/s)	32 (1.96)	19.4 (1.22)
Pressure Drop, ft water (kPa)	85.4 (240.1)	54.2 (161.9)
Heat rejection, kBTU/H (kW)	161.1 (47.2)	98.9 (29)
85°F DB, 64.5°F WB (29.4°C DB, 18.1°C WB)31% RH		
Total, kBTU/H (kW)	121.8 (35.7)	73.9 (21.6)
Sensible, kBTU/H (kW)	111.3 (32.6)	71.2 (20.9)
Flow Rate, GPM (l/s)	31.0 (1.96)	18.9 (1.19)
Pressure Drop, ft water (kPa)	80.3 (240.1)	51.5 (154)
Heat rejection, kBTU/H (kW)	157.4 (46.1)	95.9 (28.1)
80°F DB, 62.8°F WB (26.7°C DB, 17.1°C WB)37% RH		
Total, kBTU/H (kW)	153.7 (29.8)	71.6 (21)
Sensible, kBTU/H (kW)	101.8 (45.1)	64.8 (19)
Flow Rate, GPM (l/s)	30.1 (1.9)	18.3 (1.15)
Pressure Drop, ft water (kPa)	76.0 (227.1)	48.6 (145.2)
Heat rejection, kBTU/H (kW)	153.7 (45.1)	93.6 (27.4)
80°F DB, 66.5°F WB (26.7°C DB, 19.2°C WB)50% RH		
Total, kBTU/H (kW)	161.6 (26.4)	76.3 (22.4)
Sensible, kBTU/H (kW)	40.0 (47.4)	56.8 (16.6)
Flow Rate, GPM (l/s)	83.5 (2.0)	19.4 (1.22)
Pressure Drop, ft water (kPa)	55.2 (249.6)	54.2 (161.9)
Heat rejection, kBTU/H (kW)	161.6 (47.4)	98.5 (28.9)

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

Table 33 Physical data—600mm (24in.) water/glycol-cooled systems

	CR020RW	CR035RW
Fan Data	2454 (4170)	3260 (5540)
Total Airflow, CFM (m^3/h)	2454 (4170)	3260 (5540)
Total Fan Motor, hp (kW)	0.8 (0.6)	1.4 (1.06)
Number of Fans	2	
Evaporator Coil		
Face Area, ft^2 (m^2)	7.26 (0.674)	
Rows	4	5
Face Velocity, FPM (m/s)	339 (1.72)	449 (2.28)
Electric Reheat Single 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	
Number	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)	

5.1.1 Operating Limits for Water/Glycol-Cooled Units

Table 34 Operating limits for water/glycol-cooled units

Models	Maximum Water Pressure psi (kPa)	Maximum Close-Off Pressure psi (kPa)	Minimum Entering Water Temperature, °F (°C)
			Design Condition
CR020RW (water/glycol)	230 (1586)	43.5 (300)	75 (23.8)
CR035RW (water/glycol)	230 (1586)	43.5 (300)	

5.2 Electrical Data—Water/Glycol Models

Table 35 Electrical data—Water/glycol, 600mm (24in.) models

Voltage	CR035RW		CR020RW	
	460/3/60	208/3/60	460/3/60	208/3/60
Dehumidification, With or Without Humidifier, Reheat, Condensate Pump				
FLA	32.2	62.0	24.2	50.8
WSA	39.1	75.4	29.2	61.4
OPD	50	100	35	80
Dehumidification, Humidifier and Condensate Pump; NO Reheat				
FLA	28.4	53.8	20.4	42.6
WSA	33.4	63.1	23.5	49.1
OPD	50	100	35	70
Dehumidification and Condensate Pump; NO Reheat, NO Humidifier				
FLA	24.7	45.4	16.7	34.2
WSA	29.7	54.7	19.8	40.7
OPD	45	90	30	60
Dehumidification and Reheat; NO Condensate Pump, NO Humidifier				
FLA	31.0	59.7	23.0	48.5
WSA	37.9	73.1	28.0	59.1
OPD	50	100	35	80
Dehumidification; NO Reheat, NO Humidifier, NO Condensate Pump				
FLA	23.5	43.1	15.5	31.9
WSA	28.5	52.4	18.6	38.4
OPD	45	80	30	60

NOTICE

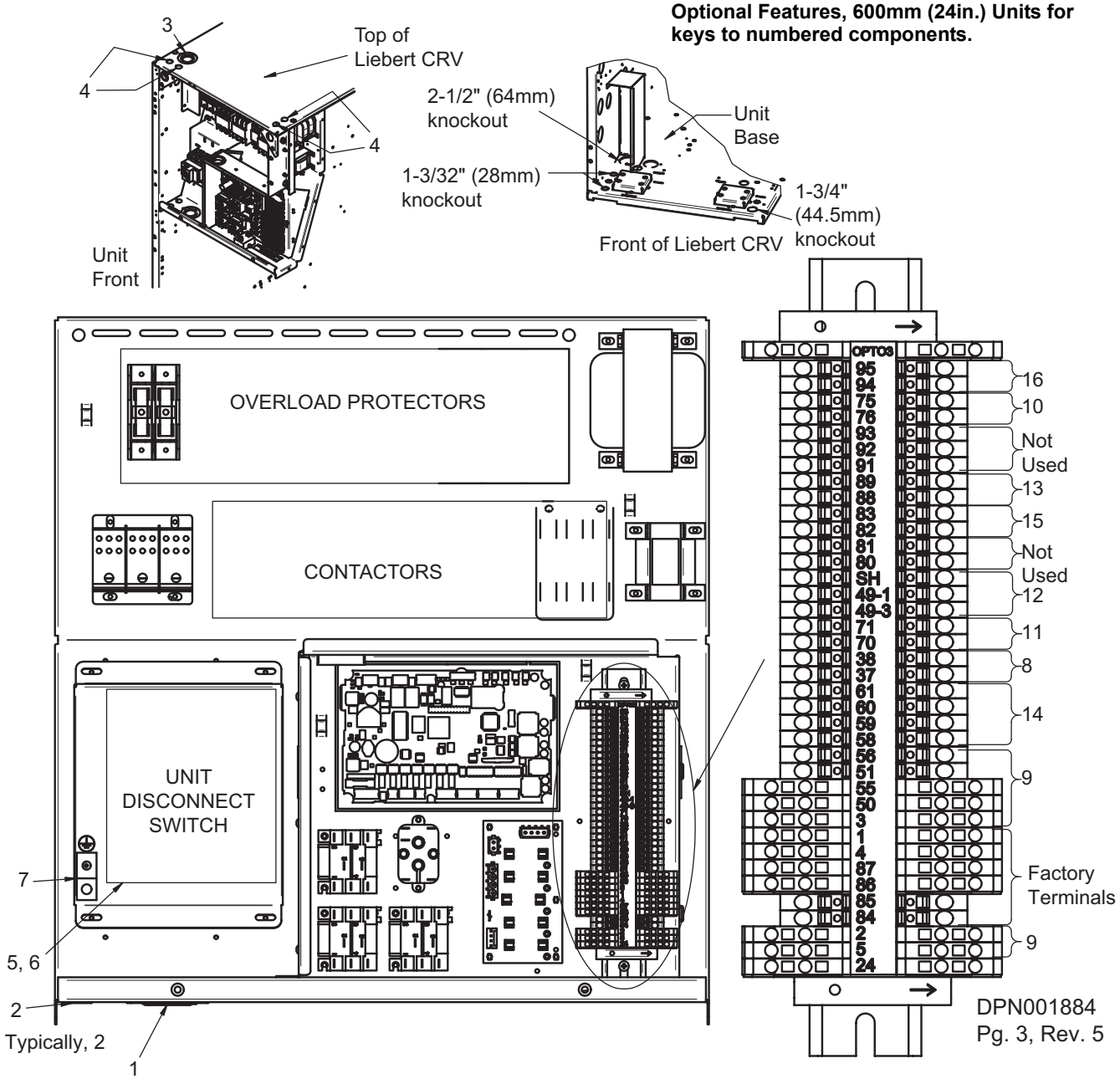
Risk of exceeding line-to-ground limit. Can cause equipment damage.

- The electrically commutated (EC) motors included in 480V CR035 and CR040 units are suitable for connection to power supplies with 300V or less line to ground potential. Excess line-to-ground voltage can cause capacitor failure internal to the motors.
- Power supplies such as 480V Wye with solidly grounded neutral have 277V line to ground and are acceptable.

Power supplies such as 480V Wye with high-resistance (or impedance) ground, 480V delta without ground or with floating ground, 480V delta with corner ground or 480V delta with grounded center tap will exceed the 300V line-to-ground limit.

Figure 35 Electrical field-connection locations

Refer to 5.2 - Electrical Data—Water/Glycol Models and 5.2.2 - Electrical Connections—Optional Features, 600mm (24in.) Units for keys to numbered components.



5.2.1 Electrical Connections—Standard Features, 600mm (24in.) Units

Source: DPN001884, Rev. 5, Pg. 1

1. **High-voltage connection through the bottom of the electric panel**—1-3/8" (34.9mm), 1-3/4" (44.5mm) and 2-1/2" (64mm) diameter concentric knockout.
2. **Low-voltage connection through the bottom of the electric panel**—Two knockouts, each 7/8" (22mm) diameter.
3. **High-voltage connection through the top of the unit**—1-3/8" (34.9mm), 1-3/4" (44.5mm) and 2-1/2" (64mm) diameter concentric knockout.
4. **Low-voltage connection through the top of the unit**—Four knockouts, each 7/8" (22mm) diameter.
5. **Three-phase electrical service**—Connect to terminals on disconnect switch. Three-phase service not by Emerson. Refer to **7.6.3 - Important Note for 460V-Rated Liebert CRV Units (CR******A)**.
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 and 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 and 50, Terminals 2 and 51, Terminals 5 and 55, or Terminals 3 and 56. Use field-supplied Class 1 wiring. Terminal 3 and 56 are used for humidifier alarm when a humidifier is installed. The remaining terminals are available for customer alarm inputs, such as smoke sensors and building fire alarms.
10. **Common alarm**—On any alarm, normally open dry contact is closed across Terminals 75 and 76 for remote indication. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
11. **Heat rejection interlock**—On any call for compressor operation, normally open dry contact is closed across Terminals 70 and 71 to heat rejection equipment. 1A, 24VAC maximum load. Use field-supplied, Class 1 wiring.
12. **CANbus Connector**—Terminal block with Terminals 49-1 (CAN-H) and 49-3 (CAN-L) + SH (shield connection). The terminals are used to connect the CANbus communication cable (provided by others) from the indoor unit to the Liebert MC, Premium model.

    CANbus Cable—CANbus cable provided by others to connect to the outdoor condenser. Cable must meet the following specifications:

    - Conductors: 22-18AWG stranded tinned copper
    - Twisted Pair (minimum 8 twists per foot)
    - Braided shield or foil shield with drain wire
    - Low Capacitance: 15pf/ft or less
    - UL approved temperature rated to 75°C
    - UL approved voltage rated to 300V
    - UV- and moisture-resistant if not provided in conduit
    - Plenum rated: NEC type CMP (if required by national or local codes)

5.2.2 Electrical Connections—Optional Features, 600mm (24in.) Units

Source: DPN001884, Rev. 5, Pg. 1

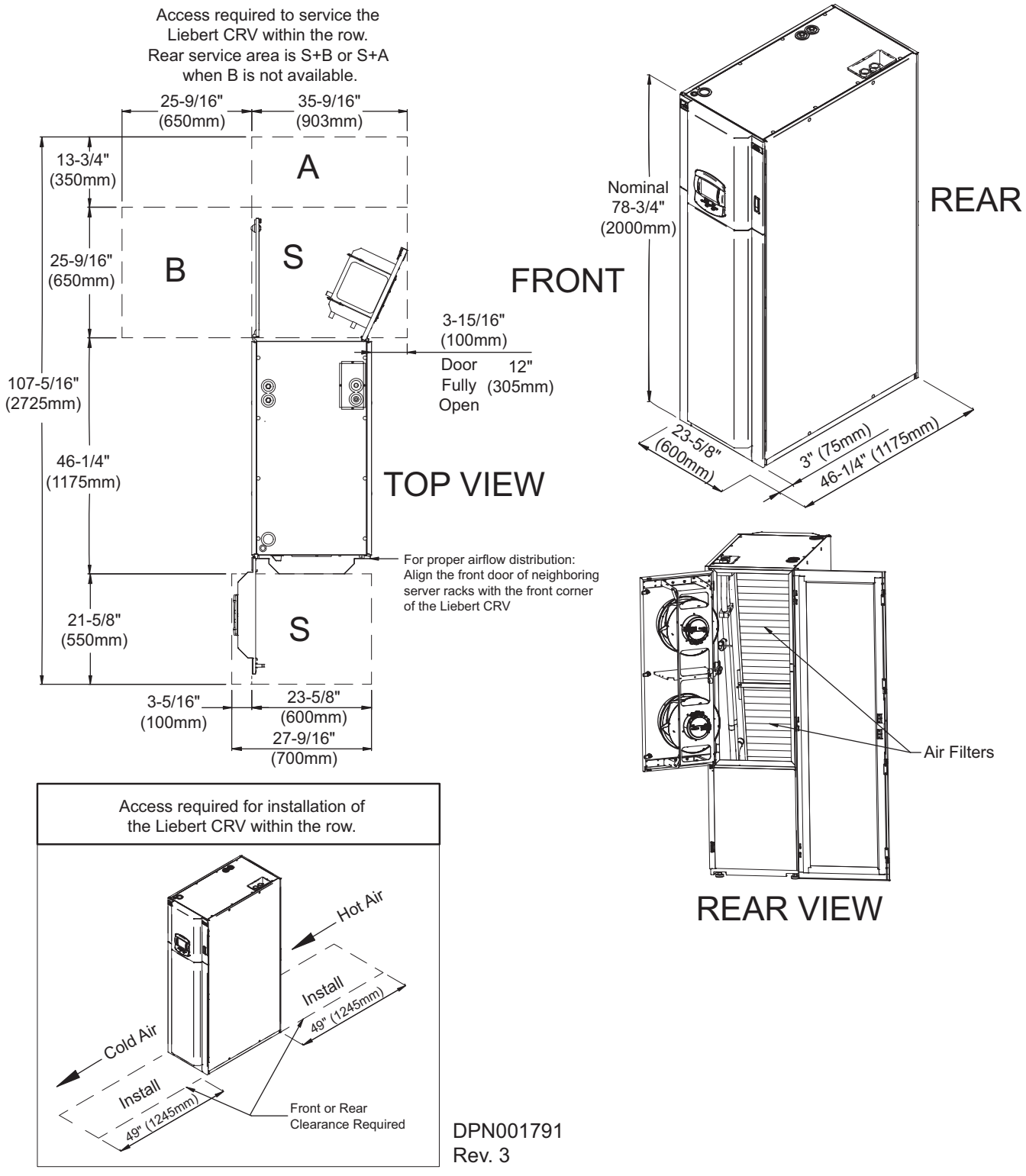
13. **Condensate pump high water alarm (available when optional pump is installed)**—On pump high-water indication, normally open dry contact is closed across Terminals 88 and 89 for remote indication. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
14. **Liebert Liqui-tect® shutdown and dry contact (available when optional Liebert Liqui-tect sensor is installed)**—On Liebert Liqui-tect activation, normally open dry contact is closed across Terminals 58 and 59 for remote indication. The Liebert Liqui-tect sensor notifies the Liebert iCOM® of indication through Terminals 60 and 61. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
15. **Reheat and humidifier lockout**—Remote 24VAC required at Terminals 82 and 83 for lockout of reheat and humidifier.
16. **Additional Common Alarm**—On any alarm, one additional normally open dry contact is closed across Terminals 94 and 95 for remote indication. 1A, 24VAC maximum load. Use Class 1, field-supplied wiring.

NOTE

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

5.3 Dimensions—Water/Glycol Systems

Figure 36 Cabinet and floor planning dimensions—Water/glycol-cooled, 600mm (24in.) wide models

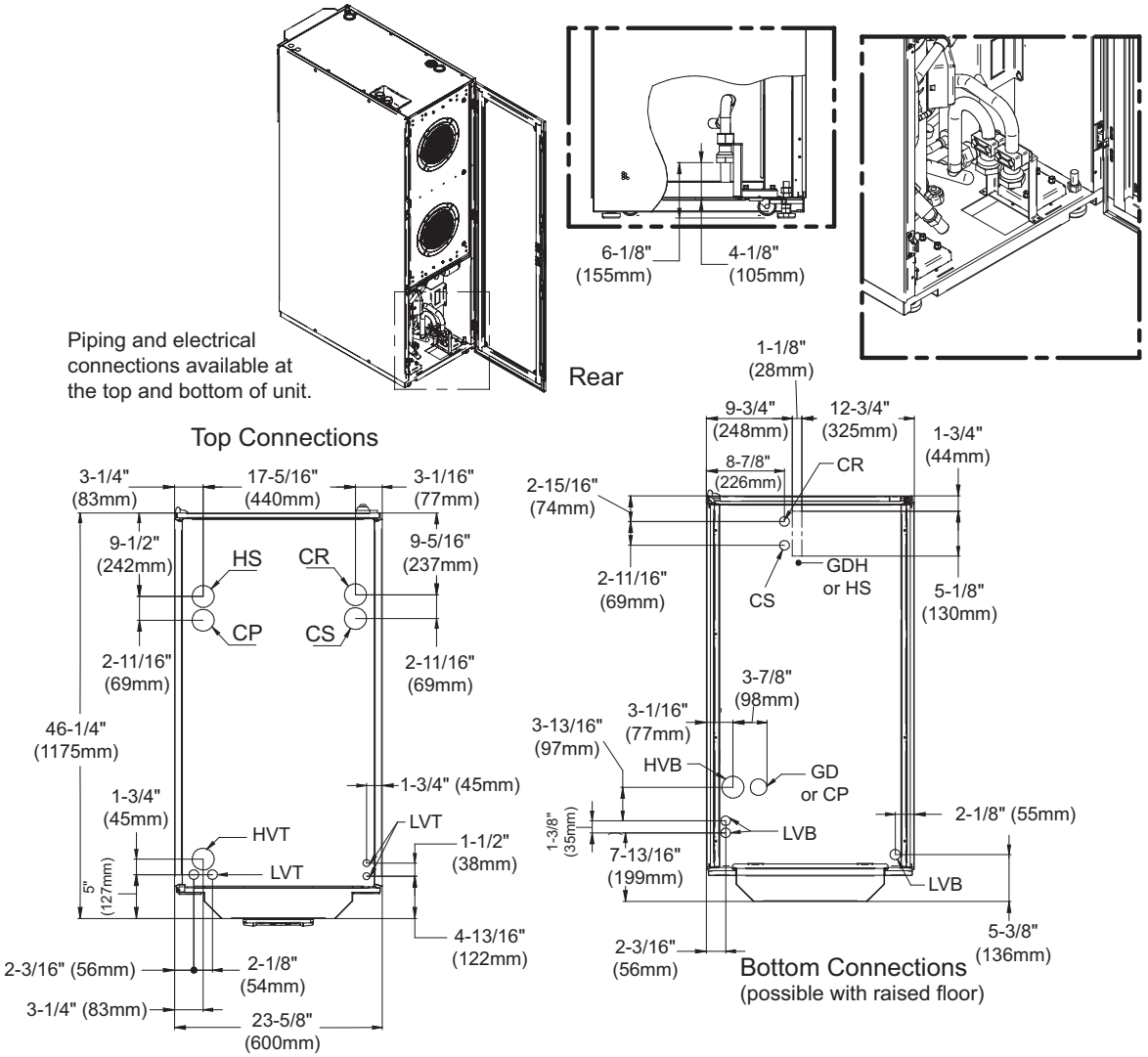


Model No.	Water/Glycol
CR020R	772 (350)
CR035R	849 (385)

Source DPN001791, Rev. 3

5.4 Piping—Water/Glycol Systems

Figure 37 Piping connections, water/glycol-cooled models



* Install a 16-20 mesh strainer, in an easily accessible location, on the Water/Glycol Supply to prevent particles from entering the heat exchanger. Strainer bypass valves are recommended to allow the strainer to be cleaned while maintaining flow to the cooling unit.

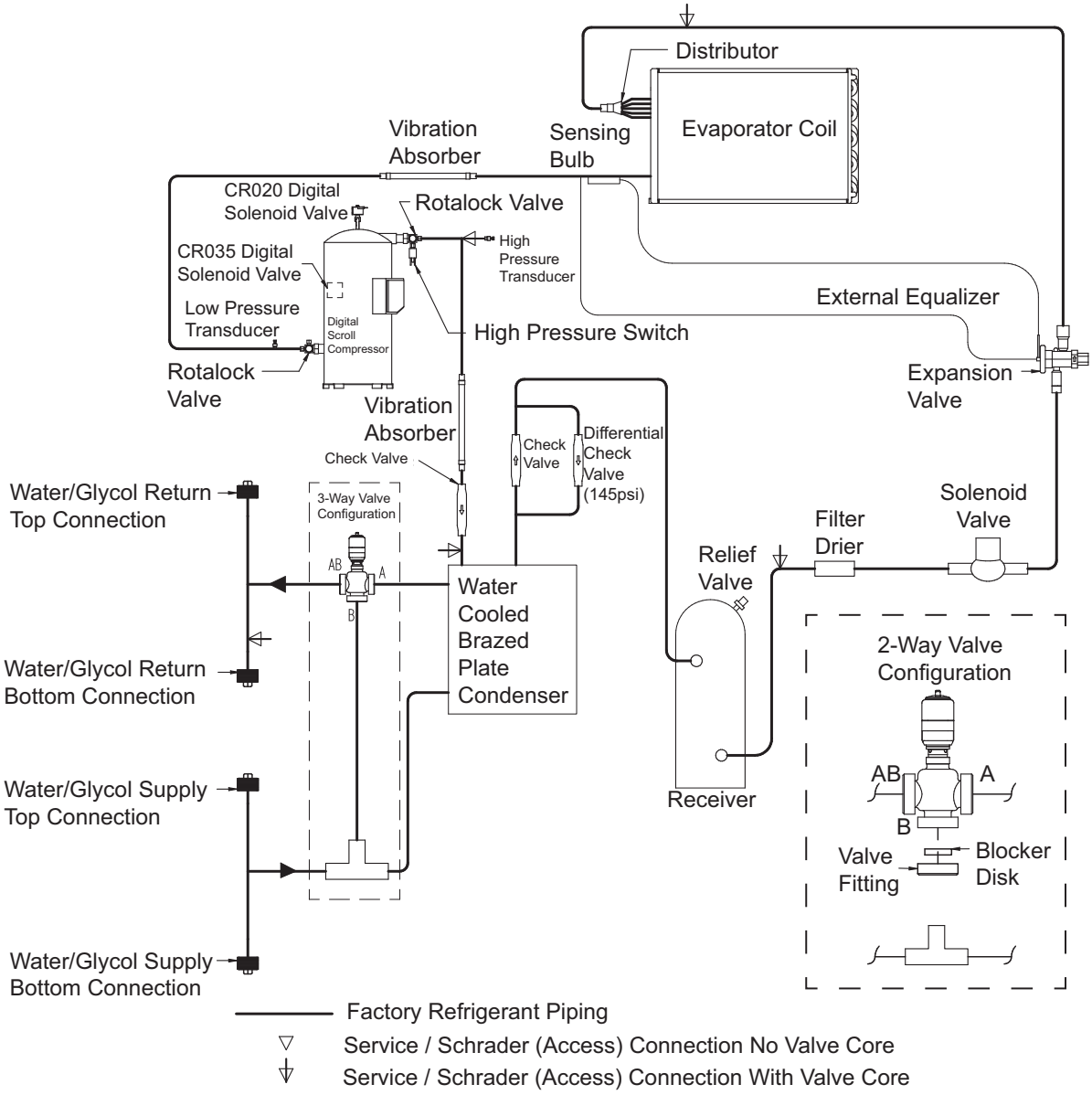
DPN001793
Rev. 2

Table 36 Unit connections, water/glycol-cooled models

Unit Connections		CR20W, CR35W
CS	Water/Glycol Coolant Supply	1-1/4" FPT
CR	Water/Glycol Coolant Return	1-1/4" FPT
GD	Gravity Coil Pan Drain	1" MPT
GDH	Gravity Humidifier Drain	N/A
HS	Humidifier Supply	1/2" FPT (top connection), 1/4" Compression Fitting (bottom connection)
CP	Condensate Pump	1/2" FPT
HVT	High-Voltage Top Connection	Combination Knockout Hole Diameter 35mm (1-3/8"), 44.5mm (1-3/4") and 63.5mm (2-1/2")
HVB	High-Voltage Bottom Entrance (feed through the base of the unit)	Knockout Hole Diameter 63.5mm (2-1/2"
LVT	Low Voltage Top Connection	Knockout Hole Diameter 22mm (7/8") 4 places
LVB	Low Voltage Bottom Entrance (feed through the base of the unit)	Knockout Hole Diameter 27.8mm (1-3/32") 2 places
LVB2	Low Voltage Bottom Entrance (feed through the base of the unit)	Knockout Hole Diameter 44.5mm (1-3/4") 1 place

Source DPN001793, Rev. 2

Figure 38 General arrangement diagram—water/glycol models - new submittal coming



1. Schematic representation shown. Do not use for specific connection locations.
2. Install a 16-20 mesh strainer, in an easily accessible location, on the water/glycol supply to prevent particles from entering the heat exchanger. Strainer bypass valves are reccomended to allow the strainer to be cleaned while maintaining flow to the cooling unit.

DPN001985
Rev. 1

Table 37 Sound data—Model CR020RW, 600mm (24in.) water/glycol model

2 Fans with Filter			Sound Power Level (PWL)										Sound Pressure Level (SPL)
	Airflow		Octave Band Frequency (Hz)									A-Scale Weighted dB (A)	At Suction side, 2m distance, free field conditions (2m, f.f, dBA)
Fan Speed %	SCFM	m^3/h	31.5 dB	63 dB	125 dB	250 dB	500 dB	1000 dB	2000 dB	4000 dB	8000 dB		
100	2454	4170	73.8	69.4	71	77.3	75.9	74.2	73.5	68.2	59.2	79.6	69.2
75	2166	3680	71.2	66.8	68.4	74.7	73.3	71.6	70.9	65.6	56.6	77	66.9
50	1780	3025	67.6	63.2	64.8	71.1	69.7	68	67.3	62	53	73.4	63.9

Level PWL sound power level

Table 38 Sound data—Model CR030RW, 300mm (12in.) water/glycol

5 Fans Without Filter			Sound Power Level (PWL)										Sound Pressure Level (SPL)
Fan Speed %	Airflow		Octave Band Frequency (Hz)									A-Scale Weighted dB (A)	At Suction side, 2 m distance, free field conditions (2m, f.f, dBA)
	SCFM	m³/h	31.5 dB	63 dB	125 dB	250 dB	500 dB	1000 dB	2000 dB	4000 dB	8000 dB		
100	3260	5540	76	76.2	80.5	82.7	77.3	73.1	74.5	69	61.9	80.9	70
75	2708	4600	71.3	71.5	75.8	78	72.6	68.4	69.8	64.3	57.2	76.2	65.7
50	2048	3480	66.3	66.5	70.8	73	67.6	63.4	64.8	59.3	52.2	71.2	61.9

5.5 Standard Features—600mm (24in.) Water/Glycol Systems

Source: DPN001905, Revision 2

Fan—The unit is equipped with two plug fans: direct driven 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 airstream. 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 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 three-level password protection system. Unit-to-Unit communication with other Liebert CRV's 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 2T rack sensors are standard with each Liebert CRV. Up to ten 2T housings (20 temperature probes) can be connected to a Liebert CRV. One 2T housing and both sensor probes are to be attached to a rack that 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 a location to remotely shut down the unit.

Common Alarm Contact—Provides 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 half-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 Knürr 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 four-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 molded case circuit interrupter disrupts the flow of power to the unit. The electric panel high-voltage compartment can be accessed only with the switch in the Off position. The switch is behind the Liebert iCOM® display door for quick access.

65,000A Short Circuit Current Rating (SCCR)—The electrical panel provides a 65k amp SCCR.

Water / Glycol Condenser—Is an efficient stainless steel brazed-plate condenser. Water-side threaded connections are provided for convenience. Proper filtration must be field-supplied when used on open-loop water systems (cooling towers, etc). Emerson recommends using a water/glycol mixture when operating on a closed-loop to avoid undesired ice formation in the wintertime,.

Three-Way Modulating Valve—A three-way modulating valve controls the water/glycol flow through the brazed-plate condenser. The Liebert iCOM manages the valve actuator movement 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).

5.6 Optional Features—600mm (24in.) Water/Glycol Systems

Source: DPN001905, Revision 2

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 back-flow 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.

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

Low Noise Package—The Low Noise Package reduces the level of sound emitted from the compressor. The package consists of a 3/8 inch closed cell polymeric 4.5 – 8.5 lb/ft^3 density compressor sound jacket that encloses the compressor. Additional half-inch closed cell polymeric 3 - 8 lb/ft^3 density sound deadening material is affixed to the underside of the superior service access panel located above the compressor and attached to the inner side of the compressor compartment panels that face the hot and cold aisles. All sound deadening material is non-shedding and located outside of the airstream.

Liebert IntelliSlot® Unity-DP—Provides ground fault isolated connectivity for unit monitoring and management. Supported management interfaces include:

- Emerson Protocol for Trellis™, Liebert SiteScan™ and Liebert Nform™
- Embedded LIFE™ Technology for Remote Service Delivery
- SNMP (v1/v2c/v3) for Network Management Systems
- HTTP/HTTPS for Web page viewing
- SMTP for e-mail
- SMS for mobile messaging
- Modbus RTU—Modbus Remote Terminal Unit (RTU) communication protocol for Building Management Systems over an RS-485 serial network (also called Modbus RTU RS-485)
- Modbus TCP—Modbus Transmission Control Protocol for Building Management Systems over an Internet or LAN network
- BACnet IP—BACnet over Internet Protocol for Building Management Systems over a Internet or LAN network
- BACnet MSTP—BACnet Master-Slave/Token-Passing (MSTP) communication protocol over an RS-485 serial network (also called BACnet MSTP RS-485)

Liebert IntelliSlot SiteLink-E Card (IS-485EXI)—Provides ground fault isolated connection to a Liebert SiteLink-E for monitoring and management. Compatible with Liebert SiteScan® Web 4.0 or newer version.

Filter—The optional filters are two deep-pleated 4-inch filters 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 24V signal.

One (1) 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—This solid-state water sensor has no moving parts and is hermetically sealed to keep out dust and dirt. The alarm system is activated when the sensor detects moisture.

6.0 HEAT REJECTION—DRYCOOLERS

6.1 Liebert Drycoolers for Water/Glycol-Cooled Liebert CRV's

Liebert drycoolers are 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 39** 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 field-supplied 16-20 mesh strainer is to be installed (not supplied by Emerson) within 10 ft (30m) upstream of the unit to prevent debris from entering the unit.

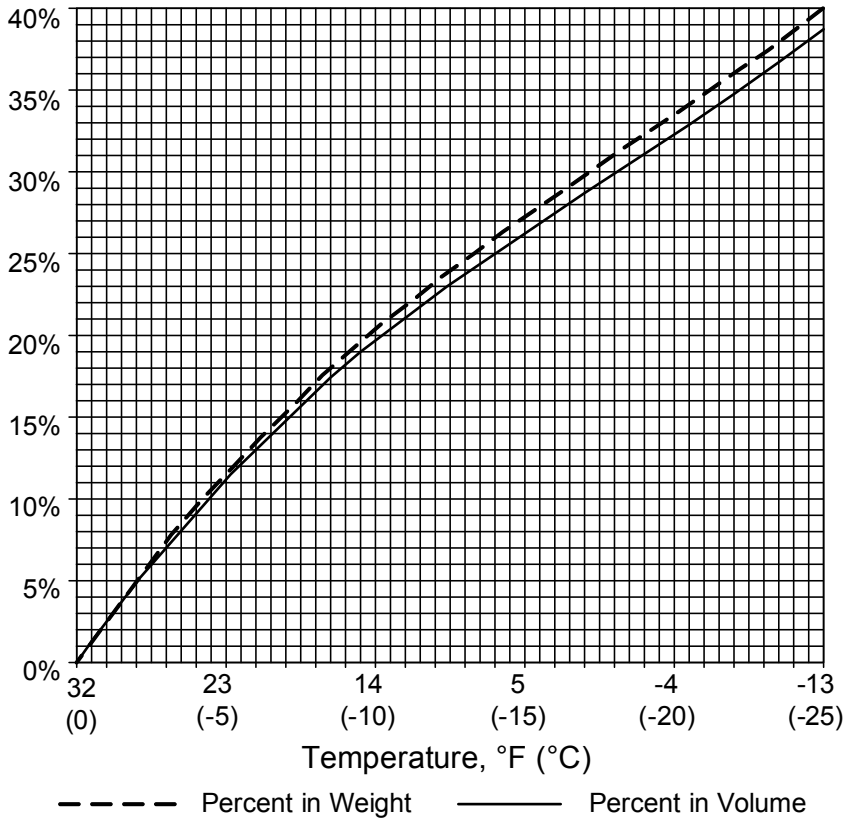
Table 39 Glycol-cooled drycooler matchups

CRV Model	Outdoor Temperature, °F (°C)	# Fans	Models [1]	Suggested Pump HP [2]
20kW	95 (35)	1	DSO112*8	1.5
	100 (38)	2	DSO174*8	1.5
	105 (41)	2	DSO225*16	2
35kW	95 (35)	2	DSO197*16	2
	100 (38)	3	DSO310*16	2
	105 (41)	4	DSO419*16	3

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

1. Matchups sized for 40% propylene glycol
2. Suggested pump selections provide at least 30ft H_2O head for piping losses

Figure 39 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.

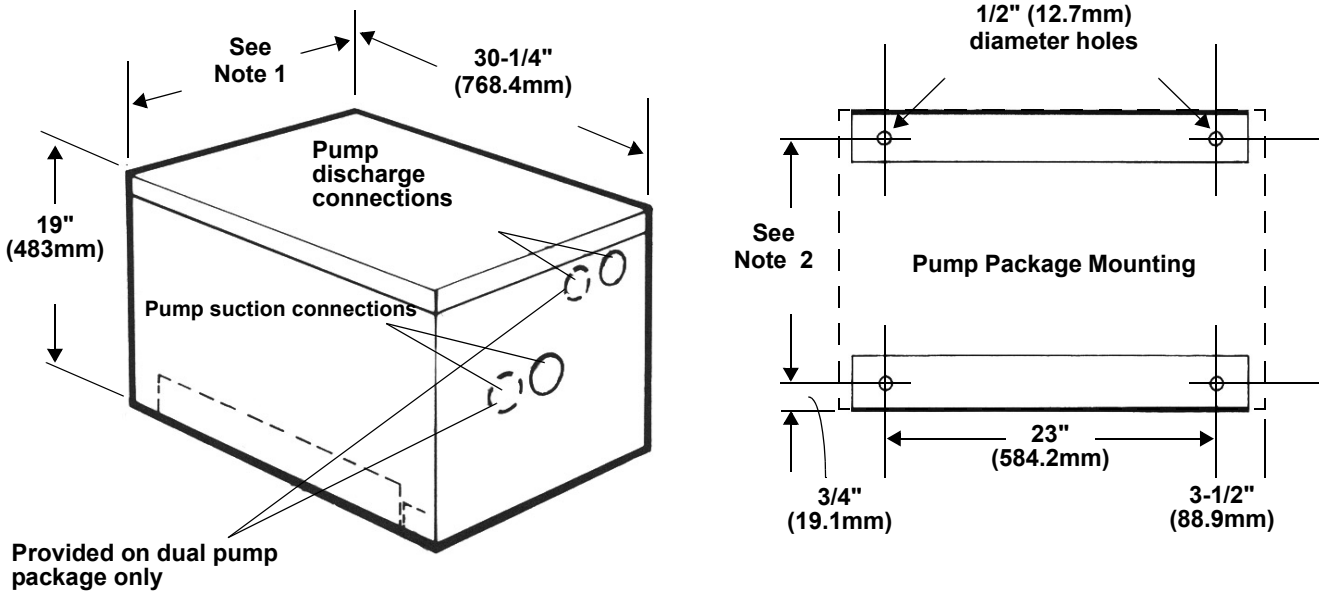
6.2 Drycooler General Data

Table 40 Drycooler electrical data

# of Fans	1				2				3				4			
Model #	112				174, 197, 225				310				419			
Pump Hp	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
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
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
3.0	3	14.1	16.8	25	3	17.6	20.3	30	3	21.1	23.8	30	3	24.6	27.3	35
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
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
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
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
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
3.0	3	6.5	7.7	15	3	8.2	9.4	15	3	9.9	11.1	15	3	11.6	12.8	15
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
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

6.3 Drycooler Pump Packages and Expansion Tank - Options

Figure 40 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 41 Expansion tank

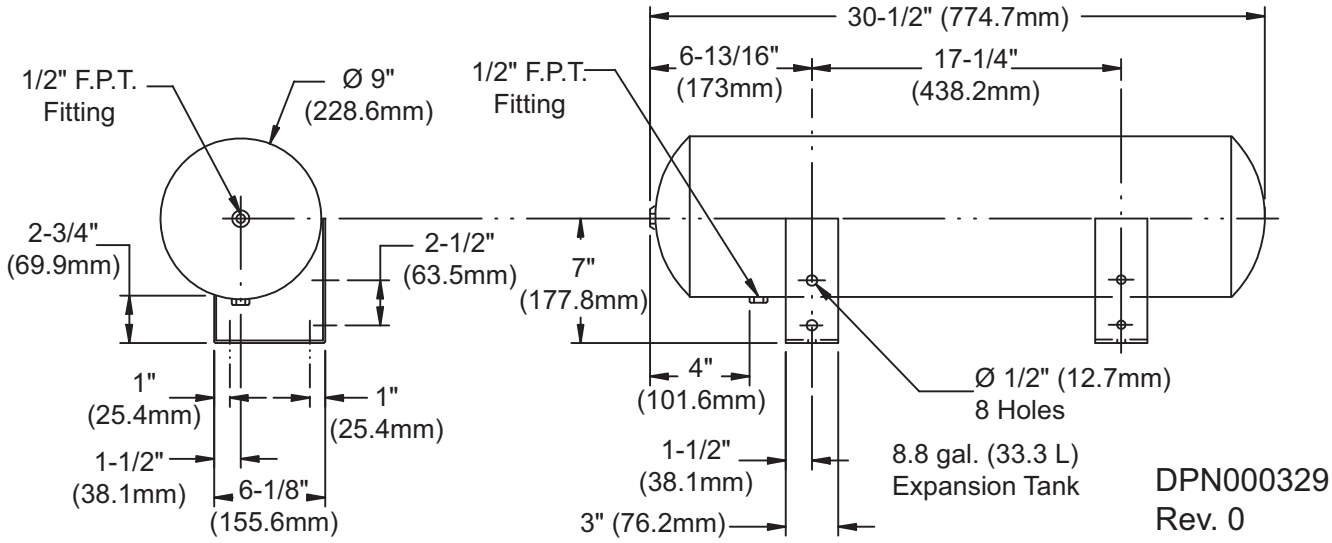
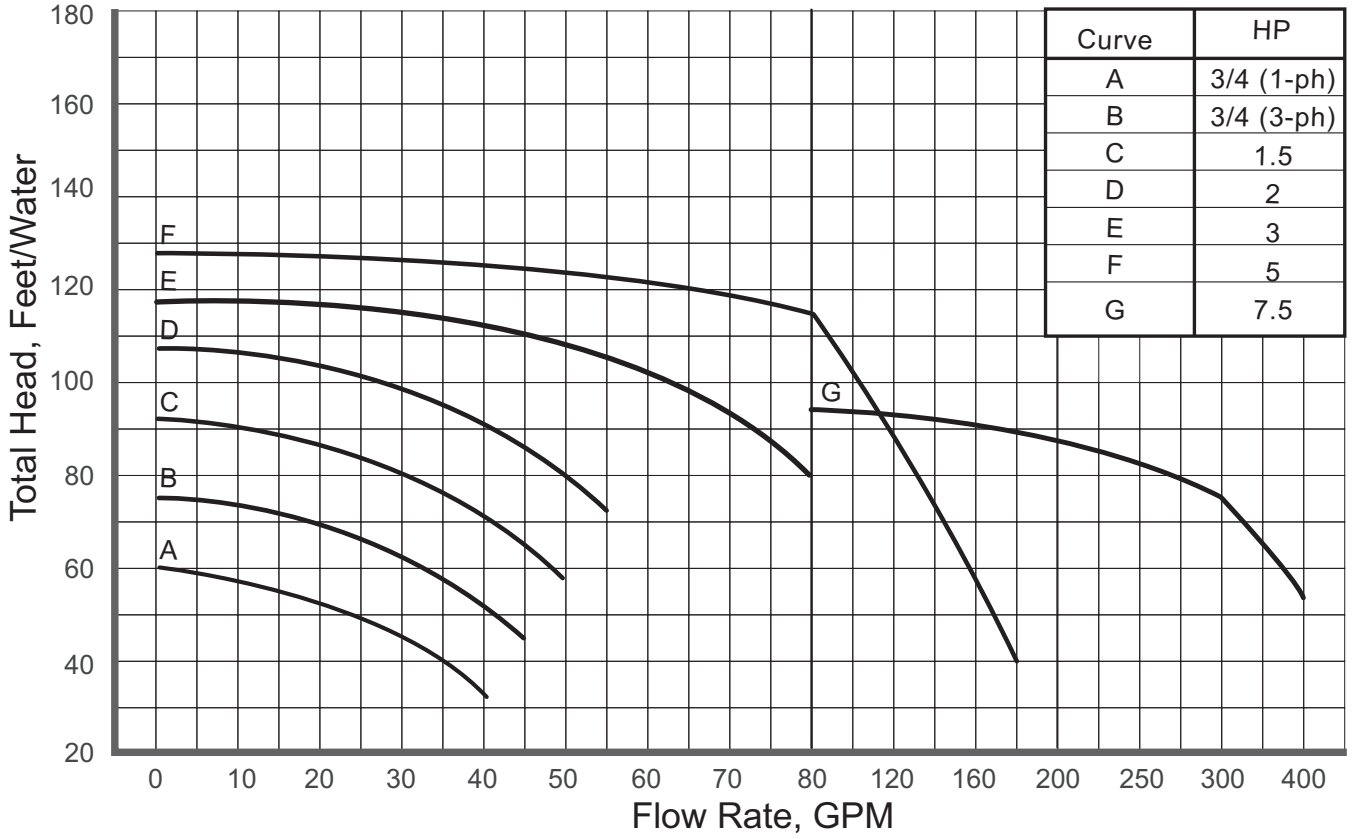


Table 41 Pump data

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.)
Source DPN000329, Rev. 0

Figure 42 Pump curve, 60Hz



6.4 Liebert Glycol-Cooled Direct Drive Drycoolers

6.4.1 Standard Features

Source: DPN000273, Revision 1

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 (660.4mm) 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.

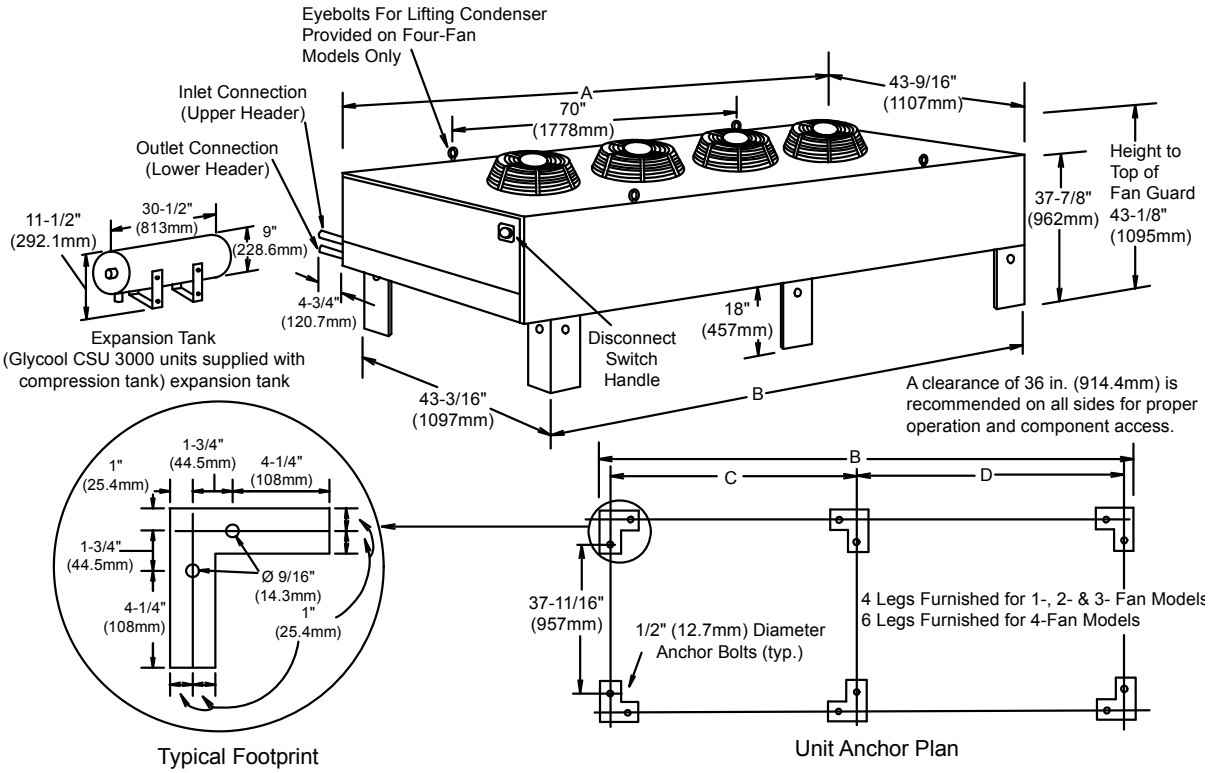
Fluid Temperature Control System (Fan Cycling)—Is complete with aquastats and electrical control circuit factory-wired in the integral control panel. Aquastats cycle fans to maintain fluid temperature as outdoor air temperature changes. Head pressure is controlled by the fluid regulating valve in the 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.

Cabinet and anchor dimensions 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.

DPN000274
Rev. 1

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)
-112	1	51-1/2 (1308)	44 (1118)	42 (1067)	—	6088 (2873)	5074 (2394)	5.8 (22.0)	470 (213)
-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)
-310	3	131-1/2 (3340)	124 (3150)	122 (3099)	—	18965 (8951)	15804 (7459)	13.1 (49.6)	886 (402)
-419	4	171-1/2 (4356)	164 (4166)	82 (2083)	80 (2032)	23650 (11163)	19708 (9302)	17.4 (65.9)	1120 (508)

Source DPN000274, Rev. 1

Table 42 Piping, direct drive drycoolers, O.D., Cu

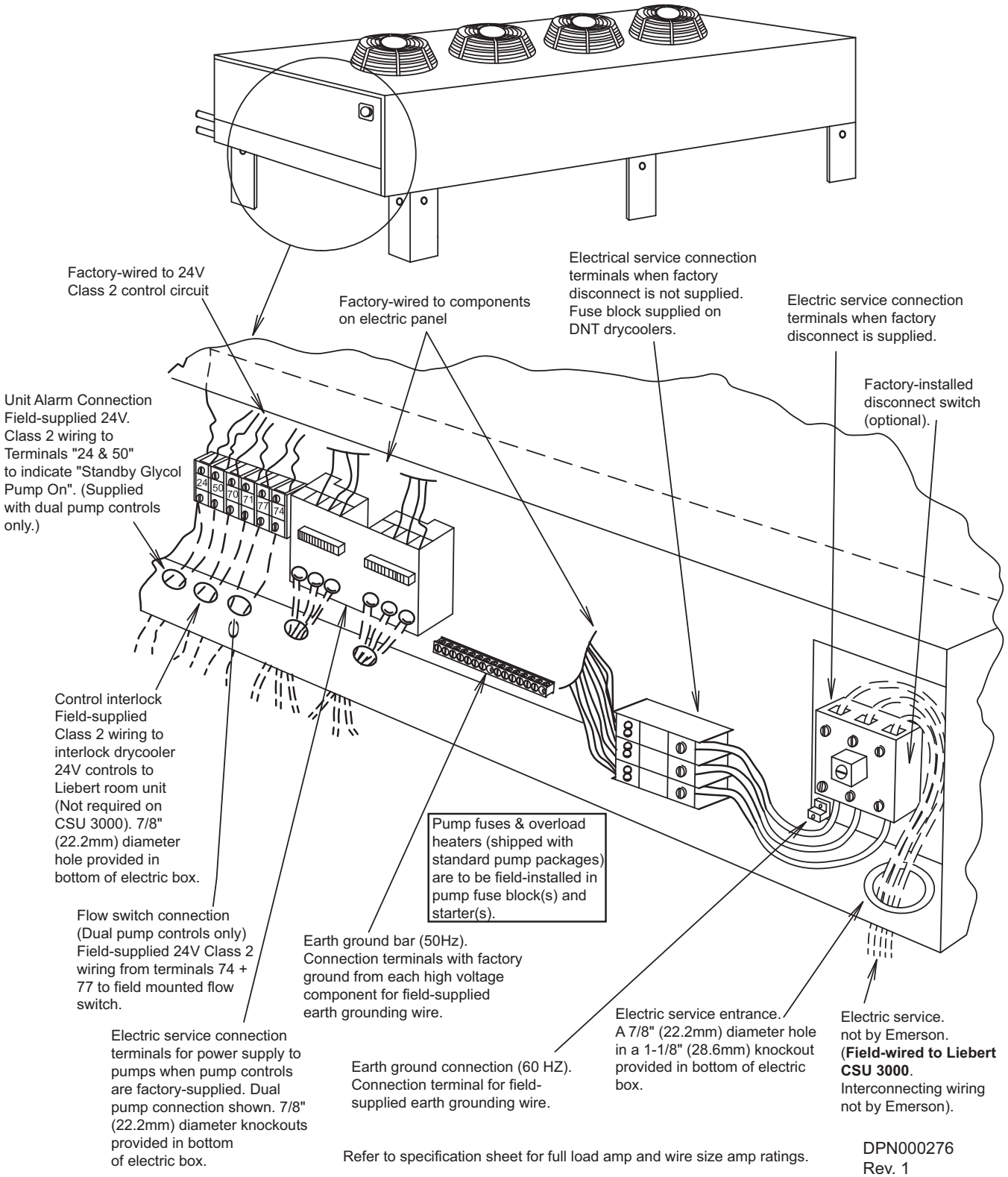
Drycooler Model #	Number of Coil Circuits	Inlet & Outlet Pipe Diameter (Inches)
-112	8	1-3/8
-112	16*, 26	2-1/8
-174	8, 16*, 24	2-1/8
-197	8	1-3/8
-197	16*, 32	2-1/8
-225	16, 26*	2-1/8
-310	16, 32*	2-1/8
-419	16, 32*	2-1/8

* Standard Circuiting

\- For model prefix designation, refer to **Figure** .

Source: DPN000274, Rev. 1

Figure 43 Fluid temperature control direct drive drycoolers



7.0 CHILLED WATER SYSTEMS—600MM (24IN.) AND 300MM (12IN.) CABINETS

7.1 Performance Data—600mm (24in.) Units

Table 43 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	50°F (10°C) EWT 10°F (5.6°C) Water Rise	50°F (10°C) EWT 14°F (7.7°C) Water Rise
105ºF DB, 71ºF WB (40.6ºC DB, 21.6ºC WB) 17% RH				
Total kW (BTU/H)	187,800 (55)	177200 (51.9)	163800 (48)	157500 (46.1)
Sensible kW (BTU/H)	177800 (52.1)	171900 (50.4)	163800 (48)	157500 (46.1)
Flow Rate, l/s (GPM)	38.3 (2.4)	25.9 (1.6)	33.6 (2.1)	23.1 (1.5)
Pressure Drop, ft H_2O (kPa)	53.1 (158.5)	25.7 (76.9)	41.0 (122.4	20.6 (61.5)
100ºF DB, 69.5ºF WB (37.8ºC DB, 20.8ºC WB) 20% RH				
Total kW (BTU/H)	173200 (50.7)	162100 (47.5)	148600 (43.5)	141900 (41.6)
Sensible kW (BTU/H)	162400 (47.6)	156300 (45.8)	148600 (43.5)	141900 (41.6)
Flow Rate, l/s (GPM)	35.4 (2.2)	23.7 (1.5)	30.5 (1.9)	20.90 (1.3)
Pressure Drop, ft H_2O (kPa)	45.9 (45.9)	22.0 (22)	34.4 (34.4)	17.1 (17.1)
95ºF DB, 67.9ºF WB (35ºC DB, 19.9ºC WB) 23% RH				
Total kW (BTU/H)	156700 (45.9)	145100 (42.5)	133000 (39)	125900 (36.9)
Sensible kW (BTU/H)	147200 (43.1)	140700 (41.2)	133000 (39)	125900 (36.9)
Flow Rate, l/s (GPM)	32.1 (2)	21.3 (1.3)	27.4 (1.7)	18.6 (1.2)
Pressure Drop, ft H_2O (kPa)	38.4 (114.7)	18.1 (54)	28.3 (84.7)	13.9 (41.5)
90ºF DB, 66.2ºF WB (32.2ºC DB, 19.0ºC WB) 27% RH				
Total kW (BTU/H)	140800 (41.3)	128700 (37.7)	117200 (34.3)	109400 (32.1)
Sensible kW (BTU/H)	131400 (38.5)	124600 (36.5)	117200 (34.3)	109400 (32.1)
Flow Rate, l/s (GPM)	28.9 (1.8)	19.0 (1.2)	24.3 (1.5)	16.2 (1)
Pressure Drop, ft H_2O (kPa)	31.8 (95)	14.6 (43.8)	22.7 (67.8)	10.9 (32.5)
85ºF DB, 64.5ºF WB (29.4ºC DB, 18.1ºC WB) 31% RH				
Total kW (BTU/H)	123200 (36.1)	111100 (32.6)	100900 (29.6)	92300(27.1)
Sensible kW (BTU/H)	115600 (33.9)	108300 (31.7)	100900 (29.6)	92300(27.1)
Flow Rate, l/s (GPM)	25.4 (1.6)	16.4 (1)	21.0 (1.3)	13.8 (0.9)
Pressure Drop, ft H_2O (kPa)	25.1 (75.1)	11.3 (33.9)	17.5 (52.2)	8.1 (24.2)
80ºF DB, 62.8ºF WB (26.7ºC DB, 17.1ºC WB) 37% RH				
Total kW (BTU/H)	106900 (31.3)	93500 (27.4)	84100 (24.6)	74300 (21.8)
Sensible kW (BTU/H)	98800 (29)	90900 (26.7)	84100 (24.6)	74300 (21.8)
Flow Rate, l/s (GPM)	22.2 (1.4)	13.9 (0.9)	17.7 (1.1)	11.2 (0.7)
Pressure Drop, ft H_2O (kPa)	19.60 (58.6)	8.4 (25.2)	12.8 (38.2)	5.6 (16.7)

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.

7.2 Performance Data—300mm (12in.) Units

Table 44 Capacities, chilled water models, CR030RC

	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	50°F (10°C) EWT 10°F (5.6°C) Water Rise	50°F (10°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)	111,918(32.8)	103,388 (30.3)	101,341 (29.7)	92,469 (27.1)
Sensible BTU/H (kW)	111,918(32.8)	103,388 (30.3)	101,341 (29.7)	92,469 (27.1)
Flow Rate, GPM (l/s)	22.8 (1.4)	15.1(1.0)	20.7 (1.3)	13.6 (0.9)
Pressure Drop, ft H_2O (kPa)	25.7 (76.6)	11.7 (34.9)	21.0 (62.6)	9.4 (28.0)
100ºF DB, 69.5ºF WB (37.8ºC DB, 20.8ºC WB) 20% RH				
Total BTU/H (kW)	100,999 (29.6)	92,128 (27.0)	90,422 (26.5)	81,550 (23.9)
Sensible BTU/H (kW)	100,999 (29.6)	92,128 (27.0)	90,422 (26.5)	81,550 (23.9)
Flow Rate, GPM (l/s)	20.7 (1.3)	13.5 (0.9)	18.5(1.2)	12.0 (0.8)
Pressure Drop, ft H_2O (kPa)	21.3 (63.5)	9.5(28.3)	17.0 (50.7)	7.4 (22.1)
95ºF DB, 67.9ºF WB (35ºC DB, 19.9ºC WB) 23% RH				
Total BTU/H (kW)	90,081 (26.4)	80,868 (23.7)	79,162 (23.2)	69,949 (20.5)
Sensible BTU/H (kW)	90,081 (26.4)	80,868 (23.7)	79,162 (23.2)	69,949 (20.5)
Flow Rate, GPM (l/s)	18.5(1.2)	(0.8) 11.9	(1.0) 16.3	(0.6) 10.3
Pressure Drop, ft H_2O (kPa)	17.3 (51.6)	7. (22.4)5	13.4 (39.9)	5.6 (16.7)
90ºF DB, 66.2ºF WB (32.2ºC DB, 19.0ºC WB) 27% RH				
Total BTU/H (kW)	78,820 (23.1)	69,266 (20.3)	67,902 (19.9)	58,006 (17.0)
Sensible BTU/H (kW)	78,820 (23.1)	69,266 (20.3)	67,902 (19.9)	58,006 (17.0)
Flow Rate, GPM (l/s)	16.2 (1.0)	10.2 (0.6)	14.1 (0.9)	8.6(0.5)
Pressure Drop, ft H_2O (kPa)	13.6 (40.5)	5.6 (16.7)	10.1 (30.1)	4.0 (11.9)
85ºF DB, 64.5ºF WB (29.4ºC DB, 18.1ºC WB) 31% RH				
Total BTU/H (kW)	67,560 (19.8)	56,983 (16.7)	56,300 (16.5)	45,723 (13.4)
Sensible BTU/H (kW)	67,560 (19.8)	56,983 (16.7)	56,300 (16.5)	45,723 (13.4)
Flow Rate, GPM (l/s)	14.0 (0.9)	8.5 (0.5)	11.7 (0.7)	6.9 (0.4)
Pressure Drop, ft H_2O (kPa)	10.2 (30.4)	4.0 (11.9)	7.2 (21.5)	2.6 (7.7)
80ºF DB, 62.8ºF WB (26.7ºC DB, 17.1ºC WB) 37% RH				
Total BTU/H (kW)	55,959 (16.4)	44,699 (13.1)	44,358 (13.0)	33,780 (9.9)
Sensible BTU/H (kW)	55,959 (16.4)	44,699 (13.1)	44,358 (13.0)	33,780 (9.9)
Flow Rate, GPM (l/s)	11.6 (0.7)	6.7 (0.4)	9.4 (0.6)	5.1 (0.3)
Pressure Drop, ft H_2O (kPa)	7.3 (21.8)	2.5 (7.5)	4.7 (14.0)	1.4 (4.2)

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 45 Capacities, chilled water models, CR034RC

	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	50°F (10°C) EWT 10°F (5.6°C) Water Rise	50°F (10°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)	126,132 (37.0)	116,367 (34.1)	114,199 (33.5)	104,584 (30.7)
Sensible BTU/H (kW)	126,132 (37.0)	116,367 (34.1)	114,199 (33.5)	104,584 (30.7)
Flow Rate, GPM (l/s)	25.3 (1.6)	16.7 (1.1)	22.9 (1.4)	15.0 (0.9)
Pressure Drop, ft H_2O (kPa)	27.5 (82.0)	12.4 (37.0)	22.5 (66.9)	10.0 (29.8)
100ºF DB, 69.5ºF WB (37.8ºC DB, 20.8ºC WB) 20% RH				
Total BTU/H (kW)	114,087 (33.4)	104,039 (30.5)	102,075 (29.9)	92,150 (27.0)
Sensible BTU/H (kW)	114,087 (33.4)	104,039 (30.5)	102,075 (29.9)	92,150 (27.0)
Flow Rate, GPM (l/s)	22.9 (1.4)	14.9 (0.9)	20.5 (1.3)	13.2 (0.8)
Pressure Drop, ft H_2O (kPa)	22.8 (67.9)	10.1 (30.0)	18.2 (54.1)	7.9 (23.5)
95ºF DB, 67.9ºF WB (35ºC DB, 19.9ºC WB) 23% RH				
Total BTU/H (kW)	101,878 (29.9)	91,465 (26.8)	89,775 (26.3)	79,420 (23.3)
Sensible BTU/H (kW)	101,878 (29.9)	91,465 (26.8)	89,775 (26.3)	79,420 (23.3)
Flow Rate, GPM (l/s)	20.4 (1.3)	13.1 (0.8)	18.0 (1.1)	11.4 (0.7)
Pressure Drop, ft H_2O (kPa)	18.4 (54.9)	7.9 (23.6)	14.3 (42.5)	6.0 (17.8)
90ºF DB, 66.2ºF WB (32.2ºC DB, 19.0ºC WB) 27% RH				
Total BTU/H (kW)	89,479 (26.2)	78,548 (23.0)	77,252 (22.6)	66,253 19.4)
Sensible BTU/H (kW)	89,479 (26.2)	78,548 (23.0)	77,252 (22.6)	66,253 (19.4)
Flow Rate, GPM (l/s)	18.0 (1.1)	11.3 (0.7)	15.5 (1.0)	9.5 (0.6)
Pressure Drop, ft H_2O (kPa)	14.4 (43.0)	6.0 (17.8)	10.8 (32.1)	4.3 (12.7)
85ºF DB, 64.5ºF WB (29.4ºC DB, 18.1ºC WB) 31% RH				
Total BTU/H (kW)	76,836 (22.5)	65,182 (19.1)	64,455 (18.9)	52,668 (15.4)
Sensible BTU/H (kW)	76,836 (22.5)	65,182 (19.1)	64,455 (18.9)	52,668 (15.4)
Flow Rate, GPM (l/s)	15.4 (1.0)	9.4 (0.6)	13.0 (0.8)	7.6 (0.5)
Pressure Drop, ft H_2O (kPa)	10.8 (32.3)	4.2 (12.5)	7.7 (22.9)	2.8 (8.3)
80ºF DB, 62.8ºF WB (26.7ºC DB, 17.1ºC WB) 37% RH				
Total BTU/H (kW)	63,894 (18.7)	51,310 (15.0)	51,219 (15.0)	39,563 (11.6)
Sensible BTU/H (kW)	63,894 (18.7)	51,310 (15.0)	51,219 (15.0)	39,563 (11.6)
Flow Rate, GPM (l/s)	12.9 (0.8)	7.4 (0.5)	10.3 (0.7)	5.7 (0.4)
Pressure Drop, ft H_2O (kPa)	7.7 (22.9)	2.7 (7.9)	5.0 (14.9)	1.5 (4.5)

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.

7.3 Physical Data—600mm (24in.) Units

Table 46 Physical data—Chilled water, 600mm (24in.) wide models

	40kW Models
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)	459.0 (2.33)
Electric Reheat Single Stage	
Capacity, BTU/H (kW)	**460V:** 20,472 (6.0) **208V:** 16,719 (4.9)
Steam Generating Humidifier	
Capacity, lb/hr (kg/hr)	5.0 (2.3)
Capacity, kW	1.79
Condensate Pump - Dual Float Type	
Capacity, GPM (l/m)	6.0 (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)
Motorized Ball Valve	
Maximum Allowable Pressure	373 psi (2572)
Maximum Close-Off Pressure	200 psi ()

7.4 Physical Data—300mm (12in.) Units

Table 47 Physical data—Chilled water 300mm (12in.) wide models

	30 kW Model	34kW Model
Fan Data		
Total Airflow, CFM (m^3/h)	2747 (4638)	3150 (5350)
Total Fan Motor, hp (kW)	1.1 (0.85)	1.4 (1.02)
Number of Fans	5	6
Evaporator Coil		
Face Area, ft^2 (m^2)	7.1 (0.66)	7.94 (0.74)
Rows	3	3
Face Velocity, FPM (m/s)	387 (1.96)	397 (2.01)
Condensate Pump - Dual Float Type		
Capacity, GPM (l/m)	1 (3.8)	
Filter Section - Washable Type		
MERV 1		
Quantity	2	
Nominal Size, in (mm)	36.6 x 9.2 x 0.5 (929 x 233 x 13)	41.0 x 9.2 x 0.5 (1040x 233 x 13)
Effective Surface Area - ft^2 (m^2)	2.0 (0.18)	2.21 (0.21)
Motorized Ball Valve		
Maximum Allowable Pressure	373 psi (2572)	
Maximum Close-Off Pressure	200 psi ()	

7.5 Operating Limits for Chilled Water Units

Table 48 Operating limits—Chilled water, 600mm (24in.) wide models

Models	Maximum Water Pressure psi (kPa)	Maximum Close-Off Pressure psi (kPa)	Minimum Entering Water Temperature, °F (°C)
			Design Condition
CR040RC (chilled water)	373 (2572)	200 (1379)	45 (7.2)

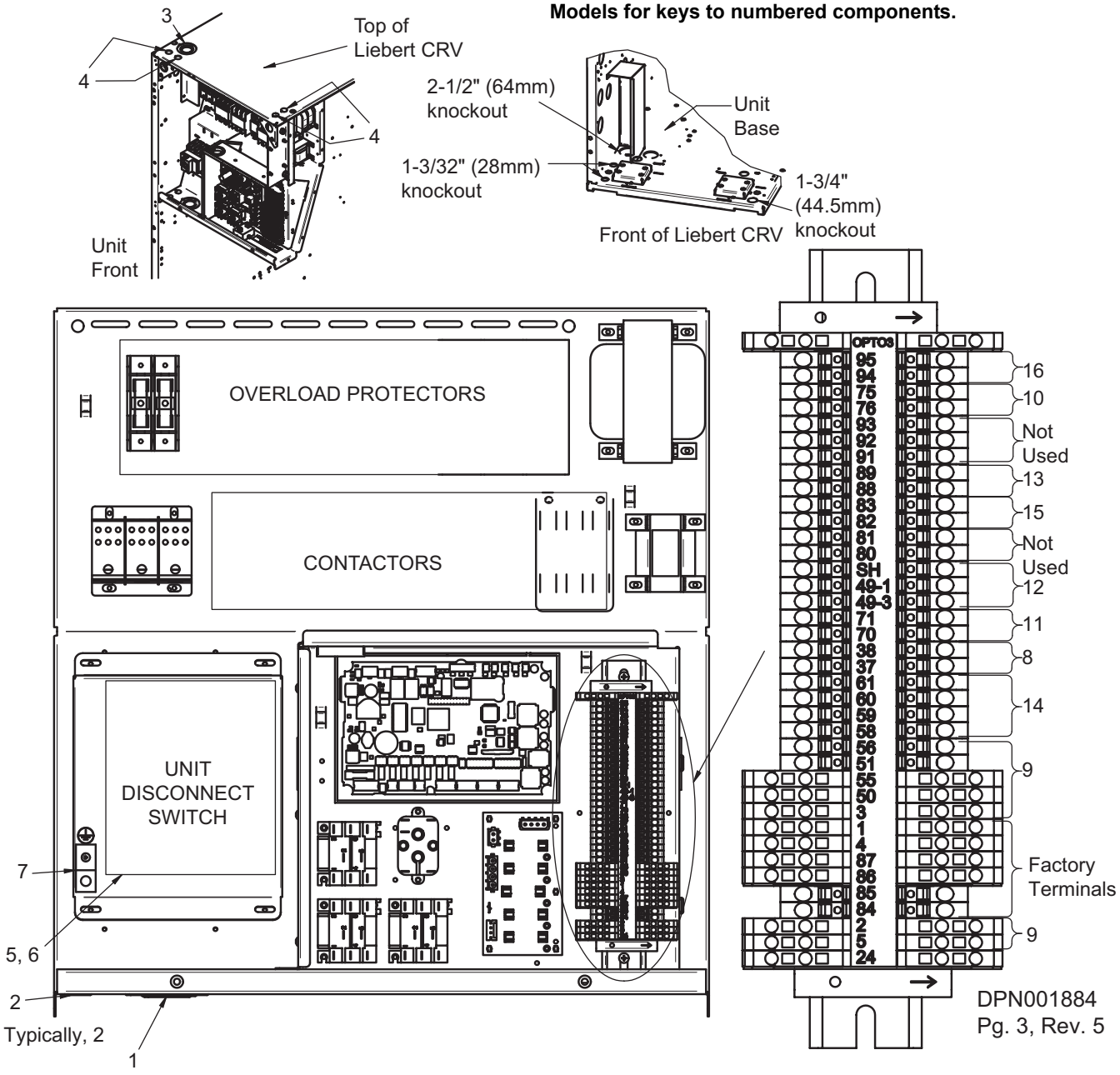
7.6 Electrical Data—600mm (24in.) Units

Table 49 Electrical data—Chilled water, 600mm (24in.) wide models

Voltage	CR040RC	
	460/3/60	208/3/60
Dehumidification, With or Without Humidifier, Reheat, Condensate Pump		
FLA	12.2	24.9
WSA	15.3	31.1
OPD	15	35
Dehumidification, Condensate Pump and Humidifier; NO Reheat		
FLA	8.4	16.7
WSA	10.5	20.9
OPD	15	25
Dehumidification and Condensate Pump; NO Reheat, NO Humidifier		
FLA	4.7	8.3
WSA	5.1	9.1
OPD	15	15
Dehumidification and Reheat; NO Condensate Pump, NO Humidifier		
FLA	11.0	22.6
WSA	13.8	28.3
OPD	15	30
Dehumidification; NO Condensate Pump, NO Reheat, NO Humidifier		
FLA	3.5	6.0
WSA	3.9	6.8
OPD	15	15

Figure 44 Electrical field-connection locations

Refer to 7.6.1 - Electrical Connections—Standard Features, 600mm (24in.) Wide Models and 7.6.2 - Electrical Connections—Optional Features, 600mm (24in.) Wide Models for keys to numbered components.



7.6.1 Electrical Connections—Standard Features, 600mm (24in.) Wide Models

Source: DPN001884, Rev. 5, Pg. 1

1. **High-voltage connection through the bottom of the electric panel**—1-3/8" (34.9mm), 1-3/4" (44.5mm) and 2-1/2" (64mm) diameter concentric knockout.
2. **Low-voltage connection through the bottom of the electric panel**—Two knockouts, each 7/8" (22mm) diameter.
3. **High-voltage connection through the top of the unit**—1-3/8" (34.9mm), 1-3/4" (44.5mm) and 2-1/2" (64mm) diameter concentric knockout.
4. **Low-voltage connection through the top of the unit**—Four knockouts, each 7/8" (22mm) diameter.
5. **Three-phase electrical service**—Connect to terminals on disconnect switch. Three-phase service not by Emerson. Refer to **7.6.3 - Important Note for 460V-Rated Liebert CRV Units (CR******A)**.
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 and 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 and 50, Terminals 2 and 51, Terminals 5 and 55, or Terminals 3 and 56. Use field-supplied Class 1 wiring. Terminal 3 and 56 are used for humidifier alarm when a humidifier is installed. The remaining terminals are available for customer alarm inputs, such as smoke sensors and building fire alarms.
10. **Common alarm**—On any alarm, normally open dry contact is closed across Terminals 75 and 76 for remote indication. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
11. **Heat rejection interlock**—On any call for compressor operation, normally open dry contact is closed across Terminals 70 and 71 to heat rejection equipment. 1A, 24VAC maximum load. Use field-supplied, Class 1 wiring.
12. **CANbus Connector**—Terminal block with Terminals 49-1 (CAN-H) and 49-3 (CAN-L) + SH (shield connection). The terminals are used to connect the CANbus communication cable (provided by others) from the indoor unit to the Liebert MC, Premium model.

    CANbus Cable—CANbus cable provided by others to connect to the outdoor condenser. Cable must meet the following specifications:

    - Conductors: 22-18AWG stranded tinned copper
    - Twisted Pair (minimum 8 twists per foot)
    - Braided shield or foil shield with drain wire
    - Low Capacitance: 15pf/ft or less
    - UL approved temperature rated to 75°C
    - UL approved voltage rated to 300V
    - UV- and moisture-resistant if not provided in conduit
    - Plenum rated:NEC type CMP (if required by national or local codes)

7.6.2 Electrical Connections—Optional Features, 600mm (24in.) Wide Models

Source: DPN001884, Rev. 5, Pg. 1

13. **Condensate pump high water alarm (available when optional pump is installed)**—On pump high-water indication, normally open dry contact is closed across Terminals 88 and 89 for remote indication. 1A, 24VAC maximum load. Use field-supplied, Class 1 wiring.
14. **Liebert Liqui-tect® shutdown and dry contact (available when optional Liebert Liqui-tect sensor is installed)**—On Liebert Liqui-tect activation, normally open dry contact is closed across Terminals 58 and 59 for remote indication. The Liebert Liqui-tect sensor notifies the Liebert iCOM® of indication through Terminals 60 and 61. 1A, 24VAC maximum load. Use Class 1, field-supplied wiring.
15. **Reheat and humidifier lockout**—Remote 24VAC required at Terminals 82 and 83 for lockout of reheat and humidifier.
16. **Additional Common Alarm**—On any alarm, one additional normally open dry contact is closed across Terminals 94 and 95 for remote indication. 1A, 24VAC maximum load. Use Class 1, field-supplied wiring.

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

7.6.3 Important Note for 460V-Rated Liebert CRV Units (CR******A)

The electronically commutated motors included in the Liebert CRV unit are suitable for connection to an electrical service providing input power to the unit with 300V or less line-to-ground potential only.

Acceptable unit input electrical service for 460V (480V) nominal units:

- 480V wye with solidly grounded neutral and 277V line-to-ground

Unacceptable unit input electrical service for 460V (480V) nominal units

- Wye with high-resistance (or impedance) ground
- Delta without ground or with floating ground
- Delta with corner ground
- Delta with grounded center tap

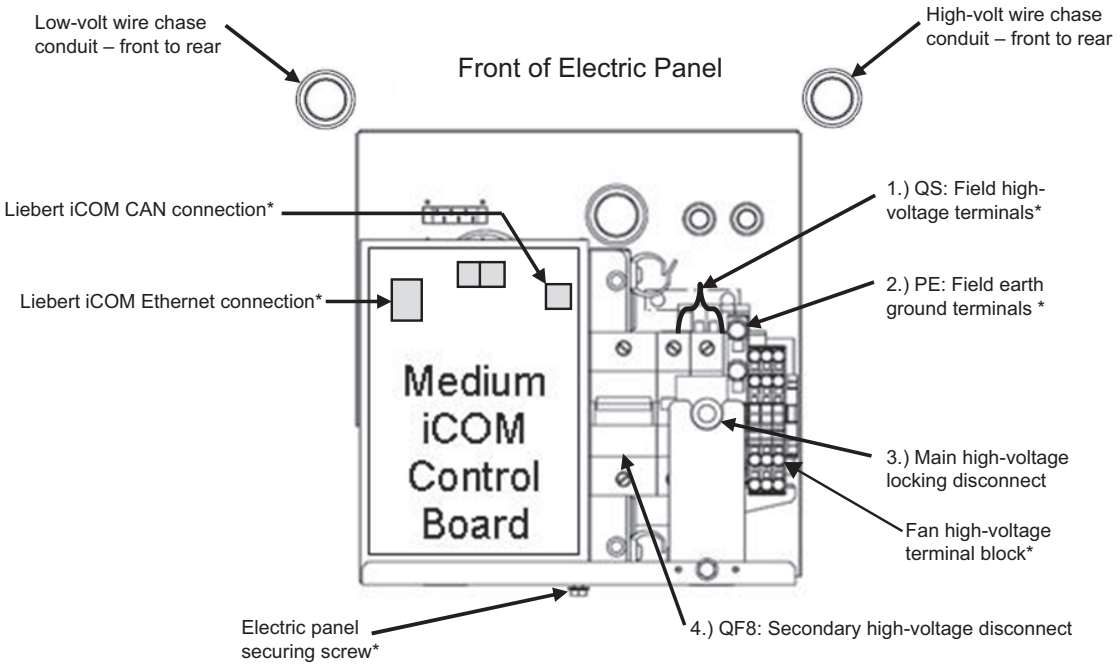
7.7 Electrical Data—300mm (12in.) Units

Table 50 Electrical data—Chilled water, 300mm (12in.) wide models

Input Power	CR030, 5-Fan Models			CR034, 6-Fan Models		
	FLA	WSA	OPD	FLA	WSA	OPD
208/230V-1ph-60Hz	6.3	6.6	15	7.5	7.8	15
240V-1ph-60Hz						
230V-1ph-60Hz						

* Control transformer can be retapped to provide 240-1ph-60Hz

Figure 45 Liebert CRV 300 Series electrical connections, front and rear of electric panel



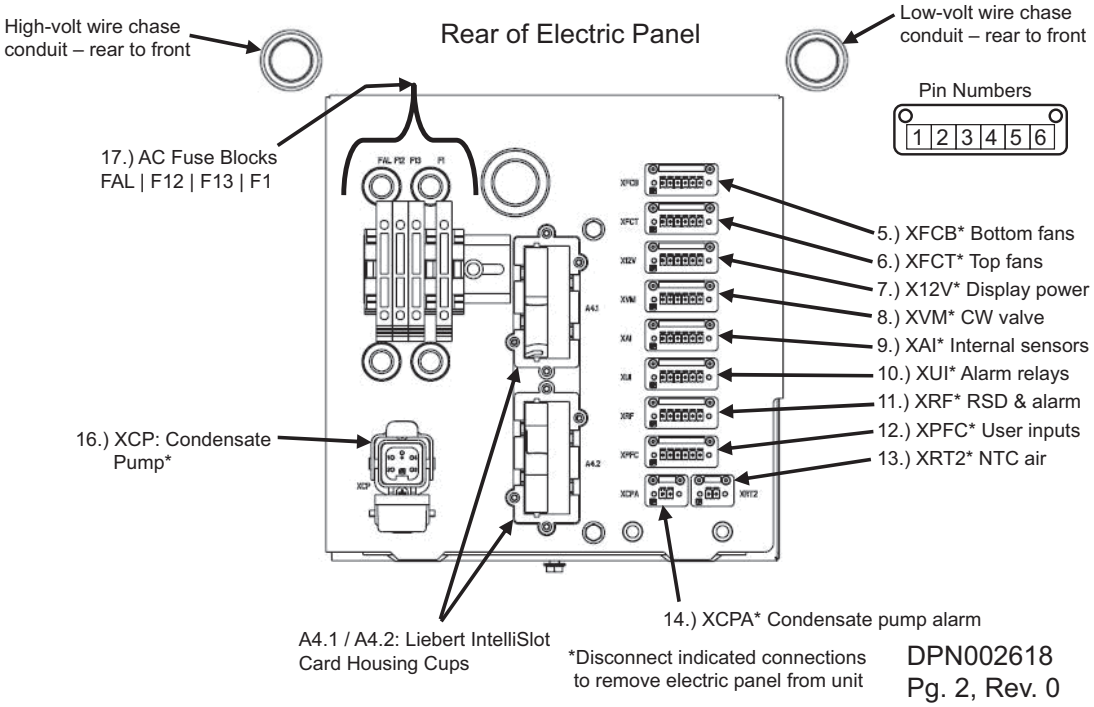
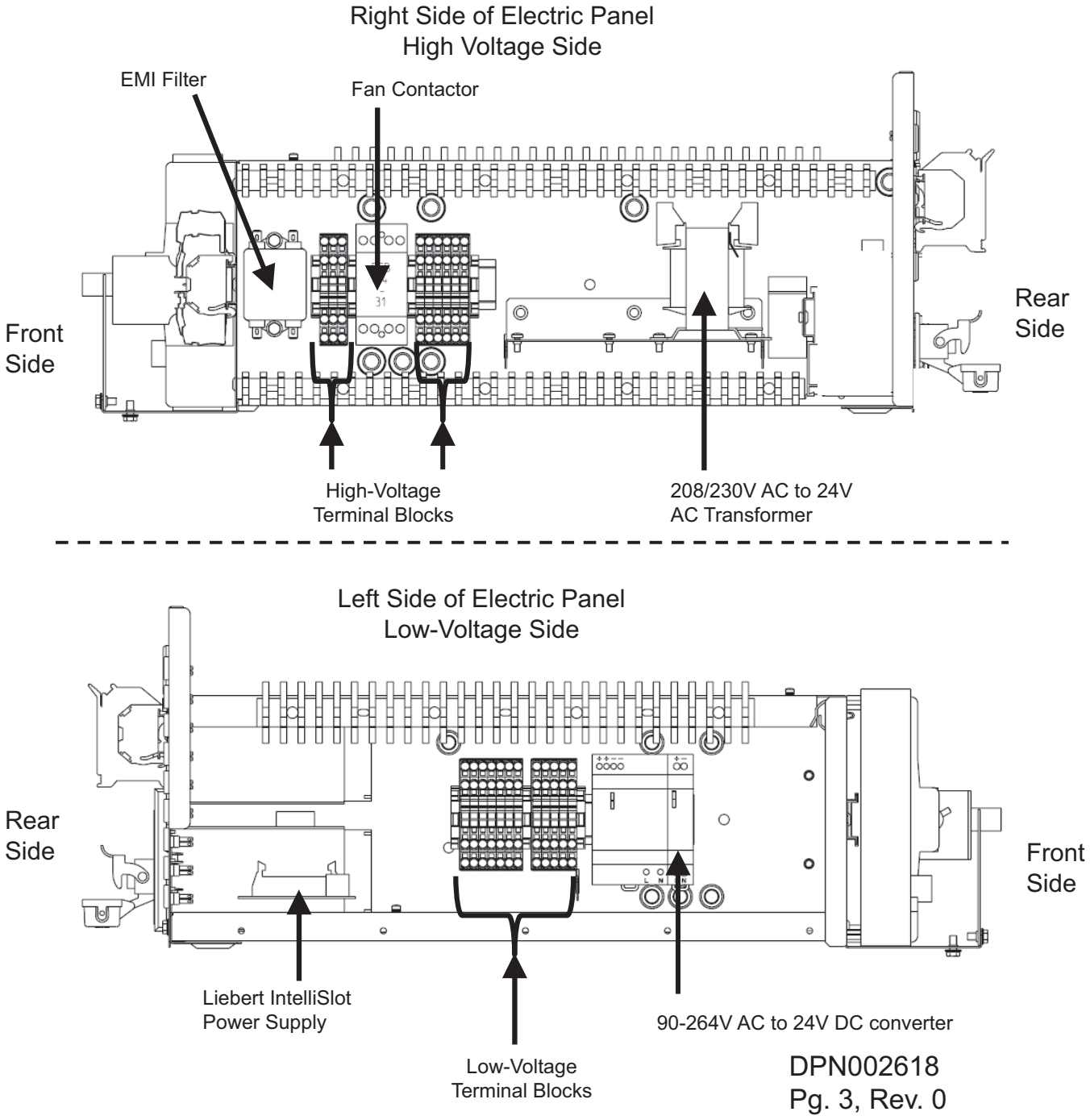


Figure 46 Liebert CRV 300 Series electrical connections, high-voltage and low-voltage



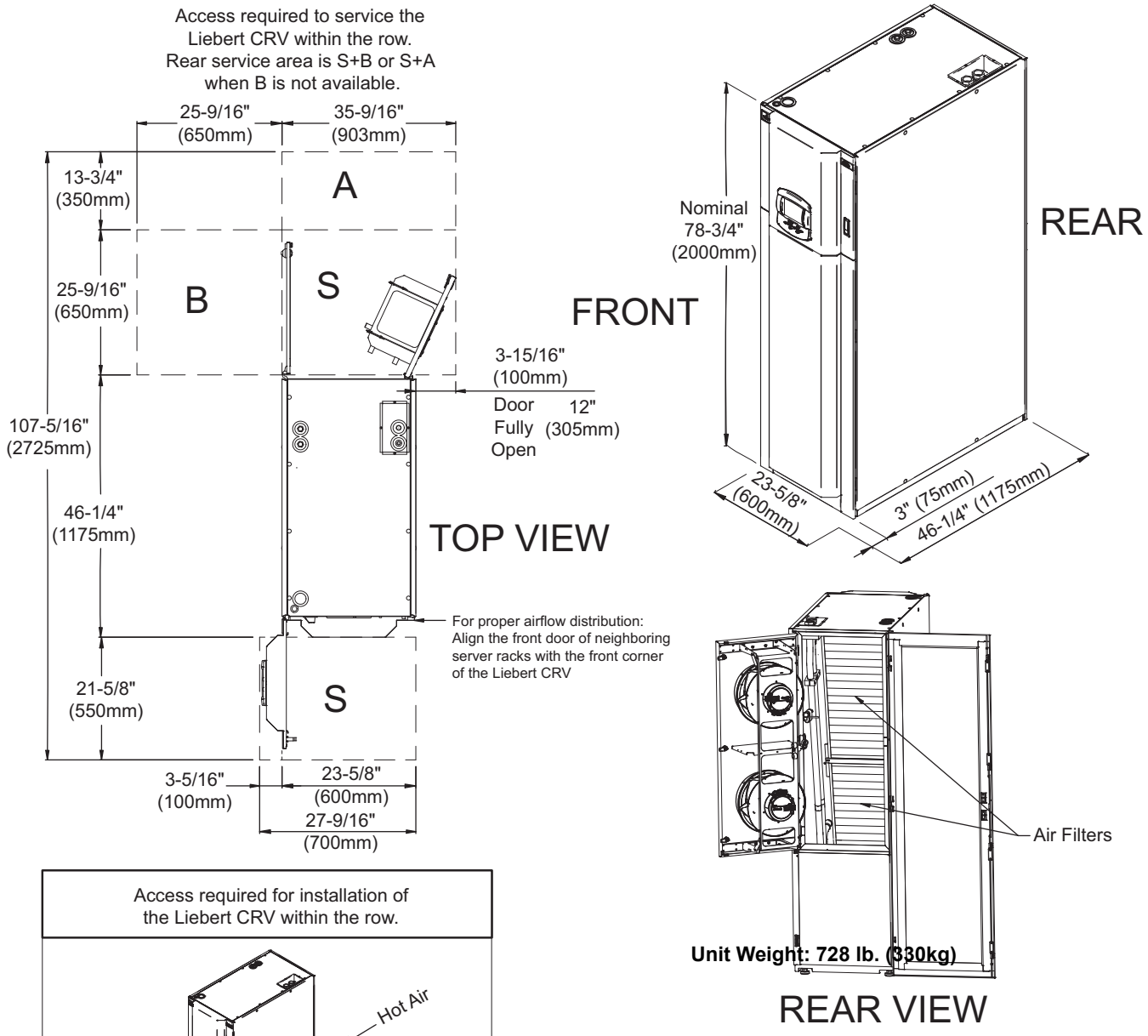
7.8 Electrical Connection Descriptions, 60Hz, 2-pole Liebert CRV 300 Series

Source: DPN2618, Rev. 0

1. **Single-phase high-voltage electrical service (QS)**—Connect to terminals on locking disconnect switch. Single-phase service not by Emerson.
2. **Earth Ground Connection (PE)**—Terminal for field-supplied earth grounding wire not by Emerson.
3. **Factory-Installed Main Locking Disconnect Switch**
4. **Secondary High-voltage Disconnect Switch (QF8)**—High-voltage feed to unit except for fan high-voltage feed.
5. **Control Board, Bottom Three Fans (XFCB)**—Fan speed control and fault communication
6. **Control Board, Top 2/3 Fans (XFCT)**—Fan speed control and fault communication
7. **Liebert iCOM® Display Power (X12V)**—(not used)
8. **Chilled Water Valve Modulation (XVM)** – 3-way valve power and actuator control
9. **Internal Sensors (XAI)**
   - Pins 1 and 2: Supply water temperature sensor
   - Pins 3 and 4: Filter clog alarm
   - Pins 5 and 6: Internal leak detection sensor
10. **Remote Input Alarms (XUI)** – Warning and General alarm relays
    - **Warning Relay** (Pins 1 and 2 jumpered, 3 and 4 jumpered)
      - Pin 1: NC
      - Pin 2: COM
      - Pin 3: NO
    - **General Alarm Relay**
      - Pin 4: NC
      - Pin 5: COM (no wires connected)
      - Pin 6: NO (no wires connected)
11. **Remote Shutdown and Alarm (XRF)**
    - **Remote On/Off** (potential free) (pins 1 and 2 jumpered, 3 and 4 jumpered)
      - Pin 1: 24VAC
      - Pin 2: remote On/Off
    - **High Temp / Smoke Sensor** (potential free)
      - Pin 3: 24VAC
      - Pin 4: alarm
12. **Two Customer Inputs (XPFC)** – Two customer alarm inputs.
    - **User Input 1** (potential free)
      - Pin 1: 24VAC
      - Pin 2: Input 1
    - **User Input 2** (potential free)
      - Pin 3: 24VAC
      - Pin 4: Input 2
13. **Supply Air NTC Temperature Sensor (XRT2)**
14. **Condensate Pump Alarm (XCPA)**
15. **Two Liebert IntelliSlot® Card Housings**
16. **Condensate Pump Single-Phase High-Voltage (XCP)**
17. **Fuse Blocks**
    - F12: High-voltage, condensate pump
    - F13: High-voltage, condensate pump
    - F1: 24VAC

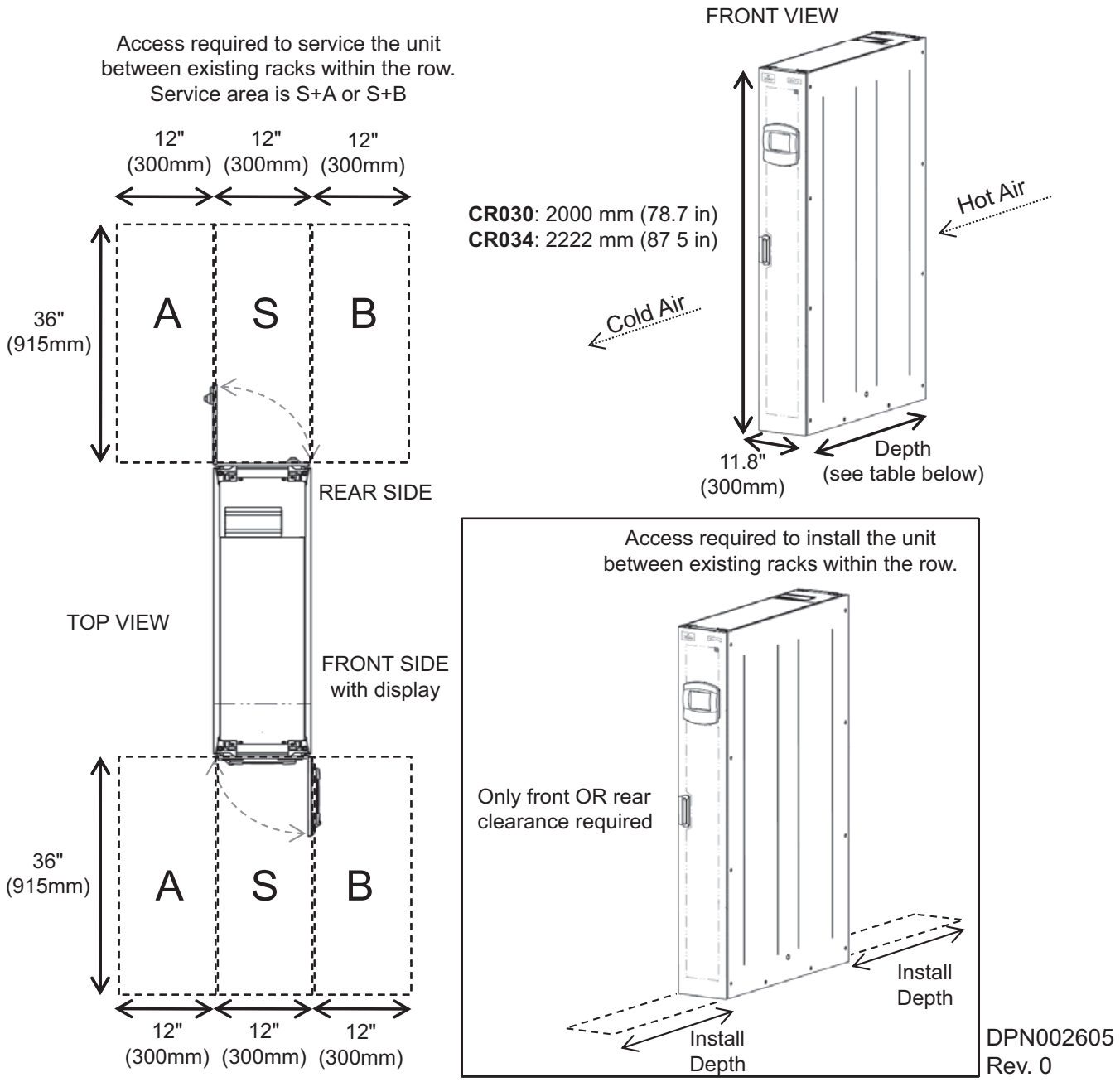
7.9 Dimensions—600mm (24in.) and 300mm (12in.) Liebert CRV Models

Figure 47 Cabinet and floor planning dimensions—Chilled water, 600mm (24 in.) wide models



DPN001791
Rev. 3

Figure 48 Dimensions and floor planning data, CR030 and CR034 chilled water models, 300mm (12in.) wide



Base Model	Height, in. (mm	Depth, in. (mm	Install Depth, in. (mm)	Dry Weight, ±5% lb (kg)
CR030R	78.7 (2,000)	43.3 (1,100)	49.2 (1,250)	365 (166)
CR0302	78.7 (2,000)	47.2 (1,200)	53.1 (1,350)	374 (170)
CR034R	87.5 (2,222)	43.3 (1,100)	49.2 (1,250)	405 (184)
CR0342	87.5 (2,222)	47.2 (1,200)	53.1 (1,350)	414 (188)

7.10 Piping—600mm (24in.) Units

Figure 49 Piping and electrical connections, chilled water models

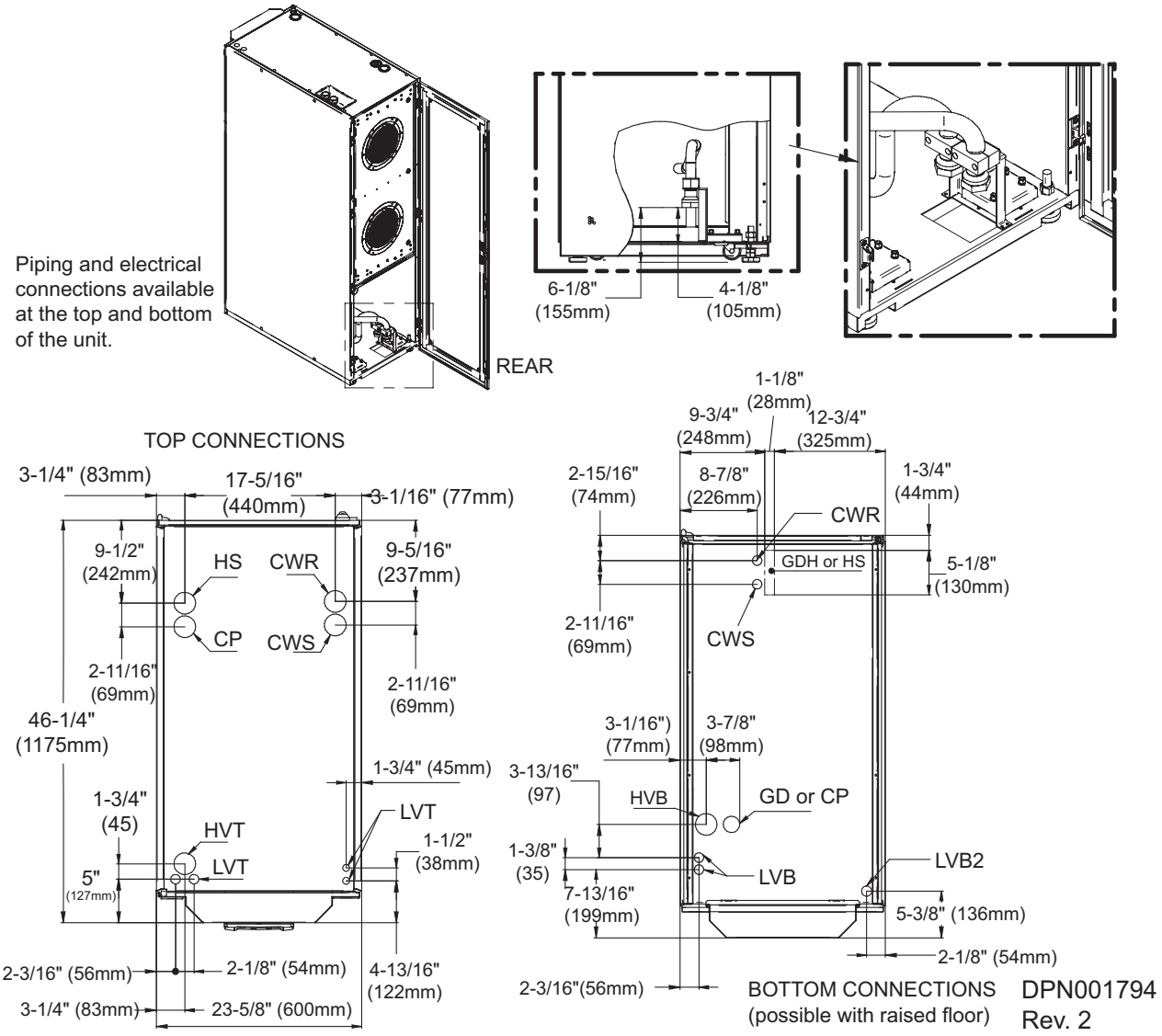
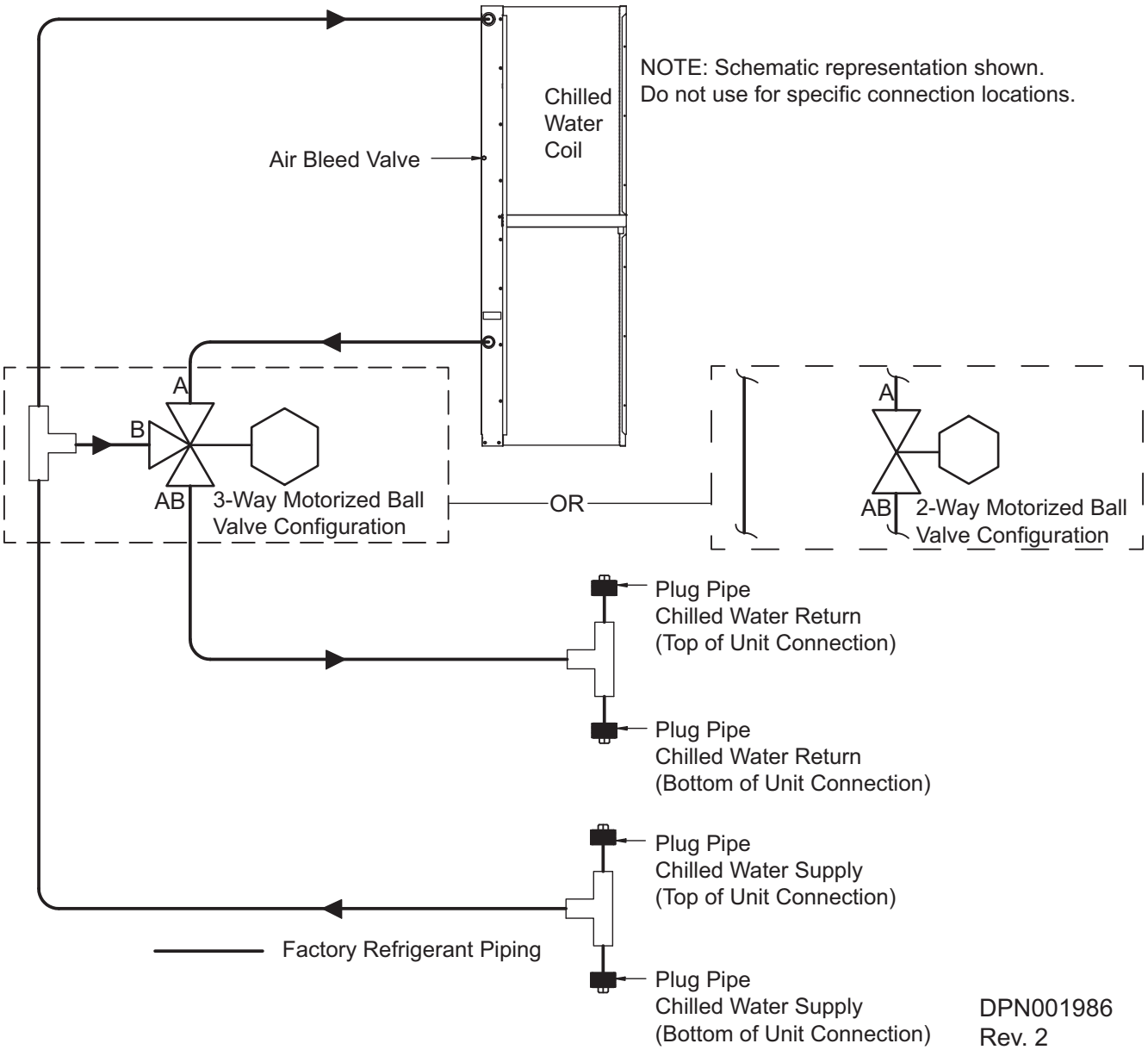


Table 51 Unit connections, chilled water models

Unit Connections		CR040C (60Hz)
CWS	Chilled Water Supply	1-1/4" FPT
CWR	Chilled Water Return	1-1/4" FPT
GD	Gravity Coil Pan Drain	1" MPT
GDH	Gravity Humidifier Drain	N/A
HS	Humidifier Supply	1/2" FPT (top connection), 1/4" Compression Fitting (bottom connection)
CP	Condensate Pump	1/2" FPT
HVT	High-Voltage Top Connection	Combination Knockout Hole Diameter 35mm (1-3/8"), 44.5mm (1-3/4") and 63.5mm (2-1/2")
HVB	High-Voltage Bottom Entrance (feed through the base of the unit)	Knockout Hole Diameter 63.5mm (2-1/2")
LVT	Low Voltage Top Connection	Knockout Hole Diameter 22mm (7/8") 4 places
LVB	Low Voltage Bottom Entrance (feed through the base of the unit)	Knockout Hole Diameter 27.8mm (1-3/32") 2 places
LVB2	Low Voltage Bottom Entrance (feed through the base of the unit)	Knockout Hole Diameter 44.5mm (1-3/4") 1 place

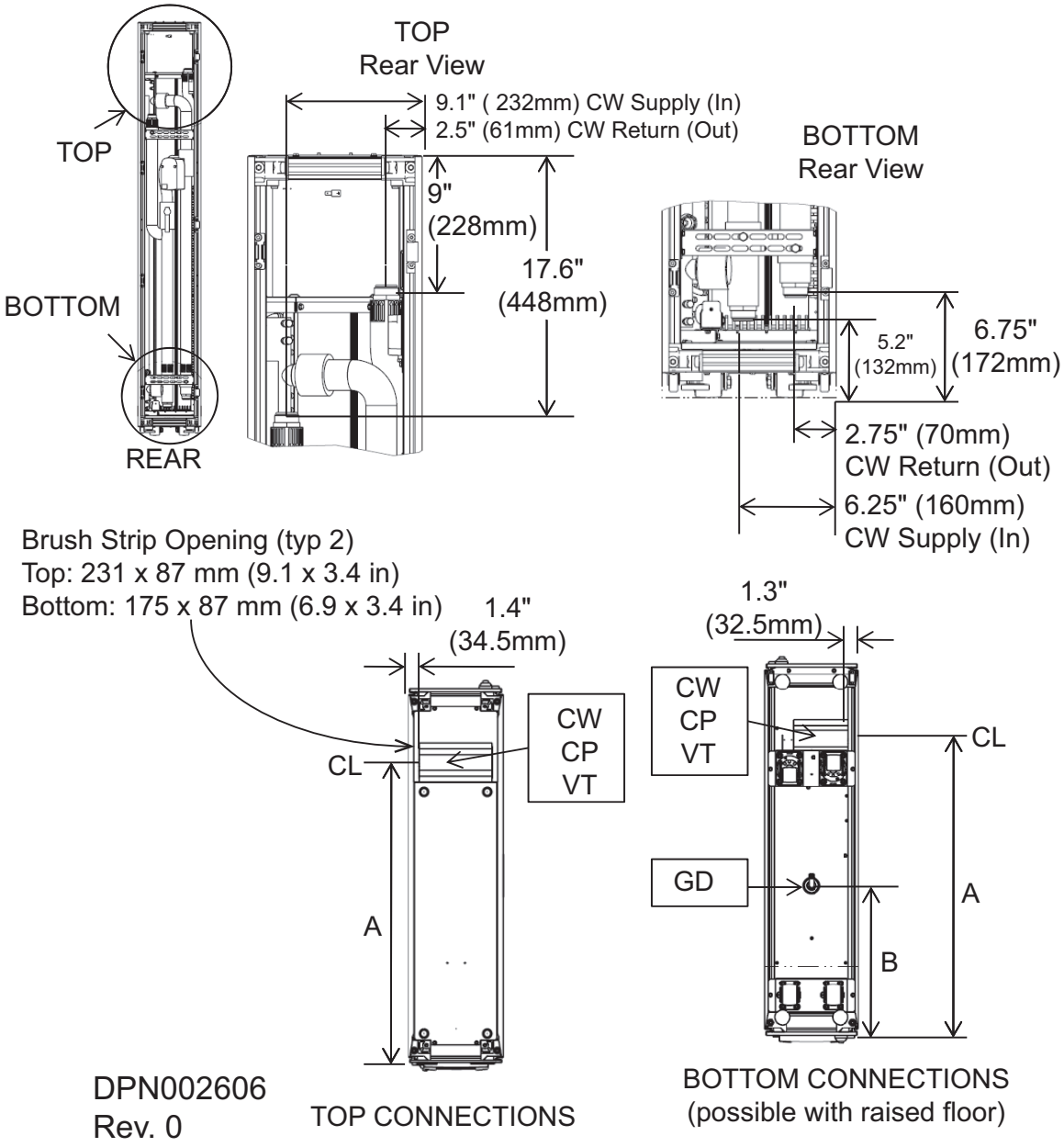
Source DPN001794, Rev. 2

Figure 50 General arrangement diagram—chilled water models CR040, 600mm (24) wide models



7.11 Piping—300mm (12in.) Units

Figure 51 Connections, CR030 chilled water models

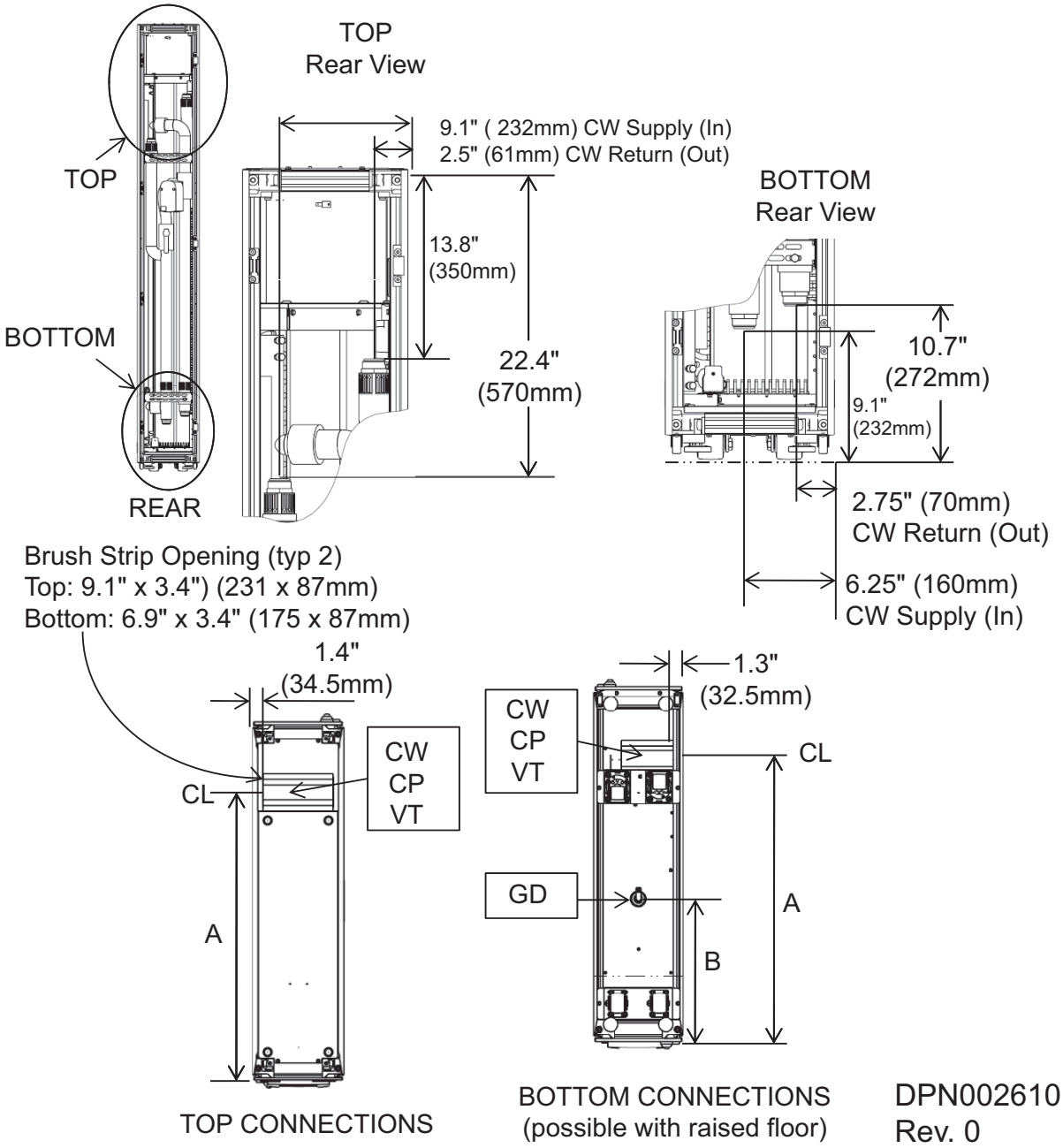


CRV 34 Models	Frame Depth, in (mm)	A, in (mm)	B, in (mm)
CR030R	43.3 (1,100)	33.9 (860)	15.0 (382)
CR0302	47.2 (1200)	37.8 (960)	19.0 (482)

Table 52 Unit connections, CR030 models

CW	Chilled Water Supply and Return	Internal pipe thread (female) NPT 1-1/4 inch union (with included adapter)
		External pipe thread (male) ISO 228 G 1-1/4 inch union, BSPP (British Standard Parallel Pipe)
		To hard-pipe, cut off the union connection and braze
CP	Condensate Pump	Hose barb for 1/4 inch (6.5mm) OD hose
GD	Gravity Drain	Hose barb for 5/8 inch (16mm) OD hose. Field-remove condensate pump; install drain trap below unit.
VT	High- and Low-Voltage Entrances	For bottom routing, feed through base up to top electric panel

Figure 52 Connections, CR034 chilled water models

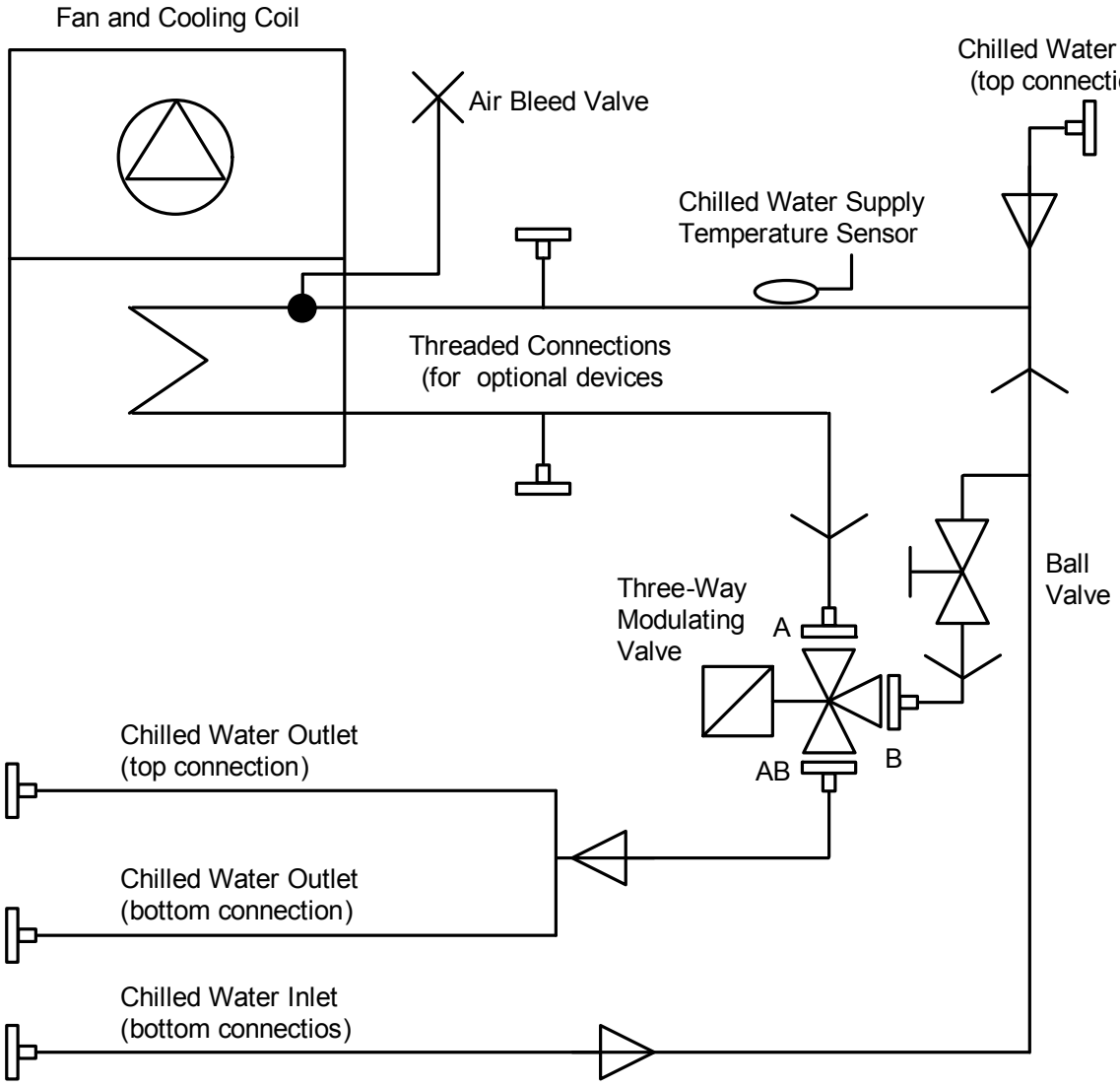


CRV 34 Models	Frame Depth, in (mm)	A, in (mm)	B, in (mm)
CR034R	43.3 (1,100)	33.9 (860)	15.0 (382)
CR0342	47.2 (1200)	37.8 (960)	19.0 (482)

Table 53 Unit connections, CR034 models

CW	Chilled Water Supply and Return	Internal pipe thread (female) NPT 1-1/4 inch union (with included adapter)
		External pipe thread (male) ISO 228 G 1-1/4 inch union, BSPP (British Standard Parallel Pipe)
		To hard-pipe, cut off the union connection and braze
CP	Condensate Pump	Hose barb for 1/4 inch (6.5mm) OD hose
GD	Gravity Drain	Hose barb for 5/8 inch (16mm) OD hose. Field-remove condensate pump; install drain trap below unit.
VT	High- and Low-Voltage Entrances	For bottom routing, feed through base up to top electric panel

Figure 53 General arrangement CR030 and CR034 chilled water models 300mm (12in.)



7.12 Sound Data—600mm (24in.) and 300mm (12in.) Chilled Water Systems

Tables 54 and **55** 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. The sound data is without the Low Sound Package compressor jacket and sound deadening panel insulation installed.

Sound power is an absolute measurement that can be used for comparisons. Sound pressure values can be used for comparisons only when all sound measurement parameters match exactly.

Table 54 Sound data—Model CR040RW, 600mm (24in.) chilled water

2 Fans with Filter			Sound Power Level (PWL)										Sound Pressure Level (SPL)
	Airflow		Octave Band Frequency (Hz)									A-Scale Weighted dB (A)	At Suction side, 2m distance, free field conditions (2m, f.f, dBA)
Fan Speed %	SCFM	m³/h	31.5 dB	63 dB	125 dB	250 dB	500 dB	1000 dB	2000 dB	4000 dB	8000 dB		
100	3325	5650	86.4	78.1	82.4	84.6	79.2	75	76.4	70.9	63.8	82.8	71.6
75	2708	4600	80.8	72.5	76.8	79	73.6	69.4	70.8	65.3	58.2	77.2	66.0
50	1972	3350	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

Table 55 Sound data—Model CR030RW, 300mm (12in.) chilled water

Five Fans Without Filter			Sound Power Level (PWL)										Sound Pressure Level (SPL)
	Airflow		Octave Band Frequency (Hz)									A-Scale Weighted dB (A)	At Suction side, 2 m distance, free field conditions (2m, f.f, dBA)
Fan Speed %	SCFM	m³/h	31.5 dB	63 dB	125 dB	250 dB	500 dB	1000 dB	2000 dB	4000 dB	8000 dB		
100	3012	5118	65.4	71.9	76.6	86.6	91.0	92.8	91.4	87.3	79.4	91.4	74.9
90	2663	4525	64.4	72.1	77.2	85.9	90.8	92.4	91.0	86.8	78.6	90.9	74.2
70	1946	3306	60.4	64.1	74.0	83.0	85.7	87.4	85.5	80.9	71.5	84.4	68.1
50	1285	2184	49.1	50.9	70.2	72.2	76.5	77.7	75.4	69.2	57.9	74.5	57.9
30	690	1172	29.1	40.6	54.8	58.8	63.1	63.5	59.0	48.9	36.9	60.3	43.8

7.13 Standard Features—600mm (24in.) Chilled Water Systems

Source: DPN001906, Revision 2

Fan—The unit is equipped with two plug fans: direct driven 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®—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 three-level password protection system. Unit-to-Unit communication with other Liebert CRV's 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 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 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 a location to remotely shut down the unit.

Common Alarm Contact—Provides 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 half-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 Knürr 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 molded 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.

65,000 AMP Short Circuit Current Rating (SCCR)—The electrical panel provides a 65k amp SCCR

Chilled Water (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 aluminium 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 three-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 Three-Way Modulating Valve—A two-way or three-way modulating valve controls the chilled water flow passing through the cooling coil. The Liebert iCOM® control manages the valve actuator movement to provide the desired amount of cooling for various entering water temperatures. Cooling capacity is regulated by bypassing chilled water around the coil. The maximum differential pressure across the closed valve is 25.4 PSI (175 kPa). Maximum system pressure is 230 PSI (1586kPa).

7.14 600mm (24in.) Chilled Water Optional Features

Source: DPN001909, Revision 3

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 back-flow 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.

Two-Way Modulating Valve—A two-way modulating valve controls the chilled water flow passing through the cooling coil. The Liebert iCOM control manages the valve actuator movement 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).

Liebert IntelliSlot® Unity-DP—Provides ground fault isolated connectivity for unit monitoring and management. Supported management interfaces include:

- Emerson Protocol for Trellis™, Liebert SiteScan™ and Liebert Nform™
- Embedded LIFE™ Technology for Remote Service Delivery
- SNMP (v1/v2c/v3) for Network Management Systems
- HTTP/HTTPS for Web page viewing
- SMTP for e-mail
- SMS for mobile messaging
- Modbus RTU—Modbus Remote Terminal Unit (RTU) communication protocol for Building Management Systems over an RS-485 serial network (also called Modbus RTU RS-485)
- Modbus TCP—Modbus Transmission Control Protocol for Building Management Systems over an Internet or LAN network
- BACnet IP—BACnet over Internet Protocol for Building Management Systems over a Internet or LAN network
- BACnet MSTP—BACnet Master-Slave/Token-Passing (MSTP) communication protocol over an RS-485 serial network (also called BACnet MSTP RS-485)

Liebert IntelliSlot Sitelink-E® Card (IS-485EXI)—Provides ground fault isolated connection to a Liebert SiteLink-E for monitoring and management. Compatible with Liebert SiteScan® Web 4.0 or newer version.

Filter—The optional filters are two deep-pleated 4-inch filters 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 24V signal.

One (1) 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—A solid-state water sensor hermetically sealed to keep out dust and dirt. The alarm system is activated when the sensor detects the presence of moisture.

7.15 Standard Features—300mm (12in.) Chilled Water Systems

Source: DPN002607, Rev. 0

Chilled Water (CW) Cooling Coil—The 300 series evaporator coil is 3 rows deep with the 30kW model having 7.1ft² (0.66m²) of face area, and the 34kW model having 7.9ft² (0.74m²) of face area. It is constructed of copper tubes and hydrophilic coated aluminium fins. The hydrophilic coating provides superior water carryover resistance. A powder-coated sheet metal condensate drain pan is provided.

Chilled Water System—The water circuit includes a three-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 or restricting the flow depending on the position of the manually adjustable ball valve. The modulating valve springs closed on loss of power (can be field-adjusted to spring open).

Fans—The 30kW model is equipped with five direct-drive propeller blade fans and the 34kW model has six fans. Each fan is powered by an Electronically Commutated DC motor; commonly referred to as EC fans. The fan speed is variable from 30-100% and automatically regulated by the Liebert iCOM control through all modes of operation; independent of cooling valve modulation. Each fan has a dedicated motor, fault monitoring circuitry, and speed controller which provides for a level of redundancy. The fans draw air through the coil and are accessible through the front door of the unit. In the event of a fan failure, each fan can be individually replaced without removing power from all the functioning fans.

Back-Draft Fan Damper—Each fan is equipped with a spring loaded back-draft damper. When a fan stops rotating during a Liebert iCOM controlled Off condition or fan failure, the dampers will automatically close to prevent cold air from short-circuiting past the inoperative fan. The dampers automatically open when fan operation is restored.

Three-Way Modulating Valve; Field-Adjustable Two-Way—A three-way modulating valve controls the chilled water flow passing through the cooling coil. A manually adjustable, internally mounted ball valve can be adjusted to provide two-way valve functionality. The Liebert iCOM control manages the three-way valve actuator movement to provide the desired amount of cooling for various entering water temperatures. Cooling capacity is regulated by bypassing chilled water around the coil or stopping the flow depending on the ball valve position. During a power outage the valve will automatically close. The maximum close off pressure is 200 PSI (1379 kPa). Maximum system pressure is 145 PSI (1,000 kPa).

Liebert iCOM Control System—The Liebert CRV is controlled by the Liebert iCOM. 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 three-level password protection system. Unit-to-Unit communication with other Liebert CRV's 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 2T rack sensors are standard with each Liebert CRV. Up to ten 2T housings (20 temperature probes) can be connected to a Liebert CRV. One 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.

Condensate Pump With High Water Alarm—It has a capacity of 1 GPH (3.8 LPH) at 10 ft (3 m) head. Pump is complete with integral float switch, safety switch, pump, and motor assembly. The safety switch shall send a signal to the local alarm on high water detection and perform the selected operation (shut down the unit or alarm). The condensate pump can be field-removed and drain trap installed below the unit for gravity draining.

Water Detection Sensor, Internal—One solid-state water sensor with no moving parts shall be provided internal to the unit. The alarm system is activated when the sensor detects the presence of moisture.

Cabinet—The patented T-slot extruded aluminum frame is extremely strong yet light, making it easy to install the unit. The cabinet is mounted on casters for quick installation and is provided with levelling feet. Both doors have a powder-coated sheet metal frame to protect against corrosion with hexagonal perforations leaving 83 percent of the door open to airflow for efficient cooling. Both doors feature a four-point latch, swing 170 degrees open and are removable. The powder coated steel side panels are secured using quarter-turn fasteners.

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 feed through the top and/or bottom of the unit.

Filter—The unit is equipped with two, half-inch thick filters rated MERV1 following ASHRAE 52.2, located within the cabinet and accessible from the rear of the unit. A filter clog alarm is included.

Locking Disconnect Switch—A circuit interrupter disrupts the flow of power to the unit. The electric panel dead-front cover can only be removed with the switch in the Off position. It is conveniently located behind the Liebert iCOM® display door for quick access.

5,000 AMP Short Circuit Current Rating (SCCR)—The electrical panel provides at least 5000A SCCR.

Swappable Electric Panel—This design attribute minimizes downtime of this high heat density local cooling unit by allowing the entire electric panel to be easily and quickly swapped out for off-site troubleshooting. All rear electric panel connections are poka-yoke.

7.16 300mm (12in.) Chilled Water Optional Features

Source: DPN002608, Rev. 0

Liebert IntelliSlot® Unity-DP—Provides ground fault isolated connectivity for unit monitoring and management. Supported management interfaces include:

- Emerson Protocol for Trellis™, Liebert SiteScan™ and Liebert Nform™
- Embedded LIFE™ Technology for Remote Service Delivery
- SNMP (v1/v2c/v3) for Network Management Systems
- HTTP/HTTPS for Web page viewing
- SMTP for e-mail
- SMS for mobile messaging
- Modbus RTU—Modbus Remote Terminal Unit (RTU) communication protocol for Building Management Systems over an RS-485 serial network (also called Modbus RTU RS-485)
- Modbus TCP—Modbus Transmission Control Protocol for Building Management Systems over an Internet or LAN network
- BACnet IP—BACnet over Internet Protocol for Building Management Systems over a Internet or LAN network
- BACnet MSTP—BACnet Master-Slave/Token-Passing (MSTP) communication protocol over an RS-485 serial network (also called BACnet MSTP RS-485)

Liebert IntelliSlot SiteLink-E® Card (IS-485EXI)—Provides ground fault isolated connection to a Liebert SiteLink-E for monitoring and management. Compatible with Liebert SiteScan® Web 4.0 or newer version.

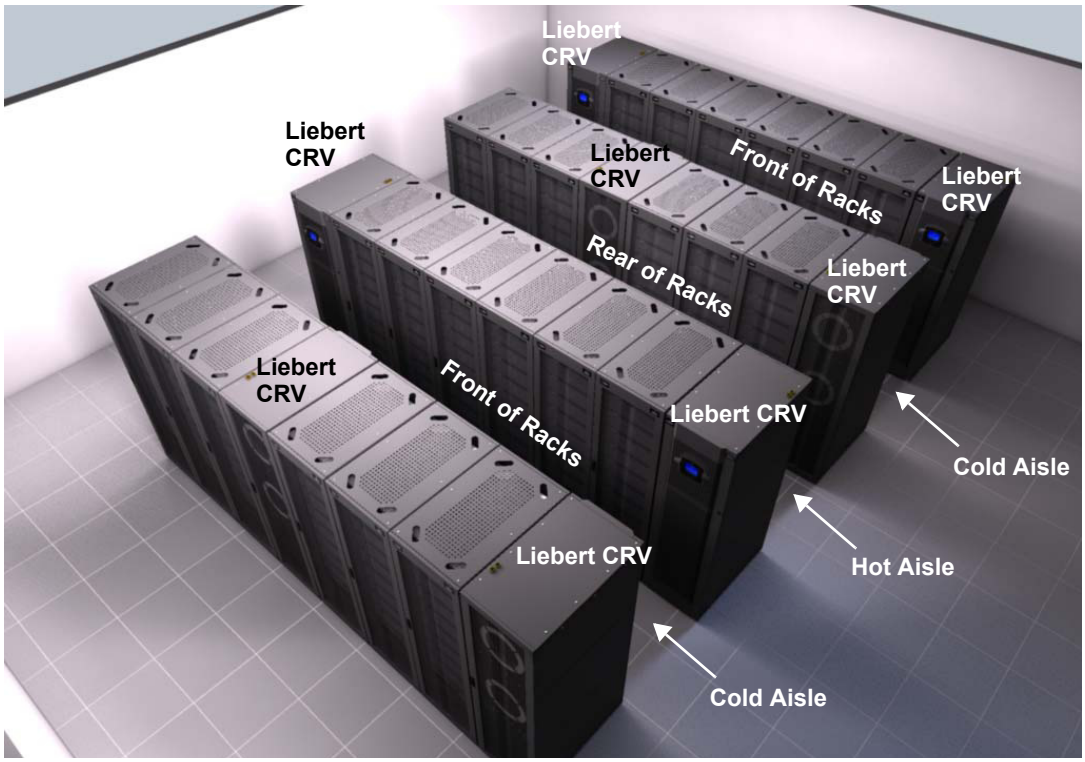
Liebert Liqui-tect® Sensor—This solid-state water sensor has no moving parts and is hermetically sealed to keep out dust and dirt. The alarm system is activated when the sensor detects the presence of moisture. The alarm can be sent to the Liebert CRV, but the Liebert Liqui-tect sensor must be powered independently (optional separate power source available through Emerson).

Frame Depth—The Liebert CRV 300 series is available in two frames; 1,100mm (43.3in) and 1,200mm (47.2in). This allows the Liebert CRV to match the depth of neighboring IT equipment racks to improve the aesthetics of the row. There are no performance differences between the two frame depths.

APPENDIX A - 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. The unit is compatible with all forms of aisle containment, but the control algorithms have been optimized for cold aisle containment with SmartAisle™ from Emerson Network Power®.

Figure 54 Example of high-density installation with alternating cold and hot aisles



A.1 UNIT-TO-UNIT (U2U)—COORDINATED COOLING OPERATION

The Liebert iCOM controls permit networking the Liebert CRV's and coordinating the units' operation to improve cooling and efficiency. In U2U mode, the networked Liebert CRV's share data from the standard temperature sensors to increase or reduce cooling. For further information, see:

- **3.10 - Standard Features—600mm (24in.) Air-Cooled Systems**
- **Figure 37 - Piping connections, water/glycol-cooled models**
- **7.13 - Standard Features—600mm (24in.) Chilled Water Systems**
- **7.15 - Standard Features—300mm (12in.) Chilled Water Systems**

A.2 SMARTAISLE™ CONFIGURATION

The SmartAisle from Emerson Network Power® is an intelligent row-based system that integrates data center racks, power, row cooling, aisle containment, monitoring and control technologies into a complete data center layout.

A.2.1 Typical SmartAisle Components

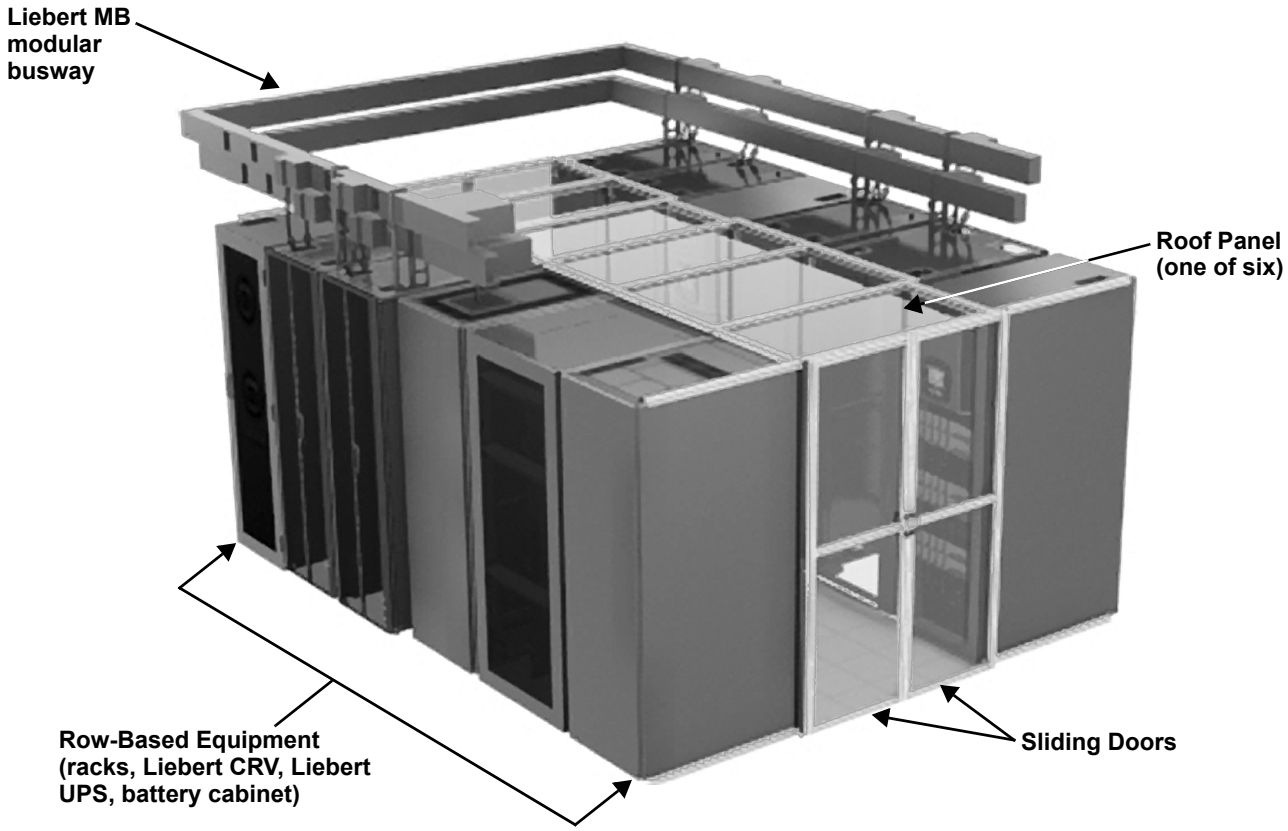
Each SmartAisle from Emerson is custom-designed, offering the most favorable layout for the installation. The design takes into account the equipment required, equipment sizes (with the heat load or power consumption), cooling equipment type (chilled water or water/glycol based) and whether cooling or power redundancy is desired.

Some typical components are:

Liebert APM™	DCF™ or DCM™ Cabinets
Liebert Battery Cabinets	Modular Containment
Liebert BDC™	Liebert MB™
Liebert CRV	Liebert PDU's

Depending on heat load and power requirements, there may be multiple Liebert Thermal Management units and multiple AC Power Protection and Distribution units.

Figure 55 SmartAisle™ installation example



A.3 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 defined hot and cold aisles: eliminate gaps between server racks and utilize blanking plates to fill open sections within the racks.
- Install the 2T rack temperature sensors on the front door of all equipment the Liebert CRV is cooling.
- Use walls or opposing racks to minimize the width of the hot and cold aisles; target 2-6 ft. (0.6 to 1.8m)

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

A.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 sample supply and return air temperatures.

When deploying multiple Liebert CRV's 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 (**Figure 56**). 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 as seen in **Figure 57**.

Cooling unit location within a row becomes less critical when deployed in 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 58** and **Figure 59**, can be very effective in simulating aisle containment. When the depths of a Liebert CRV and neighboring server rack are not the same, it is important to align the front edges of the Liebert CRV with the front edges of the neighboring server racks to allow for proper air distribution.

Figure 56 One Liebert CRV, recommended placement

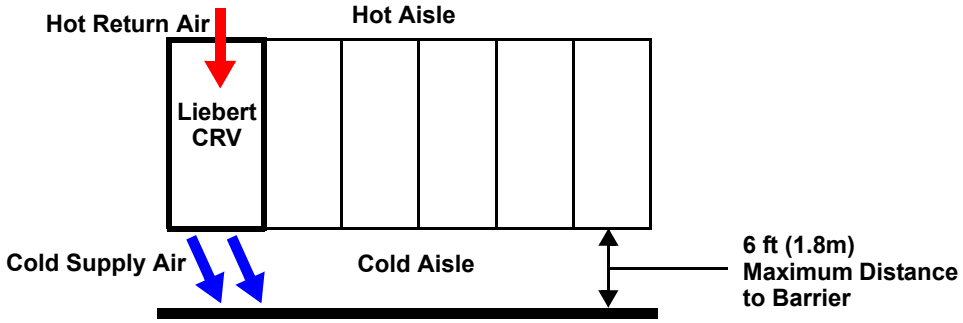


Figure 57 One Liebert CRV, alternate placement

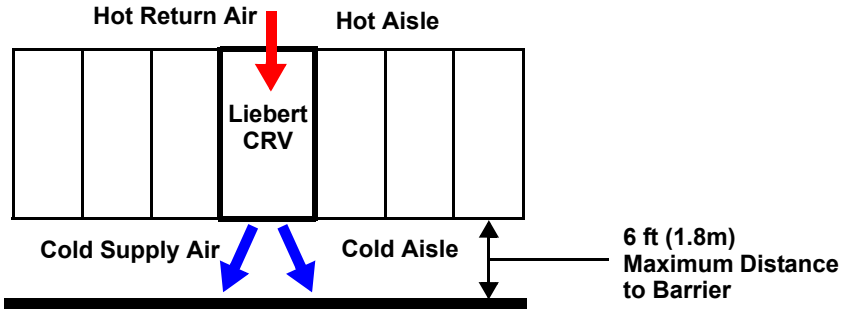


Figure 58 Simulated aisle containment using room barriers—single row

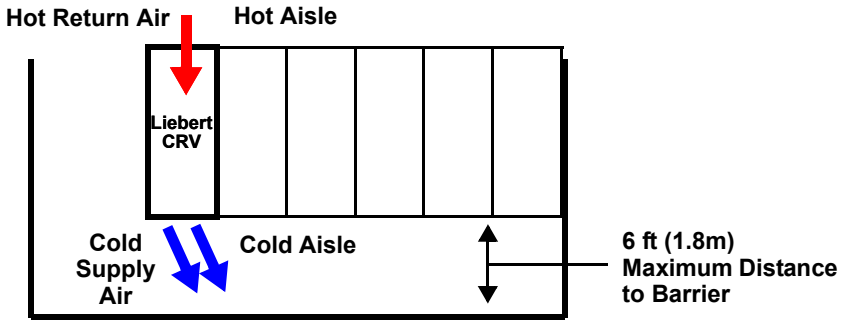
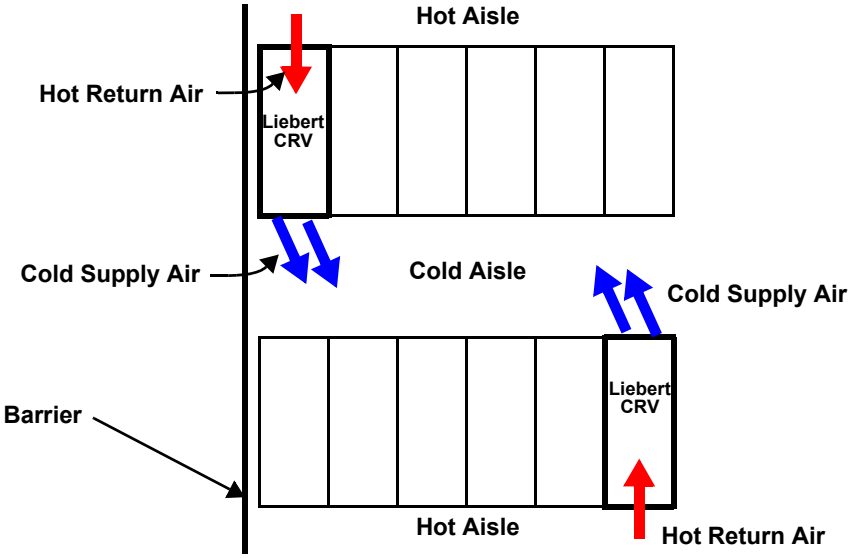


Figure 59 Simulated aisle containment using room barriers—multiple rows

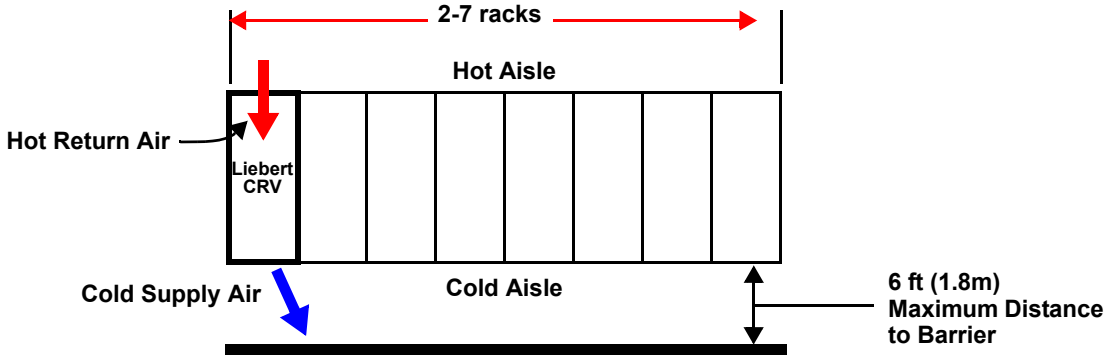


A.3.2 Number of Racks / Row Length

The number of racks the Liebert CRV can condition depends on the equipment's heat load and airflow requirements. It is recommended to oversize the Liebert CRV by approximately 20% to account for gaps where cold air is lost through server racks, obstructions (pillars, people, partly open rack doors) reducing air distribution efficiency and error in estimating server equipment heat and airflow requirements. When deployed with 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 six to seven racks away. Initially oversizing the unit provides for future data center 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 60 Number of racks, row length



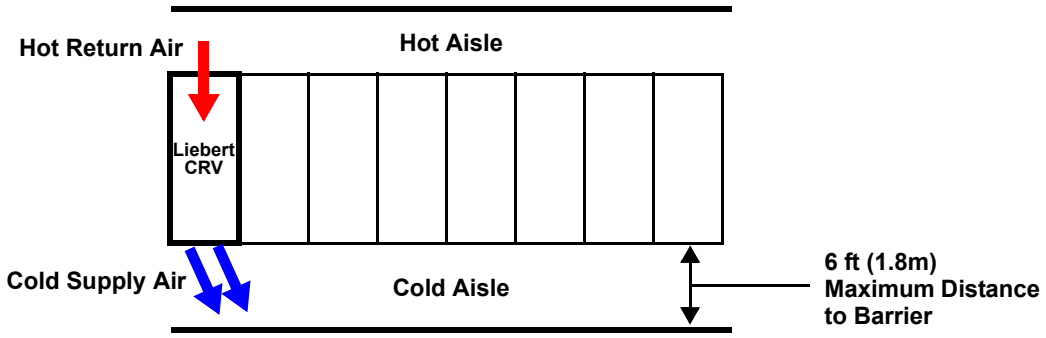
A.4 PLACEMENT IN THE ROOM

A.4.1 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.

Emerson'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 61 Depth of hot / cold aisles



A.5 REDUNDANCY ARRANGEMENT

When laying out row-based units for redundancy, it is better to run all units at a lower operating level than to shut off extra units. The units must be sufficiently sized to achieve the required cooling capacity if any of the other units within the same row fail. **Figure 62** shows an example of N+1 redundancy properly applied.

Figure 62 Example of an application with one row and N+1 redundancy—left side unit failed

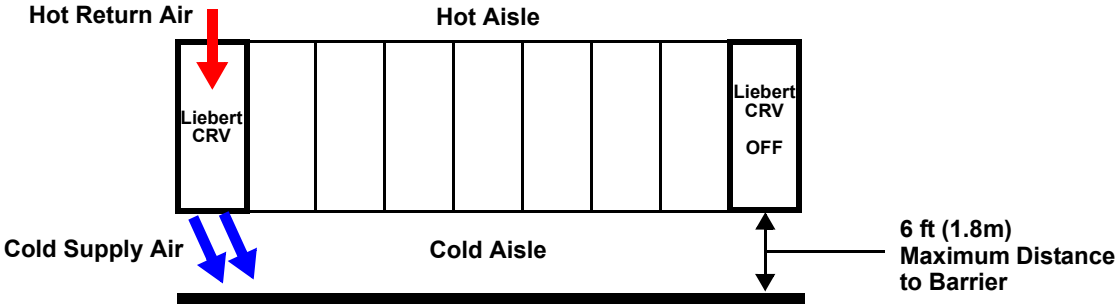
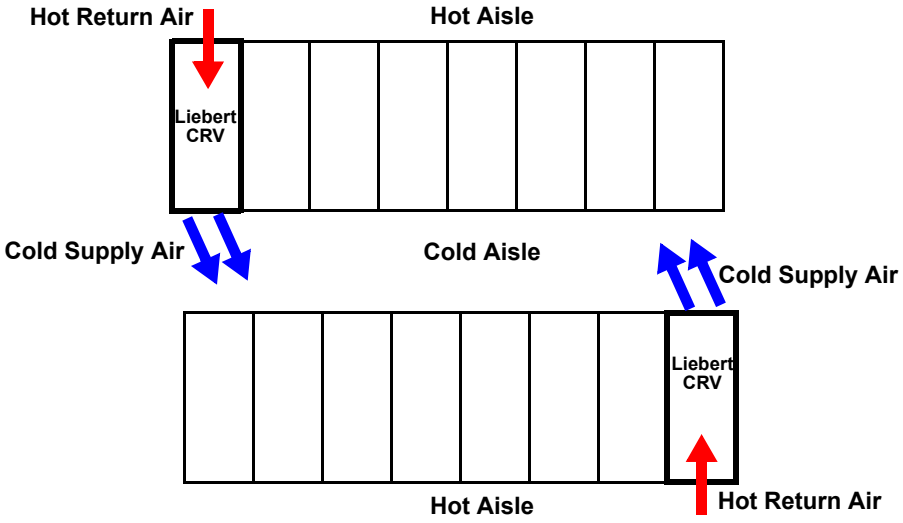


Figure 63 Example of an application with two rows and N+1 redundancy—unit at lower left failed



A.6 LIEBERT CRV APPLIED IN SMARTAISLE™ COLD AISLE CONTAINMENT

Using the Liebert CRV with the SmartAisle 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 SmartAisle, see the Emerson® Web site: **www.emerson.com**

Figure 64 Liebert CRV placement with SmartAisle cold aisle containment—Liebert CRV's in center of two rows

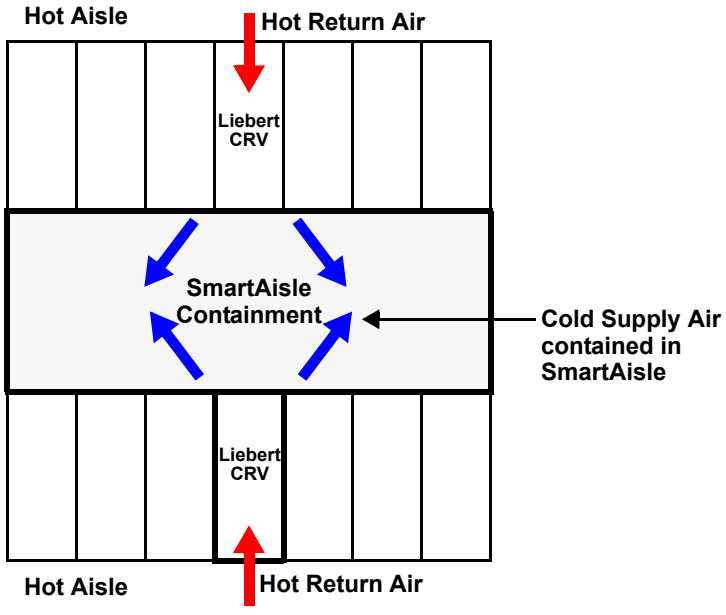
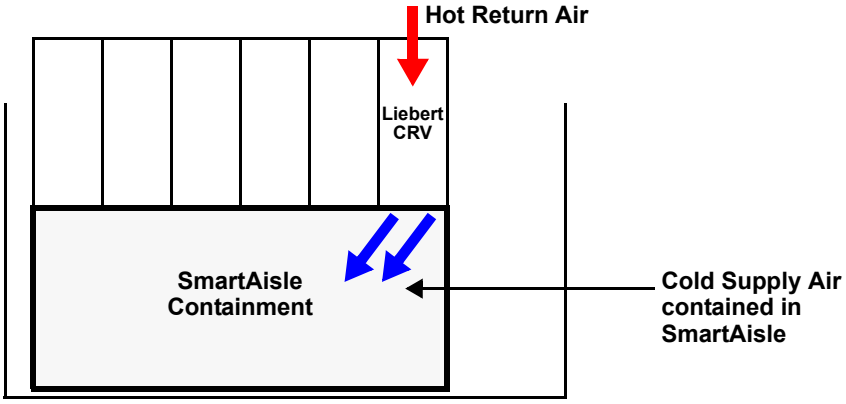


Figure 65 Liebert CRV placement with SmartAisle™ cold aisle containment—Liebert CRV at end of one row

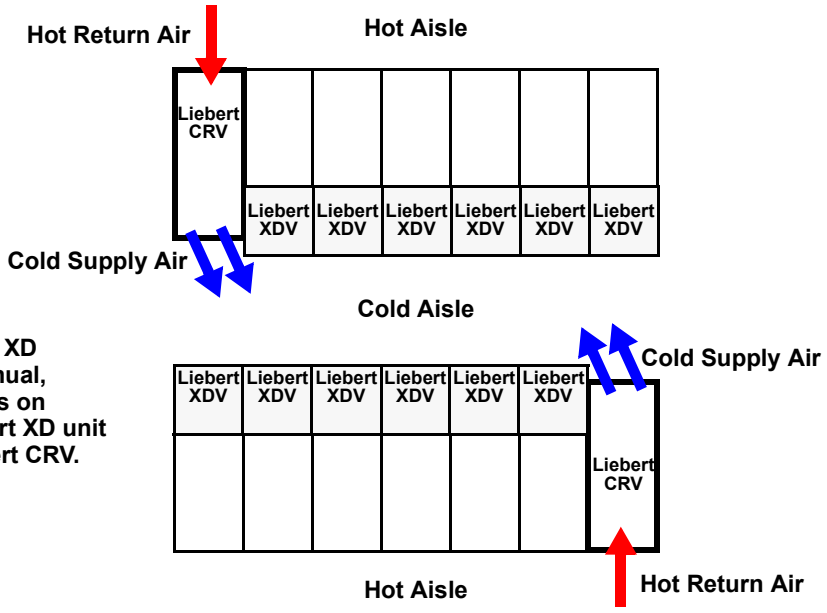


A.7 LIEBERT CRV AND LIEBERT XD™ SYSTEMS

When larger spaces (approximately 20 racks or more) require high-density cooling, row-based Liebert CRV's can be used to the support Liebert XD cooling systems. When used together, these systems are more efficient than row-based units alone.

Figure 66 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 66 Liebert CRV placement with Liebert XDV's



Refer to the Liebert XD System Design manual, SL-16655, for details on configuring a Liebert XD unit for use with a Liebert CRV.

APPENDIX B - GUIDE SPECIFICATIONS—ROW-BASED ENVIRONMENTAL CONTROL SYSTEM

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. Standard 60Hz 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 (Liebert CRV Models 19, 20 and 35)

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 Hydrophilic-Coated Evaporator Coil

Liebert CRV 600mm cabinet (Models 20 and 35)

The direct expansion tilted-slab cooling coil shall have 7.25 ft.2 (0.674 m2) face area, four or five rows deep. It shall be constructed of copper tubes and hydrophilic coated aluminum fins. The hydrophilic coating shall significantly improve the speed of condensate drainage from the fins and shall provide superior water carryover resistance. Two stainless steel condensate drain pans shall be provided.

Liebert CRV 300mm Cabinet (Model 19)

The direct expansion slab cooling coil shall have 6.2ft2 (0.576 m2) face area, three rows deep. It shall be constructed of copper tubes and hydrophilic coated aluminum fins. The hydrophilic coating shall significantly improve the speed of condensate drainage from the fins and shall provide superior water carryover resistance. One stainless steel condensate drain pan shall be 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. The 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. The 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 U.S. Clean Air Act for phaseout of HCFC refrigerants.

2.1.1.5 Low Noise Package (Optional)

The Low Noise Package shall reduce the level of sound emitted from the compressor. The package shall consist of a 3/8 inch closed cell polymeric 4.5 - 8.5 lb/ft^3 density compressor sound jacket that encloses the compressor. Additional half-inch, closed cell polymeric 3 - 8 lb/ft^3 density sound deadening material shall be affixed to the underside of the Superior Service Access Panel located above the compressor and attached to the inner side of the compressor compartment panels that face the hot and cold aisles. All sound deadening material shall be non-shedding and located outside of the airstream.

2.1.2 Water / Glycol Cooled Refrigeration System (Liebert® CRV™ 20 & 35)

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 an insulated, 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 Hydrophilic-Coated Evaporator Coil

The direct expansion, tilted-slab cooling coil shall have 7.25 ft.2 (0.674 m2) face area, four or five rows deep. It shall be constructed of copper tubes and hydrophilic coated aluminum fins. The hydrophilic coating shall significantly improve the speed of condensate drainage from the fins and shall provide superior water carryover resistance. Two stainless steel condensate drain pans shall be 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. The 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 Low Noise Package (Optional)

The Low Noise Package shall reduce the level of sound emitted from the compressor. The package shall consist of a 3/8-inch, closed-cell polymeric 4.5 - 8.5 lb/ft^3 density compressor sound jacket that encloses the compressor. Additional half-inch, closed-cell polymeric 3 - 8 lb/ft^3 density sound deadening material shall be affixed to the underside of the Superior Service Access Panel located above the compressor and attached to the inner side of the compressor compartment panels that face the hot and cold aisles. All sound deadening material shall be non-shedding and located outside the airstream.

2.1.2.6 Modulating Valve

A (2-way) (3-way) modulating valve shall control the water/glycol flow passing through the insulated, brazed-plate condenser. The Liebert 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).

2.1.2.7 Brazed-Plate Heat Exchanger

The heat exchanger shall be an insulated, 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 (Liebert CRV Model 30, 34 and 40kW)

2.1.3.1 Chilled Water System

The water circuit shall be designed to distribute water into the entire coil face area.

2.1.3.2 Hydrophilic-Coated Evaporator Coil

Liebert CRV Model 40

The chilled water tilted-slab cooling coil shall be 7.25 ft^2 (0.674m^2) face area, six rows deep. It shall be constructed of copper tubes and hydrophilic coated aluminum fins. The hydrophilic coating shall significantly improve the speed of condensate drainage from the fins and shall provide 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.

Liebert CRV Models 30 and 34

The chilled water rotated slab cooling coil shall be three rows deep with the 30kW model having 7.1ft^2 (0.66m^2) of face area, and the 34kW model having 7.9ft^2 (0.74m^2) of face area. It is constructed of copper tubes and hydrophilic coated aluminum fins. The hydrophilic coating shall significantly improve the speed of condensate drainage from the fins and shall provide superior water carryover resistance. A powder-coated steel condensate drain pan shall be provided. The water circuit shall be threaded shut with a holding charge. Field relief of the Schrader valve shall indicate a leak-free system.

2.1.3.3 Modulating Valve

Liebert CRV Model 40

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

Liebert CRV Models 30 and 34

A 3-way modulating valve controls the chilled water flow passing through the cooling coil. A manually adjustable, internally mounted ball valve can be adjusted to provide 2-way valve functionality. The Liebert iCOM control manages the 3-way valve actuator movement to provide the desired amount of cooling for various entering water temperatures. Cooling capacity is regulated by bypassing chilled water around the coil or by stopping the flow, depending on the ball valve position. During a power outage, the valve shall automatically close. The maximum close off pressure is 200 PSI (1379 kPa). The maximum system pressure is 145 PSI (1,000 kPa).

2.2 Fan Section

Liebert CRV Model 40

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 Liebert iCOM® control through all modes of operation. Each fan has a dedicated motor, fault monitoring circuitry and speed controller which provides a level of redundancy. Both impellers shall be made of steel and balanced. The EC plug fans shall be mounted on the rear fan door, the entire fan assembly shall be capable of swinging out of the unit for accessibility. The fans shall be located to blow air through the filters and tilted-slab cooling coil to ensure even air distribution and maximum coil performance.

Liebert CRV Models 30 and 34

The unit shall be equipped with (5 or 6) direct drive propeller blade fans, each powered by an Electronically Commutated DC motor; commonly referred to as EC fans. The fan speed shall be variable from 30-100% and automatically regulated by the Liebert iCOM control through all modes of operation; independent of valve modulation. Each fan shall have a dedicated motor, fault monitoring circuitry and speed controller which provides for a level of redundancy. Fan impellers shall be made of steel and balanced. The EC fans shall draw air through the slab coil and shall be accessible through the front door of the unit. In the event of a fan failure, each fan can be individually replaced without removing power from all the functioning fans.

2.2.1 Advanced Airflow Management

2.2.1.1 Supply Air Baffle System (Liebert CRV 600mm Cabinet - Models 20, 35, and 40)

A field-adjustable, modular supply air baffle system shall be located in the discharge airstream on the front of the cabinet to direct air toward the server racks and balance airflow requirements within the row. The six modular baffle segments shall be easily reconfigurable to redirect airflow as cooling requirements change. Controlling the airflow prevents hot spots and maintains high return air temperatures by not blowing cold air over racks or out the ends of aisles. By focusing the cold air where it is needed and meeting the servers' requirements, the need for excessive airflow and energy consumption is eliminated.

2.2.1.1 Supply Air Baffle System (Liebert CRV 300mm Cabinet - Model 19)

A field-adjustable, modular supply air baffle system shall be located in the discharge airstream on the front of the cabinet to direct air toward the server racks and balance airflow requirements within the row. The five modular baffle segments shall be easily reconfigurable to redirect airflow as cooling requirements change. Controlling the airflow prevents hot spots and maintains high return air temperatures by not blowing cold air over racks or out the ends of aisles. By focusing the cold air where it is needed and meeting the servers' requirements, the need for excessive airflow and energy consumption is eliminated.

2.2.1.2 Back-Draft Fan Damper (Liebert CRV 300mm Cabinet - Models 30 and 34)

When any of the fans are in a non-operational state, due to fan failure or being switched Off, a back-draft damper shall automatically close behind each of the fans to prevent the recirculation of air. This ensures that all the air propelled by the fans has passed through the cooling coil. The dampers shall automatically open when fan operation is restored.

2.3 Cabinet Construction and Accessibility

2.3.1 Cabinet Construction

Liebert CRV 600mm cabinet (Models 20, 35, and 40)

The exterior panels shall be 20 gauge steel and powder coated with charcoal 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.

Liebert CRV 300mm cabinet (Models 19)

The exterior panels of the unit shall be 20 gauge steel are powder coated with charcoal color paint to protect against corrosion and follow Knurr rack appearance guidelines to mirror the style of neighboring equipment racks. The cabinet is mounted on casters for quick installation and is provided with leveling feet. Both doors have a powder coated sheet metal frame with hexagonal perforations leaving 81% of the door open to airflow for efficient cooling. The front and rear doors shall swing 170 degrees open, shall be removable and shall feature a two-point latch. The powder-coated steel side panels are lined with ½-inch Closed Cell Polymeric insulation and secured using quarter-turn fasteners.

Liebert CRV 300mm cabinet (Model 30 and 34)

The exterior panels of the unit are powder coated with _____ color paint to protect against corrosion and follow Knurr rack appearance guidelines to mirror the style of neighboring equipment racks. The cabinet shall be constructed of extruded aluminum patented T-slot frame rails that are extremely strong yet light, making it easy to install the unit. The cabinet is mounted on casters for quick installation and is provided with leveling feet. Both doors have a powder coated sheet metal frame with hexagonal perforations leaving 81% of the door open to airflow for efficient cooling. The front and rear doors shall swing 170 degrees open, shall be removable and shall feature a four-point latch. The powder-coated steel side panels are secured using quarter-turn fasteners.

2.3.2 Serviceability

The cabinet shall be designed so all components are easily accessible for service and maintenance through either the front or rear of the unit. Units that are not fully accessible from front and rear or not serviceable in place are unacceptable.

Liebert CRV 600mm Cabinet (Models 20, 35 and 40)

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 conveniently mounted near the edge of the unit.

Liebert CRV 300mm Cabinet (Model 19)

Side access is not required. Each of the variable speed fans can be individually replaced in the unlikely event of a failure through the front door of the unit. Units with a compressor and condensate pump shall be conveniently mounted near the edge of the unit.

Liebert CRV 300mm Cabinet (Models 30 and 34)

Each of the variable speed fans can be individually replaced in the unlikely event of a failure through the front door of the unit. When non-operational, a back-draft damper automatically closes behind each of the fans to prevent the recirculation of air. If an extended amount of service is required on the electrical panel, quick-connecting wiring harnesses can be disconnected to slide out the entire assembly for easy component assess. A temporary electrical panel can be connected in its place to maintain unit functionality.

2.3.3 Supply Air Baffle System

A field-adjustable, modular supply air baffle system shall be located in the discharge airstream on the front of the cabinet to direct air toward the server racks and balance airflow requirements within the row. The five or six modular baffle segments shall be easily reconfigurable to redirect airflow as cooling requirements change. Controlling the airflow prevents hot spots and maintains high return air temperatures by not blowing cold air over racks or out the ends of aisles. By focusing the cold air where it is needed and meeting the servers' requirements, the need for excessive airflow and energy consumption is eliminated

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 shall be accessible only with the switch in the Off position. It shall be conveniently located behind the Liebert iCOM® display door for quick access.

2.5 Short Circuit Current Rating (SCCR)

Liebert CRV 600mm Cabinet (Model 20, 35, and 40)—The electrical panel shall provide at least 65,000A SCCR.

Liebert CRV 300mm Cabinet (Model 19)—The electrical panel shall provide at least 65,000A SCCR.

Liebert CRV 300mm Cabinet (Model 30 and 34)—The electrical panel shall provide at least 5000A SCCR.

2.6 Filtration

Liebert CRV 600mm Cabinet (Models 20, 35 and 40)

The filter channel shall be an integral part of the system, located within the cabinet and serviceable from the rear. The two filters shall be deep-pleated, 4 inches 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. Mesh type, cleanable filters are unacceptable.

Liebert CRV 300mm cabinet (Model 19, 30 and 34)

The two filters shall be an integral part of the system, located within the cabinet and serviceable from the rear. The filters shall be washable, half-inch thick with an ASHRAE 52.2 MERV1 rating. A filter clog alarm shall be included.

2.6.1 Extra Filter Set (Optional)

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

2.7 Electric Reheat (Optional)

Liebert CRV 600mm Cabinet (Models 20, 35 and 40)

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 controlled in one stage. The reheat elements shall be accessible from the front of the cabinet.

2.8 Steam Generating Canister Humidifier (Optional)

Liebert CRV 600mm cabinet (Model 20, 35 and 40)

A canister-type steam generating humidifier shall be factory-installed in the cooling unit and 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 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 canister shall be removable from the rear of the cabinet.

2.9 Condensate Pump

Liebert CRV 600mm cabinet (Models 20, 35 and 40) (Optional)

The dual-float 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.

Liebert CRV 600mm Cabinet (Model 19) (Optional)

The dual-float condensate pump shall have a minimum capacity of 20 GPH (75.7 l/hr) at 16 ft. (4.9 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.

Liebert CRV 300mm Cabinet (Models 30 and 34)

The condensate pump shall have a minimum capacity of 1 GPH (3.8 l/hr) at 10ft (3m) head. Pump shall be complete with integral float switch, safety switch, pump and motor assembly. The safety switch shall send a signal to the local alarm on high water detection and shall perform the selected operation (shut down the unit or alarm).

2.10 Leak Detection Sensor - Liebert CRV 300mm Cabinet (Model 30 and 34)

One solid-state water sensor with no moving parts shall be provided internal to the unit. When the sensor detects the presence of moisture the alarm system is activated.

2.11 Liebert iCOM® Microprocessor Control With Large Graphic Display

(Small Graphic Display Option is not available for Liebert CRV)

The Liebert iCOM unit control shall be factory-set to allow for precise monitoring and control of the IT equipment it is placed near. This control includes “predictive” methods to control air flow and cooling capacity based on Supply and Remote Sensors. Proportional and Tunable PID 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 shall 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.
- Predictive Humidity 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, HTTP, BACnet and SNMP.

The Liebert iCOM control processor shall be microprocessor-based with a 320x240 dot matrix graphic front monitor display and control keys for user inputs mounted in an ergonomic, aesthetic housing. The display and housing shall be viewable while the front panel is 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 with a secure login for each section. 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:

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: Two selectable graphic records shall be available from the following: return air temperature, return air humidity, dew point, supply air temperature.

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, Econ-O-Coil (FC), fan motor, humidifier and reheat.

Various Sensors: Menu shall allow setup and display of optional custom sensors.

Display Language: Customer shall be able to select the desired language at the time of the order from the following choices: (English, French, Italian, Spanish, German)

Service Contacts: Menu shall allow display of local service contact name and phone number.

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.

The Service Menus Shall be Defined as:

Setpoints: Menu shall allow setpoints within the following ranges:

- Temperature Setpoint: 41-104ºF (5-40ºC)*
- Temperature Proportional Band: +1-50ºF
- Fan Temperature Setpoint: 41-104ºF (5-40ºC)*
- 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.

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.

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. An LED on a circuit board will indicate each control output.

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.

Liebert iCOM Wall Mount Large Graphic Display vNSA Panel (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.

Liebert iCOM Control Methods and Options

Controlling Sensor Options: Liebert iCOM is flexible in the sense that it allows for controlling the capacity and fan from multiple different sensor selections and they are as follows:

Cooling Capacity

- Supply
- Remote
- Return

Fan Speed

- Supply
- Remote
- Return
- Manual (for diagnostic or to receive a signal from the BMS through the IS-UNITY-DP™ card)

Teamwork Modes of Operation: Liebert iCOM teamwork saves energy by preventing operation of units in opposite modes multiple units. There are currently 3 modes of teamwork operation, they are as follows:

Teamwork Mode 1: This operation allows the control to optimize a group of connected iCOM units using the U2U. The capacity and fan operations in coupled together in this mode.

Teamwork Mode 2: This operation allows the control to optimize a group of connected Liebert iCOM units using the U2U. The capacity and fan operations in decoupled in this mode, meaning the fan and cooling ramp and respond to the thermal load based on its controlling sensors.

Optimized Aisle - Teamwork Mode 3: This operation allows the control to optimize a group of connected iCOM units using the U2U. The capacity and fan operations in decoupled in this mode, meaning the fan and cooling ramp and respond to the thermal load based on its controlling sensors. When using Optimized Aisle the fans can be controlled by using static pressure (DP or static) with a secondary remote temperature sensor as an override to ensure the inlet rack temperature is being met.

Temperature Compensation: Liebert iCOM allows the ability to compensate the supply and return set points to maintain cooling OR return temperatures to meet cooling needs or SLA guidelines.

Dew Point Control: Liebert iCOM has the ability to control the humidity based on dew point to ensure accurate humidity control. This will eliminate needs to dehumidify or humidify based on air temperature when looking at moisture content.

Virtual Back-Draft Damper: Liebert iCOM allows for the use of a virtual back-draft damper - eliminating the need for a mechanical damper. This allows the fans to spin at a low speed (15%) to act as a damper. NOTE: EC fans are needed for this control option.

Cascade: Liebert iCOM cascade option allows the units to turn ON and OFF based on IT load when in teamwork mode 1. When utilizing Optimized Aisle, teamwork mode 3, the cascading becomes more dynamic as the units coordinate the fan speed to save energy and to meet the cooling demands. For instance, with a iCOM group of 6 units and only 50% of the IT capacity the iCOM will only operate 4 units at 80% fan speed and leave the other 2 units in standby/cascade. As the load increases and more IT equipment is added to the data center the Liebert iCOM will automatically respond to the new load and bring on the 5 unit increasing the units in operation to 5. As the load shifts up or down based on load, capacity and server utilization the control shall meet the needs by cascading unit ON or putting them back into standby.

Virtual Master: As part of the robust architecture of the Liebert iCOM control it allows for a virtual master that coordinates operation. If for any reason the virtual master was to become disconnected the control will shift responsibility to the next unit in the group.

Remote 2T Sensor Sharing: Each Liebert CRV unit can have 10-2T sensors connected and used as a controlling sensor. As part of the U2U network and teamwork those sensors can be shared and used to control the units and provide greater flexibility, visibility and control using that to respond to changes in the data center. Those sensors can be as a minimum, maximum or average temperature to control.

Quick Start: Each Liebert CRV unit be equipped with a quick start feature that allows the unit to quickly recover from a loss of power.

Global Condenser: Direct Expansion Liebert CRV's can be matched to a premium global condenser device that will provide an intelligent communication link. This enables enhanced monitoring and alarming, diagnostics insight, nighttime low noise mode and fan reversal for cleaning mode.

2.12 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.

2.12.1 Additional Rack Temperature Sensor(s) (Optional)

_____ additional 2T rack temperature sensors shall be provided.

2.12.2 Additional CAN Cables for Rack Sensors (Optional)

_____ additional _____ feet (m) long CAN cables shall be provided.

2.13 Liebert vNSA™ (Optional)

The Liebert vNSA network switch is designed for connecting multiple Ethernet-ready devices. The unit shall have one or two 8-port switches, providing a total of 8 or 16 Ethernet ports. The Liebert vNSA shall have 100-240VAC single phase for proper operation. A universal power supply (12V, 1.5A) is installed inside a steel ensure secured with a key lock, with a hard-wired connection for 120V or 230V operation. A Liebert iCOM® display shall be mounted on the front. Liebert iCOM shall permit interconnecting Liebert CRV units to communicate through the use two CAT5 or better network patch cables with RJ45 connectors to connect devices to available ports.

The number of ports available for Ethernet-ready devices varies by the number of 8-port switches included. The Liebert iCOM display use one port for connection to the Liebert iCOM display. The 16-port model uses two ports to interconnect the switches.

Model	# Ports	# of Ports Needed to Connect		# Ports Available	Maximum Liebert CRV's that may be connected
		To Liebert iCOM Display	Upper & Lower Switches		
vNSA8-iCOM-CR	8	1	N/A	7	3 units
vNSA16-iCOM-CR	16	1	2	13	6 units

2.14 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.

2.15 Communication Interfaces

2.15.1 Remote Shutdown Terminal

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

2.15.2 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.

2.15.3 Liebert CRV 600mm Cabinet (Models 20, 35 and 40) 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 while on Emergency Power.

2.15.4 Liebert CRV 600mm Cabinet (Models 20, 35 and 40), One Extra Common Alarm Contact (Optional)

One additional contact (total of two sets) of normally open (n/o) contacts for remote indication of unit alarms shall be provided.

2.15.5 Liebert IntelliSlot® Unity-DP Card (Optional)

The Liebert IntelliSlot Unity Card (IS-UNITY-DP) shall provide ground fault isolated RS-485 Modbus, BACnet IP and Modbus IP network connectivity to Building Management Systems for unit monitoring and management. Also, it shall provide ground fault isolated 10/100 baseT Ethernet connectivity for unit monitoring and management. The supported management interfaces include: SNMP for Network

Management Systems, HTTP for Web page viewing, SMTP for e-mail and SMS for mobile messaging. The card shall support IP and 485 protocols simultaneous.

2.15.6 Liebert Nform® - (Optional Advanced Monitoring)

The Critical Infrastructure Management software shall centrally monitor and manage distributed equipment using the customer's existing network infrastructure. The system shall provide the Critical Infrastructure Management and Monitoring for Air Conditioning (CRAC) systems, Uninterruptible Power Supply (UPS) systems, Power Distributions Units (PDU), Static Transfer Switches (STS), Direct Current Power Systems (DC), Power Distribution Strips (PDU), Alber® Battery Monitoring, Rack Enclosure Monitoring, Leak Detection Systems and other critical infrastructure systems as specified. The system shall have an architecture that allows up to 10,000 managed devices, including Liebert and third-party devices, in a single-server installation.

2.15.6.1 System Requirements

All material and equipment used shall be standard components, regularly manufactured and available and not custom-designed especially for this project. All systems and components shall have previously been thoroughly tested and proven in actual use prior to installation on this project.

The manufacturer will furnish or supply a site-specific Critical Infrastructure Management software system based on customer requirements. The system must be a software-only solution; no substitutions will be accepted.

The system architecture shall consist of network interface cards that will be installed in all critical infrastructures that at a minimum support HTTP and SNMP simultaneously.

The system shall receive SNMP traps from managed equipment and display the alarm notification in a graphical user interface.

The system shall be based on SNMP Open Protocols and integrate seamlessly with Emerson Network Power, Aperture® software suite and Network Management Systems.

Open protocol support shall include:

- HTTP(S)
- TCP/IP/v4, TCP/IP/v6
- SNMP v.1, SNMP v.2

The system will have the capability of being remotely monitored and managed 24 hours a day, 7 days a week by the manufacturer.

The system shall have the ability to be deployed worldwide.

The system shall operate as a client-to-server application.

The Web interface of each managed device shall integrate directly into the system.

The system shall support Enterprise level databases including Microsoft® SQL™.

The system shall support exporting of all recorded parametric trend data.

The system shall operate on a server defined by the customer. Specific server brand or function is not permissible.

The system shall support virtual server environments by default.

The system shall include at no additional cost one (1) year of Software Assurance.

2.15.6.2 Approved Products

The Critical Infrastructure Monitoring System shall be Liebert Nform as manufactured by Emerson Network Power, Liebert Corporation. No substitutions will be accepted.

2.15.6.3 Scope of Work

2.15.6.3.1 Owner-Supplied Items

The owner shall furnish the following system components:

- Network (LAN) hardware and software required to provide an Ethernet backbone to be used for transport of IP data packets from network interface cards installed in all equipment to the Critical Infrastructure server and to the Liebert Nform workstations. These components may include hubs, routers, cabling, network operating systems, firewalls, IP addresses, Virtual

Private Network (VPN) and other components as required. The owner will supply network drops for the Critical Infrastructure server, workstation clients and all network-interfaced equipment.

- Dedicated Critical Infrastructure server meeting the following minimum requirements:
  - Microsoft® Windows® 7, XP, 2003, Windows Vista® or Windows Server® 2008 operating system
  - Pentium™ 3.0GHz single processor or better (1.8GHz dual processor or better recommended)
  - 4 GB of RAM (memory) or better
  - 40 GB hard drive (SCSI recommended)
  - 10/100 BaseT network port or better
  - Monitor / keyboard and mouse port as required for setup
  - Standard USB ports
  - CD or DVD-ROM drive for software installation (CD/DVD-RW suggested for installation and backup)
- Critical Infrastructure server may be Virtual Environment compatible
- Critical Infrastructure Workstation PCs meeting the following minimum requirements:
  - System should meet the minimum requirements for Microsoft Windows 7, XP, 2003, Windows Vista or Windows Server 2008 operating systems.
  - Microsoft Internet Explorer® v6.0 or better
  - 1 GB RAM
  - 10 GB hard disk

The owner shall supply the following information to facilitate system implementation:

- IP addresses and subnet masks and other information as required to configure network devices
- Provide a person as the nominated system owner for administrator purposes
- Secure location for hardware and server

2.15.6.3.2 Critical Infrastructure System Vendor Responsibilities

Provide hardware and software as listed.

- Critical Infrastructure software and licenses for server and workstation installations.
- Provide Software Assurance for the first year at no additional cost.
- Provide 7 x 24 system application and service support through a toll-free number.
- Provide warranty (parts and labor) per the manufacturer's warranty statement.
- Vendor shall be ISO9001 listed for design and manufacture of environmental control systems for Critical Monitoring and Control applications.

2.15.7 Liebert IntelliSlot SiteLink-E® CARD (Optional)

The Liebert IntelliSlot SiteLink-E Card shall provide ground fault isolated connection to a Liebert SiteLink-E for monitoring and management. Liebert SiteLink-E supports Emerson interfaces as a BACnet router that provides the communications link between Liebert units and other protocols and modules. The Liebert SiteLink-E is designed to communicate with Liebert equipment—cooling units, UPS's and Power Distribution Units—and route the information over a BACnet, Modbus or LONWorks™ network to a Building Automation System (BAS) workstation. Required for communication with Liebert SiteScan® Web 4.0 or newer.

2.15.8 Liebert Liqui-tect® 410 Point Leak Detection Sensor for Remote Mounting (Optional)

A total of _____ (quantity) solid-state water sensor(s) with no moving parts and hermetically sealed to keep out dust and dirt shall be provided. The Liebert Liqui-tect 410 (LT410) shall provide a single-point detection of leaks. The point detection sensor shall have two gold-plated sensing probes to prevent corrosion resistance and to provide accurate readings. The LT410 shall constantly monitor points for leaks, internal faults and power failures and warn of any abnormal conditions. Mounting brackets shall allow for sensor height adjustment and leveling. The LT410 shall provide two independent outputs to signal both a local alarm panel and a remote building management system or external equipment. The LT410 shall be rated for 24VAC, 50/60Hz and 0.10 amp.

2.15.9 Liebert Liqui-tect® 460 Zone Leak Detection Module with Cable Kit for Remote Mounting (Optional)

A total of _____ (quantity) zone water sensor cables with no moving parts and hermetically sealed to keep out dust and dirt shall be provided. The Liebert Liqui-tect 460 (LT460) shall provide a zone detection of leaks. The LT460 shall constantly monitor points for leaks, internal faults and power failures and warn of any abnormal conditions. LEDs shall provide status indication and also ensure the cable is properly installed and operational under raised floors. The LT460 shall provide two independent outputs provide a signal to a local alarm panel, Liebert environmental unit, remote building management system or external equipment.

Liebert Liqui-tect 460 Module

The LT460 shall consist of a metal enclosure with a hinged top door providing access to the internal circuit board for wiring termination and configuration of DIP switches. The LT460 shall monitor up to 100 feet of connected LT500Y leak detection cable.

LT500Y Leak Detection Cable

The cable material and construction shall allow the cable to lie flat when used with hold-down clips. The LT500Y shall be plenum-rated and UL-listed for safe operation. Cables shall be available in lengths of 20, 25, 30, 35 and 45 feet.

The LT460 shall be rated for 24VAC, 50/60Hz and 0.12A.

2.16 Heat Rejection

2.16.1 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.

2.16.1.1 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.

2.16.1.2 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.

2.16.2 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.

2.16.2.1 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.

2.16.2.2 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.

2.16.2.3 Pump Package

2.16.2.3.1 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.

2.16.2.3.2 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.

3.3 Field Quality Control

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

APPENDIX C - EXTRA AIRFLOW—STANDARD ON 600 SERIES, CONFIGURABLE ON 300 SERIES

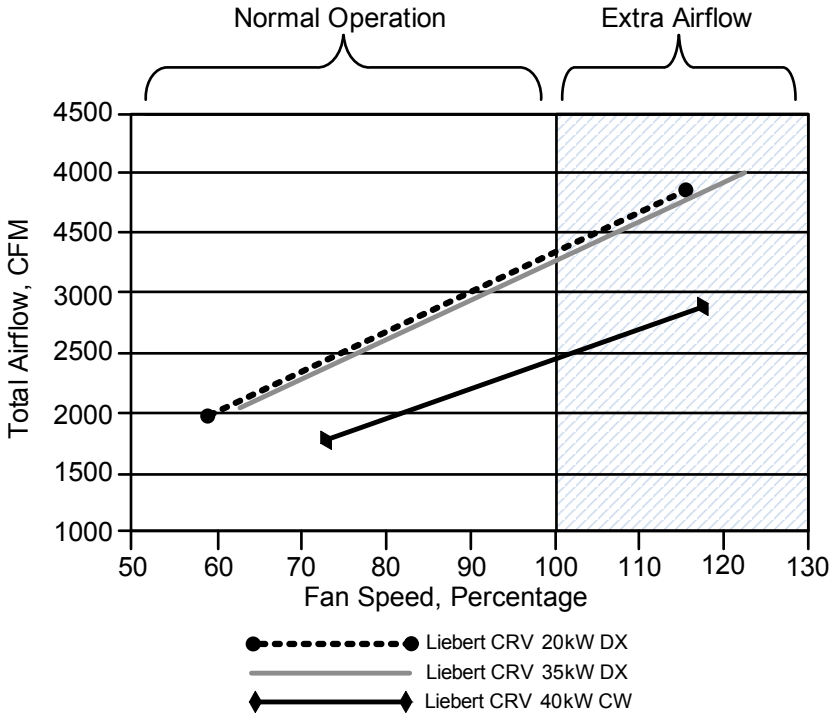
The Liebert CRV has the capability of providing additional airflow to correct for lower density air at higher elevations and during emergency conditions. The Liebert CRV catalog cooling capacity is based on 100% fan speed. During normal operation, the Liebert CRV will automatically modulate its airflow and cooling capacity to satisfy the aisle's requirements. The unit will automatically increase the fan speed above 100% during the following conditions:

- In the event that one of the two fans fail, the functioning fan will increase to maximum speed to help compensate for the lost airflow. The unit will automatically modulate its cooling capacity to avoid undesirable conditions if necessary (coil freezing and high/low refrigerant head pressure conditions).
- If a different Liebert CRV experiences a problem that requires help from other nearby Liebert CRV's, the healthy units will automatically increase their fan speed above 100% to provide additional airflow and/or cooling (requires Liebert iCOM® unit-to-unit Teamwork communication).
- A room can become extremely hot during a power failure when heat-generating server equipment continues to run on backup power while air conditioners are without power. The Liebert CRV will automatically utilize its extra airflow if a room is extremely hot after a power outage to cool the room back to setpoint as fast as possible.

Table 56 Nominal Airflow

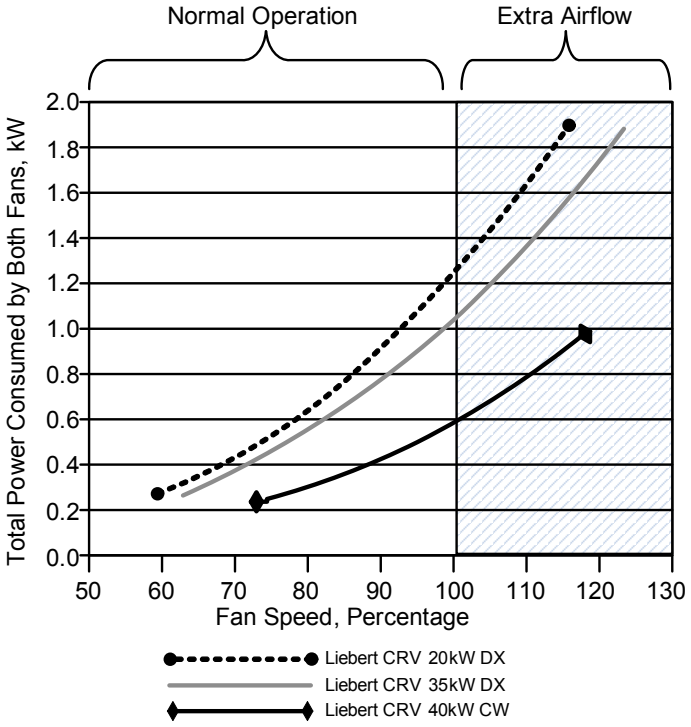
Liebert CRV Model	Catalog Rating 100% Fan Speed (CFM)	Max Fan Speed (CFM)	Extra Airflow
CRV 20kW DX	2455	2890	18%
CRV 35kW DX	3260	4005	23%
CRV 40kW CW	3325	3855	16%

Figure 67 Nominal Airflow



Since the fans are spinning at partial speed during normal operating conditions, the energy consumption is much lower than the nameplate rating of the motors. This provides the same energy saving benefits of using smaller size fans without the risk of running short on airflow.

Figure 68 Nominal Energy Consumption of Both Fans



Technical Support / Service

Web Site
www.liebert.com
Monitoring
liebert.monitoring@emerson.com
800-222-5877
Outside North America: +00800 1155 4499
Single-Phase UPS & Server Cabinets
liebert.upstech@emerson.com
800-222-5877
Outside North America: +00800 1155 4499
Three-Phase UPS & Power Systems
800-543-2378
Outside North America: 614-841-6598
Environmental Systems
800-543-2778
Outside the United States: 614-888-0246

Locations

United States
1050 Dearborn Drive
P.O. Box 29186
Columbus, OH 43229
Europe
Via Leonardo Da Vinci 8
Zona Industriale Tognana
35028 Piove Di Sacco (PD) Italy
+39 049 9719 111
Fax: +39 049 5841 257
Asia
29/F, The Orient Square Building
F. Ortigas Jr. Road, Ortigas Center
Pasig City 1605
Philippines
+63 2 687 6615
Fax: +63 2 730 9572

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www.emerson.com