Liebert® HPC-S™ Air-Cooled Liquid Chiller

160 to 350 kW, 60Hz

System Design Manual

Technical Support Site

If you encounter any installation or operational issues with your product, check the pertinent section of this manual to see if the issue can be resolved by following outlined procedures. Visit https://www.VertivCo.com/en-us/support/ for additional assistance.

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MODEL NUMBER NOMENCLATURE - CONFIGURATION NUMBER

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F	G	0	0	8	0	0	0	5	1	3	1	0	B	0	0	1	0

Digits 7, 8, 11, 13, 15, 16 and 18 - Factory-Determined

Digits 7, 8, 15, 16 and 18 = 0

Digit 13 = 1

Digit 11 = 3

Digits 4-6 - Air-Cooled Chiller with Economizer Nominal Size[1]

052 = Nominal 175 kW (50 ton)

080 = Nominal 264 kW (75 ton)

110 = Nominal 338 kW (96 ton)

Digit 9 - Monitoring

0 = No monitoring card provided

2 = IS-WEBL (Liebert IntelliSlot® Web Card)

3 = IS-485L (Liebert IntelliSlot Modbus Card

4 = IS-485EXI (Liebert SiteScan® Protocol Card)

5 = IS-WEBL (Liebert IntelliSlot Web Card) + IS-485L (Liebert IntelliSlot 485 Modbus Card)

6 = IS-WEBL (Liebert IntelliSlot Web Card) + IS-485EXI (Liebert SiteScan Protocol Card)

7 = IS-485L (Liebert IntelliSlot 485 Modbus Card) + IS-485EXI (Liebert SiteScan™ Protocol Card)

8 = IS-IPBML (Liebert IntelliSlot Web/Modbus IP/BACnet IP Card)

Digit 10 - Buffer Tank

0 = No buffer tank provided

1 = With buffer tank factory-installed

Digit 12 - Pumps and Piping Options

0 = No pumps or piping options

1 = No pumps provided; with piping options

2 = Single standard head centrifugal pump with piping options

3 = Single high head centrifugal pump with piping options

4 = Dual standard head centrifugal pumps with piping options

5 = Dual high head centrifugal pumps with piping options

6 = Single inverter driven standard head centrifugal pump with piping options

Digit 14 - Electrical Panel Options

0 = No electric panel options

1 = With electric heaters

A = Fast start ramp

B = Fast start ramp and electric heaters

Digit 17 - Condenser Coil Filter Guard

0 = No condenser coil guard / filter

1 = With condenser coil guard / filter

1. Capacity Rating Point at 95°F ambient, 10% EG, 50°F Leaving Fluid Temperature and 62°F Entering Fluid Temperature

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1 INTRODUCTION

1.1 Product Description

The Liebert HPC-S is an air-cooled liquid chiller utilizing scroll compressors, electrically commutated (EC) condenser fans, thermal expansion device, integral economizing coil, brazed plate heat exchanger and Liebert iCOM® microprocessor controls. The entire unit is run tested at the factory prior to shipment to the customer site. The unit is only used with constant flow through the chiller. All units are 460/3/60 only.

1.1.1 Frame and Unit Cabinet

The unit frame and unit cabinet are constructed of 2mm steel with a highly robust polyester-powder, RAL7032 paint. The base is constructed of 3 mm galvanized steel channels with use of strategic rivets to increase resistance to mechanical deformation. All sections containing the refrigerant and hydronic circuits, low-voltage and high-voltage sections use removable panels with captive, quarter turn, keyed fasteners to provide access and weather protection. Unit panels for sections used for access to condenser fans are secured with captive screws. All non-structural panels are removable for maintenance. The cabinet contains all factory wiring, refrigeration components, hydronic piping, high-voltage electrical components, low-voltage electrical components, economizing coil and any special features required.

1.1.2 Electrically Commutated (EC) Condenser Fans

Condenser fans are direct driven with electronically commutated (EC) motors and fan blades to deliver industry-leading efficiency and noise levels.

Fans are statically and dynamically balanced prior to use in the unit. Integral fan guards protect fans from contacting foreign objects and provide for safety of operating personnel. Condenser air is discharged vertically upward and intake is on single side only. Fan speed is varied to maximize refrigeration and economizer system control at low ambient conditions. Fans are removed from unit for shipment after run testing in factory and shipped in an export packaging container with the unit. The installation of the fans is the responsibility of the installing contractor.

1.1.3 Compressors

Each unit contains four compressors arranged in two independent circuits to provide overall unloading capability of the entire unit down to 25% (single compressor operating). Compressors are Copeland scroll compressors with self-lubricated Teflon bearings and use R-410A refrigerant. Compressors are solid mounted as close as possible on rigid rails to minimize stress of interconnected tubing and reduce gas-oil equalization line length. These compressors rails are mounted on rubber mounts to prevent vibration transmission to the structure. The compressors include crankcase heater, oil indicating sight glass and oil charge/discharge connections.

1.1.4 Evaporator

The evaporator is a direct expansion, weld-brazed plate type evaporators fabricated from seamless carbon stainless steel AISI 316 with welds of pure copper. The design includes intertwined circuits so the primary fluid is always cooled by at least one circuit. Evaporators are externally insulated with closed-cell elastomer and connected with lines equipped for drainage and vent connections. The corrugation of the plates is optimized specifically for R-410A refrigerant.

1.1.5 Combination Condenser and Economizer Coil

Condenser coils are constructed of copper tubes and aluminum fins mounted in vertical configuration. The combination condenser coil pack has headers at opposite end of the coil for the two different heat exchange media (refrigerant and water/glycol solution). Condenser coil tubes are leak tested to 650 psi (45 bar). The condenser coil shall be equipped with additional sub-cooling circuit that increases the efficiency of the refrigeration system. Fluid economizer coil headers shall have vent and drainage valves.

1.1.6 Refrigeration Circuit Components

Each refrigeration circuit includes a high pressure safety switch, low pressure safety switch, TXV, filter dryer with disposable cartridge, moisture indicating sight glass, high pressure safety valves, manual shut-off valves, high pressure gauges and low pressure gauges.

1.1.7 Fluid Circuit

Fluid circuit piping is constructed of carbon steel pipes connected with grooved, rigid couplings with gaskets. Piping and fluid-containing components are insulated with closed-cell, synthetic elastomer. A factory-installed flow switch is provided to confirm fluid flow to the evaporator. The fluid circuit requires a minimum of 10% glycol solution and must not exceed a 50% glycol solution. Units with factory-provided pumps must not exceed a 30% glycol solution.

1.1.8 High-Voltage Electrical

The electrical panel is designed, constructed and tested in compliance with relevant U.S. and Canadian safety standards. The panel contains the main unit switch, electrical contactors and overcurrent protection devices. The electrical panel is kept cool through ventilation and has an option for heaters for low ambient installations. Electrical panel uses cleanable filters for ventilation air openings.

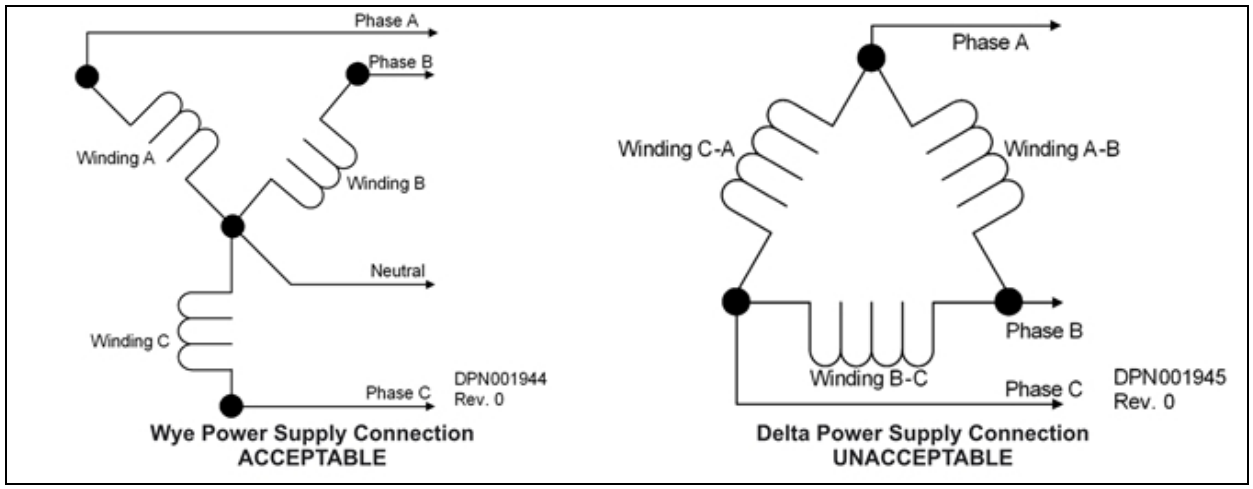
This unit has a high Short Circuit Current Rating (SCCR) of 65kA at the unit's rated voltage. The SCCR value is the maximum amperage that the unit can withstand (for a very short duration) when a short circuit occurs. The SCCR should not be confused with a kAIC value that includes a device that can interrupt when a short occurs. All Liebert HPC-S's for the U.S. and Canadian markets are designed for 460V, 3-phase, 60Hz single point power only.

Input Power Connections—Wye Connection with Earthed Neutral Required

The Liebert HPC-S is designed to operate properly with Wye-connected power with earthed neutral. The neutral wire does not need to be connected to the HPC-S unit.

Three-phase distribution Delta-connected and Wye-connected power systems without a ground or with a floating ground are unacceptable power. A Wye-connected power system with a high resistance ground (HRG) is unacceptable.

Figure 1.1 Wye vs. Delta power supply connection diagram



Acceptable Power Supply

- 460V Wye with solidly grounded neutral (277V line to ground)

Unacceptable Power Supply

- 460V Wye without ground connection or with high-resistance (or impedance) ground
- 460V without ground or with high-resistance (or impedance) ground

1.1.9 Liebert iCOM®

The Liebert HPC-S uses the Liebert iCOM microprocessor-based unit controller to control all functions of the chiller including, but not limited to: compressor staging, condenser fan staging and speed control, economizer system control including three-way valve position and compressor run time management to ensure equal run time of compressors. The Liebert iCOM controller has a display interface measuring at least 320 x 240 pixels and push buttons for data entry.

1.1.10 Monitoring Cards

The Liebert HPC-S can come equipped with Liebert IntelliSlot® Cards directly from the factory. Up to two cards can be installed in each chiller. The different card options are:

- Liebert IntelliSlot Web Card (IS-WEBL) shall be provided to deliver 10/100 baseT Ethernet and RS-485 Modbus network connectivity. The supported management interfaces shall include: SNMP for Network Management Systems (example, HP OpenView), Web pages and RS-485 Modbus for Building Management Systems
- Liebert IntelliSlot Web Card (IS-IPBML) shall be provided to deliver communications via the following protocols: HTTP, HTTPS, Telnet, Modbus IP, BACnet IP and Vertiv Protocol.
- Liebert IntelliSlot 485 Card (IS485-L) shall be provided to deliver RS-485 Modbus network connectivity to Building Management Systems for unit monitoring and management.
- Liebert IntelliSlot SiteScan Web Protocol (IS-485EXI) shall be provided to deliver ground fault isolated EIA-485 Vertiv Protocol connection to a Liebert SiteLink-E® allowing Liebert SiteScan® Web 4.0 monitoring and communications.

1.1.11 Buffer Tank

The Liebert HPC-S can come with buffer tank pre-installed from the factory. This buffer tank can also be ordered as a shipped loose item. The tank is 264 gallons (1,000 liters) whether pre-installed at the factory or shipped loose. The purpose of the tank is to provide increased thermal inertia and system volume in applications with short piping runs. This will reduce the frequency of compressor starts and diminishes the operation issues associated with sudden load variations. It is not meant to provide ride-through in the event of a unit failure. The buffer tank is built of carbon steel and coated with an anti-condensate insulation with woven PVC outer layer for outdoor installation. The tank comes with a manometer and temperature sensor well, air purge valve, discharge valve and sinking connection for electric heaters. The buffer tank is installed on the return side of the piping system internal to the chiller. Refer to Figure 3.17 on page 31 for further information. This tank is not ASME certified.

1.1.12 Pumps and Piping Options

The Liebert HPC-S can come with a variety of different pump options factory-installed. These pump options are controlled by the Liebert iCOM®. These pumps may be utilized to provide flow through the entire chilled water system if the system as long as the system head is not in excess of what the pump can provide. In multi-chiller systems, these unit-based pumps will typically just provide the pumping power through their respective chiller with pumping for the system provided by a variable speed system pump. Pumping options for the Liebert HPC-S are:

- No pumps or piping specialties provided
- No pumps provided, With piping options
- Single standard head centrifugal pump with piping options
- Single high head centrifugal pump with piping options
- Dual standard head centrifugal pump with piping options
- Dual high head centrifugal pump with piping options
- Single inverter driven, standard head centrifugal pump with piping options

1.1.13 General Notes on Pump and Piping Options

No Pumps Provided, With Piping Options

The unit comes without pumps but does include these factory-installed piping components: expansion vessel, hydraulic safety valve and manual air vent. Units only included these components if this options is selected. They are not included as standard.

Single Pump Options

The pump is a single-stage, close-coupled, in-line pump by Grundfos. The pump is equipped with a fan-cooled asynchronous motor. Motor and pump shafts are connected via a rigid sleeve coupling. The pumps are connected with a mechanical shaft seal. The pumps are of the top-pull-out design, (i.e. the power head: motor, pump head and/or motor stool and impeller) can be removed for maintenance or service while the pump housing remains in the piping. The pump does not use a bearing since the radial and axial forces are absorbed by the fixed bearing in the motor drive-end. The impeller is hydraulically balanced to minimize axial forces. Pumps shafts are stainless steel and a brass neck ring provides protection with use of ethylene glycol fluid mixtures. The pump housing, motor stool and motor stator housing are all electrocoated. The motor stool is equipped with a manual air vent screw for venting of the pump housing and shaft seal chamber. Circulation of liquid through the duct of the air vent screw ensures lubrication and cooling of the shaft seal. Single pump options also include these factory-installed piping components: expansion vessel, hydraulic safety valve and manual air vent.

Dual Pump Options

The pumps are single-stage, close-coupled, in-line Grundfos pumps. The pumps are equipped with fan-cooled asynchronous motors. Motor and pump shafts are connected by a rigid sleeve coupling. The pumps are connected with a mechanical shaft seal. The pumps are of the top-pull-out design (i.e., the power head: motor, pump head and/or motor stool and impeller) and can be removed for maintenance or service while the pump housing remains in the piping.

The pumps do not use a bearing because the radial and axial forces are absorbed by the fixed bearing in the motor drive-end. The impeller is hydraulically balanced to minimize axial forces. The twin-head pumps are designed with parallel power heads. A non-return flap valve in the common discharge port is opened by the flow of the pumped liquid and prevents backflow of the liquid into the idle pump head.

The pumps operate in a lead/lag pattern to minimize wear. The dual-pump setup does not permit taking one pump out of service for repair or replacement while the other pump is operating.

Pumps shafts are stainless steel and a brass neck ring provides protection with use of ethylene glycol fluid mixtures. The pump housing, motor stool and motor stator housing are all electrocoated. The motor stool is equipped with a manual air vent screw for venting of the pump housing and shaft seal chamber. Circulation of liquid through the duct of the air vent screw lubricates and cools the shaft seal. Single-pump options also include these factory-installed piping components: expansion vessel, hydraulic safety valve and manual air vent.

Inverter Driven Option

The pump is a single-stage, close-coupled, in-line pump by Grundfos. The pump is equipped with a fan-cooled asynchronous motor. Motor and pump shafts are connected via a rigid sleeve coupling. The pumps are connected with a mechanical shaft seal. The pumps are of the top-pull-out design, (i.e. the power head: motor, pump head and/or motor stool and impeller) can be removed for maintenance or service while the pump housing remains in the piping. The pump does not use a bearing since the radial and axial forces are absorbed by the fixed bearing in the motor drive-end. The impeller is hydraulically balanced to minimize axial forces. The pump speed is controlled by a signal from Liebert iCOM® transmitted via low-voltage control wiring. The motor itself has a built in frequency converter so a separate variable frequency drive is not required. The pump speed is varied to maintain a constant flow in the most energy efficient manner possible while the unit pressure changes during switches in and out of economizer mode. It is not meant to vary the flow across the chiller evaporator. Pumps shafts are stainless steel and a brass neck ring provides protection with use of ethylene glycol fluid mixtures. The pump housing, motor stool and motor stator housing are all electrocoated. The motor stool is equipped with a manual air vent screw for venting of the pump housing and shaft seal chamber. Circulation of liquid through the duct of the air vent screw provides lubrication and cooling of the shaft seal. Single-pump options also include these factory-installed piping components: expansion vessel, hydraulic safety valve and manual air vent.

Electrical Panel Options

The Liebert HPC-S electrical panel can be modified with a Fast Start Ramp and/or Electric Heater. The options are:

- Fast Start Ramp—Speeds up restarting the unit and reduces the time required to return to full power. To do this, the Liebert iCOM overrides internal compressor start and restart time restrictions. This requires UPS power to the Liebert iCOM main board (UPS power feed by others). The time between restoration of power and full unit capacity is about 80 seconds with this feature and about 8 minutes without this feature.
- Electric Panel Heater—This is option is used in applications that require extended periods of time in low ambient conditions. It is recommended whenever the minimum ASHRAE design temperature is below 23°F (-5°C).

Condenser Coil Filter Guard

The condenser coil filter guard is a composed of expanded metal cloth sandwiched between two layers of rigid metal netting held together in a sheet metal frame. These filters are removable without tools. The condenser coil filter guards protects against hail and other debris and help filter out airborne particles such as milkweed, cottonwood and leaves.

Remote Buffer Tank (Ships Separate from Unit)

This optional tank is identical to the factory-installed optional buffer tank. This tank may be installed remotely from the unit on either the supply or return side of the chiller. This tank is not ASME certified.

2 GENERAL DATA

Table 2.1 General data, Liebert HPC-S, all models

Size	FG0052	FG0080	FB0110
Number of Compressors	4	4	4
Evaporator			
Type	Brazed Plate		
Water Storage (Evaporator Only), gal (liter)	1.48 (5.6)	2.59 (9.8)	3.28 (12.4)
Maximum Flow (High water flow rates may cause corrosion and vibration inside the fluid components), gpm (lps)	177 (11.2)	265 (16.7)	313 (19.7)
Minimum Flow, gpm (lps)	90.3 (5.69)	134 (8.47)	184 (11.6)
Free-Cooling Coil			
Type	Copper Tubes / Aluminum Fins		
Number of Coils	1	1	1
Coil Area, ft2 (m2)	63.9 (5.94)	85.3 (7.92)	106.6 (9.8)
Number of Rows	3	3	3
Fins Per Foot	122	122	122
Condenser			
Number of Coils	1	1	1
Number of Rows	3	3	3
Fins Per Foot	122	122	122
Fan			
Type	EC Plug Fan		
Number	4	5	5
Diameter, in. (mm)	35 (900)	35 (900)	35 (900)
Airflow per fan, cfm (cmh)	11,550 (19,623)	10,430 (17,720)	10,430 (17,720)
Power per motor, kW	2.77	2.86	2.86
Motor rpm, maximum	989	989	989
General Unit			
Number of Refrigeration Circuits	2	2	2
Capacity Steps, %	4	4	4
Refrigeration Charge per Circuit, lb. (kg)	44.1 (20.0)	57 (25.9)	57 (25.9)
Oil Charge per Circuit, gal (liters)	Circuit #1 1.80 (6.8) Circuit #2 1.80 (6.8)	Circuit #1 1.80 (6.8) Circuit #2 1.66 (6.3)	Circuit #1 1.66 (6.3) Circuit #2 1.66 (6.3)
Internal Water Volume (buffer tank not included), gal (liters)	33.3 (126)	38.8 (146)	39.9 (151)
Minimum Ambient Temperature, °F (°C)	-13 (-25)	-13 (-25)	-13 (-25)
Maximum Ambient Temperature, °F (°C)	125 (51.7)	120 (48.9)	110 (43.3)
Refrigerant High Pressure Switch, psig	609.2		
Refrigerant High Pressure Safety Valve, psig	653.1		

Table 2.1 General data, Liebert HPC-S, all models (continued)

Size	FG0052	FG0080	FB0110
Refrigerant High Pressure Safety Valves per Circuit	1	1	1
Refrigerant High Pressure Safety Valve Connection, in	G. 1" ISO 228		
Refrigerant Low Pressure Switch, psig	72.5	72.5	72.5
Optional Expansion Tank Volume, gal (liters)	3.2 (12.1)	3.2 (12.1)	3.2 (12.1)
Electrical Data			
Power Supply, V/Hz/Phase	460/60/3 (3-Wire Y System)		
Acceptable Voltage Range, Volts	±10%	±10%	±10%
Number of Fans	4	4	4
Fan Motor Power, each fan, kW	2.8	2.8	2.8
Fan Motor Nominal Current, A	4.3	4.3	4.3
Fan Motor FLA, A	4.4	4.4	4.4
Single compressor 1 and 3 - RLA current, A	25.0	46.7	60.7
Single compressor 2 and 4 - RLA current, A	25.0	29.3	46.7
Single compressor 1 and 3 - LRA current, A	140	272.0	310.0
Single compressor 2 and 4 - LRA current, A	140	179.0	272.0
Total Unit Full Load Amps (FLA) - No Pumps	117.6	174.0	236.8
Unit Wire Size Amps (WSA) - No Pumps, A	123.9	185.7	252.0
Unit Overcurrent Protection Device (OPD) Size - No Pumps, Amps	125.0	225.0	300.0
Total Unit Full Load Amps (FLA) - Standard Head Pumps	126.9	186.0	248.8
Unit Wire Size Amps (WSA) - Standard Head Pumps, Amps	133.2	197.7	264.0
Unit Overcurrent Protection Device (OPD) Size - Standard Head Pumps, Amps	150.0	225.0	300.0
Total Unit Full Load Amps (FLA) - High Head Pumps	129.6	191.2	254.0
Unit Wire Size Amps (WSA) - High Head Pumps, Amps	135.9	202.9	269.2
Unit Overcurrent Protection Device (OPD) Size - High Head Pumps, Amps	160.0	225.0	300.0

2.1 Performance Data

Table 2.2 Performance data—FG0052 with Economizer coil

Outdoor Ambient Temperature, °F (°C)	Cooling Capacity Tons (kW)	Unit Power Consumption, kW	EER	Fluid Flow Rate GPM (L/S)
62°F entering fluid temperature, 50°F leaving fluid temperature, 10% ethylene glycol w/o pumps				
115 (46.1)	43.0 (151.4)	74.0	2.04	103.6 (6.6)
105 (40.6)	47.5 (166.9)	67.0	2.49	113.8 (7.3)
95 (35.0)	51.5 (181.2)	61.0	2.99	123.3 (7.9)
85 (29.4)	55.2 (194.1)	55.0	3.52	131.9 (8.4)
75 (23.9)	58.4 (205.4)	51.0	4.05	139.3 (8.9)
65 (18.3)	61.2 (215.4)	47.0	4.59	146.3 (9.3)
55 (12.8)	63.7 (223.9)	44.0	5.08	152.0 (9.67)
45 (7.2)	65.7 (231.2)	42.0	5.50	157.0 (10.0)

Table 2.2 Performance data—FG0052 with Economizer coil (continued)

Outdoor Ambient Temperature, °F (°C)	Cooling Capacity Tons (kW)	Unit Power Consumption, kW	EER	Fluid Flow Rate GPM (L/S)
62°F entering fluid temperature, 50°F leaving fluid temperature, 20%ethylene glycol w/o pumps				
115 (46.1)	42.6 (150.0)	74.0	2.03	105.7 (6.7)
105 (40.6)	47.0 (165.3)	67.0	2.47	116.0 (7.4)
95 (35.0)	51.0 (179.4)	61.0	2.96	125.6 (8.0)
85 (29.4)	54.6 (192.1)	55.0	3.49	134.3 (8.6)
75 (23.9)	57.8 (203.2)	51.0	4.02	141.9 (9.0)
65 (18.3)	60.6 (213.0)	47.0	4.55	149.0 (9.5)
55 (12.8)	63.0 (221.4)	44.0	5.04	154.8 (9.9)
45 (7.2)	65.0 (228.5)	42.0	5.46	159.9 (10.2)
62°F entering fluid temperature, 50°F leaving fluid temperature, 30%ethylene glycol w/o pumps				
115 (46.1)	— (148.6)	74.0	2.01	—
105 (40.6)	46.5 (163.5)	67.0	2.45	119.0 (7.6)
95 (35.0)	50.4 (177.4)	60.0	2.94	128.7 (8.2)
85 (29.4)	54.0 (189.9)	55.0	3.46	137.5 (8.8)
75 (23.9)	57.1 (200.7)	50.0	3.95	145.3 (9.3)
65 (18.3)	59.8 (210.2)	47.0	4.51	152.4 (9.7)
55 (12.8)	62.1 (218.3)	44.0	5.00	158.3 (10.1)
45 (7.2)	64.1 (225.3)	42.0	5.41	163.4 (10.4)
62°F entering fluid temperature, 50°F leaving fluid temperature, 40% ethylene glycol w/o pumps				
115 (46.1	41.9 (147.2)	74.0	2.00	111.2 (7.1)
105 (40.6	46.0 (161.9)	67.0	2.43	122.9 (7.8)
95 (35.0	49.9 (175.6)	60.0	2.92	133.1 (8.5)
85 (29.4	53.4 (187.8)	55.0	3.43	141.9 (9.0)
75 (23.9	56.4 (198.4)	50.0	3.95	149.9 (9.5)
65 (18.3	59.1 (207.9)	46.0	4.45	157.3 (10.0)
55 (12.8	61.4 (215.9)	44.0	4.96	163.3 (10.4)
45 (7.2	63.3 (222.7)	41.0	5.37	168.4 (10.7)

Table 2.3 Performance data—FG0080 with Economizer coil

Outdoor Ambient Temperature, °F (°C)	Cooling Capacity Tons (kW)	Unit Power Consumption, kW	EER	Fluid Flow Rate GPM (L/S)
62°F (16.6°) entering fluid temperature, 50°F (10°C) leaving fluid temperature, 10% ethylene glycol w/o pumps				
115 (46.1)	64.9 (228.3)	116.0	1.96	158.0 (0.6)
105 (40.6)	71.0 (249.7)	107.0	2.34	173.5 (0.8)
95 (35.0)	76.8 (270.2)	97.0	2.78	187.4 (0.9)
85 (29.4)	82.3 (289.5)	89.0	3.26	200.3 (1.1)
75 (23.9)	87.3 (307.1)	81.0	3.78	212.3 (1.3)
65 (18.3)	92.1 (323.9)	74.0	4.35	223.6 (1.5)
55 (12.8)	96.4 (339.0)	69.0	4.95	234.5 (1.6)

Table 2.3 Performance data—FG0080 with Economizer coil (continued)

Outdoor Ambient Temperature, °F (°C)	Cooling Capacity Tons (kW)	Unit Power Consumption, kW	EER	Fluid Flow Rate GPM (L/S)
45 (7.2)	100.5 (353.4)	63.0	5.59	244.4 (2.0)
62°F (16.6°) entering fluid temperature, 50°F (10°C) leaving fluid temperature, 20% ethylene glycol w/o pumps				
115 (46.1)	64.4 (226.4)	116.0	1.96	161.3 (0.6)
105 (40.6)	70.3 (247.4)	106.0	2.33	177.1 (0.8)
95 (35.0)	76.1 (267.6)	97.0	2.76	191.1 (0.9)
85 (29.4)	81.5 (286.6)	89.0	3.23	204.3 (1.1)
75 (23.9)	86.4 (304.0)	81.0	3.75	216.4 (1.3)
65 (18.3)	91.1 (320.5)	74.0	4.32	227.8 (1.5)
55 (12.8)	95.3 (335.1)	68.0	4.92	238.7 (1.7)
45 (7.2)	99.3 (349.2)	63.0	5.54	248.7 (2.0)
62°F (16.6°) entering fluid temperature, 50°F (10°C) leaving fluid temperature, 30% ethylene glycol w/o pumps				
115 (46.1)	— (224.1)	116.0	1.94	—
105 (40.6)	69.6 (244.8)	106.0	2.31	181.5 (0.8)
95 (35.0)	75.3 (264.7)	97.0	2.74	195.9 (0.9)
85 (29.4)	80.6 (283.4)	88.0	3.21	209.3 (1.0)
75 (23.9)	85.4 (300.2)	81.0	3.71	221.4 (1.3)
65 (18.3)	89.9 (316.3)	74.0	4.28	233.5 (1.5)
55 (12.8)	94.1 (331.0)	68.0	4.87	244.2 (1.7)
45 (7.2)	98.0 (344.7)	63.0	5.49	254.4 (2.0)
62°F (16.6°) entering fluid temperature, 50°F (10°C) leaving fluid temperature, 40% ethylene glycol w/o pumps				
115 (46.1)	63.2 (222.1)	115.0	1.92	171.0 (0.6)
105 (40.6)	69.0 (242.5)	106.0	2.30	187.6 (0.7)
95 (35.0)	74.5 (262.1)	96.0	2.72	202.3 (0.9)
85 (29.4)	79.7 (280.3)	88.0	3.18	215.9 (1.1)
75 (23.9)	84.5 (297.1)	81.0	3.69	228.5 (1.3)
65 (18.3)	89.0 (312.9)	74.0	4.24	240.9 (1.5)
55 (12.8)	93.1 (327.3)	68.0	4.83	251.9 (1.8)
45 (7.2)	969.2 (3408.8)	63.0	5.44	262.4 (2.0)

Table 2.4 Performance data—FBG0110 with Economizer coil

Outdoor Ambient Temperature, °F (°C)	Cooling Capacity Tons (kW)	Unit Power Consumption, kW	EER	Fluid Flow Rate GPM (L/S)
62°F (16.6°) entering fluid temperature, 50°F (10°C) leaving fluid temperature, 10% ethylene glycol w/o pumps				
115 (46.1)	0.10 (—)	—	—	—
105 (40.6)	90.0 (316.7)	161.0	1.96	219.1 (0.6)
95 (35.0)	98.4 (346.0)	147.0	2.36	239.4 (0.7)
85 (29.4)	106.2 (373.4)	134.0	2.79	259.2 (0.9)
75 (23.9)	113.4 (398.9)	122.0	3.27	276.2 (1.0)
65 (18.3)	120.4 (423.3)	112.0	3.79	292.5 (1.2)

Table 2.4 Performance data—FBG0110 with Economizer coil (continued)

Outdoor Ambient Temperature, °F (°C)	Cooling Capacity Tons (kW)	Unit Power Consumption, kW	EER	Fluid Flow Rate GPM (L/S)
55 (12.8)	126.7 (445.5)	103.0	4.34	308.1 (1.4)
45 (7.2)	132.7 (466.7)	95.0	4.91	322.8 (1.6)
62°F (16.6°) entering fluid temperature, 50°F (10°C) leaving fluid temperature, 20% ethylene glycol w/o pumps				
115 (46.1)	0.20 (—)	—	—	0.0 (0.)
105 (40.6)	89.3 (314.0)	161.0	1.95	223.7 (0.6)
95 (35.0)	97.5 (342.8)	146.0	2.34	244.3 (0.7)
85 (29.4)	105.1 (369.8)	133.0	2.78	264.4 (0.9)
75 (23.9)	112.3 (394.9)	122.0	3.25	281.6 (1.0)
65 (18.3)	119.1 (418.9)	111.0	3.77	298.1 (1.2)
55 (12.8)	125.3 (440.7)	102.0	4.31	313.9 (1.4)
45 (7.2)	131.1 (461.2)	94.0	4.88	328.5 (1.6)
62°F (16.6°) entering fluid temperature, 50°F (10°C) leaving fluid temperature, 30% ethylene glycol w/o pumps				
115 (46.1)	—	—	—	—
105 (40.6)	88.4 (310.9)	160.0	1.94	229.6 (0.6)
95 (35.0)	96.5 (339.3)	146.0	2.33	250.5 (0.7)
85 (29.4)	104.0 (365.8)	133.0	2.76	271.0 (0.9)
75 (23.9)	111.0 (390.4)	121.0	3.23	288.5 (1.0)
65 (18.3)	117.6 (413.6)	111.0	3.74	304.9 (1.2)
55 (12.8)	123.7 (435.0)	102.0	4.28	321.0 (1.4)
45 (7.2)	129.5 (455.3)	94.0	4.85	336.0 (1.6)
62°F (16.6°) entering fluid temperature, 50°F (10°C) leaving fluid temperature, 40% ethylene glycol w/o pumps				
115 (46.1)	—	—	—	0.00
105 (40.6)	87.6 (308.1)	160.0	1.93	237.3 (0.6)
95 (35.0)	95.6 (336.1)	145.0	2.32	258.9 (0.7)
85 (29.4)	103.0 (362.2)	132.0	2.74	280.0 (0.9)
75 (23.9)	109.9 (386.4)	121.0	3.21	297.9 (1.0)
65 (18.3)	116.4 (409.3)	110.0	3.72	314.8 (1.2)
55 (12.8)	122.3 (430.3)	101.0	4.26	331.2 (1.4)
45 (7.2)	128.0 (450.2)	93.0	4.82	346.6 (1.6)

Table 2.5 Pump performance

Model #	FG0052	FG0080	FB0110
Standard head pressure			
Water Flow, gpm (lps)	139.5 (8.8)	212.5 (13.4)	272.4 (17.2)
Available Head Pressure, ft. of water (kPa)	29 (200)	23 (159)	4 (28)
Number of Pumps	1 or 2	1 or 2	1 or 2
Pump Manufacturer	Grundfos		
Pump Rotor Model	65-340/2	65-390/2	65-390/2

Table 2.5 Pump performance (continued)

Model #	FG0052	FG0080	FB0110
Nominal Motor Power, kW	5.5	7.5	7.5
Noise Level (*), dB(A)	68	65	65
High Head Pressure			
Water Flow, gpm (lps)	139.5 (8.8)	212.5 (13.4)	274.4 (17.3)
Available Head Pressure, psig (kPa)	39 (269)	36 (248)	17 (117)
Number of pumps	1 or 2	1 or 2	1 or 2
Pump Manufacturer	Grundfos		
Pump Rotor Model	65-390/2	65-480/2	65-480/2
Nominal Motor Power, kW	7.5	11	11
Noise Level (*), dB(A)	65	64.5	64.5
* According to ISO 3744			

Table 2.6 Ethylene glycol, % in weight of total mixture

Parameter	Ethylene Glycol, % in weight					
	0	10	20	30	40	50
Freezing Temperature, °F (°C)	32 (0)	24 (-4.4)	14 (-10)	2 (-16.7)	-13 (-25)	-35 (-37.8)
Mixture density at 68°F (20°C), lb/gal US (kg/liter)	—	8.487 (1.017)	8.621 (1.033)	8.746 (1.048)	8.880 (1.064)	9.013 (1.080)

2.2 Sound Pressure Level and Sound Power Level

The values of SPL and PWL for every octave band frequency in the following table are measured with the Liebert HPC-S-S in standard configuration (without pumps), full load operation and free field conditions. The values are measured 39.4" (1m) from unit in accordance with the ISO 3744 average method.

Table 2.7 Sound pressure / power level

Models	Octave Band Frequency, Hz								
	63	125	250	500	1000	2000	4000	8000	Total(dB[A])
SPL Sound Pressure Levels (dB)									
FG0052	87	83	79	76	75	71	63	55	79.0
FG0080	88	83	79	76	75	71	63	56	79.5
FB0110	88	83	79	76	75	71	63	56	79.5
PWL Sound Power Levels (dB)									
FG0052	107	102	98	95	94	90	82	75	98.5
FG0080	108	103	99	96	95	91	83	76	99.5
FB0110	108	103	99	96	95	91	83	76	99.5
Sound power levels tolerance for each octave band: -0/+2 dB									

Table 2.8 Weights and shipping dimensions

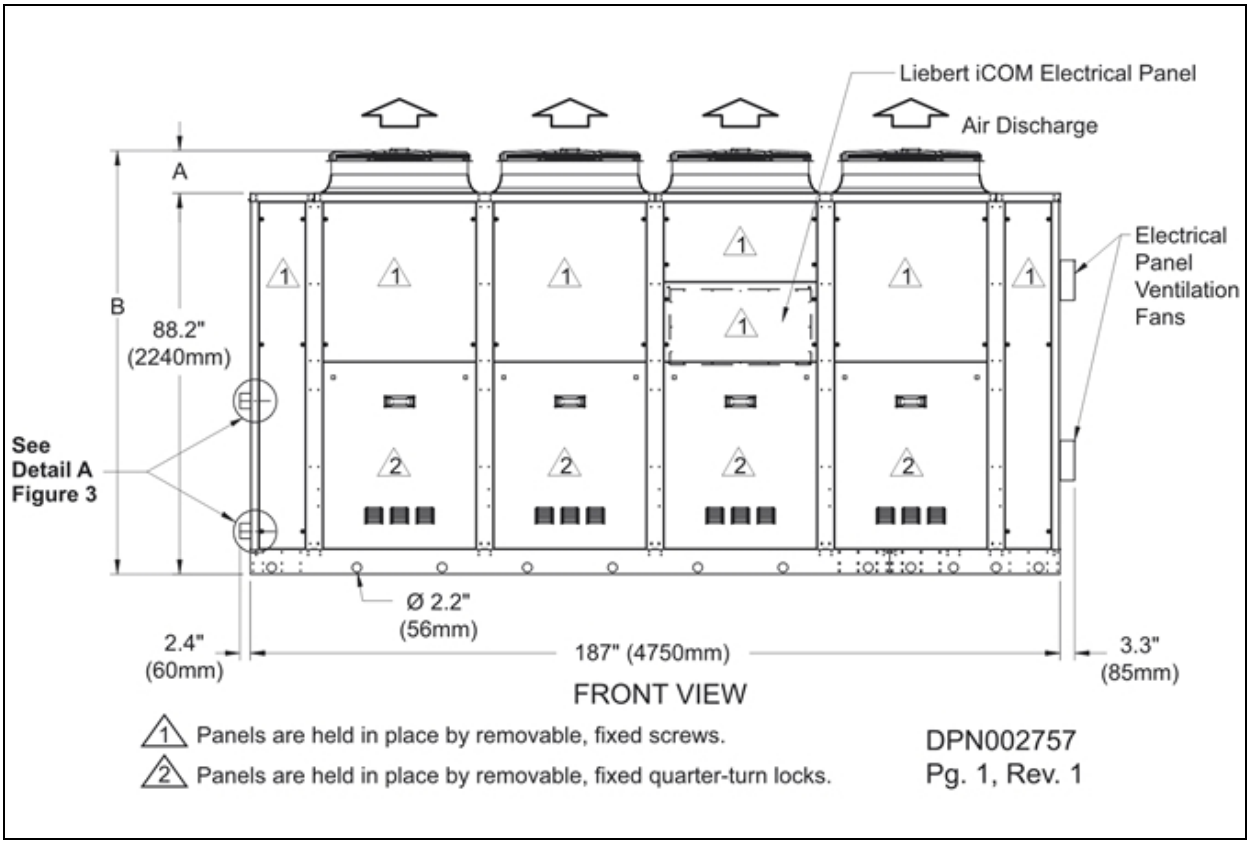
Configuration	Shipping Dimensions, in (mm)	Weight, lb (kg)
FG0052 Shipping Weights (Condenser Fans Shipped Separately)		
Base Unit Shipping Weight without Buffer Tank	195x60x92 (4953x1524x2337)	4,880 (2,214)
Base Unit Shipping Weight with Buffer Tank	240x60x92 (6096x1524x2337)	5,848 (2,654)
Condenser Fans Shipping Crate #1 (Qty of 2 fans)	42x42x45 (1067x1067x1143)	300 (136)
Condenser Fans Shipping Crate #2 (Qty of 2 fans)	42x42x45 (1067x1067x1143)	300 (136)
Base Unit Operating Weight without Buffer Tank (accounts for mass of water in unit)	—	5,598 (2,539)
Base Unit Operating Weight with Buffer Tank (accounts for mass of water in unit)	—	7,710 (3,497)
Options—Additional Weight		
No Pumps, With Piping Specialties (Digit 12 = 1)	—	22 (10)
Single Standard Head Pump with Piping Specialties (Digit 12 = 2)	—	243 (110)
Single High Head Pump with Piping Specialties (Digit 12 = 3)	—	247 (112)
Dual Standard Head Pump with Piping Specialties (Digit 12 = 4)	—	441 (200)
Dual High Head Pump with Piping Specialties (Digit 12 = 5)	—	449 (204)
Single Inverter Driven Pump with Piping Specialties (Digit 12 = 6)	—	276 (125)
Condenser Coil Filter Guard (Digit 17 = 1)	—	66 (30)
FG0080 Shipping Weights (Condenser Fans Shipped Separately)		
Base Unit Shipping Weight without Buffer Tank	240x60x92 (6096x1524x2337)	6,070 (2,754)
Base Unit Shipping Weight with Buffer Tank	275x60x92 (6985x1524x2337)	7,038 (3,193)
Condenser Fans Shipping Crate #1 (2 Condenser Fans)	42x42x45 (1067x1067x1143)	300 (136)
Condenser Fans Shipping Crate #2 (3 Condenser Fans)	42x42x45 (1067x1067x1143)	400 (181)
Base Unit Operating Weight without Buffer Tank (accounts for mass of water in unit)	—	6,943 (3,149)
Base Unit Operating Weight with Buffer Tank (accounts for mass of water in unit)	—	9,055 (4,107)
Options—Additional Weight		
No Pumps, With Piping Specialties (Digit 12 = 1)	—	22 (10)
Single Standard Head Pump with Piping Specialties (Digit 12 = 2)	—	247 (110)
Single High Head Pump with Piping Specialties (Digit 12 = 3)	—	375 (170)
Dual Standard Head Pump with Piping Specialties (Digit 12 = 4)	—	450 (204)
Dual High Head Pump with Piping Specialties (Digit 12 = 5)	—	721 (327)
Single Inverter Driven Pump with Piping Specialties (Digit 12 = 6)	—	450 (204)
Condenser Coil Filter Guard (Digit 17 = 1)	—	110 (50)
FB0110 Shipping Weights (Condenser Fans Shipped Separately)		
Base Unit Shipping Weight without Buffer Tank	195x60x92 (4953x1524x2337)	6,174 (2,800)
Base Unit Shipping Weight with Buffer Tank	240x60x92 (6096x1524x2337)	7,144 (3,240)
Condenser Fans Shipping Crate #1 (2 Condenser Fans)	42x42x45 (1067x1067x1143)	300 (136)
Condenser Fans Shipping Crate #2 (3 Condenser Fans)	42x42x45 (1067x1067x1143)	400 (181)

Table 2.8 Weights and shipping dimensions (continued)

Configuration	Shipping Dimensions, in (mm)	Weight, lb (kg)
Base Unit Operating Weight without Buffer Tank (accounts for mass of water in unit)	—	7,053 (3,199)
Base Unit Operating Weight with Buffer Tank (accounts for mass of water in unit)	—	9,165 (3,497)
Options—Additional Weight		
No Pumps, With Piping Specialties (Digit 12 = 1)	—	22 (10)
Single Standard Head Pump with Piping Specialties (Digit 12 = 2)	—	247 (110)
Single High Head Pump with Piping Specialties (Digit 12 = 3)	—	375 (170)
Dual Standard Head Pump with Piping Specialties (Digit 12 = 4)	—	450 (204)
Dual High Head Pump with Piping Specialties (Digit 12 = 5)	—	721 (327)
Single Inverter Driven Pump with Piping Specialties (Digit 12 = 6)	—	450 (204)
Condenser Coil Filter Guard (Digit 17 = 1)	—	110 (50)

3 DIMENSIONAL DRAWINGS

Figure 3.1 Dimensions, fan sizes and piping connections for Liebert HPC-S model FG0052, no buffer tank



Model	EC Fans		Chilled Water Connection, 3	Chilled Water Connection, 4
	Diameter 35.4" (900mm)			
	A in. (mm)	B in. (mm)	Inlet in. (mm)	Outlet in. (mm)
FG0052	11.4 (289)	99.6 (2529)	NPS 3 3.5 (89) OD	NPS 3 3.5 (89) OD
Source: DPN002757, Pg. 1, Rev. 1				

Figure 3.2 Dimensions and clearances for Liebert HPC-S model FG0052, no buffer tank

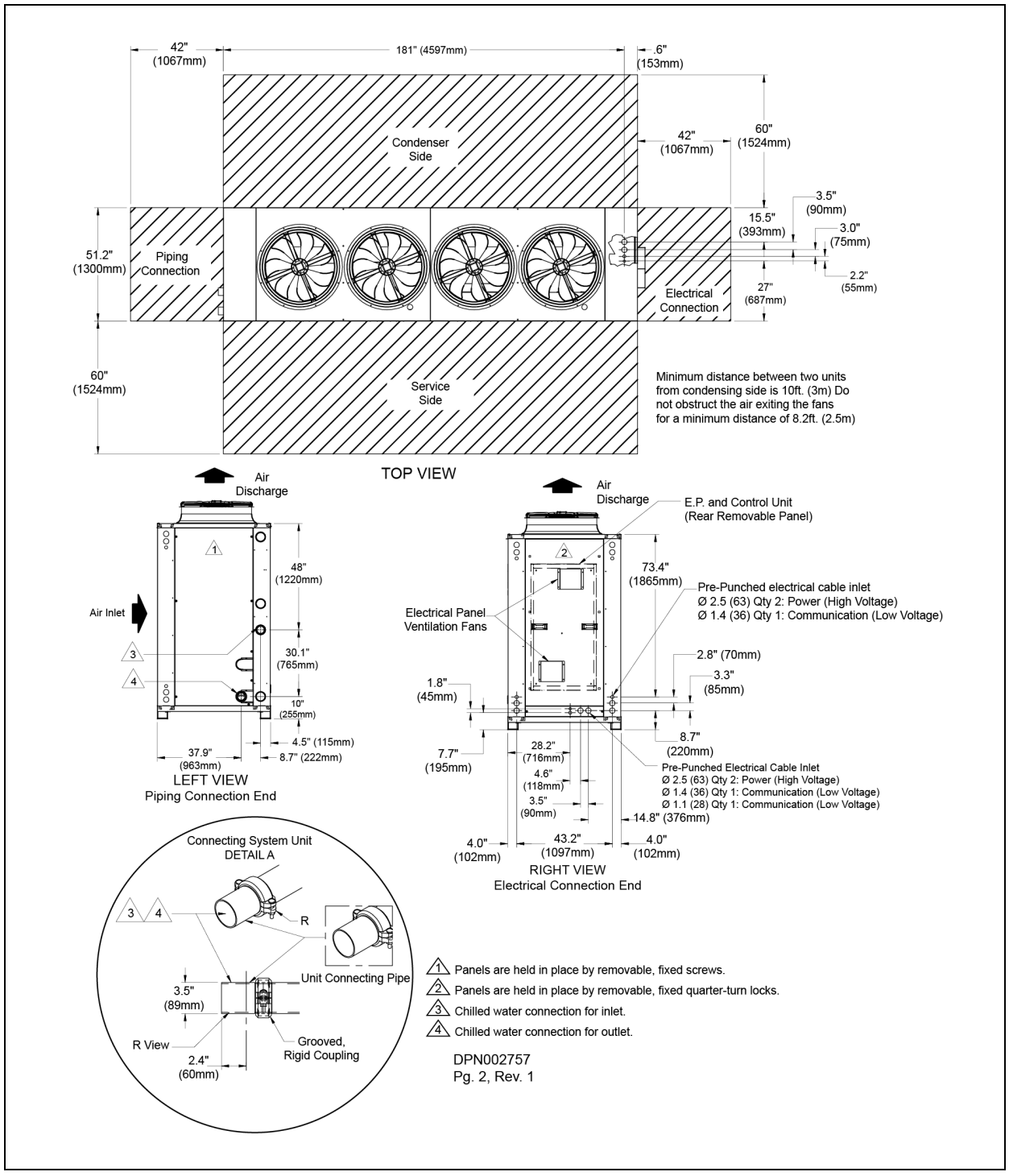
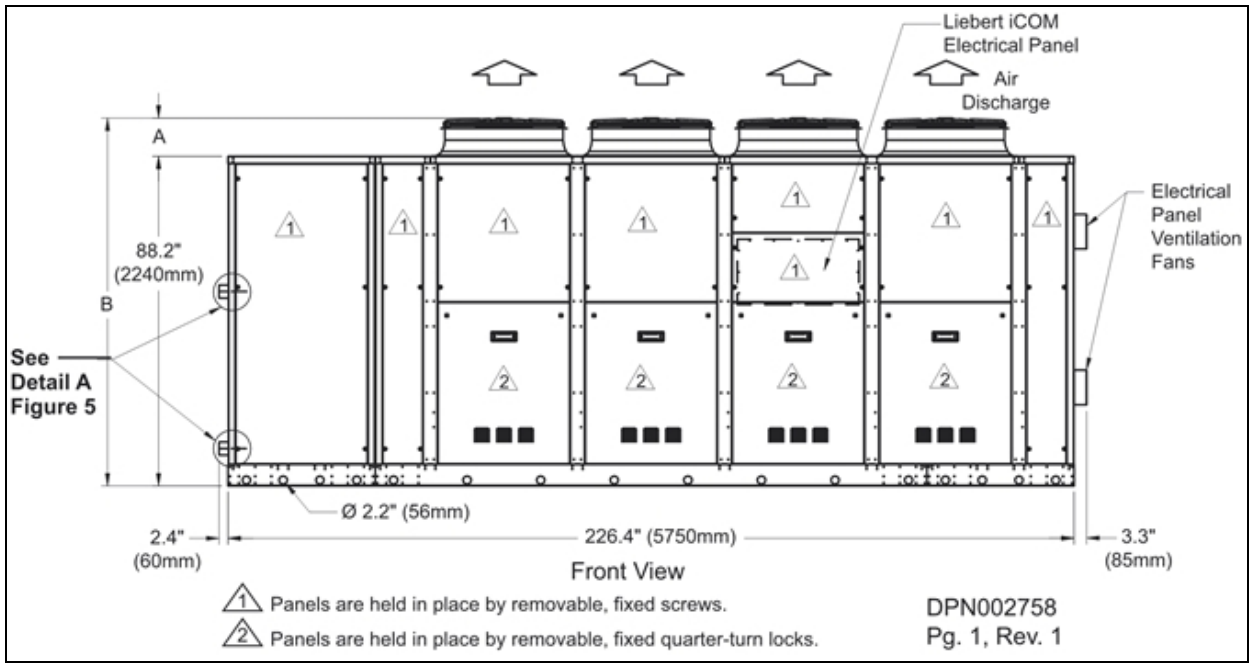


Figure 3.3 Dimensions, fan sizes and piping connections for Liebert HPC-S model FG0052 with buffer tank



Model	EC Fans		Chilled Water Connection, 3	Chilled Water Connection, 4
	Diameter 35.4" (900mm)			
	A in. (mm)	B in. (mm)	Inlet in. (mm)	Outlet in. (mm)
FG0052	11.4 (289)	99.6 (2529)	NPS 3 3.5 (89) OD	NPS 3 3.5 (89) OD
Source: DPN002758, Pg. 1, Rev. 1				

Figure 3.4 Dimensions and clearances for Liebert HPC-S model FG0052 with buffer tank

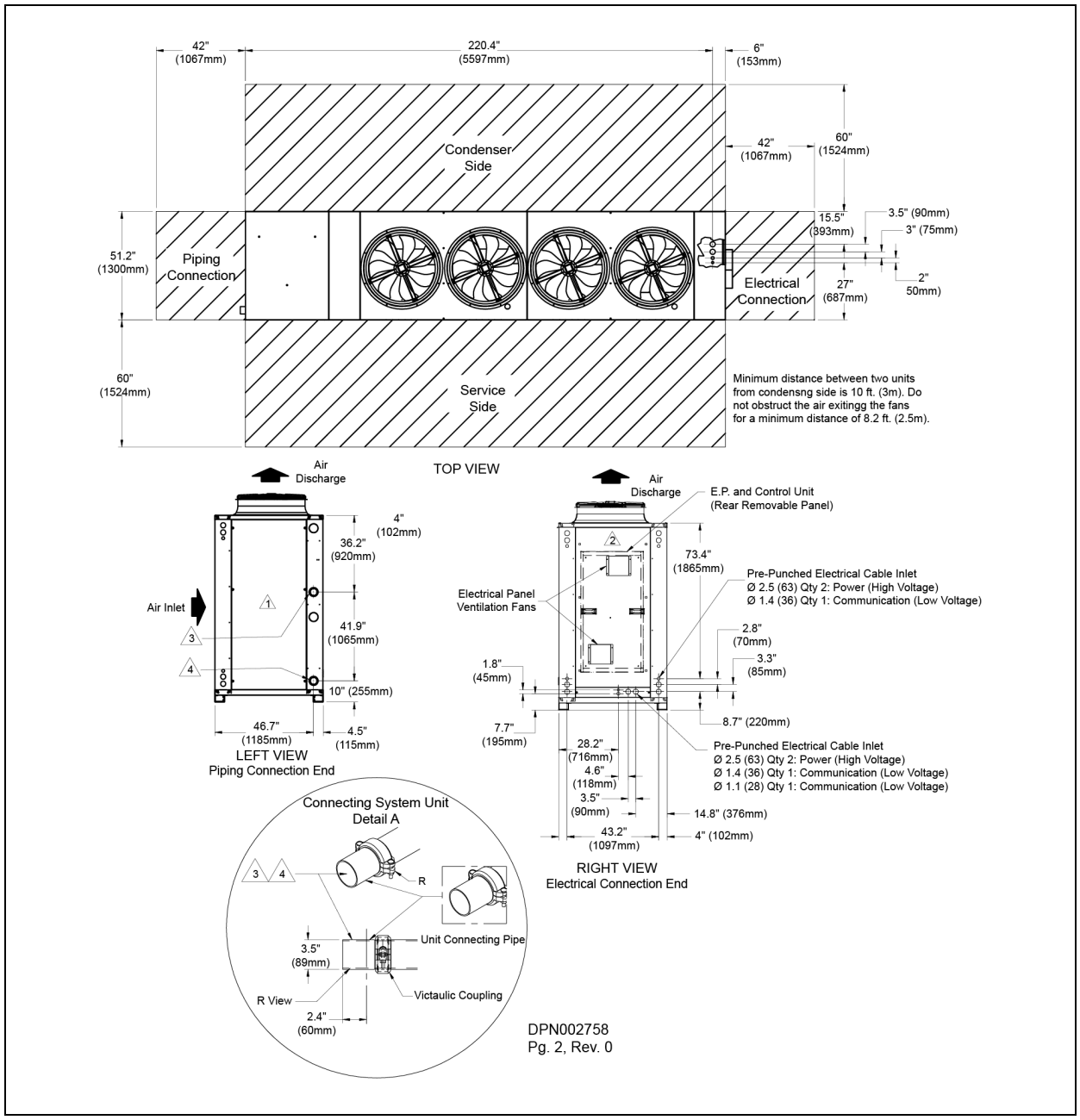
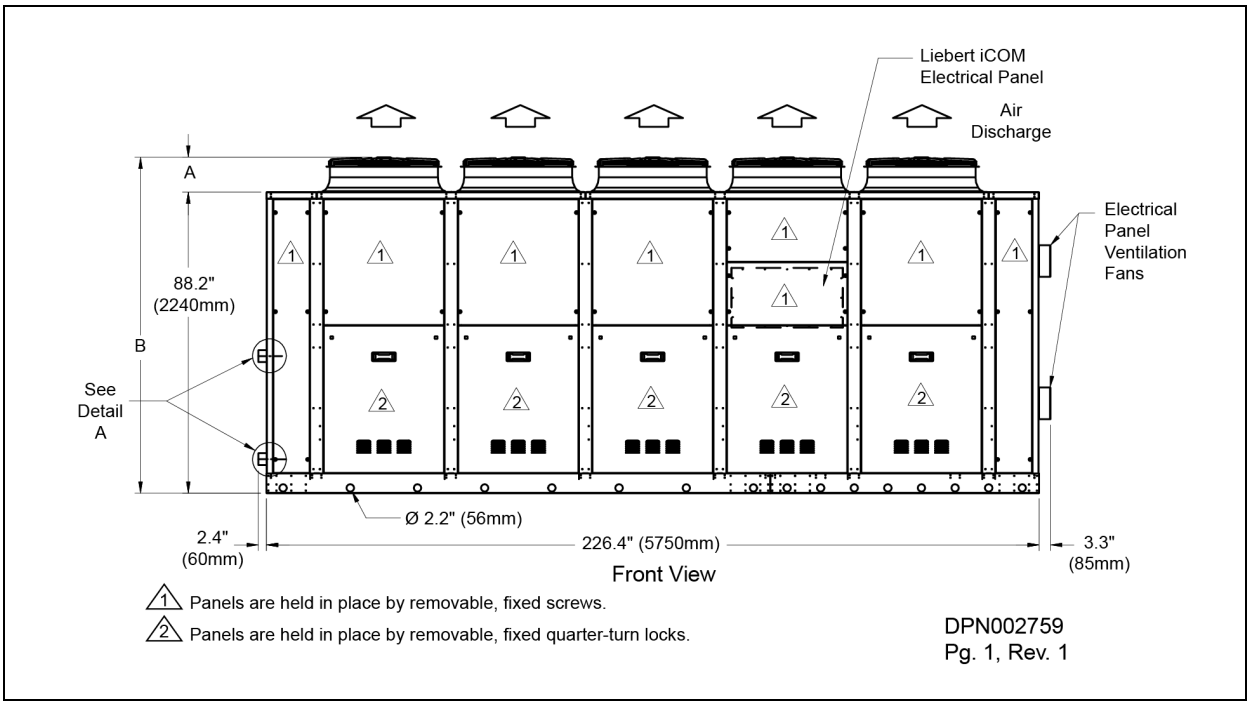


Figure 3.5 Dimensions, fan sizes and piping connections for Liebert HPC-S models FG0080 and FB0110, no buffer tank



Model	EC Fans	
	Diameter 35.4" (900mm)	
	A in. (mm)	B in. (mm)
FG0080	11.4 (289)	99.6 (2529)
FG0110	11.4 (289)	99.6 (2529)
Source: DPN002759, Pg. 1, Rev. 1		

Figure 3.6 Dimensions and clearances for Liebert HPC-S models FG0080 and FB0110, no buffer tank

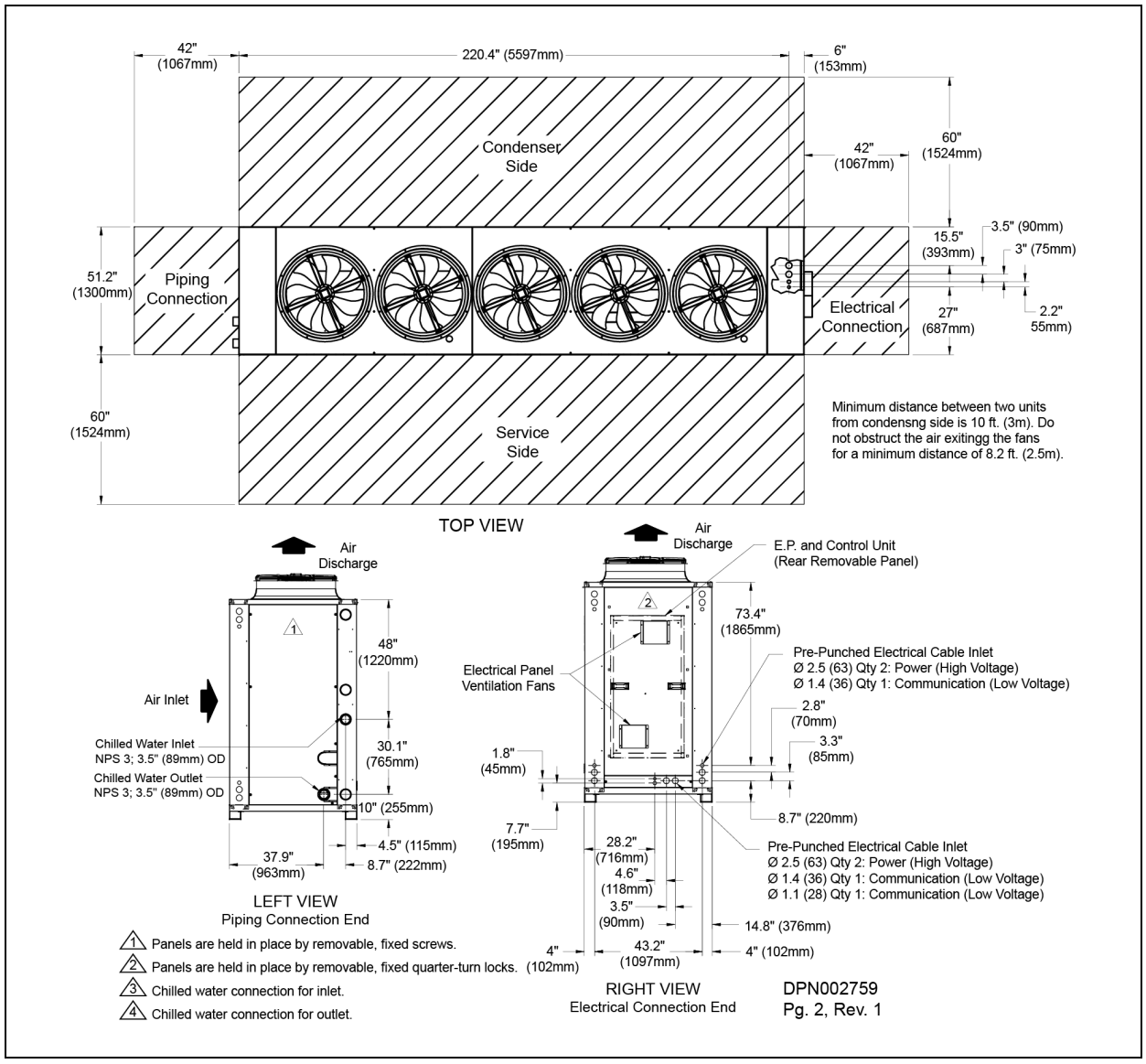
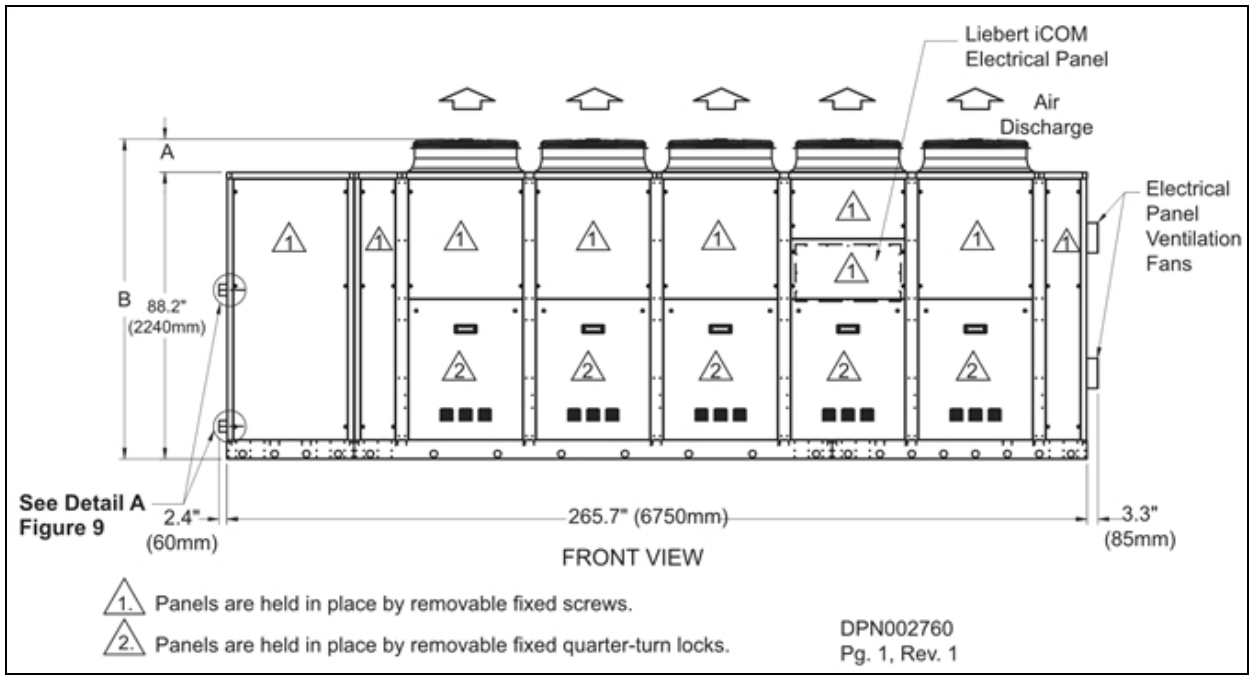


Figure 3.7 Dimensions, fan sizes and piping connections for Liebert HPC-S models FG0080 and FB0 110 with integral free-cooling and buffer tank



Model	EC Fans		Chilled Water Connection, 3	Chilled Water Connection, 4
	Diameter 35.4" (900mm)			
	A in. (mm)	B in. (mm)	Inlet in. (mm)	Outlet in. (mm)
FG0080	11.4 (289)	99.6 (2529)	NPS 3 3.5 (89) OD	NPS 3 3.5 (89) OD
FG0110	11.4 (289)	99.6 (2529)	NPS 3 3.5 (89) OD	NPS 3 3.5 (89) OD

Source: DPN002760, Pg. 1, Rev. 1

Figure 3.8 Dimensions and clearances for Liebert HPC-S models FG0080 and FB0 110 with integral free-cooling and buffer tank

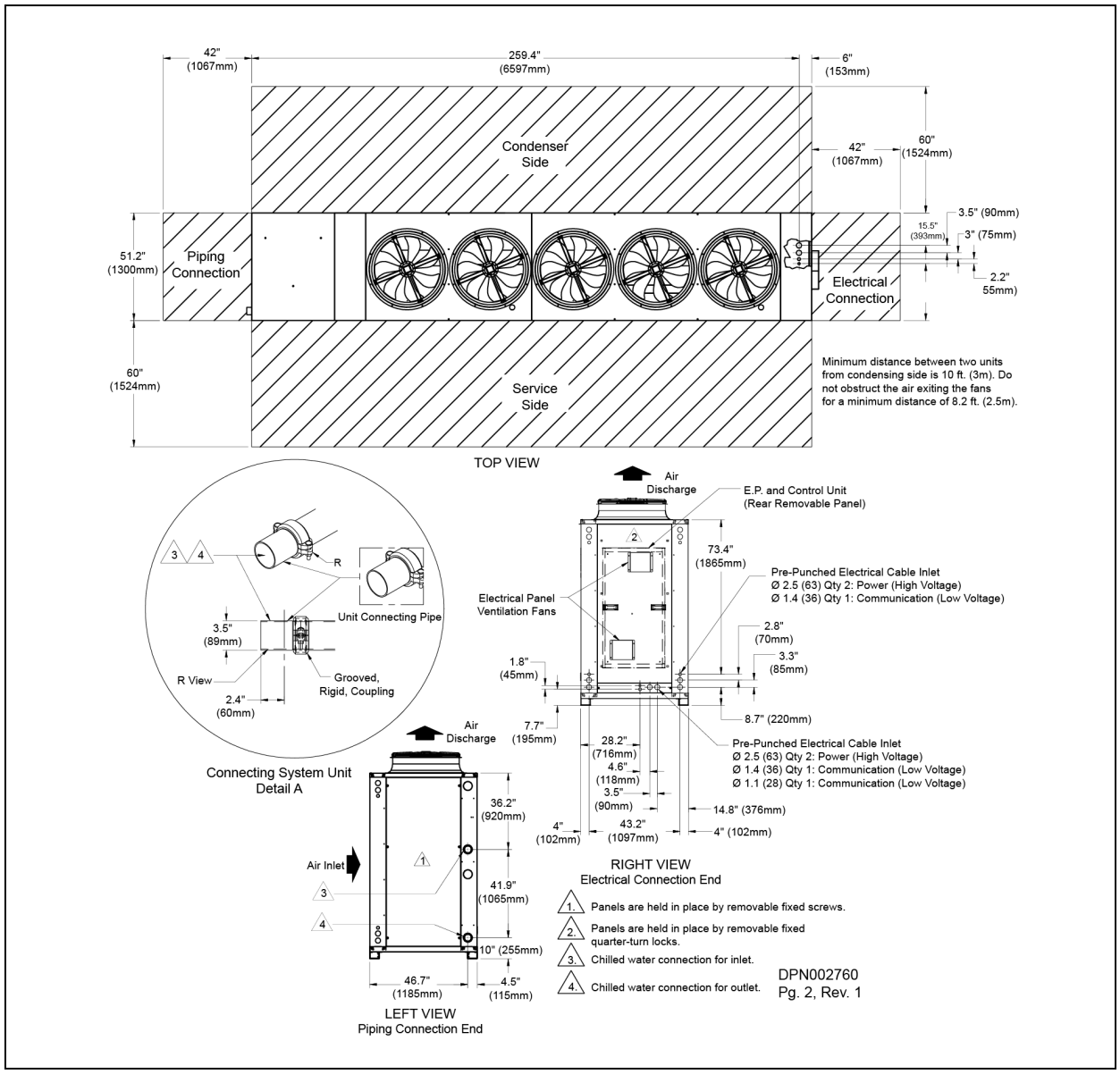


Figure 3.9 Isometric views FG0052 without buffer tank

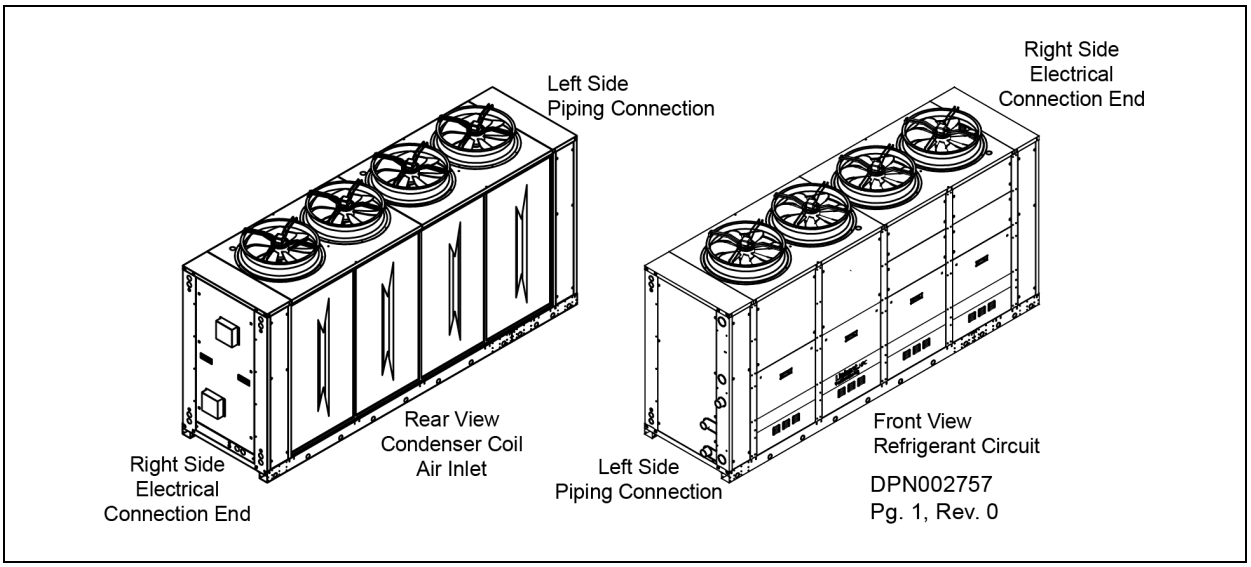


Figure 3.10 Isometric views FG0052 with buffer tank

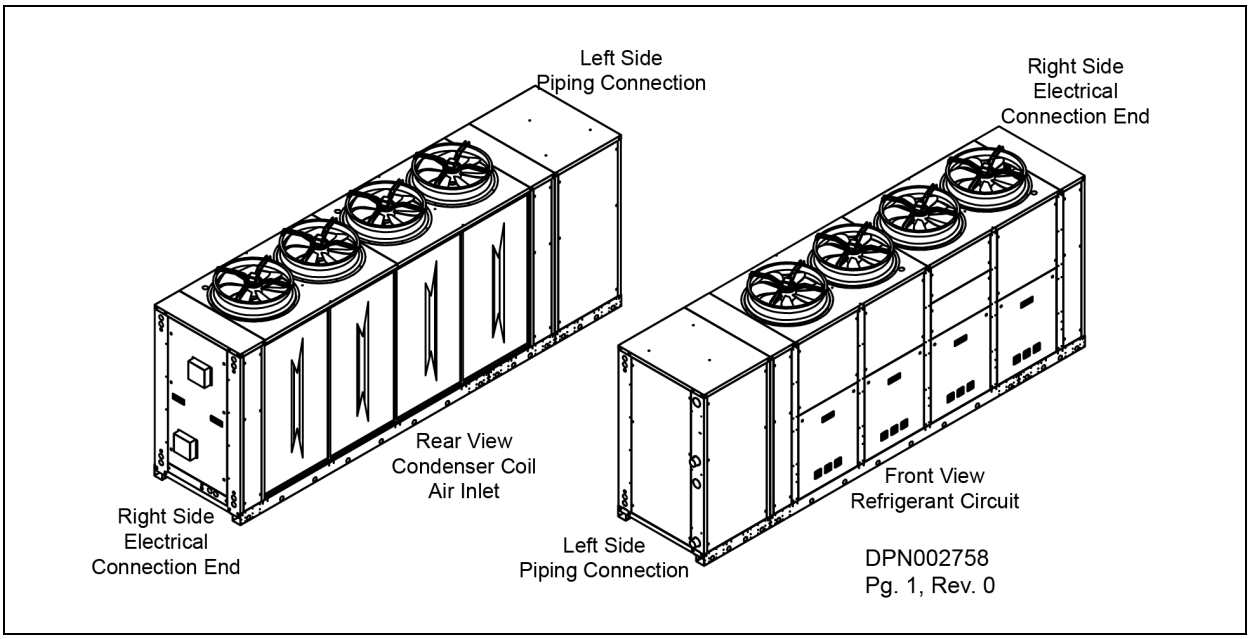


Figure 3.11 Isometric views FG0080 / FB0110 without buffer tank

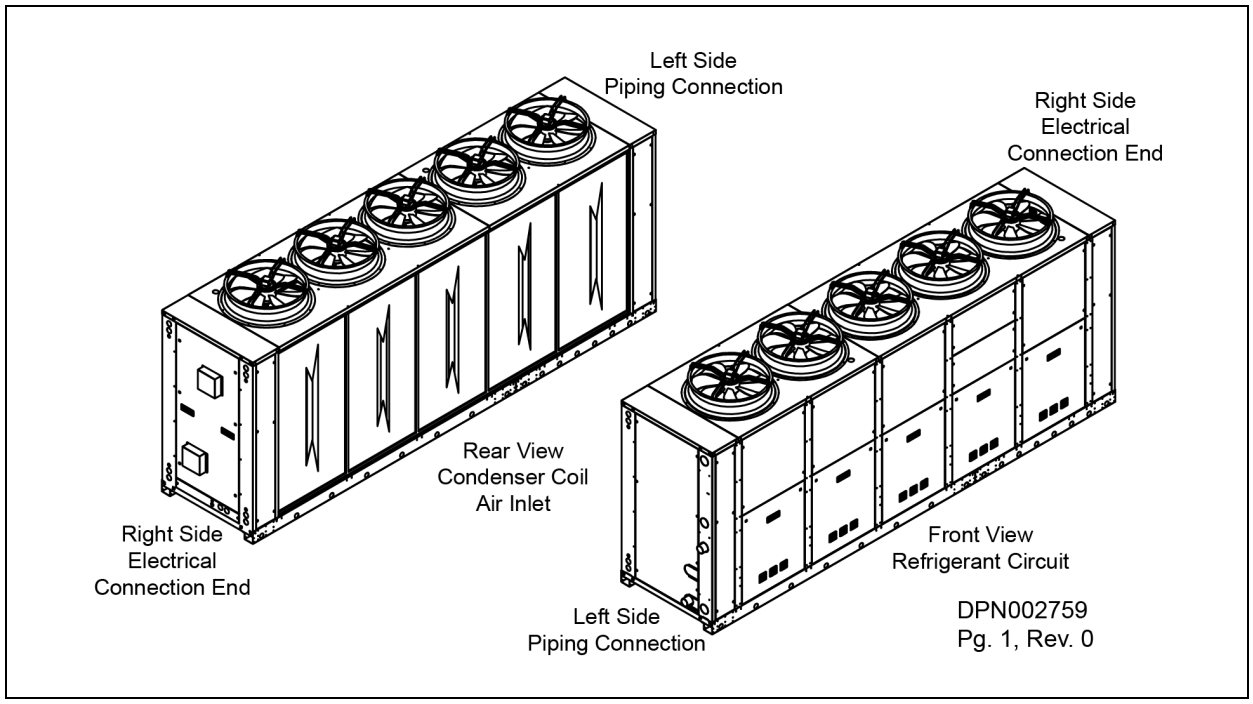


Figure 3.12 Isometric views FG0080 / FB0110 with buffer tank

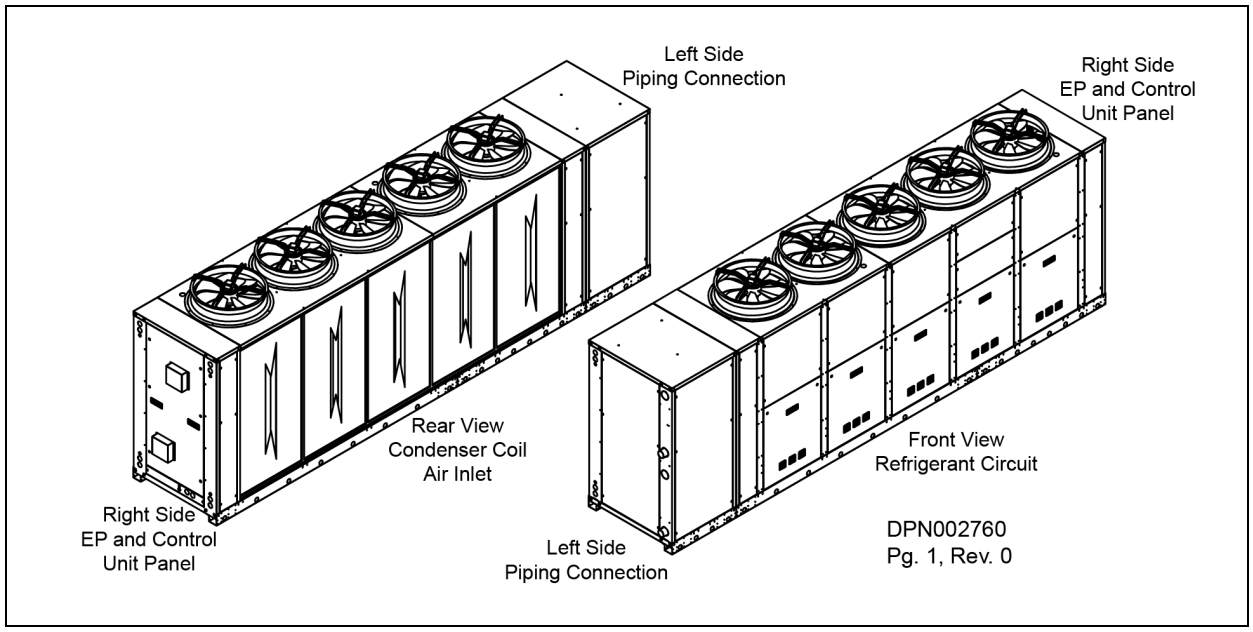


Figure 3.13 High-voltage and low-voltage electrical field connections

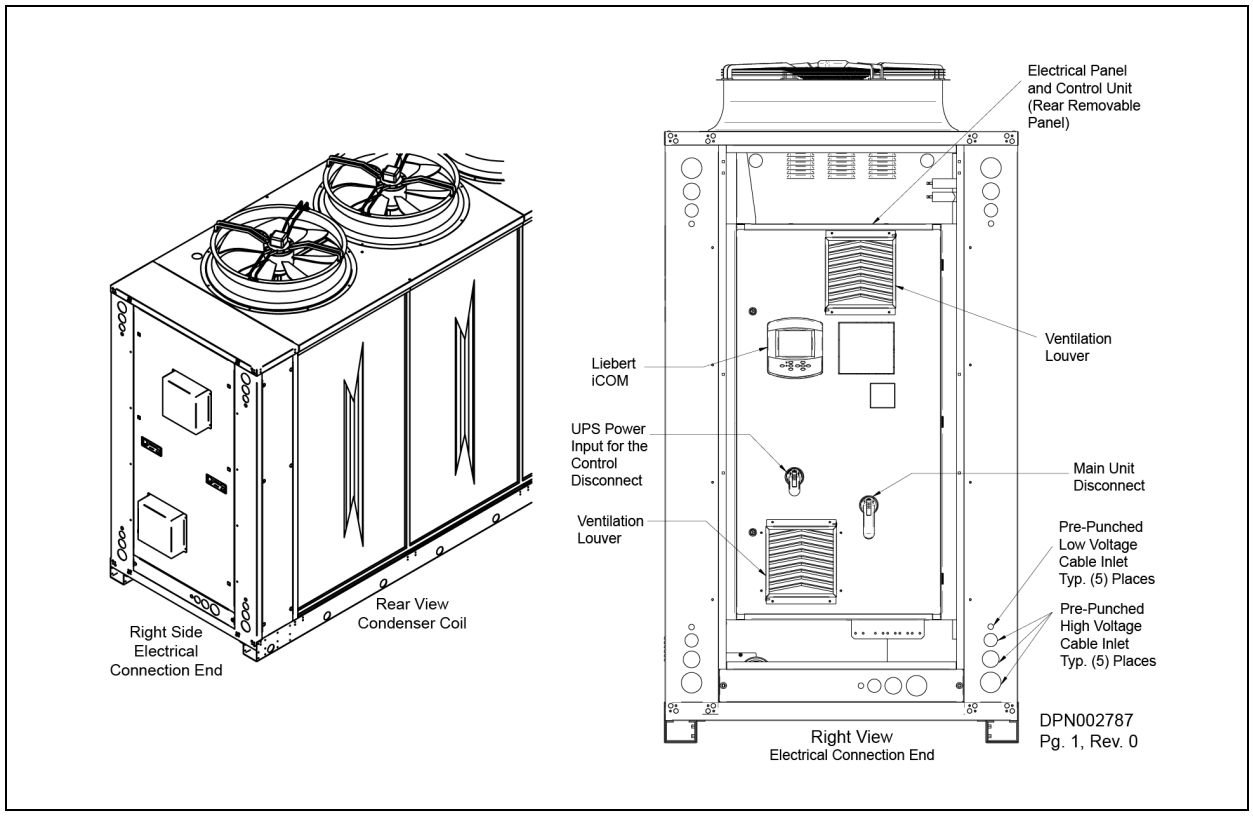


Figure 3.14 High-voltage, low-voltage electrical field connection locations and cable entry points

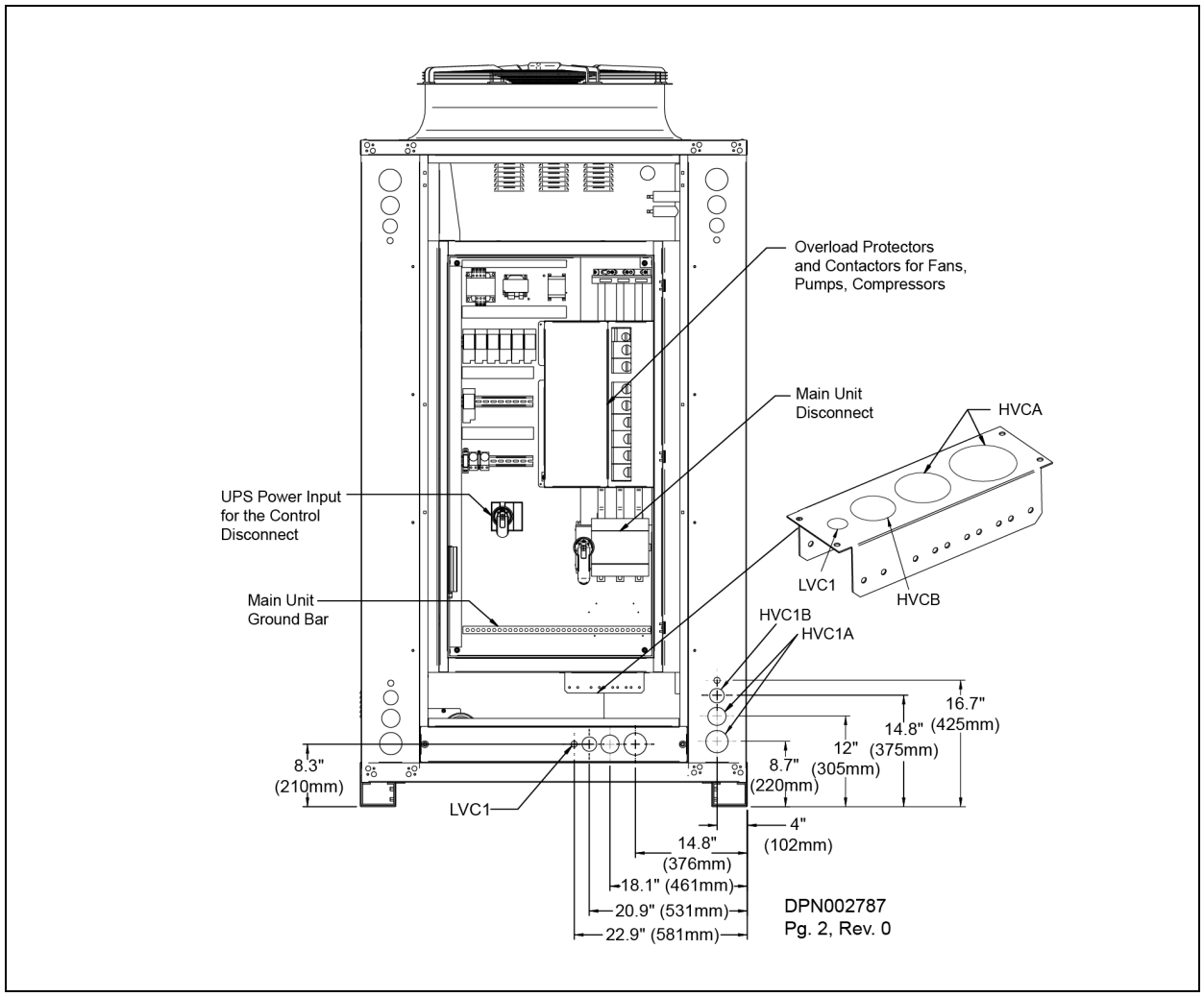


Table 3.1 Key to numbered components in Figure 3.14 above

Unit Connections	Description	Knockout Hole Diameter, In. (mm)
LVC	Low-Voltage Connection Bracket for Cables Electrical Panel Inlet	.9 (22)
HVCA	High-Voltage Connection Main Supply Bracket for Cables Electrical Panel Inlet	2.4 (62) 3 (76.2)
HVCB	High-Voltage Connection UPS Supply Bracket for Cables Electrical Panel Inlet	2 (50)
LVC1	Low-Voltage Connection Front Right Jamb	.9 (22)
HVC1A	High-Voltage Connection Main Supply Front Right Jamb	2.4 (62) 3 (76.2)
HVC1B	High-Voltage Connection UPS Supply Front Right Jamb	2 (50)
Source: DPN002787, Rev. 0		

Figure 3.15 High-voltage, low-voltage electrical connection locations

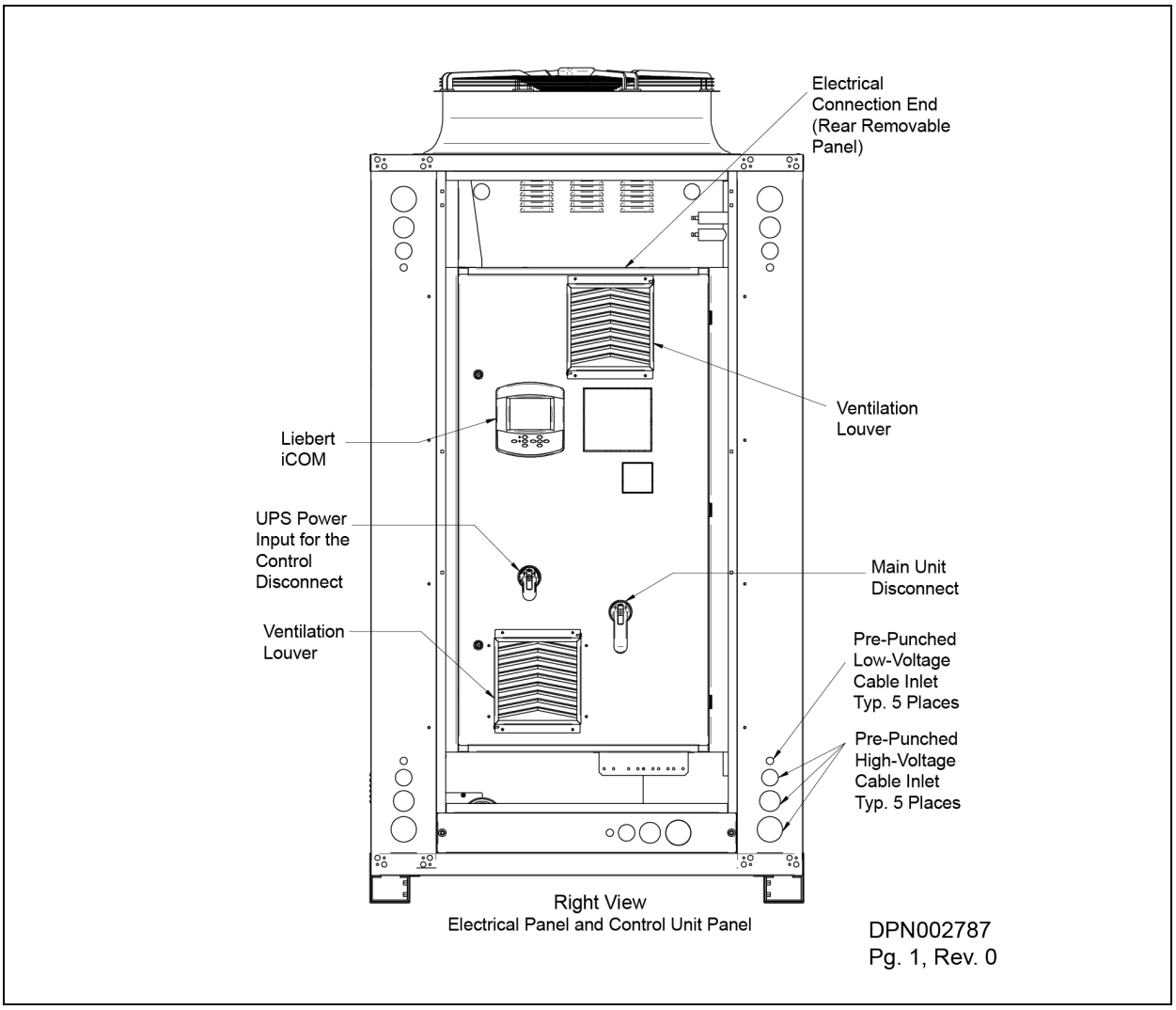


Figure 3.16 Suggested internal pathways for high-voltage, low-voltage electrical wiring

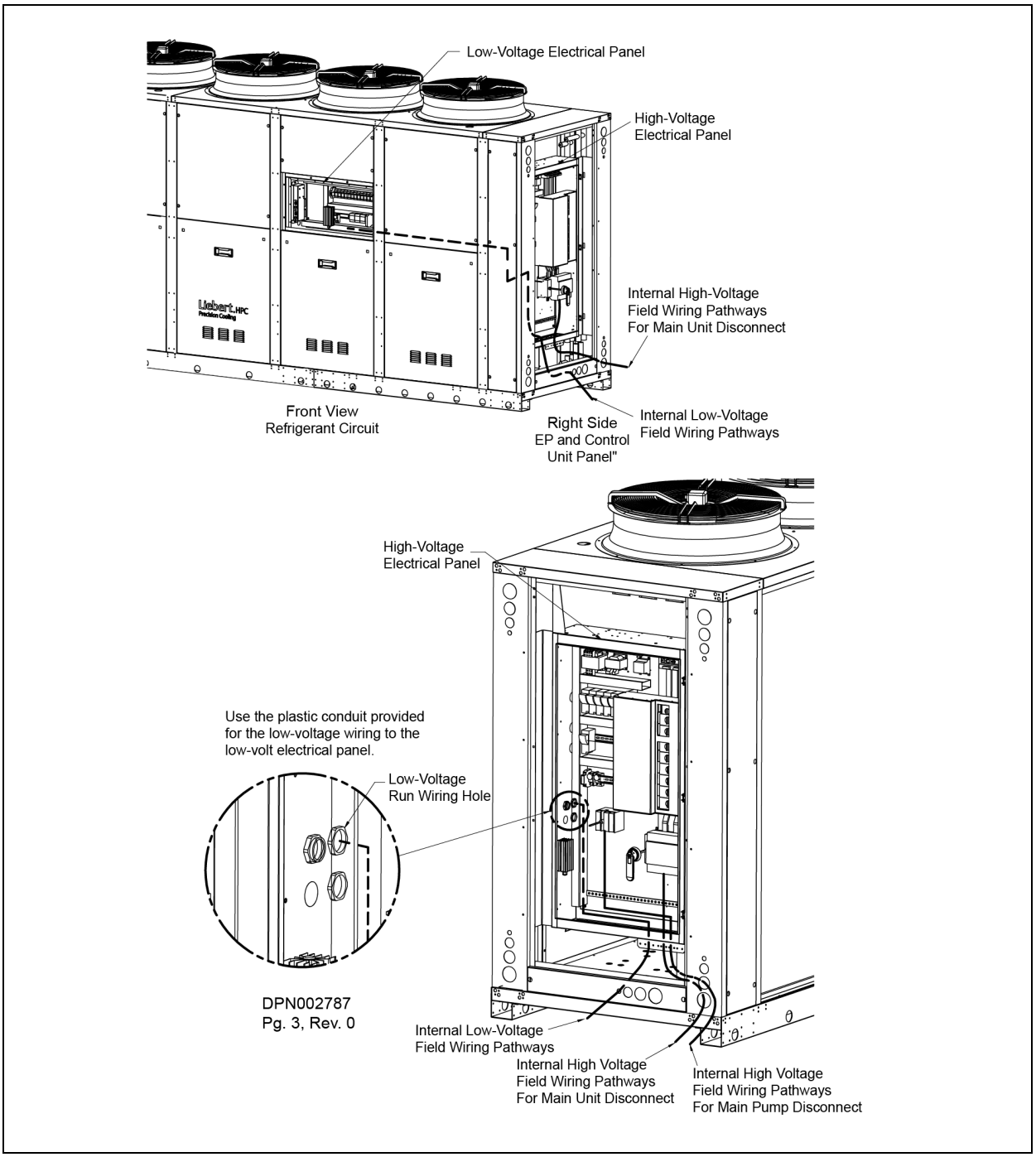


Figure 3.17 Liebert HPC-S fluid circuit schematic

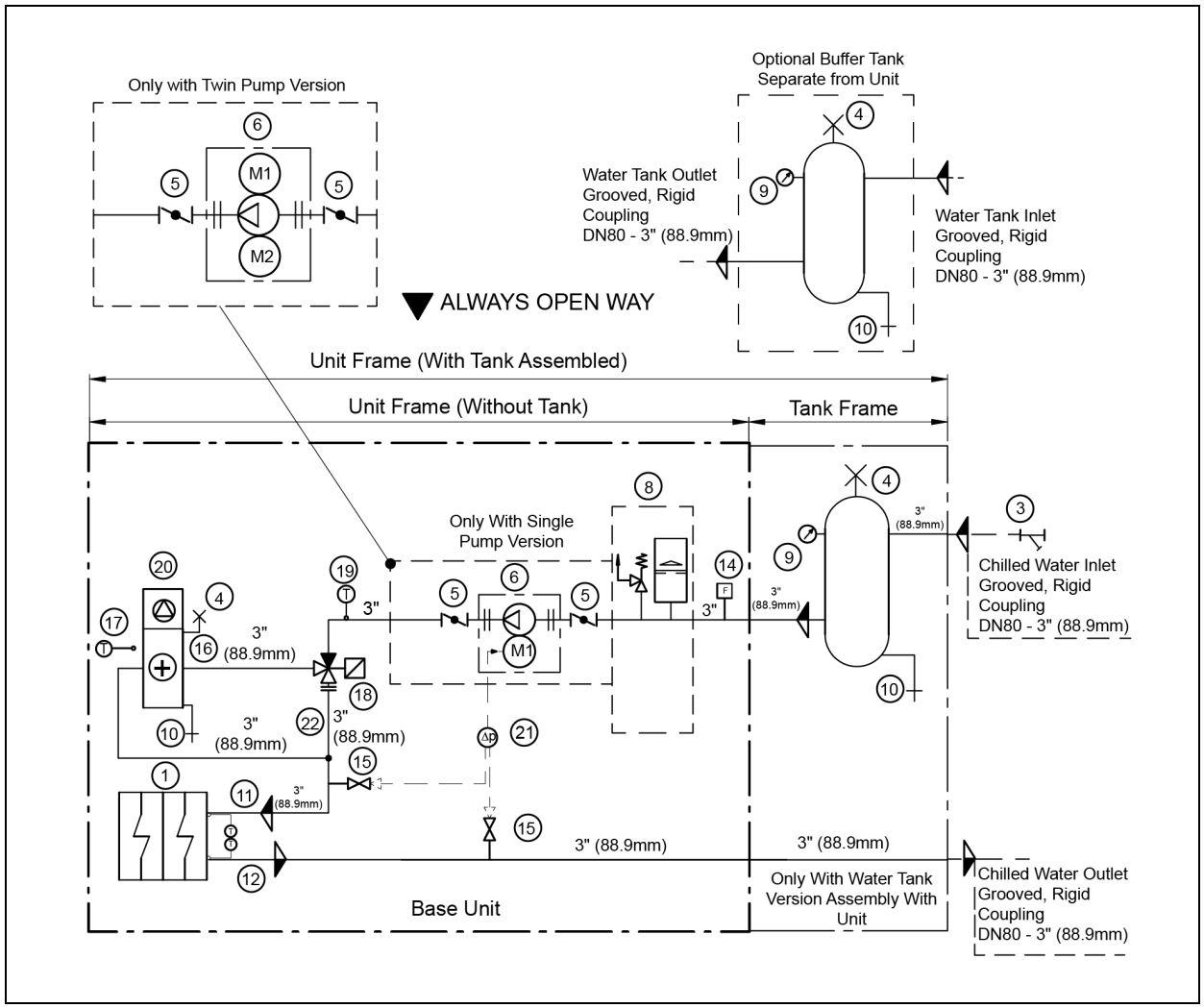


Table 3.2 Key to numbered components in Figure 3.17 above

Ref.	Description	Ref.	Description
1	Evaporator	12	Water Outlet Evaporator Probe
3	Water Filter (Optional)	14	Flow Switch
4	Manual Air Valve	15	Service Valve With Cap
5	Isolation Valve	16	Free-Cooling Coil
6	Single Pump (Optional)	17	Air Temperature Sensor
7	Twin Pump (Optional)	18	Three-Way Valve
8	Expansion Tank + Safety Valve (Optional)	19	Control Free-Cooling Thermostat Sensor
9	Manometer	20	Fans
10	Discharge Valve	21	Diff. Transducer (Only With Inverter Pump)
11	Water Inlet Evaporator Probe	22	Calibrate Baffle

Figure 3.18 Refrigerant circuit diagram

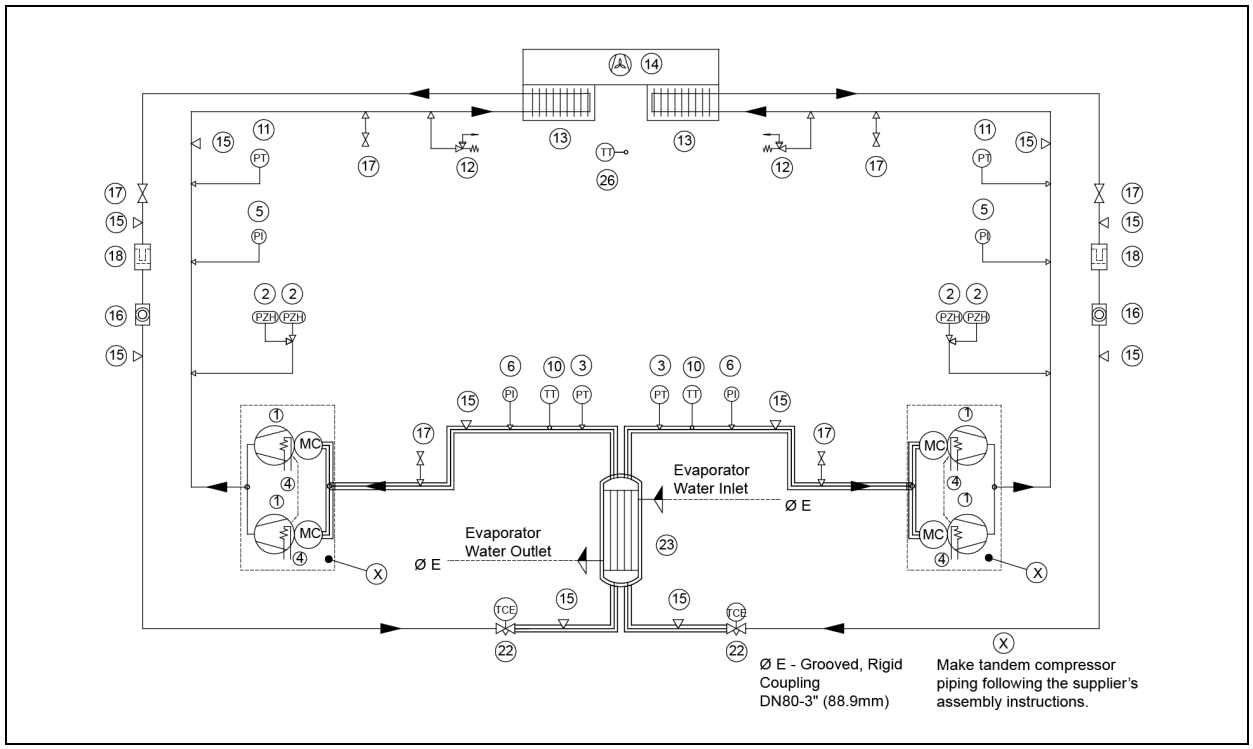


Table 3.3 Key to numbered components in Figure 3.18 above

Tag	Description	Tag	Description
1	Compressor	14	Condenser fans
2	High-pressure switch	15	Service connection
3	Transducer pressure sensor (low-pressure control)	16	Sight glass
4	Crankcase heater	17	Shutoff valve
5	High pressure manometer	18	Filter dryer
6	Low pressure manometer	19	—
7	—	20	—
8	—	21	—
9	—	22	Electronic expansion valve
10	Thermostatic temperature sensor	23	Evaporator
11	Transducer pressure sensor (High pressure control)	24	—
12	Safety valve	25	—
13	Condenser	26	External air temperature sensor

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