Precision Cooling
For *Business-Critical Continuity™*

Liebert DS™

User Manual

28-105kW, 8-30 Tons, Upflow and Downflow, 50/60Hz

Liebert®

EMERSON™
Network Power

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SAVE THESE INSTRUCTIONS

This manual contains important safety instructions that should be followed during the installation and maintenance of the Liebert DS™. Read this manual thoroughly before attempting to install or operate this unit.

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

Adhere to all warnings, cautions and installation, operating and safety instructions on the unit and in this manual. Follow all operating and user instructions.

⚠ WARNING

Risk of electric shock. Can cause injury or death.

Disconnect local and remote power supplies before working within.

Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power.

The iCOM microprocessor does not isolate power from the unit, even in the "unit off" mode. Some internal components require and receive power even during the "unit off" mode of iCOM control.

The Liebert-supplied optional disconnect switch is inside the unit. The line side of this switch contains live high voltage.

The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic.

Follow all local codes.

⚠ WARNING

Risk of explosive discharge from high-pressure refrigerant. Can cause injury or death.

This unit contains fluids and gases under high pressure. Relieve pressure before working with piping.

⚠ WARNING

Risk of refrigerant system rupture or explosion from overpressurization. Can cause equipment damage, injury or death.

If a pressure relief device is not provided with the condenser unit, the system installer must provide and install a discharge pressure relief valve rated for a maximum of 500 psig (34bar) in the high side refrigerant circuit. Do not install a shutoff valve between the compressor and the field installed relief valve.

One or more additional pressure relief valves are required downstream of any and all field-installed isolation valves as shown in **Figures 32** and **33**. Do not isolate any refrigerant circuits from overpressurization protection.

For systems requiring EU CE compliance (50Hz), the pressure relief valve must be CE certified to the EU Pressure Equipment Directive by an EU "Notified Body."

NOTE

A pressure relief valve is provided with Liebert Lee-Temp condensers. A fusible plug is provided on Liebert Fan Speed Control condensers. The Liebert indoor cooling unit has a factory-installed high pressure safety switch in the high side refrigerant circuit.

⚠ WARNING

Risk of high-speed moving parts. Can cause injury or death.

Disconnect all local and remote electric power supplies before working in the unit.

CAUTION

Risk of contact with hot surfaces. Can cause injury.

The compressors, refrigerant discharge lines, humidifiers and reheats are extremely hot during unit operation. Allow sufficient time for them to cool before working within the unit cabinet. Use extreme caution and wear protective gloves and arm protection when working on or near hot compressors, discharge lines, humidifiers and reheats.

CAUTION

Risk of leaking water. Can cause equipment and building damage.

This unit requires a water drain connection. It may also require an external water supply to operate.

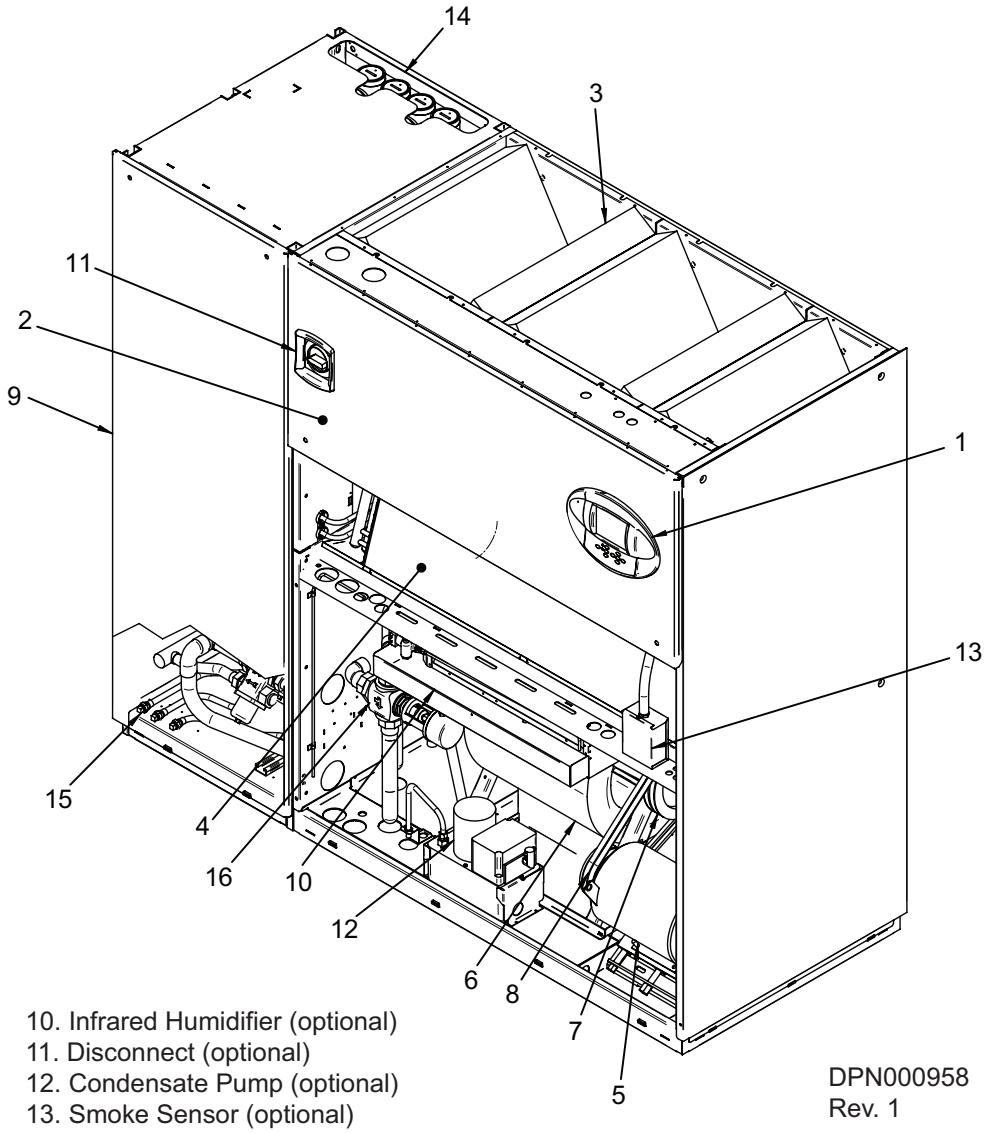
Improper installation, application and service practice can result in water leakage from the unit. Water leakage can result in severe property damage and loss of critical data center equipment.

Do not locate unit directly above any equipment that could sustain water damage.

Liebert recommends installing leak detection equipment for unit and supply lines.

1.0 LIEBERT DS COMPONENTS AND NOMENCLATURE

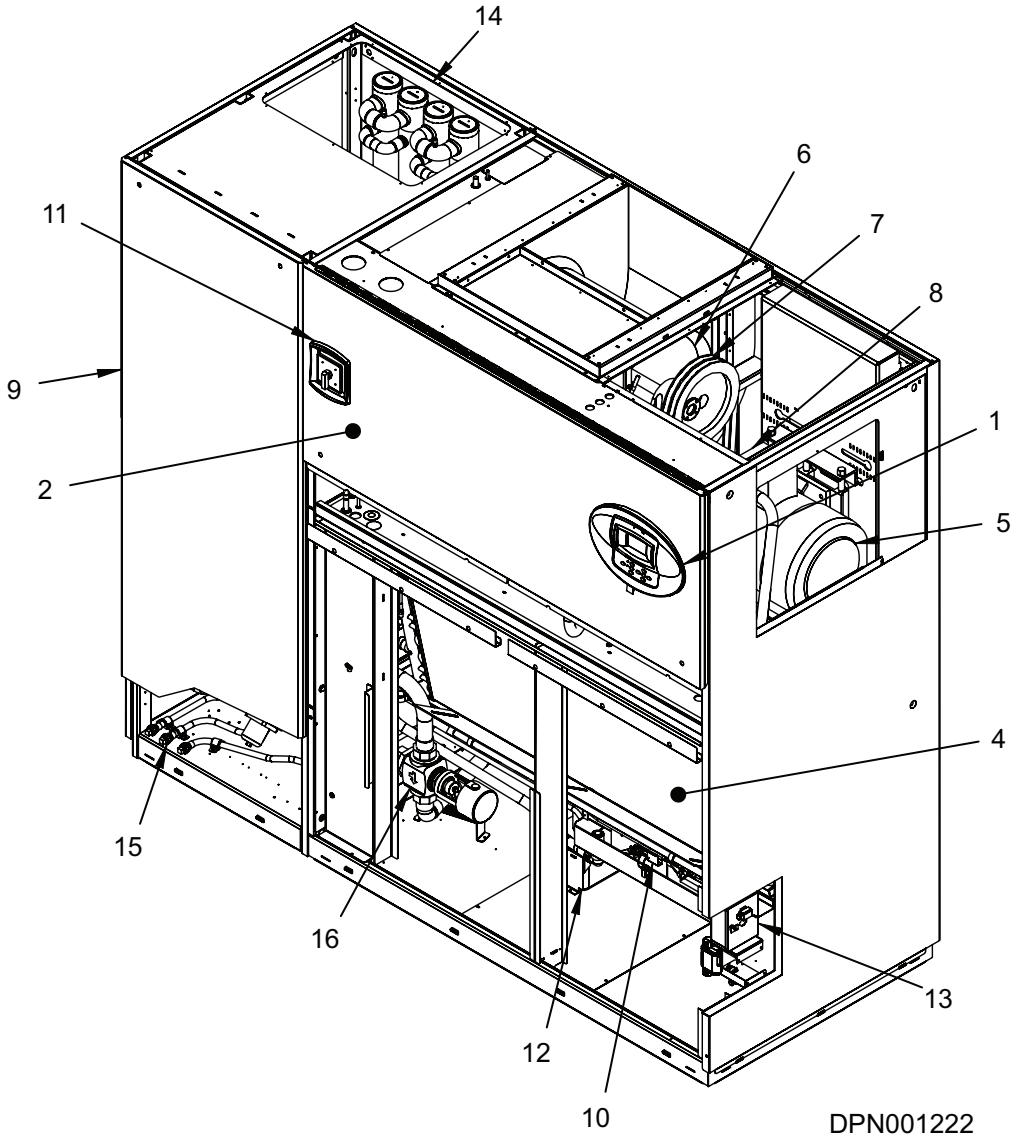
Figure 1 Downflow model component locations



DPN000958
Rev. 1

1. iCOM Control Display
2. Electric Box
3. Filters
4. Evaporator Coil
5. Motor
6. Blower
7. Fan Pulley
8. Motor Sheave and Belts
9. Compressor Section
10. Infrared Humidifier (optional)
11. Disconnect (optional)
12. Condensate Pump (optional)
13. Smoke Sensor (optional)
14. Condenser Cleanout Plugs (fluid cooled units only)
15. Condenser Drain Plugs (fluid cooled units only)
16. Econ-O-Coil Valve (GLYCOOL/Dual Cooling)

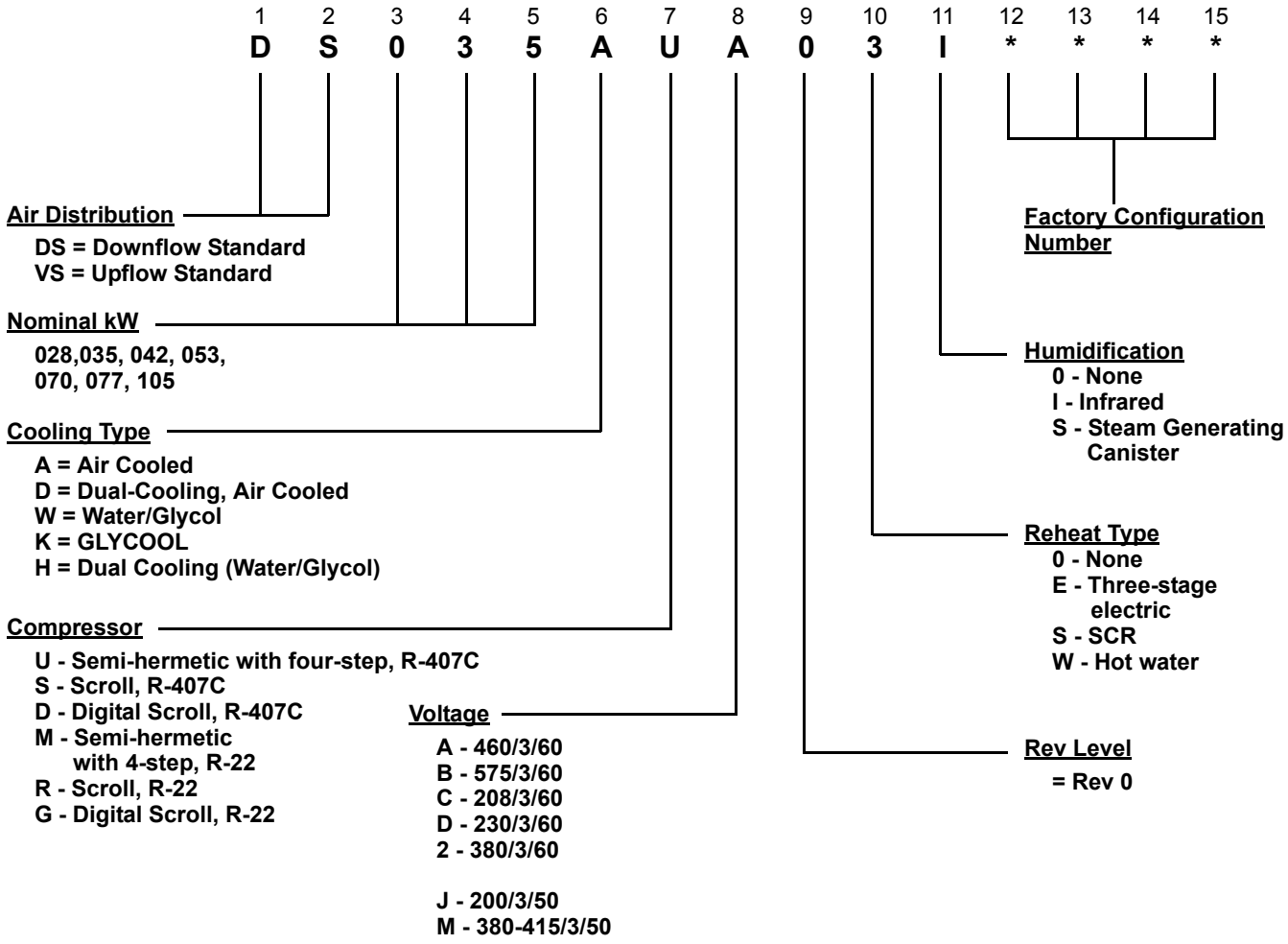
Figure 2 Upflow model component locations



DPN001222
Rev. 0

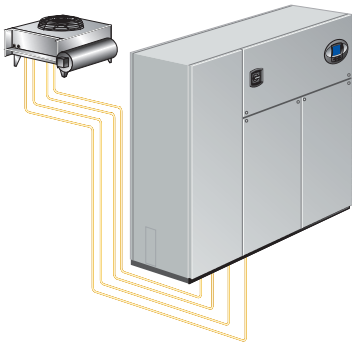
1. iCom Control Display
2. Electric Box
3. Filters
4. Evaporator Coil
5. Motor
6. Blower
7. Fan Pulley
8. Motor Sheave and Belts
9. Compressor Section
10. Infrared Humidifier (optional)
11. Disconnect (optional)
12. Condensate Pump (optional)
13. Smoke Sensor (optional)
14. Condenser Cleanout Plugs (fluid cooled units only)
15. Condenser Drain Plugs (fluid cooled units only)
16. Econ-O-Coil Valve (GLYCOOL/Dual Cooling)

Figure 3 Liebert DS model number nomenclature

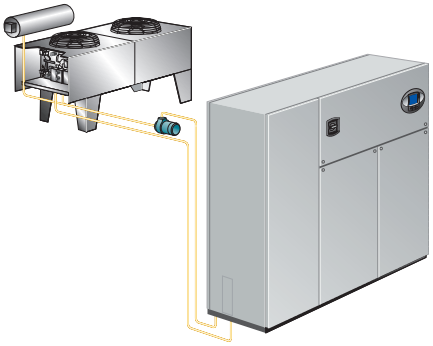


2.0 COOLING CONFIGURATIONS

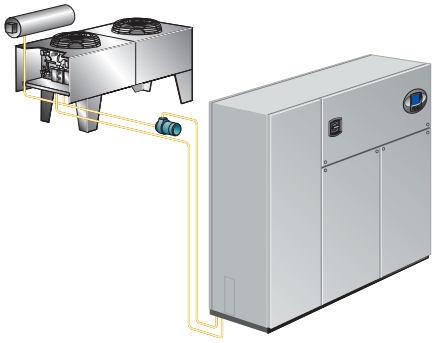
NOTE
All field-installed piping must comply with applicable local, state and federal codes.



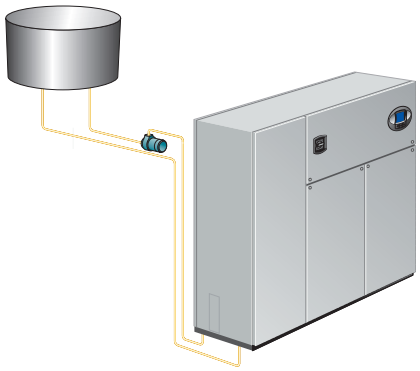
Air Cooled
Air cooled unit piping is spun closed from the factory and contain a nitrogen holding charge. Each installation requires refrigerant piping to a condenser.



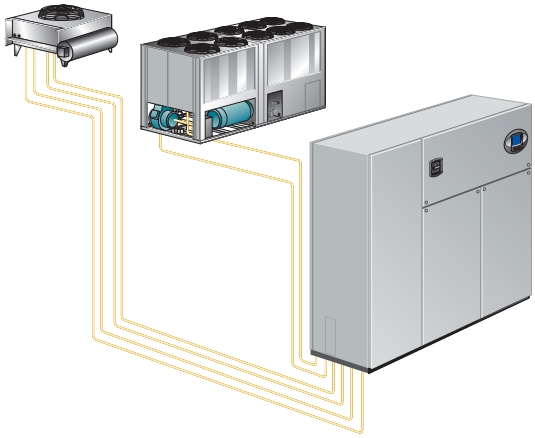
Glycol Cooled
Glycol cooled units are factory-charged and tested. Field-installed piping is required from the unit to the drycooler and pump package.



GLYCOOL
GLYCOOL units are factory-charged and tested. Field-installed piping is required from the unit to the drycooler and pump package. An additional coil is included for use when fluid temperatures are sufficiently low (below room temperature). Cooling is provided by circulating cold glycol through this second coil, reducing compressor operation.



Water Cooled
Water cooled units are factory-charged and tested. Field-installed water piping is required from the unit to the cooling tower.



Dual Cool
This system has all of the features of a compressorized system, but adds a second cooling coil that is connected to a source of chilled water. Cooling is provided by circulating water through this second coil and reducing compressor operation.

3.0 PRE-INSTALLATION GUIDELINES

3.1 Room Preparation

- Verify the floor is level, solid and sufficient to support the unit. See **Table 2** for unit weights.
- Confirm that the room is properly insulated and has a sealed vapor barrier.
- For proper humidity control, keep outside or fresh air to an absolute minimum (less than 5% of total air circulated in the room).
- Avoid locating units in an alcove or at the end of a long narrow room. Locate the units as close as possible to the largest heat load.
- Allow minimum recommended clearances for routine maintenance and service. See **Figures 4** through **17** for dimensions.
- An under-floor water detection system is recommended. Contact your local Liebert representative for additional information.

3.2 Air Distribution

3.2.1 Downflow Units

- Verify the raised floor has been properly sized for unit airflow and is free of any unintended restrictions.
- Perforated floor tiles in the raised floor should ensure minimal pressure loss.
- Avoid floor elevations less than 7-1/2" (191mm).
- Ensure clearance above the unit for filter removal.

3.3 Connections

- Plan the routing of wiring, piping and ductwork to the unit. See **Figures 31** and **39** through **52** for unit connection locations.
- The unit requires a drain, which must comply with all applicable codes. This drain line may contain boiling water. See **7.1.1 - Condensate Piping—Field-Installed** for details.
- Three-phase electrical service is required for all models. Electrical service must conform to national and local electrical codes. See equipment nameplate for details.
- If seismic requirements exist, consult your local Liebert representative for information regarding a seismic rated floor stand.

4.0 LIEBERT DS DIMENSIONS AND WEIGHTS

Table 1 Shipping dimensions, domestic and export, inches (mm)

Model Number	028 / 035 / 042	053 / 070 / 077	105
	L x W x H, in (mm)	L x W x H, in (mm)	L x W x H, in (mm)
DSAS, DSAD, DSAR, DSAG, DSDS, DSDD, DSDR, DSDG	90 x 42 x 82 (2286 x 1067 x 2083)	102 x 42 x 82 (2591 x 1067 x 2083	136 x 42 x 82 (3454 x 1067 x 2083)
DSAU, DSAM, DSDU, DSDM		114 x 42 x 82 (2896 x 1067 x 2083)	
DSWS, DSWD, DSWR, DSWG DSHS, DSHD, DSHR, DSHG			
DSWU, DSWM, DSHU, DSHM			

Table 2 Shipping weights, approximate, kg

Size	Cooling Type	Compressor Type	Downflow Unit Weight, lb		Upflow Unit Weight, lb	
			Domestic	Export	Domestic	Export
8-12 Ton	Air	Semi	1918	2088	1968	2138
		Scroll	1608	1778	1658	1828
	Air D/C	Semi	2068	2238	2118	2288
		Scroll	1758	1928	1808	1978
	W/G	Semi	2068	2238	2118	2288
		Scroll	1918	2088	1968	2138
	G/C	Semi	2218	2388	2268	2438
		Scroll	2068	2238	2118	2288
15 Ton	Air	Semi	2512	2712	2512	2712
		Scroll	2070	2260	2220	2410
	Air D/C	Semi	2692	2892	2692	2892
		Scroll	2250	2440	2400	2590
	W/G	Semi	2812	3012	2812	3012
		Scroll	2382	2582	2532	2732
	G/C	Semi	2992	3192	2992	3192
		Scroll	2562	2762	2712	2912
20 Ton	Air	Semi	2562	2762	2662	2862
		Scroll	2120	2310	2220	2410
	Air D/C	Semi	2742	942	2842	3042
		Scroll	2300	2490	2400	2590
	W/G	Semi	2862	3062	2962	3162
		Scroll	2432	2632	2532	2732
	G/C	Semi	3042	3242	3142	3342
		Scroll	2612	2812	2712	2912

Table 2 Shipping weights, approximate, kg (continued)

Size	Cooling Type	Compressor Type	Downflow Unit Weight, lb		Upflow Unit Weight, lb	
			Domestic	Export	Domestic	Export
22 Ton	Air	Semi	2612	2812	2662	2862
		Scroll	2170	2360	2220	2410
	Air D/C	Semi	2792	2992	2842	3042
		Scroll	2350	2540	2400	2590
	W/G	Semi	2912	3112	2962	3162
		Scroll	2470	2660	2532	2732
	G/C	Semi	3092	3292	3142	3342
		Scroll	2650	2840	2712	2912
30 Ton	Air	Semi	3223	3443	N/A	N/A
		Scroll	3103	3323	N/A	N/A
	Air D/C	Semi	3583	3803	N/A	N/A
		Scroll	3463	3683	N/A	N/A
	W/G	Semi	3593	3813	N/A	N/A
		Scroll	3473	3693	N/A	N/A
	G/C	Semi	3953	4173	N/A	N/A
		Scroll	3833	4053	N/A	N/A

Figure 4 Cabinet and floor planning dimensional data—downflow, air cooled, 28-42kW (8-12 tons), semi-hermetic compressor models

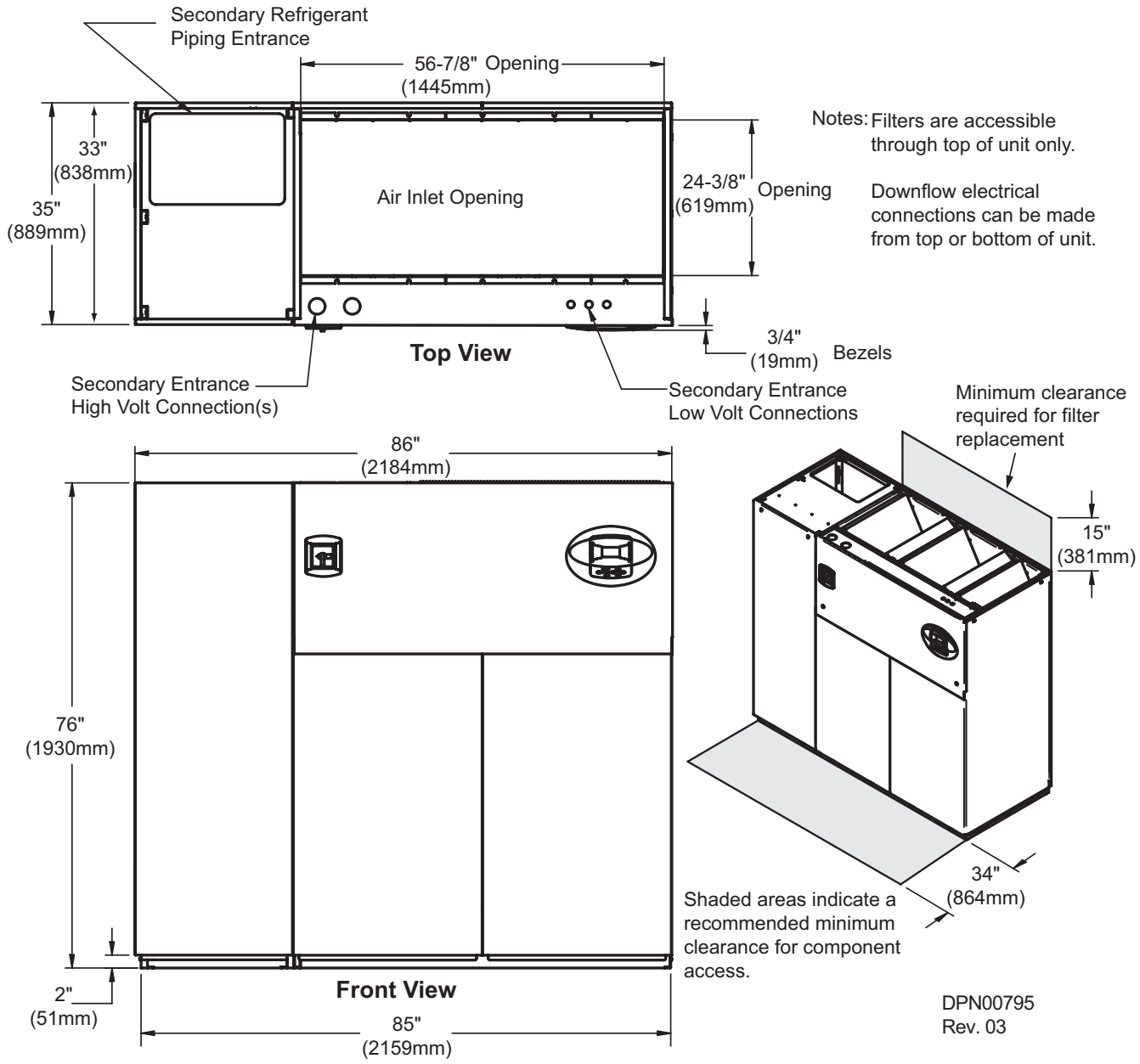


Table 3 Weights for downflow, air cooled, 28-42kW (8-12 tons), semi-hermetic compressor models

	Dry Weight - lb. (kg), Approximate
Model No.	**028, 035, 042**
Air Cooled	1780 (809)
Dual Cool	1930 (877)

Figure 5 Cabinet and floor planning dimensional data—downflow, air cooled, 28-42kW (8-12 tons), scroll compressor models

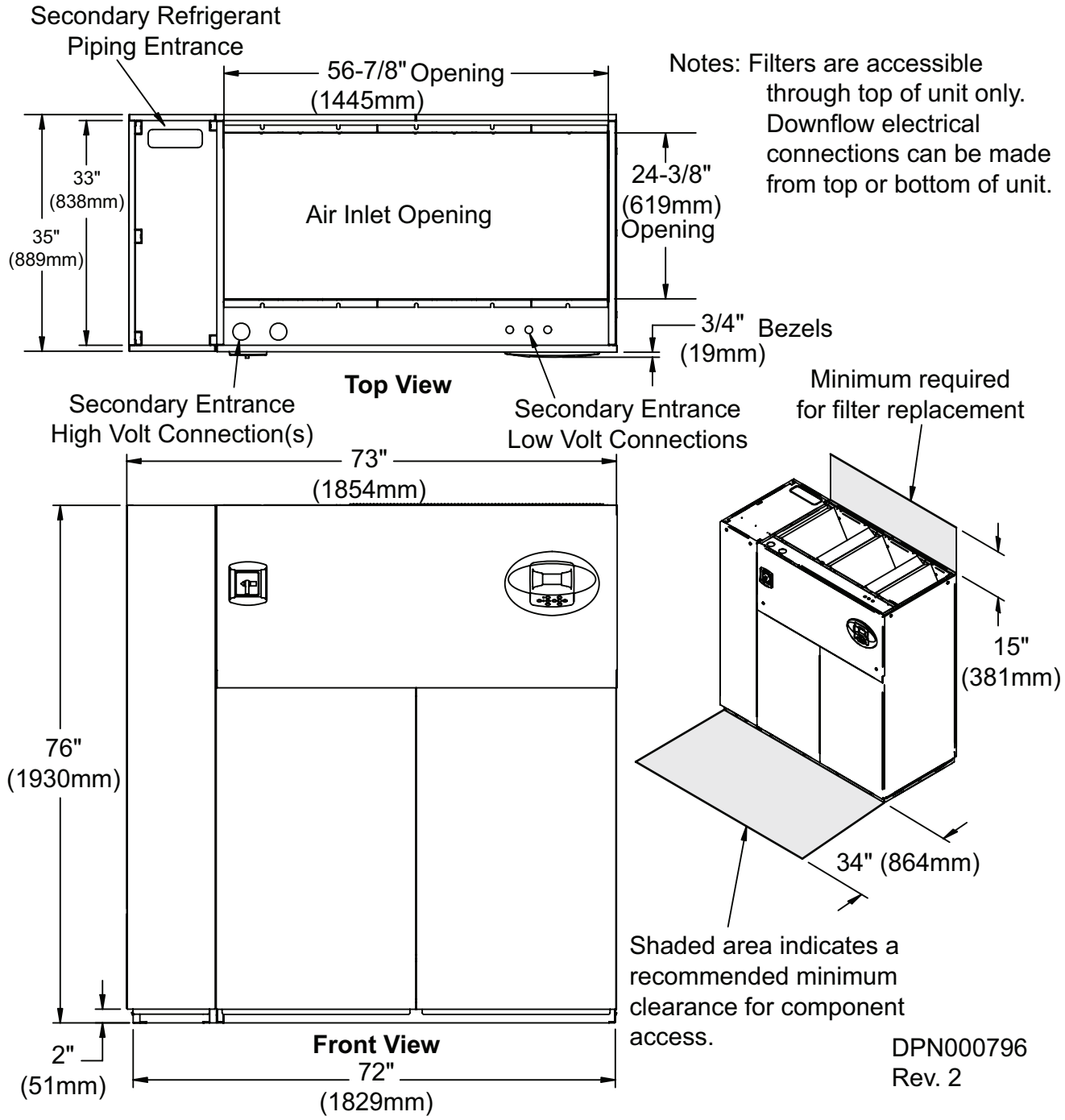


Table 4 Weights for downflow, air cooled, 28-42kW (8-12 tons), scroll compressor models

Dry Weight, lb (kg), Approximate	
Model No.	**028, 035, 042**
Air Cooled	1470 (668)
Dual Cool	1620 (736)

Figure 6 Cabinet and floor planning dimensional data—downflow, water/glycol/GLYCOOL, 28-42kW (8-12 tons) all compressor models

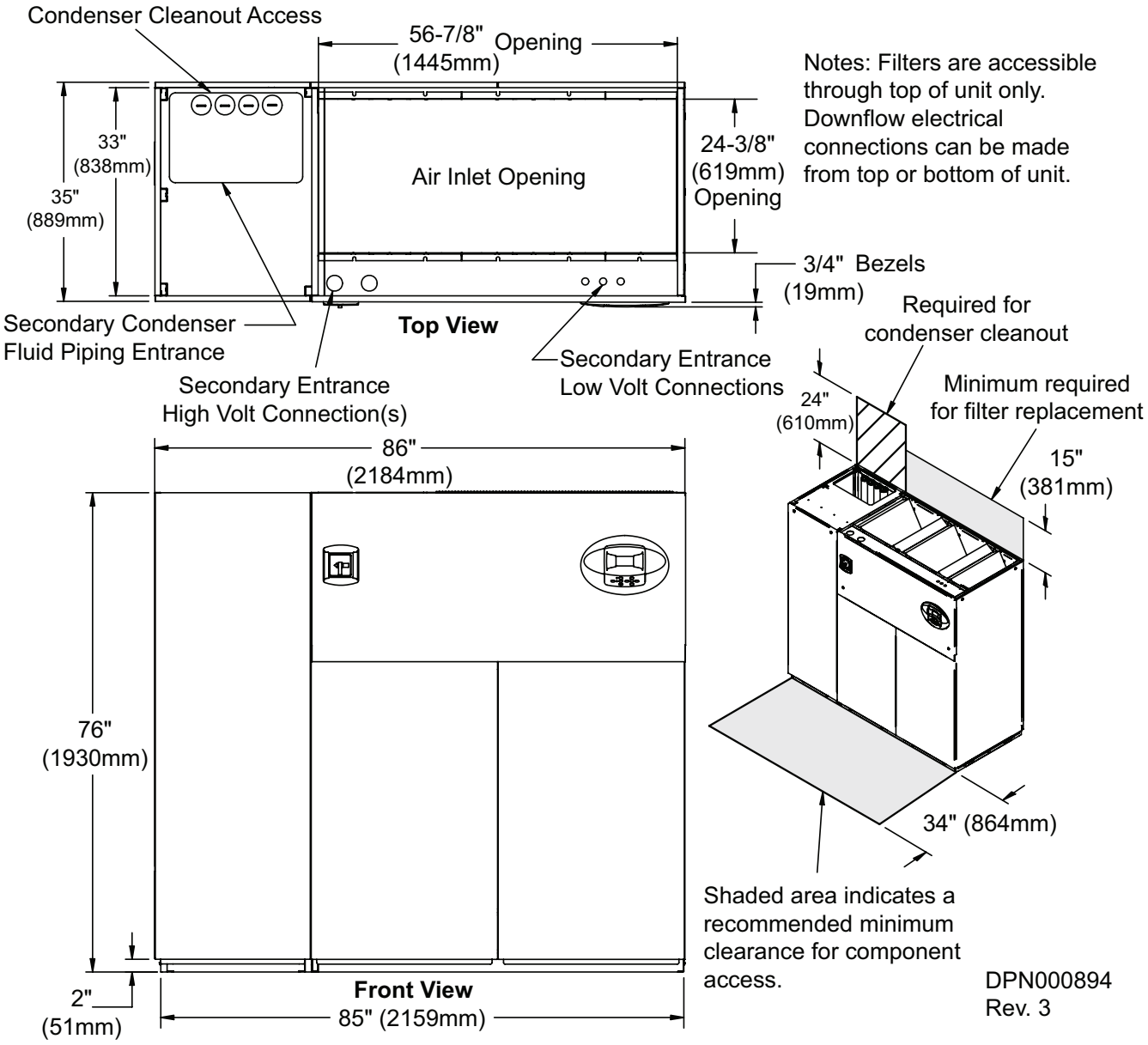


Table 5 Weights for downflow, water/glycol/GLYCOOL, 28-42kW (8-12 tons), all compressor models

Compressor Type	Dry Weight - lb. (kg), Approximate	
	Model	028, 035, 042
Semi-Hermetic Compressor	Water/Glycol	1930 (877)
	GLYCOOL/Dual Cool	2080 (945)
Scroll or Digital Scroll Compressor	Water/Glycol	1780 (809)
	GLYCOOL/Dual Cool	1930 (877)

Figure 7 Cabinet and floor planning dimensional data—downflow, air cooled, 53-77kW (15-22 tons), semi-hermetic compressor models

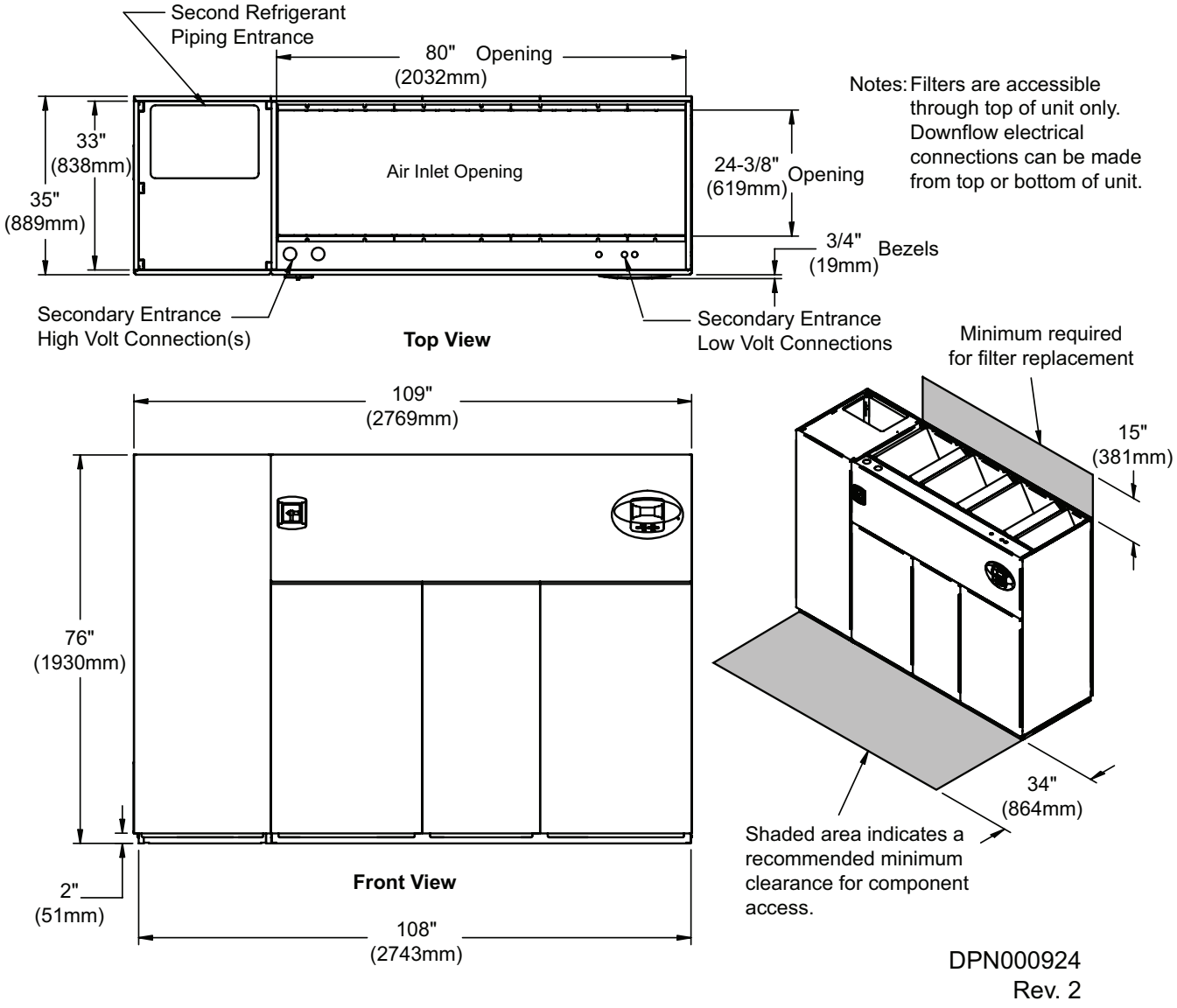


Table 6 Weights for downflow, air cooled, 53-77kW (15-22 tons), semi-hermetic compressor models

Model	Dry Weight, lb (kg) Approximate		
	053	070	077
Air Cooled	2350 (1069)	2400 (1091)	2450 (1114)
Dual Cool	2530 (1150)	2580 (1173)	2630 (1196)

Figure 8 Cabinet and floor planning dimensional data—downflow, air cooled, 53-77kW (15-22 tons), scroll compressor models

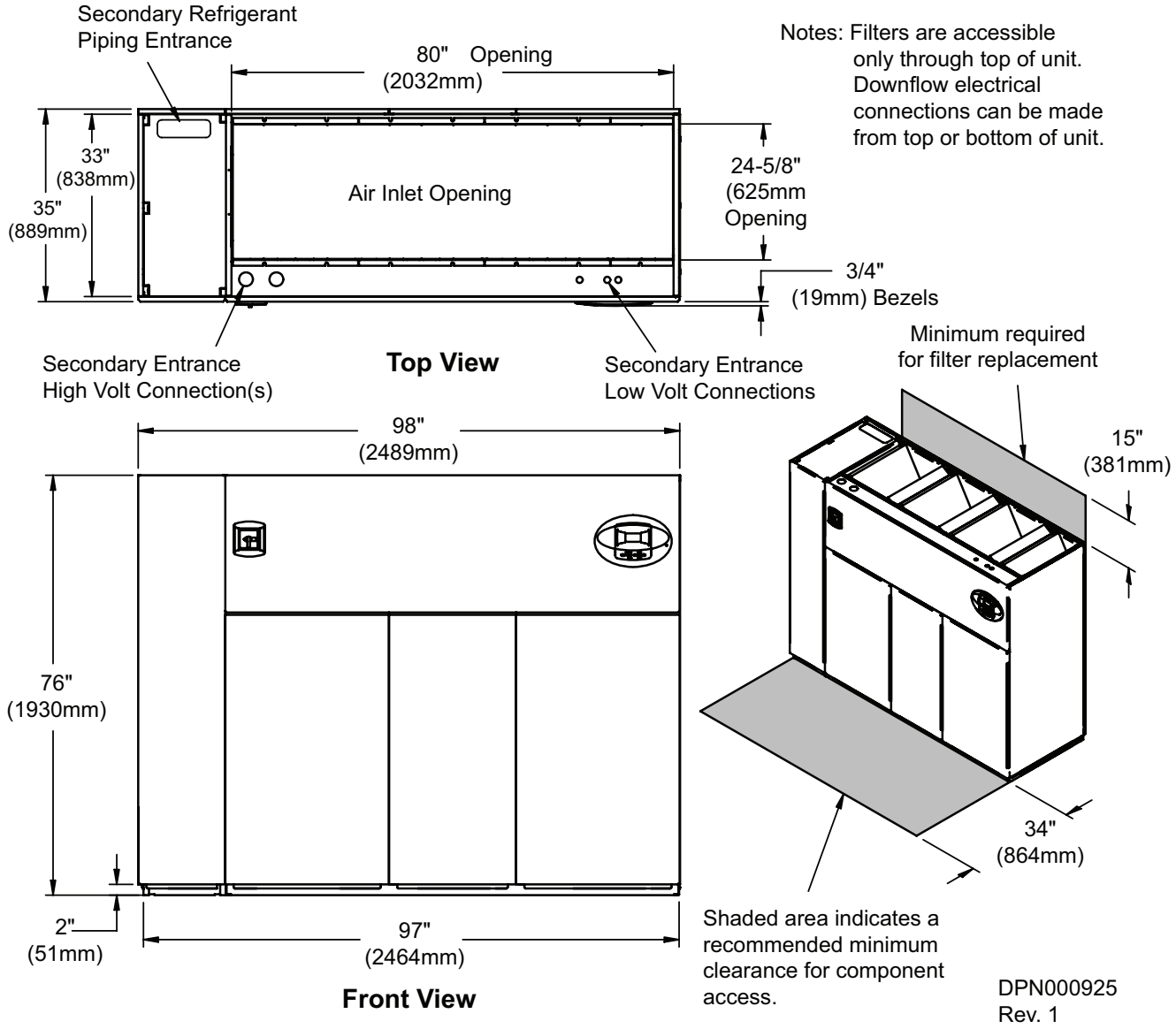


Table 7 Weights for downflow, air cooled, 53-77kW (15-22 tons), scroll compressor models

Model No.	Dry Weight, lb (kg) Approximate		
	053	070	077
Air Cooled	1920 (873)	1970 (896)	2020 (919)
Dual Cool	2100 (955)	2150 (978)	2200 (1000)

Figure 9 Cabinet and floor planning dimensional data—downflow, water/glycol/GLYCOOL, 53-77kW (15-22 tons), all compressor models

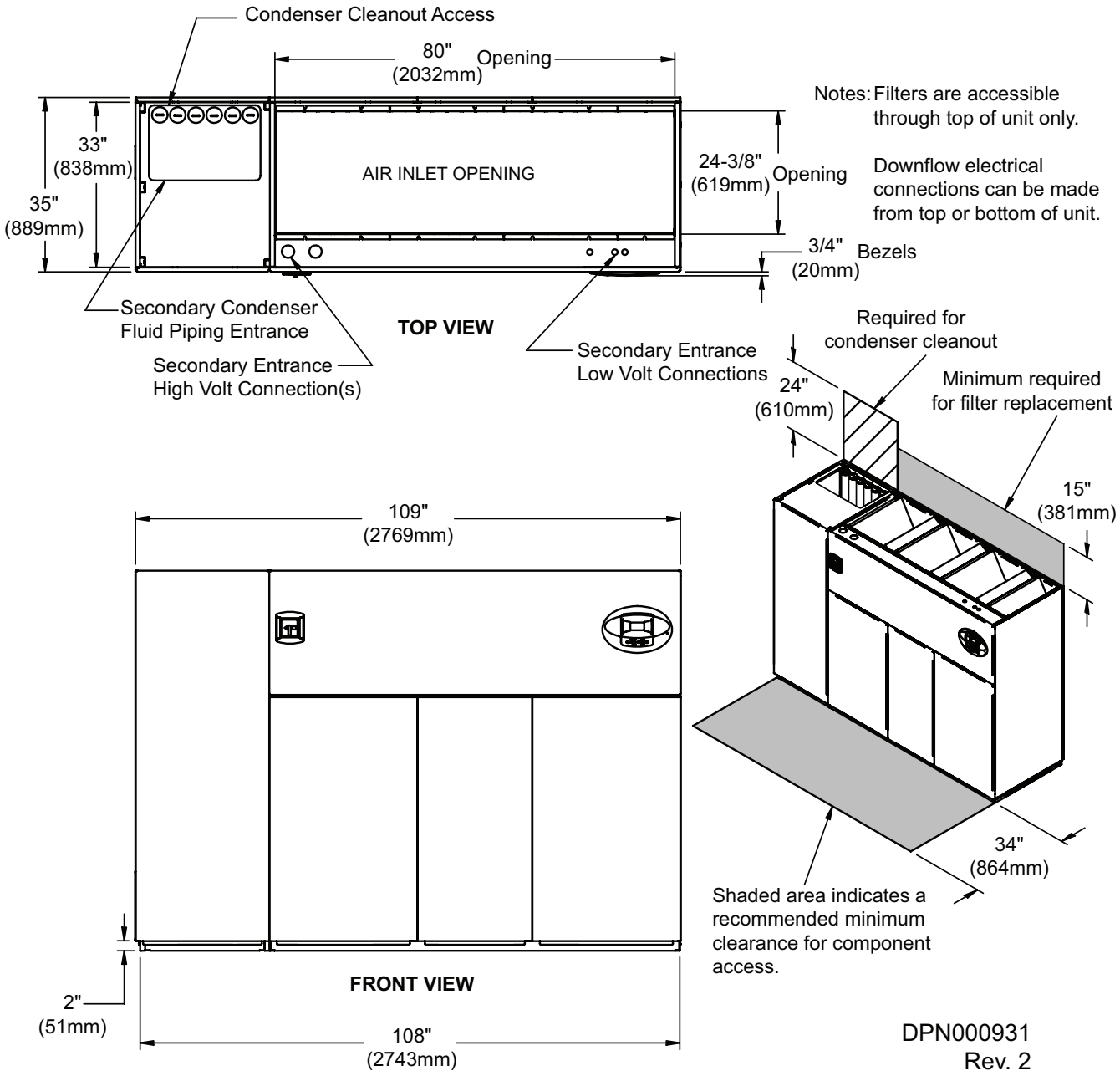


Table 8 Weights for downflow, water/glycol/GLYCOOL, 53-77kW (15-22 tons), all compressor models

Compressor Type	Model	Dry Weight, lb (kg), Approximate		
		053	070	077
Semi-Hermetic Compressor	Water/Glycol	2650 (1205)	2700 (1228)	2750 (1250)
	GLYCOOL/Dual Cool	2830 (1287)	2880 (1310)	2930 (1332)
Scroll or Digital Scroll Compressor	Water/Glycol	2220 (1010)	2270 (1032)	2320 (1055)
	GLYCOOL/Dual Cool	2400 (1091)	2450 (1114)	2500 (1137)

Figure 10 Cabinet and floor planning dimensions—downflow, air cooled, 105kW (30 tons), all compressor models

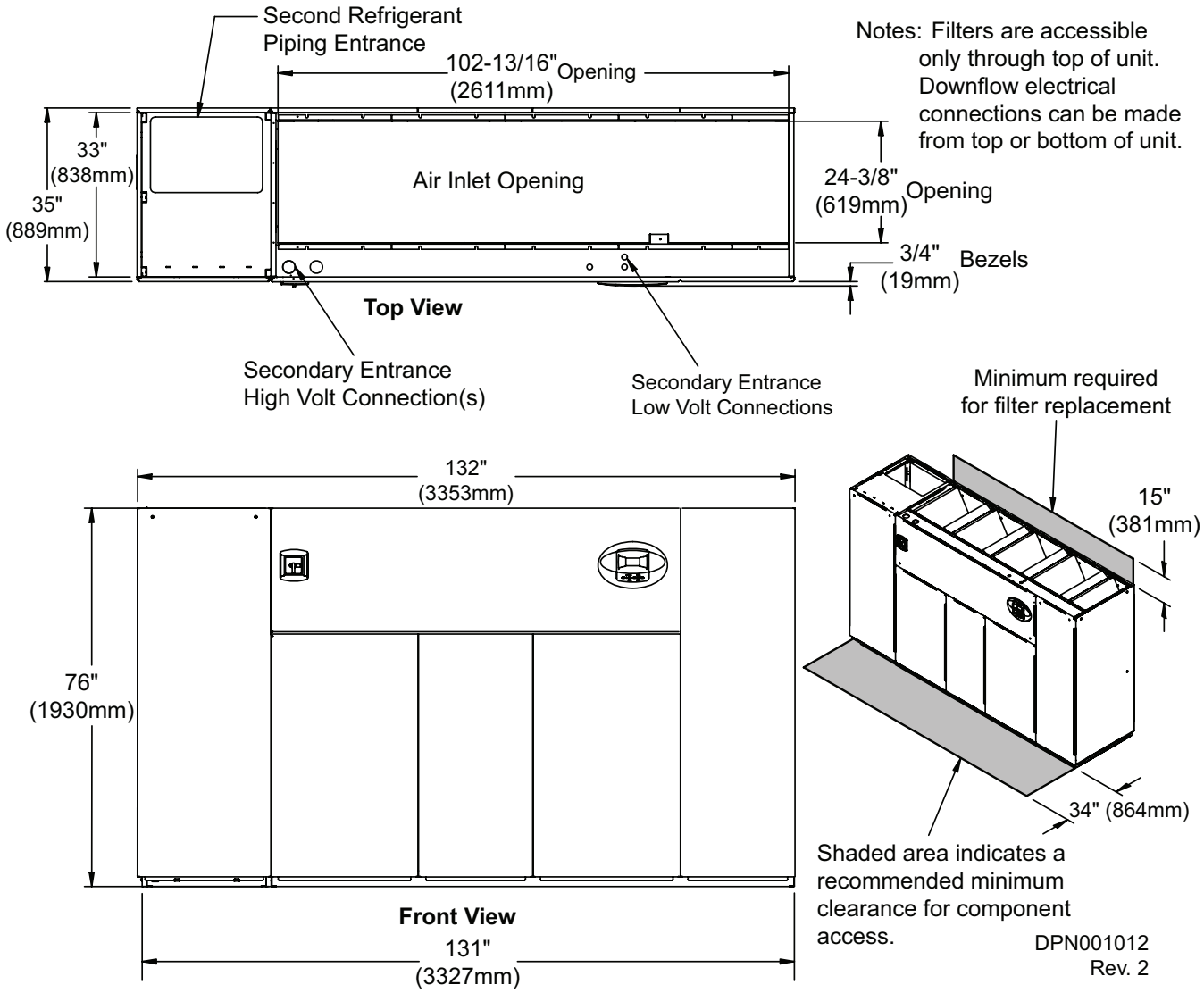


Table 9 Weights for downflow, air cooled, 105kW (30 tons), all compressor models

Compressor Type	Dry Weight, lb (kg) approximate	
	Model	105
Semi-Hermetic Compressor	Air Cooled	3040 (1382)
	Dual Cool	3400 (1545)
Scroll Compressor	Air Cooled	2920 (1327)
	Dual Cool	3280 (1491)

Figure 11 Cabinet and floor planning dimensional data—downflow, water/glycol/GLYCOOL, 105kW (30 tons), all compressor models

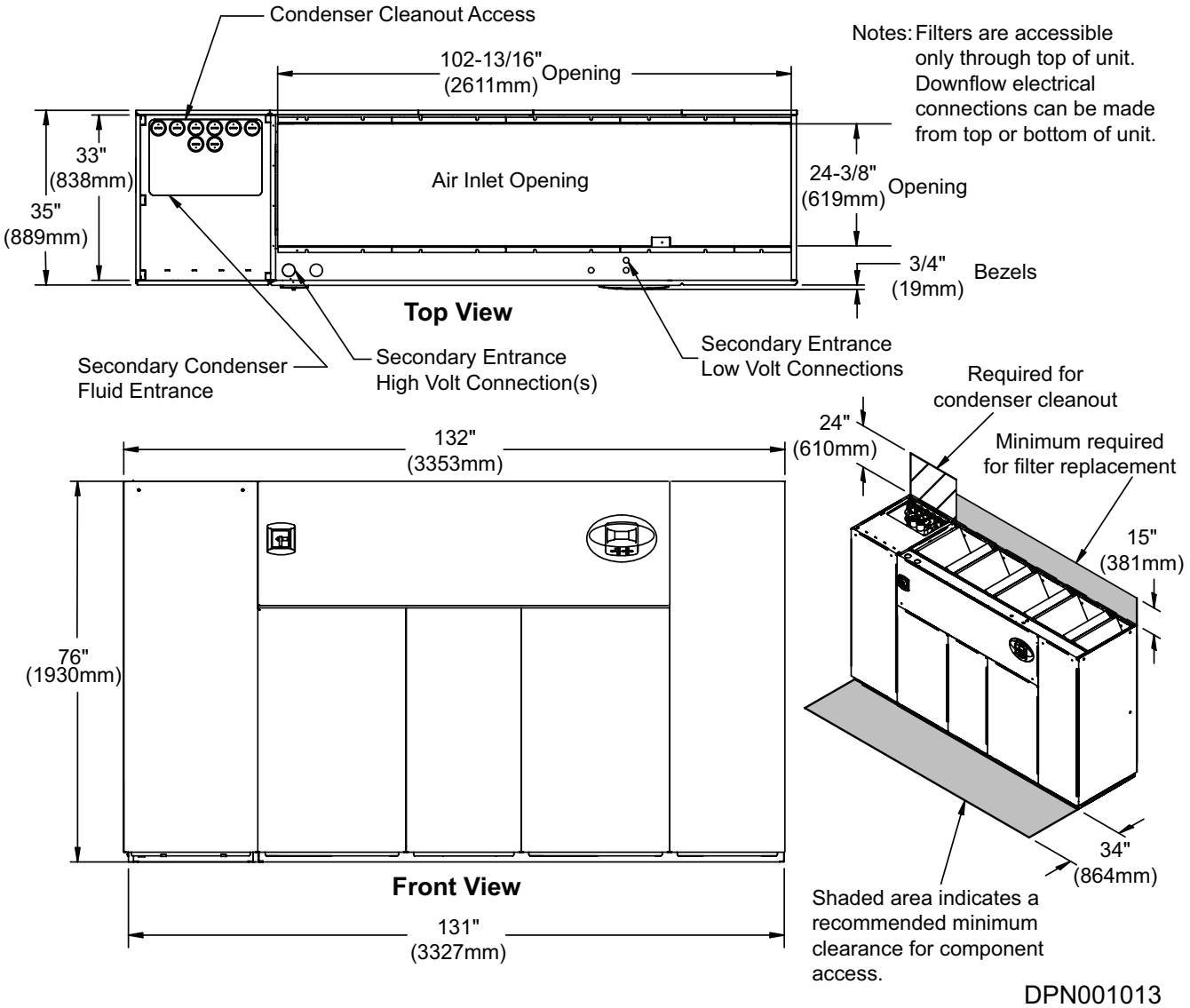
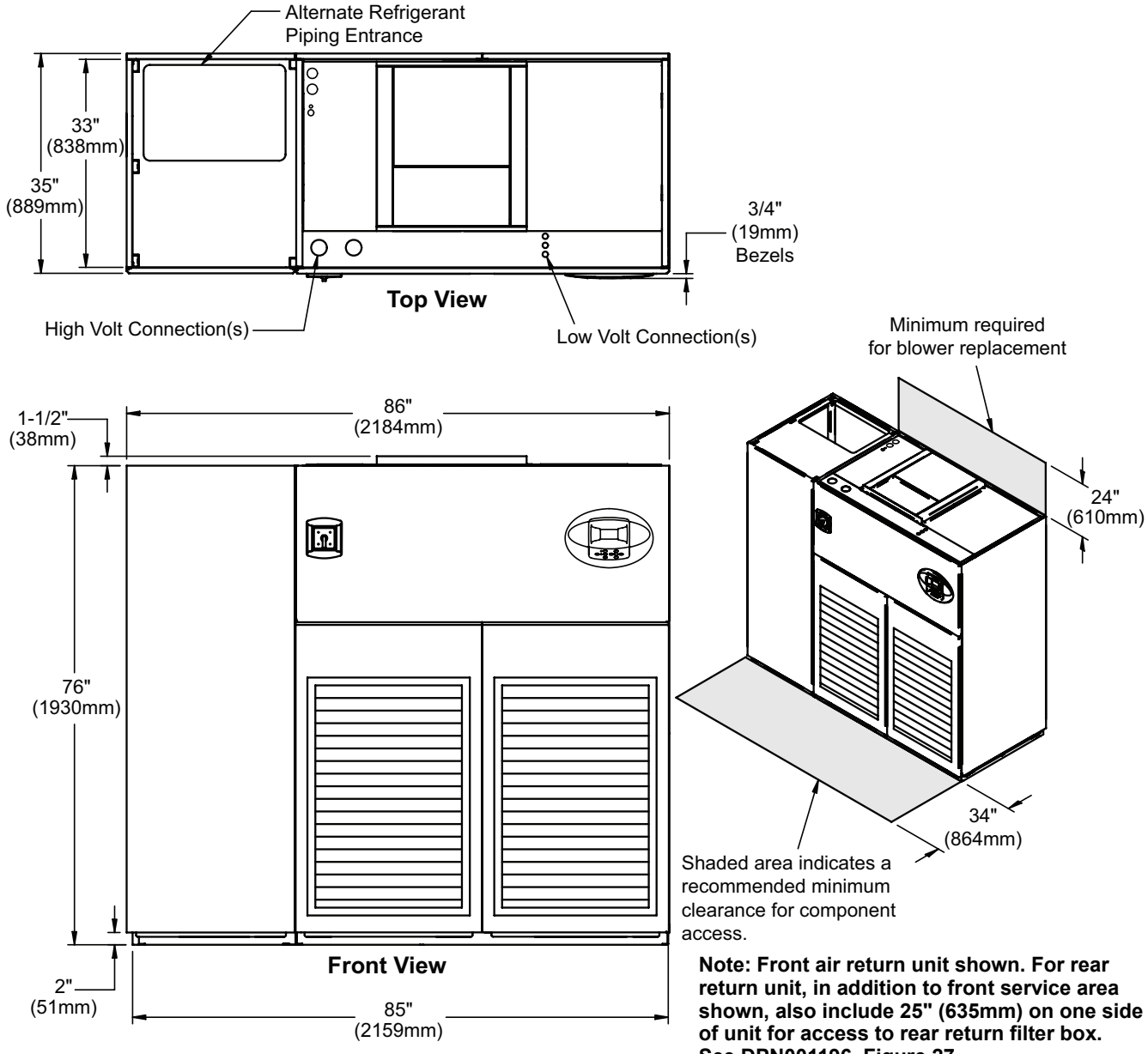


Table 10 Weights for downflow, water/glycol/GLYCOOL, 105kW (30 tons), all compressor models

Compressor Type	Dry Weight, lb (kg) approximate	
	Model	105
Semi-Hermetic Compressor	Water/Glycol	3410 (1550)
	GLYCOOL/Dual Cool	3770 (1714)
Scroll Compressor	Water/Glycol	3290 (1495)
	GLYCOOL/Dual Cool	3650 (1659)

Figure 12 Cabinet and floor planning dimensional data—upflow, air cooled 28-42kW (8-12 tons), semi-hermetic compressor models



Note: Front air return unit shown. For rear return unit, in addition to front service area shown, also include 25" (635mm) on one side of unit for access to rear return filter box. See DPN001196, Figure 27.

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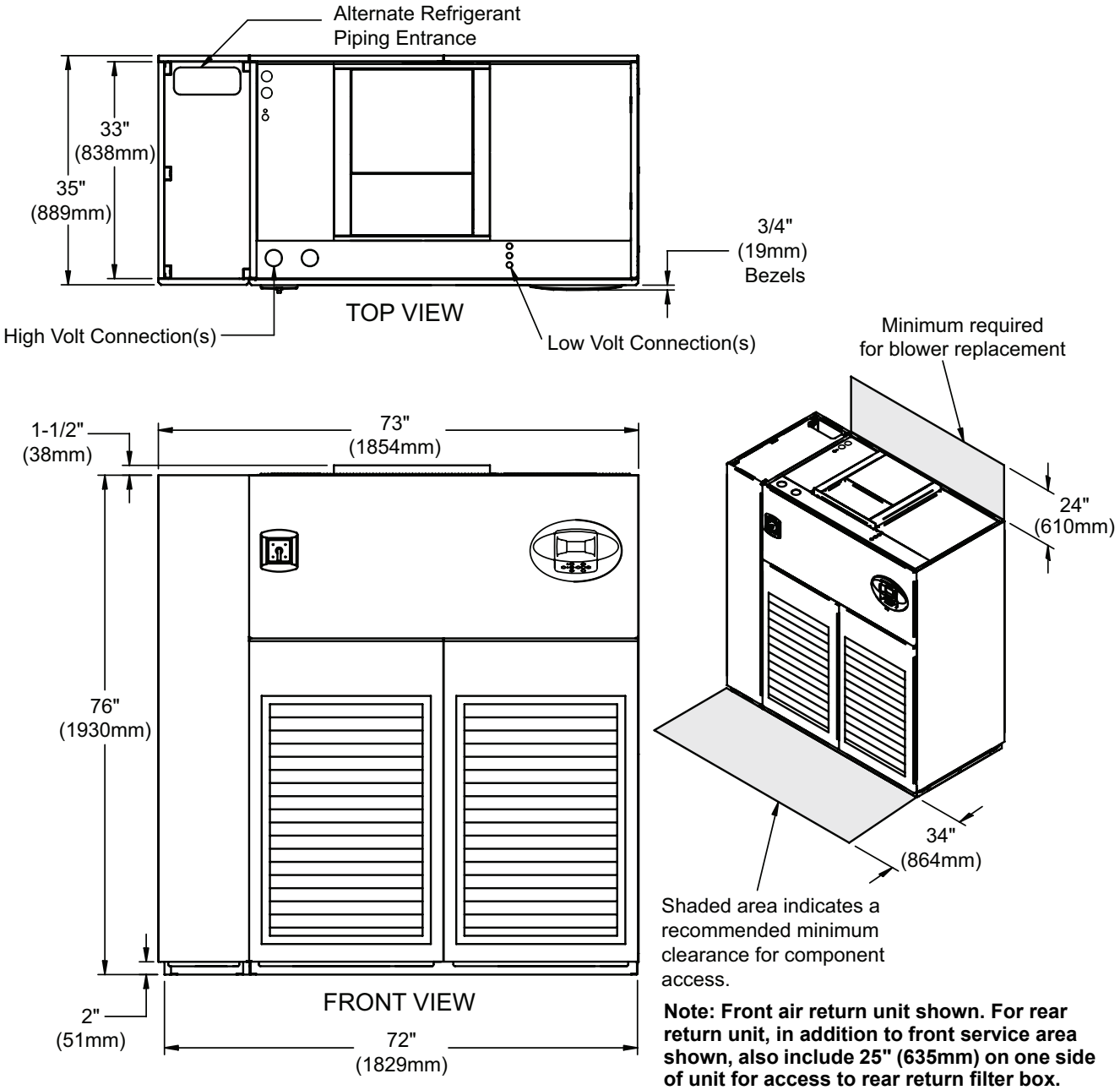
Table 11 Weight for upflow, air cooled, 28-42kW (8-12 tons), semi-hermetic compressor models

	Dry Weight, lb (kg) approximate
Model No.	**028-042**
Air Cooled	1830 (830)
Dual Cool	1980 (898)

Figure 13 Cabinet and floor planning dimensional data—upflow, air cooled 28-42kW (8-12 tons), scroll or digital scroll compressor models



Note: Front air return unit shown. For rear return unit, in addition to front service area shown, also include 25" (635mm) on one side of unit for access to rear return filter box. See DPN001196, Figure 27.

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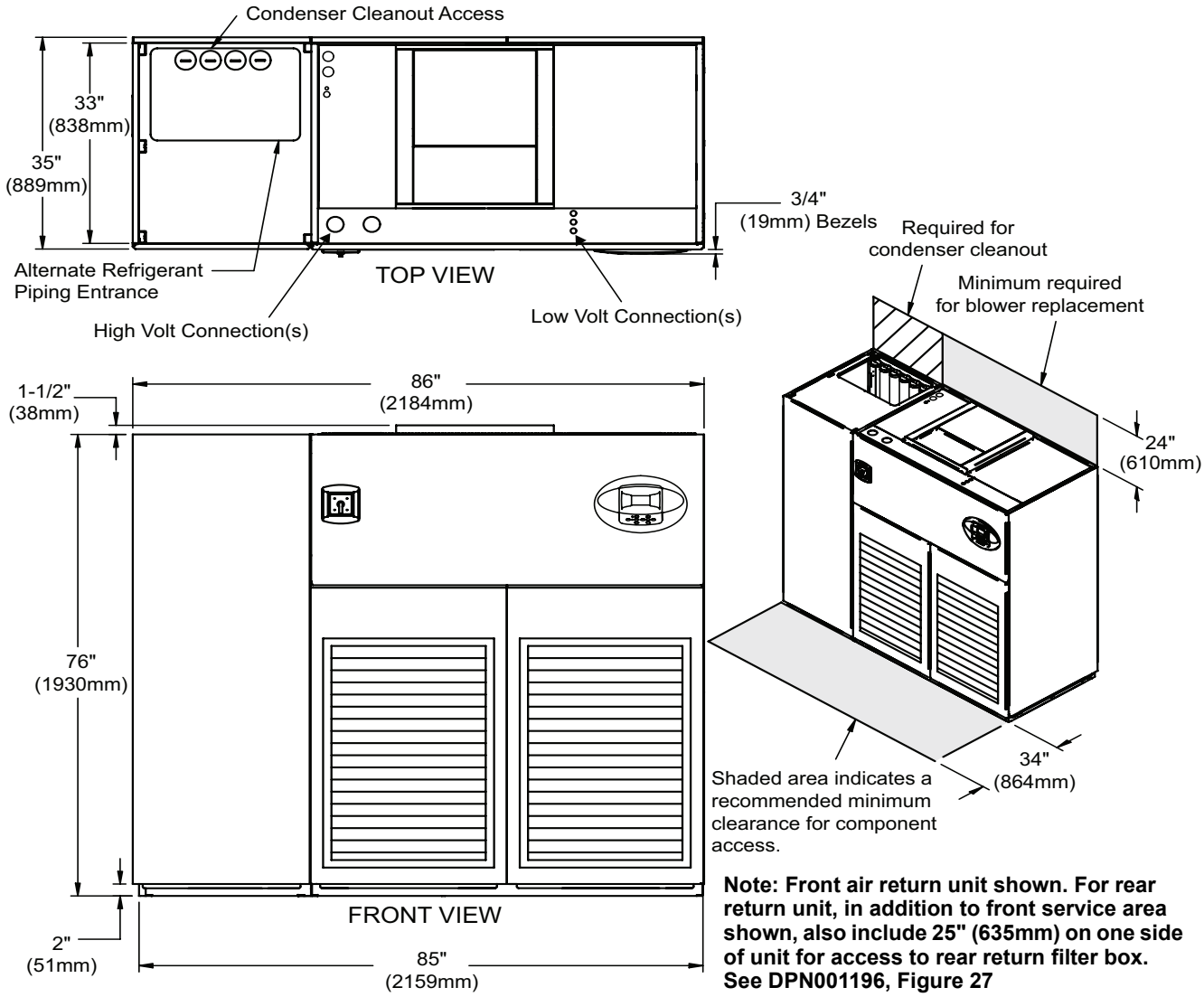
Rev. 1

Table 12 Weight for upflow, air cooled, 28-42kW (8-12 tons), scroll or digital scroll compressor models

	Dry Weight, lb (kg) approximate
Model No.	**028-042**
Air Cooled	1520 (689)
Dual Cool	1670 (758)

Figure 14 Cabinet and floor planning dimensional data—upflow, water/glycol/GLYCOOL, 28-42kW (8-12 tons), all compressor models



Note: Front air return unit shown. For rear return unit, in addition to front service area shown, also include 25" (635mm) on one side of unit for access to rear return filter box. See DPN001196, Figure 27

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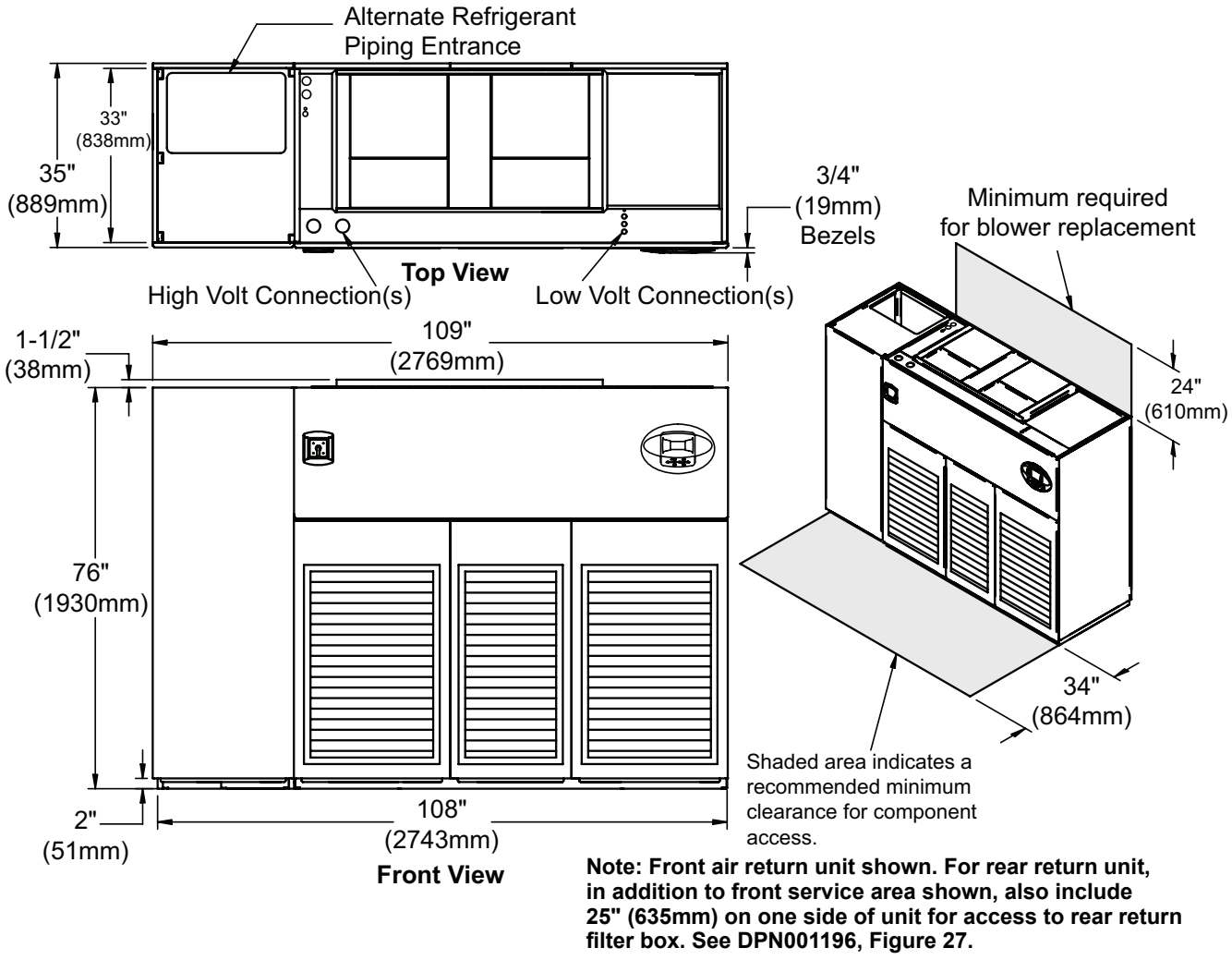
Table 13 Weights for upflow, water/glycol/GLYCOOL, 28-42kW (8-12 tons), all compressor models

Compressor Type	Dry Weight, lb (kg) approximate	
	Model	028-042
Semi-Hermetic	Water/Glycol	1980 (898)
	GLYCOOL/Dual Cool	2130 (966)
Scroll or Digital Scroll	Water/Glycol	1830 (830)
	GLYCOOL/Dual Cool	1980 (898)

Figure 15 Cabinet and floor planning dimensional data—upflow, air cooled, 53-77kW (15-22 tons), semi-hermetic compressor models



Note: Front air return unit shown. For rear return unit, in addition to front service area shown, also include 25" (635mm) on one side of unit for access to rear return filter box. See DPN001196, Figure 27.

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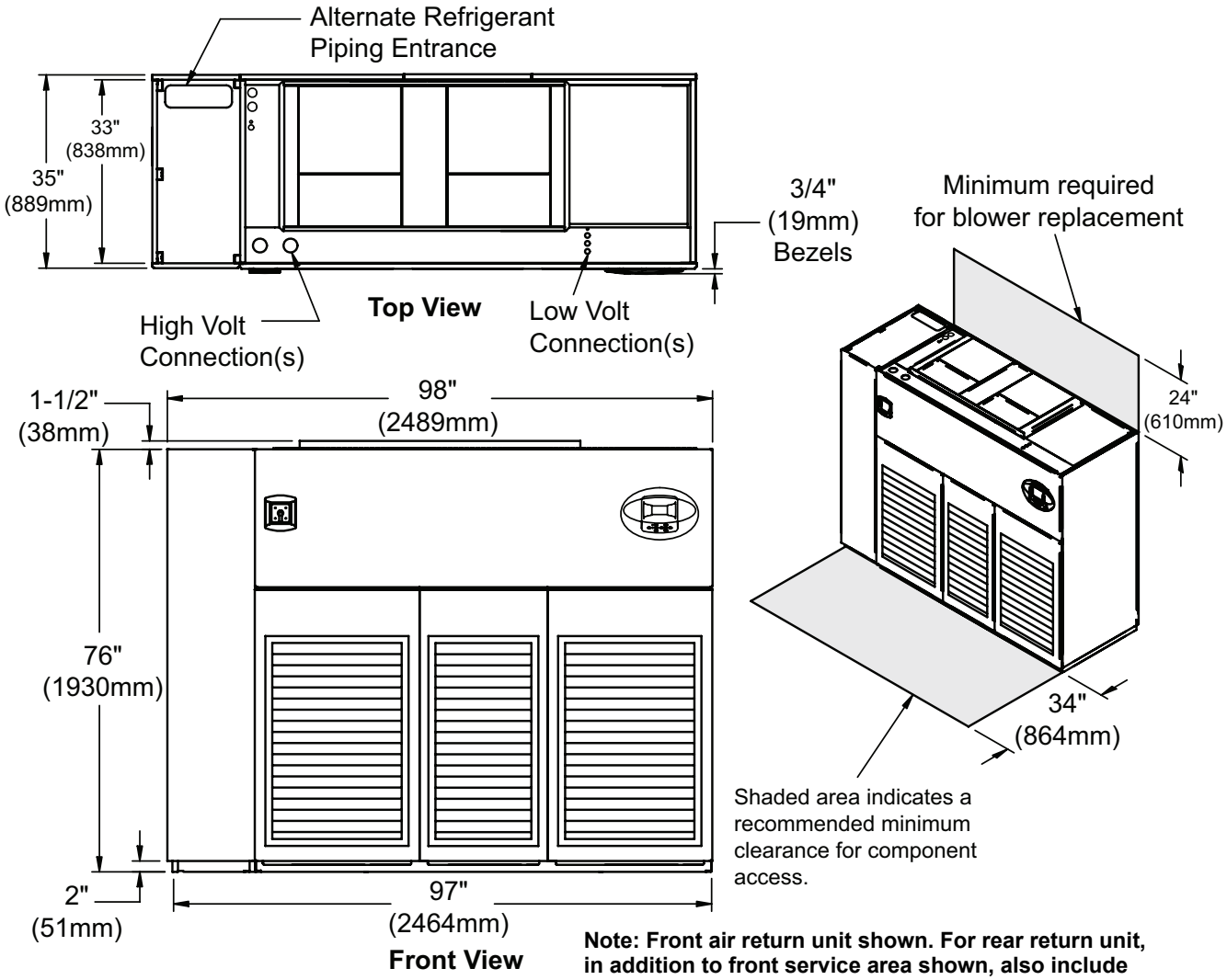
Rev. 1

Table 14 Weights for upflow, air cooled, 53-77kW (15-22 tons), semi-hermetic compressor models

Model	Dry Weight, lb (kg) approximate	
	053	070, 077
Air Cooled	2350 (1069)	2500 (1134)
Dual Cool	2530 (1150)	2680 (1216)

Figure 16 Cabinet and floor planning dimensional data—upflow, air cooled, 53-77kW (15-22 tons), scroll or digital scroll compressor models



Note: Front air return unit shown. For rear return unit, in addition to front service area shown, also include 25" (635mm) on one side of unit for access to rear return filter box. See DPN001196, Figure 27.

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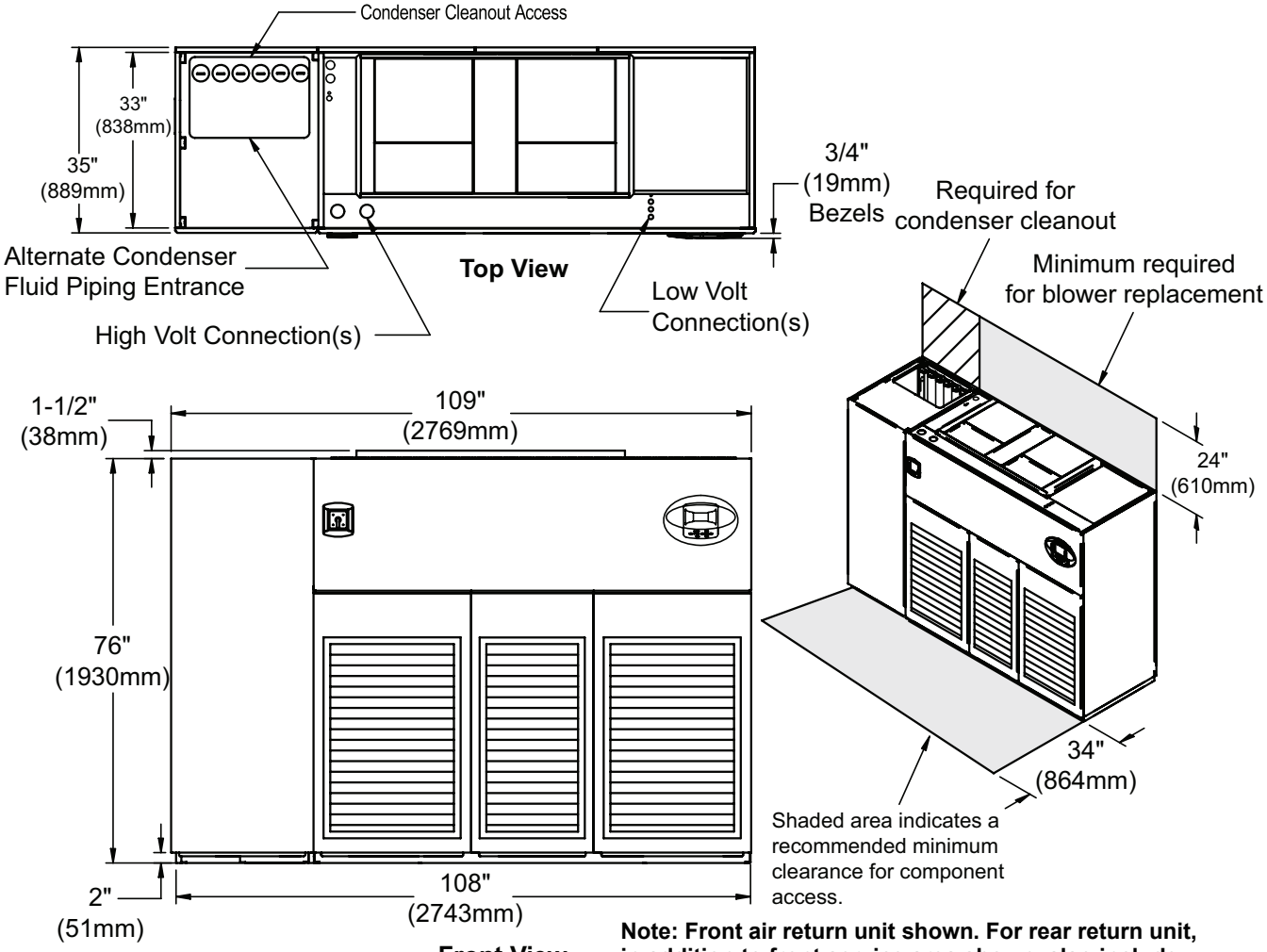
Rev. 1

Table 15 Weight for upflow, air cooled, 53-77kW (15-22 tons), scroll or digital scroll compressor models

Model No.	Dry Weight, lb (kg) approximate		
	053	070	077
Air Cooled	1920 (873)	1970 (896)	2020 (919)
Dual Cool	2100 (955)	2150 (978)	2200 (1000)

Figure 17 Cabinet and floor planning dimensional data—upflow, water/glycol/GLYCOOL, 53-77kW (15-22 tons), all compressor models



Note: Front air return unit shown. For rear return unit, in addition to front service area shown, also include 25" (635mm) on one side of unit for access to rear return filter box. See DPN001196, Figure 27.

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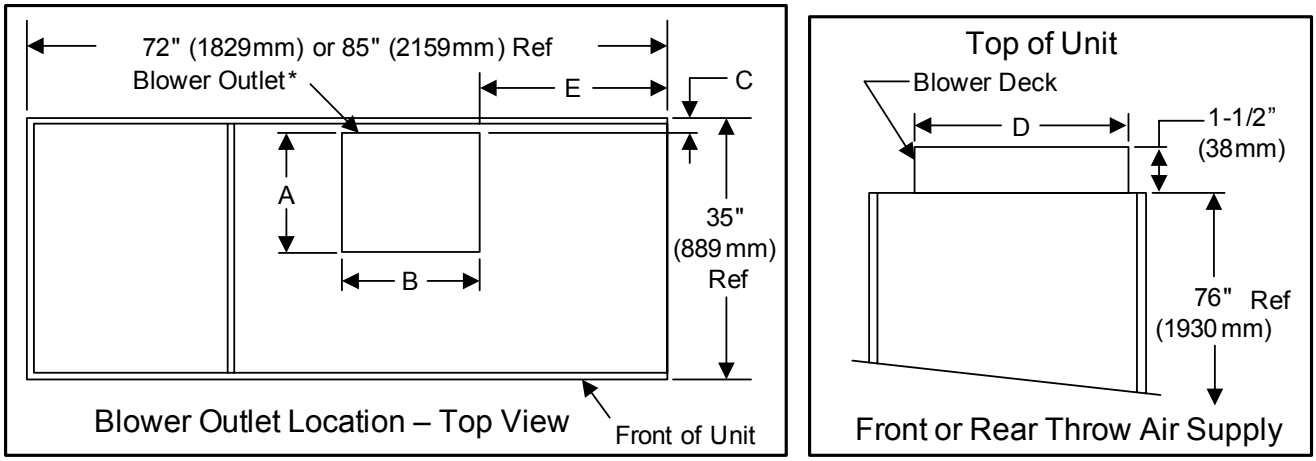
Table 16 Weights for upflow, water/glycol/GLYCOOL, 53-77kW (15-22 tons), all compressor models

Compressor Type	Dry Weight, lb (kg) approximate		
	Model	053	070, 077
Semi-Hermetic Compressor	Water/Glycol	2650 (1205)	2800 (1270)
	GLYCOOL/Dual Cool	2830 (1287)	2980 (1352)
Scroll or Digital Scroll Compressor	Water/Glycol	2370 (1075)	
	GLYCOOL/Dual Cool	2550 (1157)	

Figure 18 Blower outlet and deck dimensional data—upflow, 28-42kW (8-12 tons)



* Duct flange not provided

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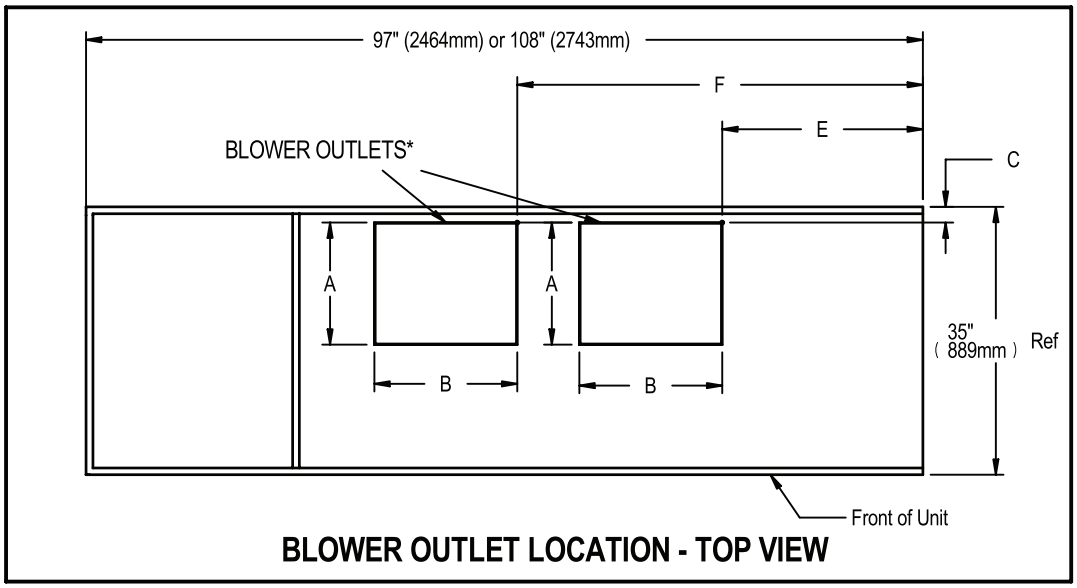
Table 17 Dimensional data for upflow, 28-42kW (8-12 tons)

Models	Blower	Supply	A	B	C	D	E
28-42kW (8-12 Tons)	15 x 15	Front Throw	15-7/8" (404mm)	18-5/8" (472mm)	2-1/8" (54mm)	25-5/8" (651mm)	25" (635mm)
		Rear Throw	15-7/8" (404mm)	18-5/8" (472mm)	11-5/8" (295mm)	25-5/8" (651mm)	25" (635mm)
	15 x 11	Front Throw	15-7/8" (404mm)	14-1/2" (368mm)	2-1/8" (54mm)	25-5/8" (651mm)	25" (635mm)
		Rear Throw	15-7/8" (404mm)	14-1/2" (368mm)	11-5/8" (295mm)	25-5/8" (651mm)	25" (635mm)

Figure 19 Blower outlet and deck dimensional data—upflow, 53-77kW (15-22 tons)



* Duct flanges not provided.

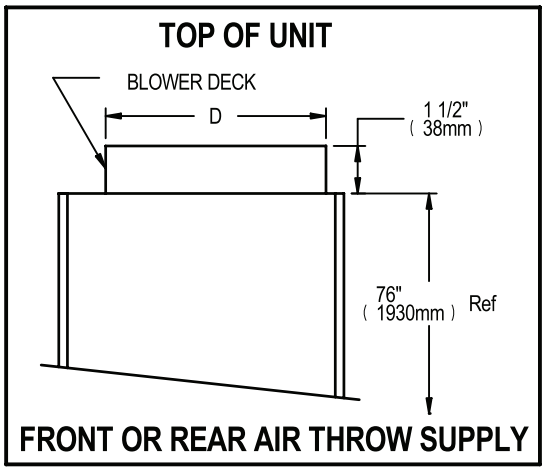


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Table 18 Blower outlet and deck dimensional data for upflow, 53-77kW (15-22 tons)

Models	Blower	Supply	Dimensional Data, Inches (Mm)					
			A	B	C	D	E	F
53-77kW (15-22 Tons)	15 x 15	Front Throw	15-7/8" (404mm)	18-5/8" (472mm)	2-1/8" (54mm)	25-5/8" (651mm)	18-5/8" (472mm)	54-1/2" (1385mm)
		Rear Throw	15-7/8" (404mm)	18-5/8" (472mm)	10-5/8" (269mm)	25-5/8" (651mm)	18-5/8" (472mm)	54-1/2" (1385mm)
	15 x 11	Front Throw	15-7/8" (404mm)	14-11/16" (373mm)	2-1/8" (54mm)	25-5/8" (651mm)	14-11/16" (373mm)	58-7/16" (1484mm)
		Rear Throw	15-7/8" (404mm)	14-11/16" (373mm)	10-5/8" (269mm)	25-5/8" (651mm)	14-11/16" (373mm)	58-7/16" (1484mm)

5.0 EQUIPMENT INSPECTION AND HANDLING

Upon arrival of the unit and before unpacking it, verify that the labeled equipment matches the bill of lading. Carefully inspect all items for damage, either visible or concealed. For initial access use a 7/32" Allen wrench for panel removal. Damage should be immediately reported to the carrier and a damage claim filed with a copy sent to Liebert Corporation or to your sales representative.

5.1 Packaging Material

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

SAFETY INFORMATION

WARNING

Risk of top-heavy unit falling over. Can cause equipment damage, injury or death.

Read all of the following instructions before attempting to move the unit, lift it, remove packaging or prepare the unit for installation.

CAUTION

Risk of sharp edges, splinters and exposed fasteners. Can cause personal injury.

Only properly trained personnel wearing appropriate safety headgear, gloves, shoes and glasses should attempt to move the unit, lift it, remove packaging or prepare the unit for installation.

CAUTION

Risk of overhead interference. Can cause unit and/or structure damage.

The unit may be too tall to fit through a doorway while on the skid. Measure the unit and doorway heights and refer to the installation plans to verify clearances prior to moving the unit.

CAUTION

Risk of damage from forklift. Can cause exterior and/or underside damage.

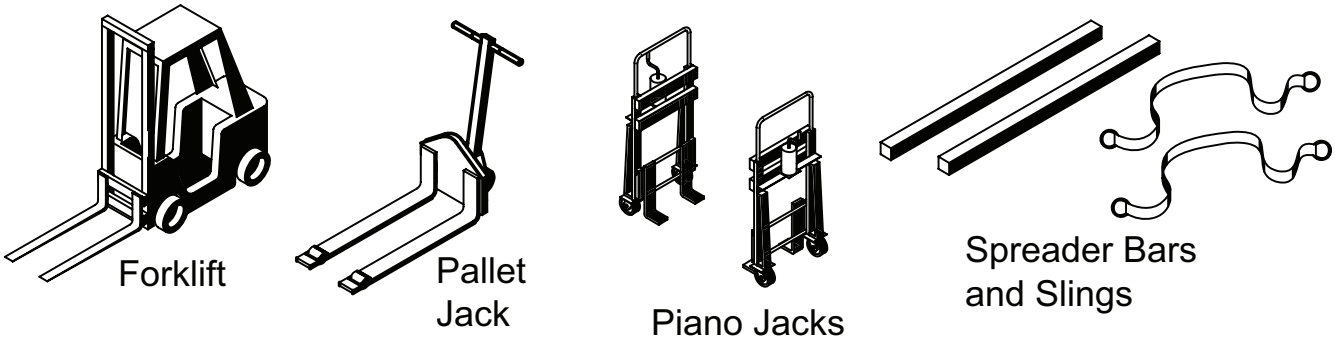
Keep tines of the forklift level and at a height suitable to fit below the skid and/or unit.

CAUTION

Risk of improper storage. Can cause unit damage.

Keep the unit upright, indoors and protected from dampness, freezing temperatures and contact damage.

Figure 20 Equipment recommended for handling Liebert DS



If possible, transport the Liebert DS with a forklift or pallet jacks. If that is not possible, use a crane with belts or cables, slings and spreader bars.

- If using a forklift or pallet jack, make sure that the forks (if adjustable) are spread to the widest allowable distance that will fit under the skid.

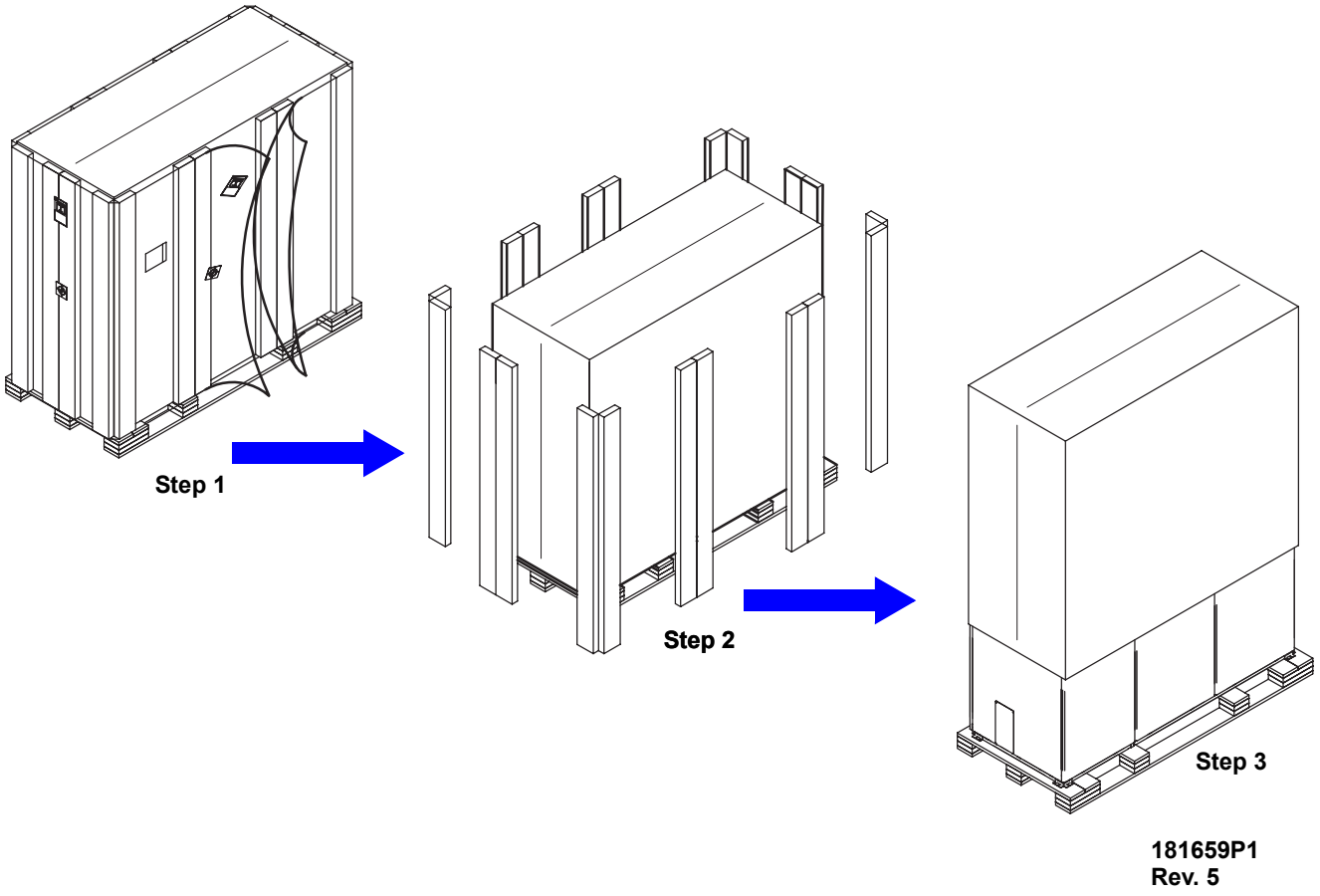
  Ensure the fork length is suitable for the unit length.
- When moving the packaged Liebert DS with a forklift, lift the unit from the designated "heavy side" of the unit no higher than 6" (152mm) off the ground. Ensure that the opposite end still touches the ground.
- The unit is to be pulled by the fork lift—If the unit must be lifted higher than 6" (152mm) great care must be exercised: Personnel who are not directly involved in moving the unit must be kept 20' (5m) or farther from the lift point of the unit.
- Always refer to the location of the center of gravity indicators when lifting the Liebert DS.

5.2 Unpacking the Unit

Remove outer packaging when ready to install the unit.

- Remove the exterior stretch wrap packaging material from around the unit, exposing the protective corner and side packaging planks.
- Remove the corner and side packaging planks from the unit, exposing the bag over the unit.
- Remove the bag from the unit when ready to remove the skid and install the unit.

Figure 21 Removing packaging



5.2.1 Removing the Unit from the Skid With a Forklift

1. Align a forklift with either the front or rear side of the unit.

WARNING

Risk of improper moving. Can cause equipment damage, injury or death.

Use the center of gravity indicators on the unit to determine the entry points for the tines (see **Figure 24**). The center of gravity varies depending on the unit size and selected options.

The forklift's tines must be equally spaced on either side of the center of gravity indicator.

2. Insert the tines of the forklift completely under the base of the Liebert DS.

WARNING

Risk of improper moving. Can cause equipment damage, injury or death.

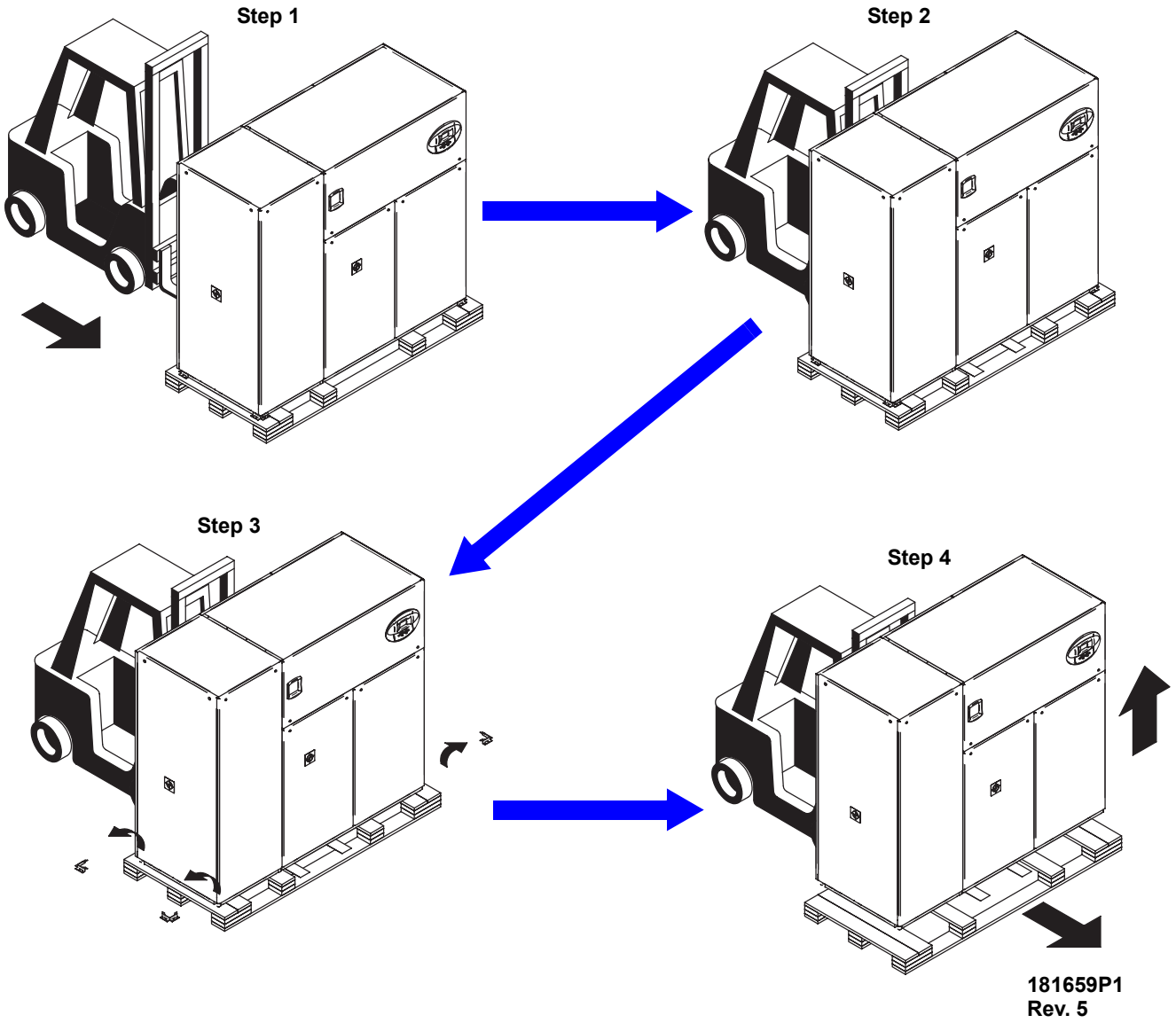
Ensure that the tines are level, not angled up or down.

The tines must be at a height that will allow proper clearance under the unit.

Ensure the tines extend beyond the opposite side of the unit.

3. Remove the lag bolts from each bracket holding the Liebert DS to the skid.
4. Lift the unit off the skid—no more than 6" (152mm)—and remove the skid.

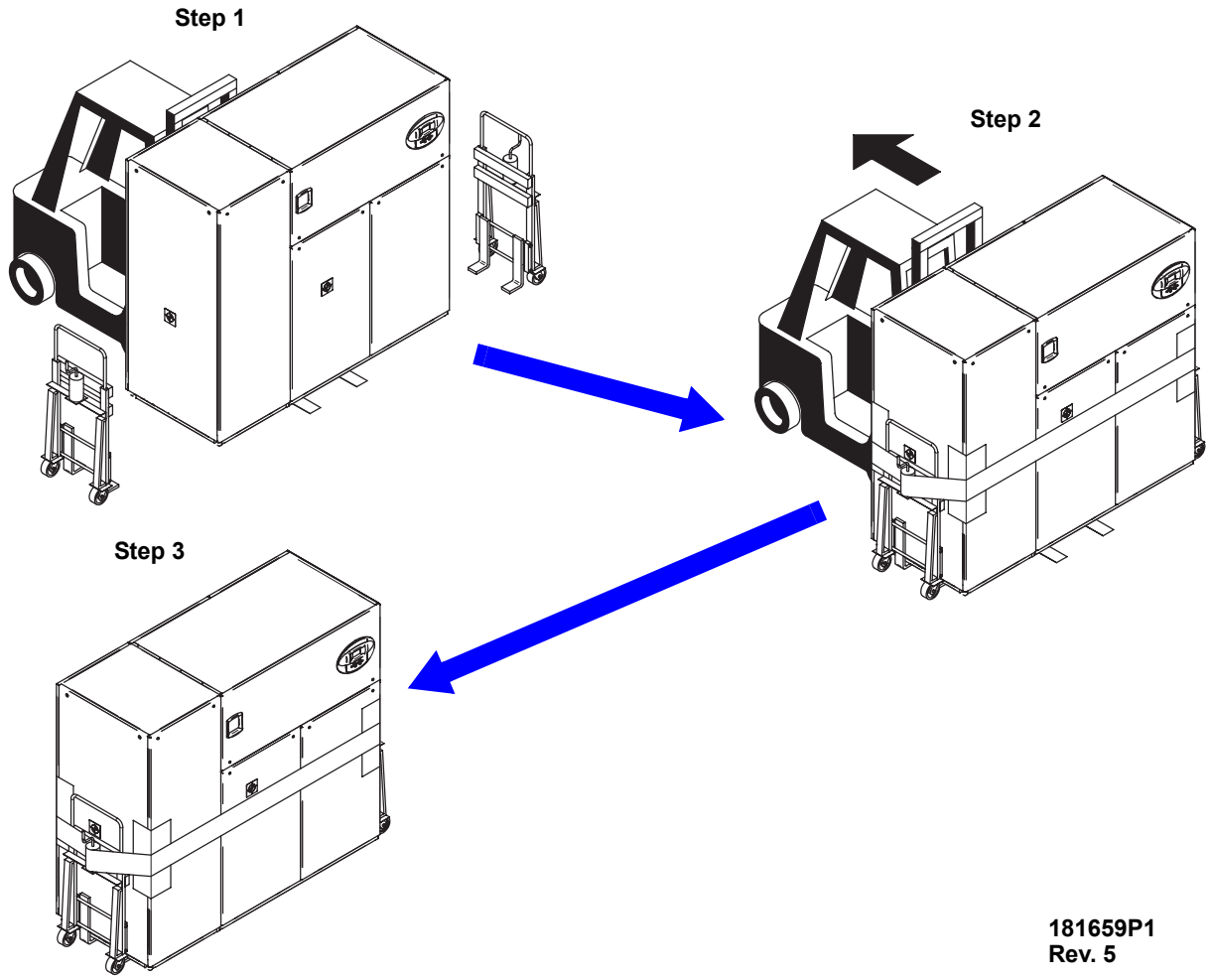
Figure 22 Remove the unit from the skid



5.2.2 Moving the Unit to the Installation Location with Piano Jacks

1. With the Liebert DS elevated, place two piano jacks into position—one at either end of the unit.
2. Lower the Liebert DS to a height suitable for the piano jacks and place protective material between the Liebert DS and the piano jacks.
3. Secure the unit to the piano jacks and remove the forklift.
4. Use the piano jacks to move the Liebert DS for installation.

Figure 23 Moving the unit to its installation location



5.2.3 Removing Piano Jacks

1. Lower the unit as much as the piano jacks will allow.
2. Undo all strapping holding the piano jacks to the unit.
3. Use a pry bar or similar device to lift one end of the unit just enough to allow removal of the piano jack from that end.
4. Repeat **Step 3** to remove the piano jack on the opposite end.
5. Remove all material that might have been used to protect the unit from the piano jacks and strapping.

5.2.4 Removing Liebert DS from Skid Using Rigging

WARNING

Risk of improper moving. Can cause equipment damage, injury or death.

Use the center of gravity indicators (see **Figure 24**) on the unit to determine the position of the slings. The center of gravity varies depending on the unit size and selected options.

The forklift's tines must be equally spaced on either side of the center of gravity indicator.

1. Space the slings equidistant on either side of the center of gravity indicator (see **Figure 24**).

Figure 24 Locate center of gravity marker and place slings

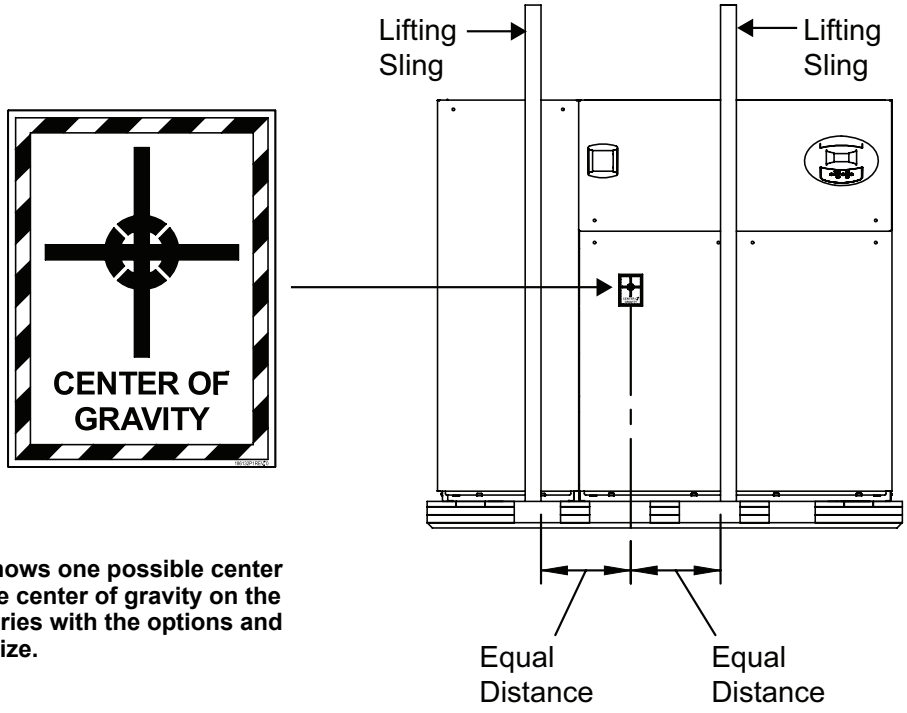


Illustration shows one possible center of gravity. The center of gravity on the Liebert DS varies with the options and the model's size.

2. Place the slings between the bottom rails of the Liebert DS and the top of the skid.

NOTE

Unit is shown without packaging. These instructions may be applied with the outer packaging in place.

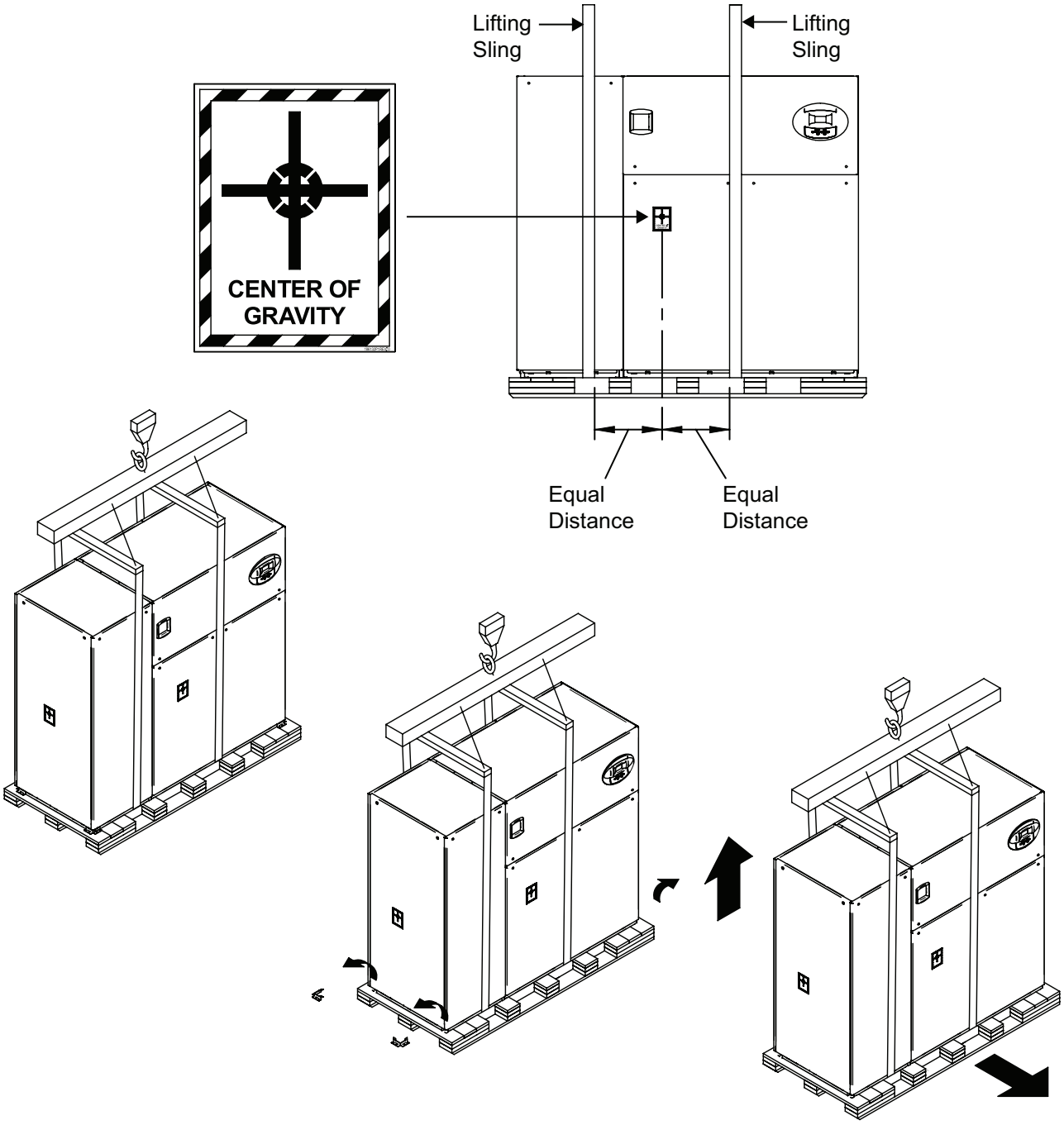
3. Use spreader bars or a similar device and padding to ensure the Liebert DS will not be damaged when the unit is lifted. Lifting will force the slings toward the Liebert DS and the slings may damage the unit unless it is properly protected.
4. Remove the lag bolts from the bracket securing the Liebert DS to the shipping skid.
5. Remove the brackets.

NOTE

Depending on final installation location, the skid may need to remain under the unit. Therefore, the lag bolts and brackets would not yet be removed.

6. Lift the Liebert DS off the skid.
7. Move the skid from under the unit.

Figure 25 Using rigging to lift Liebert DS off skid



5.3 Semi-Hermetic Compressor Spring Isolation System

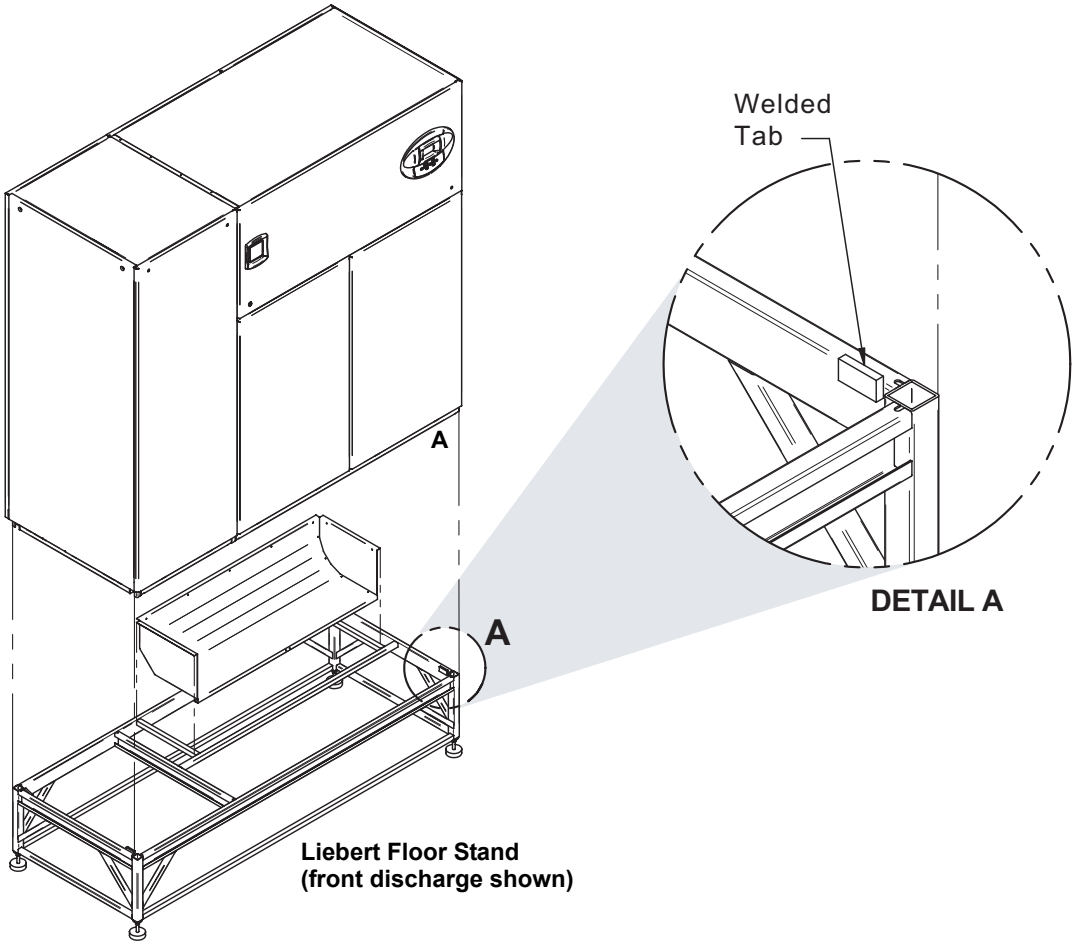
Shipping blocks under all semi-hermetic compressors must be removed and the springs must be adjusted before startup.

1. Loosen nuts at each of the four compressor feet and remove the two shipping blocks.
2. Beginning with one compressor foot, retighten nut until the washer under the nut can no longer be rotated by finger.
3. Loosen the nut half a turn. The washer will be slightly loose.
4. Repeat for remaining feet and recheck all when done

5.4 Placing the Unit on a Floor Stand

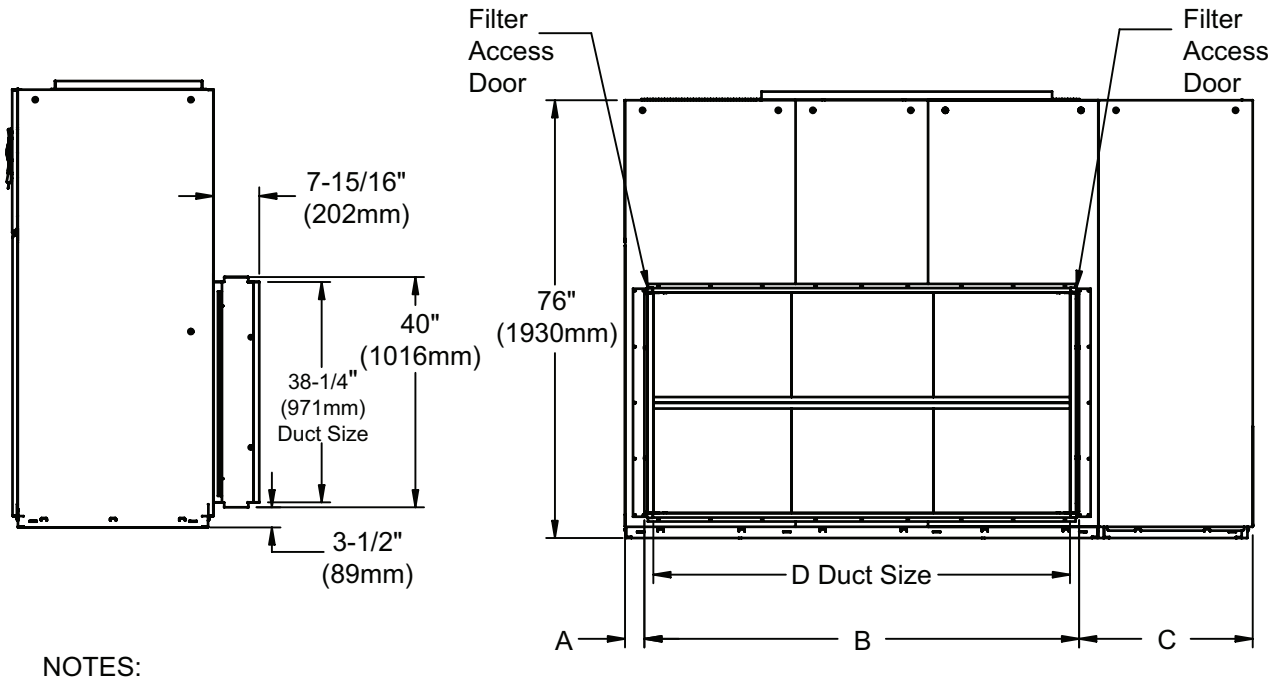
Liebert Floor Stand—Ensure that the optional turning vane is installed in the floor stand (if included) prior to placing the unit. Refer to the floor stand installation sheet, 182278P1, located inside the floor stand package. Lower the unit onto the floor stand. Refer to Detail A in **Figure 26**. Be sure to align the welded tabs on top of the floor stand with the inside of the unit frame base.

Figure 26 Setting the unit on a floor stand



Upflow rear return configurations use a filter box that attaches to the back of the Liebert DS. Refer to rear return installation sheet, 187230P1, located inside rear-return filter box package.

Figure 27 Rear return filter box dimensional data



NOTES:
1. Filters can be accessed from either side.
2. 25" (635mm) minimum clearance provided on one side for filter access.
3. Filter boxes are shipped flat and must be field assembled.

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Table 19 Rear return filter box dimensional data

Compressor Type	Dimensional Data in (mm)				
	A	B	C	D	# Filters
28-42kW (8-12 Tons) Air-Cooled Scroll and Air-Cooled Digital Scroll Models	4-1/4 (108)	50-3/4 (1289)	18 (457)	47-5/8 (1210)	4
28-42kW (8-12 Tons) Semi-Hermetic and all Water/Glycol/Glycool Models	4-1/4 (108)	50-3/4 (1289)	31 (787)	47-5/8 (1210)	4
53-77kW (15-22 Tons) Air-Cooled Scroll and Air-Cooled Digital Scroll Models	3-1/4 (83)	75-1/2 (1918)	19-1/4 (489)	72-3/8 (1838)	6
53-77kW (15-22 Tons) Semi-Hermetic and all Water/Glycol/Glycool Models	3-1/4 (83)	75-1/2 (1918)	30-1/4 (768)	72-3/8 (1838)	6
105kW (30 Tons) All Models	2-1/4 (57)	100-1/4 (2546)	29-1/2 (749)	97-1/8 (2467)	8

Figure 28 Downflow unit ducting and plenum ducting

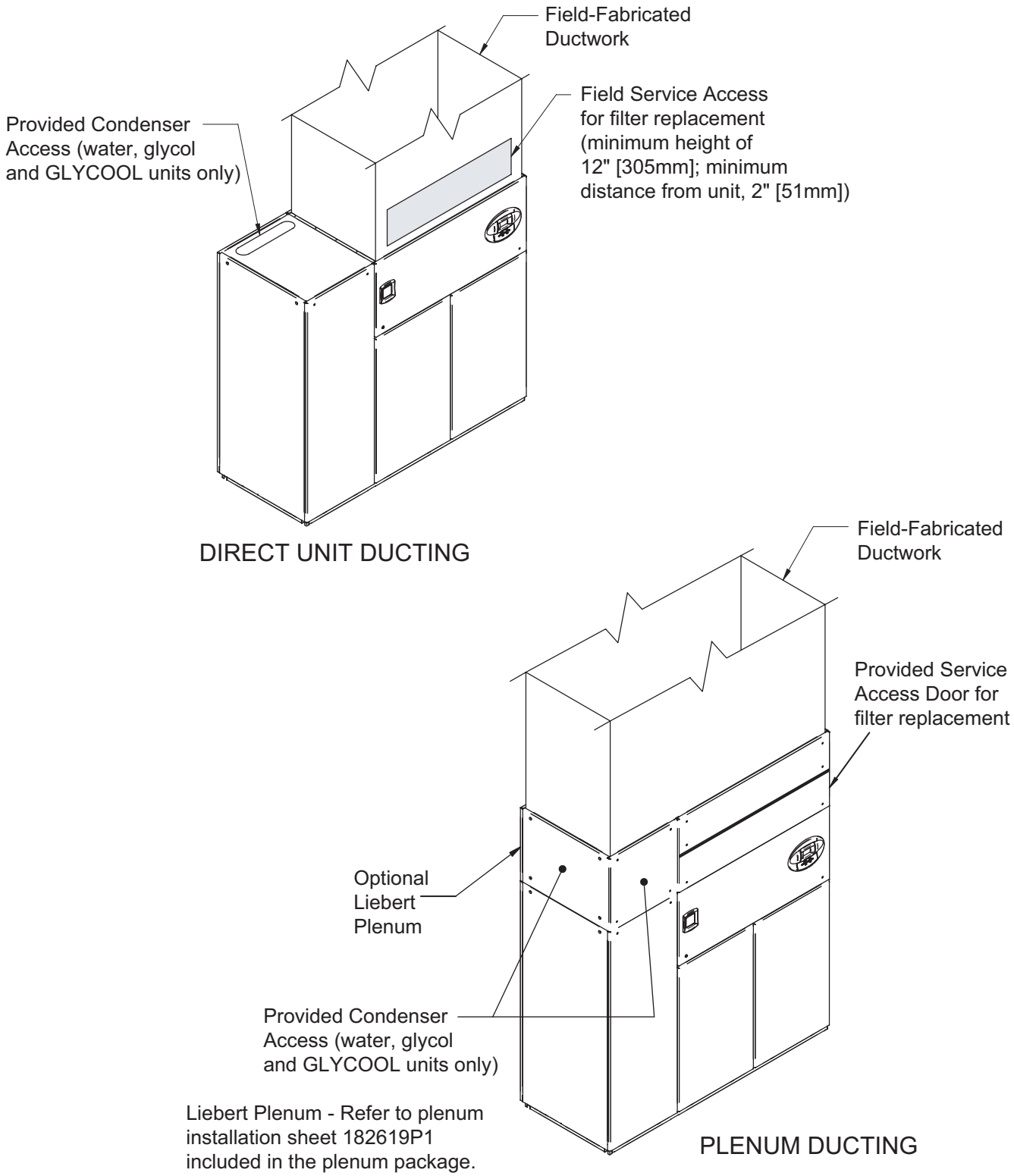
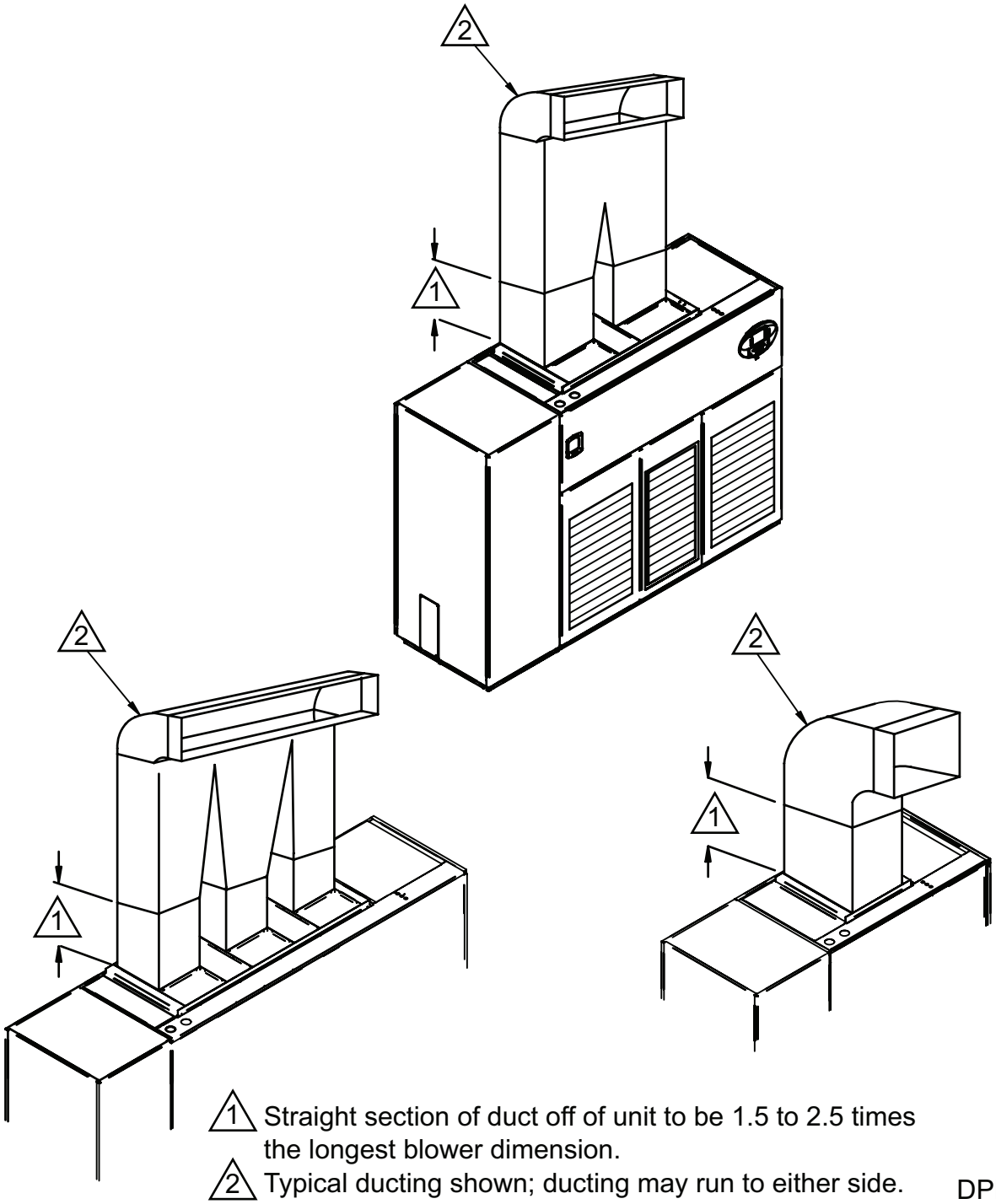


Figure 29 Upflow ducting configurations



1 Straight section of duct off of unit to be 1.5 to 2.5 times the longest blower dimension.

2 Typical ducting shown; ducting may run to either side.

* Follow standard practices on all duct work.

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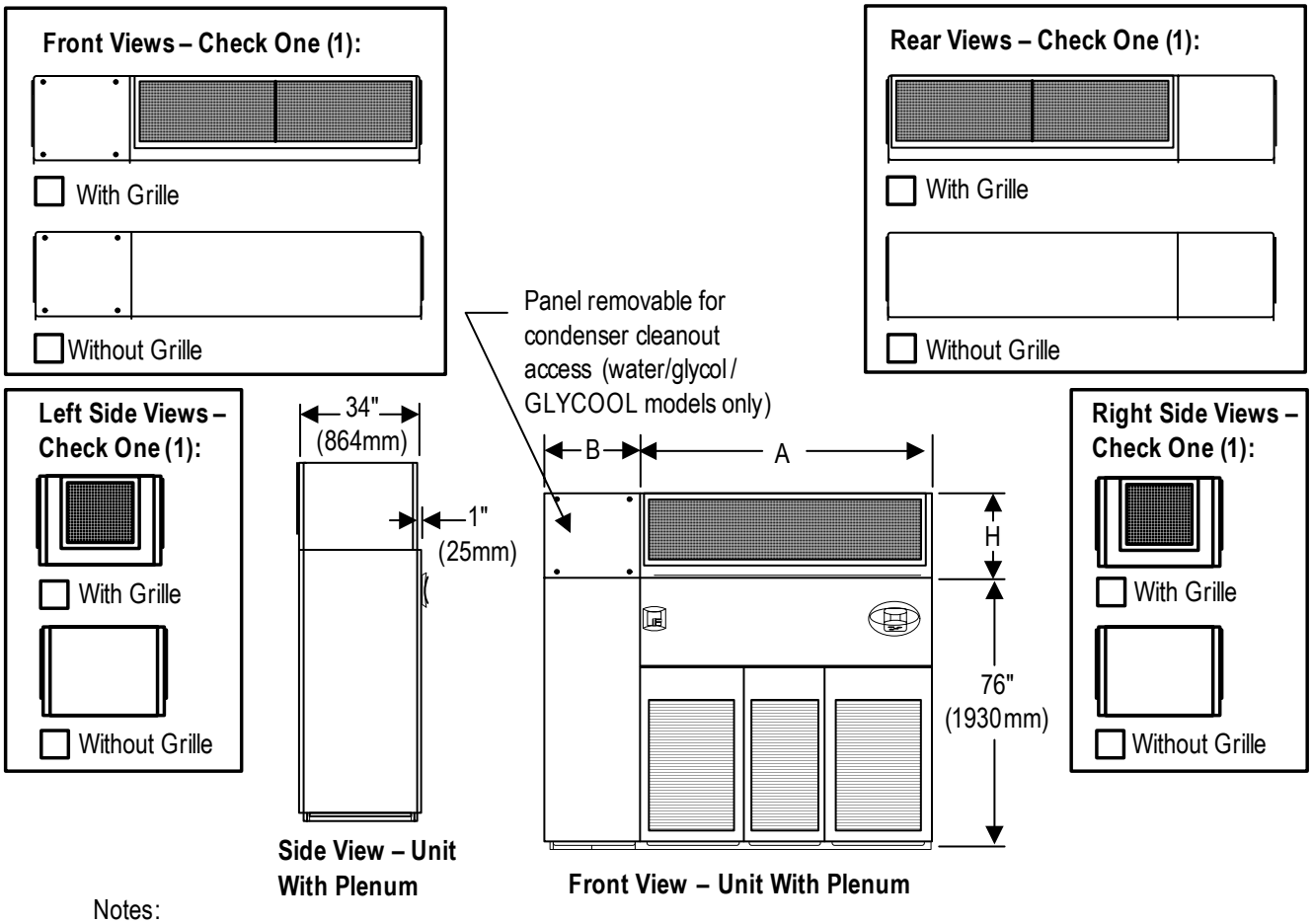
Figure 30 Upflow unit plenum dimensional data



Notes:

1. Typical 53-77kW (15-22ton) unit orientation shown with grille plenum . View varies by unit size and plenum selection .
2. All plenums are shipped flat and must be field assembled .
3. Optional grille plenum kits must include front or rear grille .
4. Non-grille plenums are open on the top and not designed with duct flange .

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Plenum Dimensional Data in (mm)			Grille Size in (mm) - Nominal	
	A	B	Front/Rear Grilles	Side Grille
28-42kW (8-12 Tons) Air-Cooled Scroll and Air-Cooled Digital Scroll Models	59-1/4 (1505)	13-3/4 (349)	18 x 55 (457 x 1397)	18 x 20 (457 x 508)
28-42kW (8-12 Tons) Semi-Hermetic and all Water/Glycol/GLYCOOL Models	59-1/4 (1505)	26-3/4 (679)	18 x 55 (457 x 1397)	18 x 20 (457 x 508)
53-77kW (15-22 Tons) Air-Cooled Scroll and Air-Cooled Digital Scroll Models	82-1/4 (2089)	15-3/4 (400)	18 x 78 (457 x 1981)	18 x 20 (457 x 508)
53-77kW (15-22 Tons) Semi-Hermetic and all Water/Glycol/GLYCOOL Models	82-1/4 (2089)	26-3/4 (679)	18 x 78 (457 x 1981)	18 x 20 (457 x 508)
105kW (30 Tons) All Models	105-1/4 (2673)	26-3/4 (679)	(1) 18 x 20 (457 x 508) (1) 18 x 78 (457 x 1981)	18 x 20 (457 x 508)

6.0 ELECTRICAL CONNECTIONS

Three-phase electrical service is required for all models. Electrical service must conform to national and local electrical codes. Refer to equipment nameplate regarding wire size and circuit protection requirements. Refer to electrical schematic when making connections. Refer to **Figure 31** for electrical service entrances into unit.

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

⚠ WARNING

Risk of electric shock. Can cause injury or death.

Disconnect local and remote power supplies before working within.

Use voltmeter to make sure power is turned off before making any electrical connections.

Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power.

50Hz Models Only: Re-install all terminal covers before connecting power to the unit. Failure to install these covers exposes high voltage terminals.

Follow all local codes.

⚠ WARNING

Risk of improper wiring, piping, moving, lifting and handling. Can cause equipment damage, injury or death.

Installation and service of this equipment should be done only by qualified personnel who have been specially trained in the installation of air conditioning equipment.

⚠ CAUTION

Risk of backward compressor rotation. Can cause equipment damage.

Three-phase power must be connected to the unit line voltage terminals in the proper sequence so that scroll compressors rotate in the proper direction.

⚠ CAUTION

Risk of improper electrical supply connection. Can cause equipment damage.

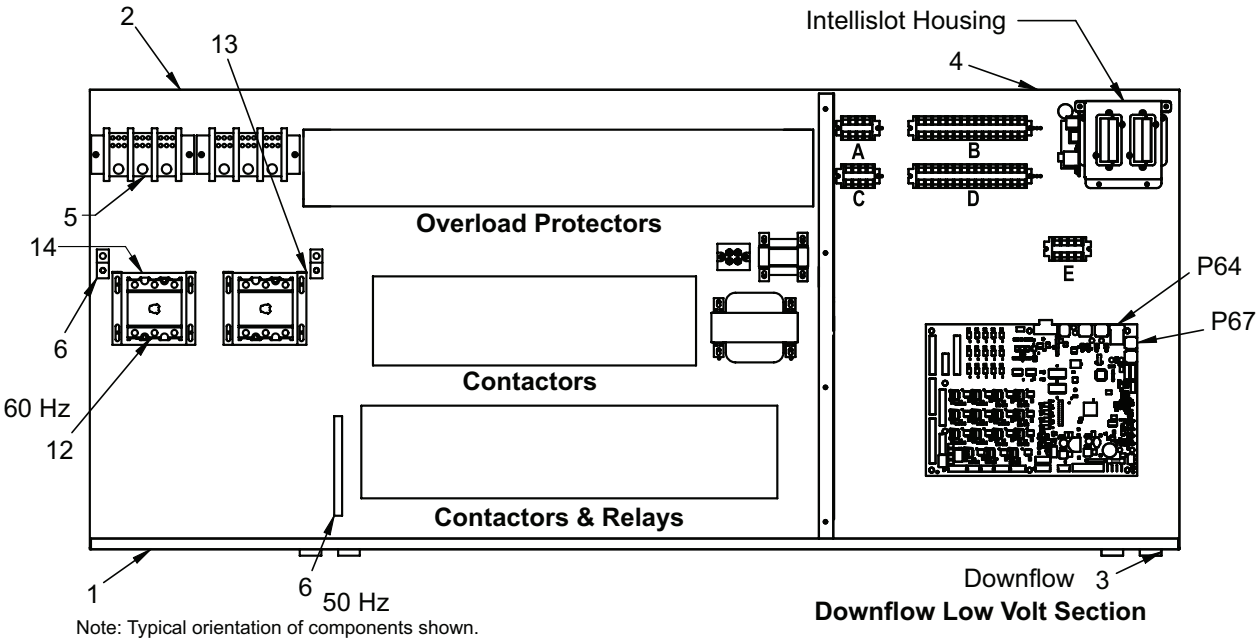
See transformer label for primary tap connections. Installer will need to change transformer primary taps if applied unit voltage is other than pre-wired tap voltage.

⚠ CAUTION

Risk of overheated terminals. Can cause wiring and component damage.

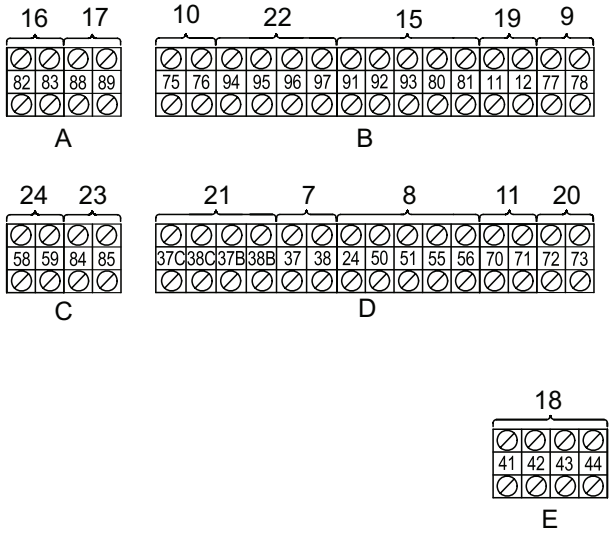
Use copper wiring only. Make sure that all connections are tight.

Figure 31 Electrical field connections



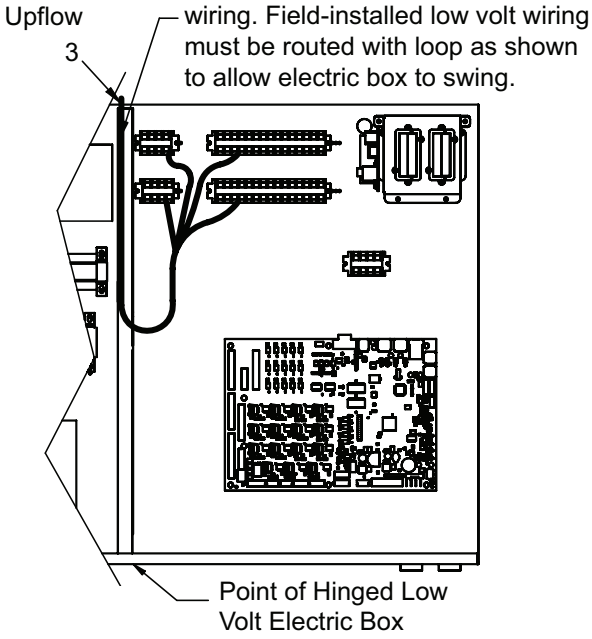
Downflow Low Volt Section

Note: Typical orientation of components shown.
Component location varies by option and unit size.



Refer to 6.1 - Electrical Field Connection Descriptions for keys to numbered items.

CAUTION:
Risk of broken or shorted low volt wiring. Field-installed low volt wiring must be routed with loop as shown to allow electric box to swing.



Upflow Low Volt Section

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6.1 Electrical Field Connection Descriptions

Standard Electrical Connections

1. **Primary high voltage entrance**—2-1/2" (64mm); 1-3/4" (44mm); 1-3/8" (35mm) diameter concentric knockouts located in bottom of box.
2. **Secondary high voltage entrance**—2-1/2" (64mm); 1-3/4" (44mm); 1-3/8" (35mm) diameter concentric knockouts located in top of box.
3. **Primary low voltage entrance**—Three 1-1/8" (28mm) diameter knockouts in bottom of unit.
4. **Secondary low voltage entrance**—Three 1-1/8" (28mm) diameter knockouts in top of box.
5. **Three-phase electrical service**—Terminals are on high voltage terminal block (disregard if unit has optional disconnect switch). Three-phase service not by Liebert.
6. **Earth ground**—Terminal for field-supplied earth grounding wire.
7. **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.
8. **Customer alarm inputs**—Terminals for field-supplied, normally open contacts, having a minimum 75VA, 24VAC rating, between terminals 24 and 50, 51, 55, 56. Use field-supplied Class 1 wiring. Terminal availability varies by unit options.
9. **SiteScan**—Terminals 77(-) and 78(+) for a two-wire, twisted pair, communication cable (available from Liebert) to optional SiteScan.
10. **Common alarm**—On any alarm, normally open dry contact is closed across terminals 75 and 76 for remote indication. 1A, 24VAC max load. Use Class 1 field-supplied wiring.
11. **Heat rejection interlock**—On any call for compressor operation, normally open dry contact is closed across terminals 70 and 71 to heat rejection equipment. 1A, 24VAC max load. Use Class 1 field-supplied wiring.

Optional Electrical Connections

12. **Factory installed disconnect switch**.
13. **Secondary disconnect switch and earth ground**.
14. **Three-phase electrical service**—Terminals are on top of disconnect switch. Three-phase service not by Liebert.
15. **Smoke sensor alarm**—Factory wired dry contacts from smoke sensor are 91-common, 92-NO and 93-NC. Supervised contacts, 80 and 81, open on sensor trouble indication. This smoke sensor is not intended to function as, or replace, any room smoke detection system that may be required by local or national codes. 1A, 24VAC max load. Use Class 1 field-supplied wiring.
16. **Reheat and humidifier lockout**—Remote 24VAC required at terminals 82 and 83 for lockout of reheat and humidifier.
17. **Condensate alarm (with condensate pump option)**—On pump high water indication, normally open, dry contact is closed across terminals 88 and 89 for remote indication. 1A, 24VAC max load. Use Class 1 field-supplied wiring.
18. **Analog inputs**—Terminals for up to two customer-supplied analog inputs. Device 1 wires to 41(-) and 42(+). Device 2 wires to 43(-) and 44(+).
19. **Remote humidifier**—On any call for humidification, normally open dry contact is closed across terminals 11 and 12 to signal field-supplied remote humidifier. 1A, 24VAC max load. Use Class 1 field-supplied wiring.
20. **Auxiliary cool contact**—On any call for Econ-O-Coil operation, normally open dry contact is closed across terminals 72 and 73 on dual cool units only. 1A, 24VAC max load. Use Class 1 field-supplied wiring.

Optional Low Voltage Terminal Package Connections

21. **Remote unit shutdown** - Two additional contact pairs available for unit shutdown (labeled as 37B and 38B, 37C and 38C). Replace jumpers with field-supplied, normally closed switch having a minimum 75VA, 24VAC rating. Use Class 1 field-supplied wiring.
22. **Common alarm**—On any alarm, two additional normally open dry contacts are closed across terminals 94 and 95 and 96 and 97 for remote indication. 1A, 24VAC max load. Use Class 1 field-supplied wiring.
23. **Main fan auxiliary switch**—On closure of main fan contactor, normally open dry contact is closed across terminals 84 and 85 for remote indication. 1A, 24VAC max load. Use Class 1 field-supplied wiring.
24. **Liqui-tect shutdown and dry contact**—On Liqui-tect activation, normally open dry contact is closed across terminals 58 and 59 for remote indication (Liqui-tect sensor ordered separately). 1A, 24VAC max load. Use Class 1 field-supplied.

NOTE

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

7.0 PIPING

All fluid and refrigeration connections to the unit, with the exception of the condensate drain, are sweat copper. Factory-installed piping brackets must not be removed. Field-installed piping must be installed in accordance with local codes and must be properly assembled, supported, isolated and insulated. Avoid piping runs through noise-sensitive areas, such as office walls and conference rooms.

Refer to specific text and detailed diagrams in this manual for other unit-specific piping requirements.

All piping below the elevated floor must be located so that it offers the least resistance to air flow. Careful planning of the piping layout under the raised floor is required to prevent the air flow from being blocked. When installing piping on the subfloor, it is recommended that the pipes be mounted in a horizontal plane rather than stacked one above the other. Whenever possible, the pipes should be run parallel to the air flow.

7.1 Fluid Connections

CAUTION

Risk of leaking water. Can cause equipment and building damage.

This unit requires a water drain connection. It may require an external water supply to operate.

Improper installation, application and service practice can result in water leakage from the unit. Water leakage can result in severe property damage and loss of critical data center equipment.

Do not locate unit directly above any equipment that could sustain water damage.

Liebert recommends installing leak detection equipment for unit and supply lines.

7.1.1 Condensate Piping—Field-Installed

- Do not reduce drain lines
- Do not expose drain line to freezing temperatures
- Drain line may contain boiling water. Use copper or other suitable material
- Drain line must comply with local building codes
- Liebert recommends installing under-floor leak detection equipment

Gravity Drain

- 3/4" NPT drain connection is provided on units **without** optional factory-installed condensate pump
- Pitch drain line toward drain a minimum of 1/8" (3mm) per 1 foot (305mm) of length
- Drain is trapped internally. Do not trap external to equipment
- Drain line must be sized for 2 gpm (7.6 l/m) flow

Condensate Pump

- 1/2" copper sweat connection is provided on units **with** optional factory-installed condensate pump
- Condensate Pump (60Hz): Condensate pump is rated for approximately 400 gph at 10 feet total head
- Condensate Pump (50Hz): Condensate pump is rated for approximately 315 gph at 10 feet total head
- Size piping based on available condensate head

7.1.2 Humidifier Supply Water—Optional Infrared

- 1/4" supply line; maximum water pressure is 150 psi (1034kPa)
- Size humidifier supply line for 1 gpm (3.8 l/m), with a minimum water pressure of 20 psi (138kPa)
- Do not supply de-ionized water to the humidifier

7.1.3 Requirements of Systems Using Water or Glycol

These guidelines apply to the field leak checking and fluid requirements for field piping systems, including Liebert chilled water, hot water, condenser (water or glycol), GLYCOOL and drycooler circuits.

General Guidelines

- Equipment damage and personal injury can result from improper piping installation, leak checking, fluid chemistry and fluid maintenance.
- Follow local piping codes, safety codes.
- Qualified personnel must install and inspect system piping.
- Contact a local water consultant regarding water quality, corrosion protection and freeze protection requirements.
- Install manual shutoff valves at the supply and return line to each indoor unit and drycooler to permit routine service and emergency isolation of the unit.

CAUTION

Risk of frozen fluids. Can cause equipment damage and building damage.

Freezing system fluids can rupture piping. Complete system drain-down cannot be ensured. When the field piping or unit may be exposed to freezing temperatures, charge the system with the proper percentage of glycol and water for the coldest design ambient.

Automotive antifreeze is unacceptable and must NOT be used in any glycol fluid system.

CAUTION

Risk of corrosion. Can cause equipment damage.

Read and follow individual unit installation instructions for precautions regarding fluid system design, material selection and use of field-provided devices. Liebert systems contain iron and copper alloys that require appropriate corrosion protection.

Contact a local water consultant regarding water quality, corrosion and freeze protection requirements.

Water chemistry varies greatly by location, as do the required additives, called inhibitors, that reduce the corrosive effect of the fluids on the piping systems and components. The chemistry of the water used must be considered, because water from some sources may contain corrosive elements that reduce the effectiveness of the inhibited formulation. Preferably, surface waters that are classified as soft and are low in chloride and sulfate ion content should be employed. Proper inhibitor maintenance must be performed in order to prevent corrosion of the system. Consult glycol manufacturer for testing and maintenance of inhibitors.

Commercial ethylene glycol (Union Carbide Ucartherm, Dow Chemical Dowtherm SR-1 and Texaco E.G. Heat Transfer Fluid 100), when pure, is generally less corrosive to the common metals of construction than water itself. It will, however, assume the corrosivity of the water from which it is prepared and may become increasingly corrosive with use if not properly inhibited.

CAUTION

Risk of oxide layer formation. Can cause equipment damage.

Idle fluid allows the collection of sediment that prevents the formation of a protective oxide layer on the inside of tubes. Keep unit switched ON and system pump operating.

Leak Checking of Unit and Field Piping

Liebert unit fluid systems are factory-checked for leaks and may be shipped with a nitrogen holding charge. Liebert unit fluid circuits should be checked for leaks at installation as described below.

NOTE

During leak checking of field-installed piping, Liebert recommends that the unit be isolated using field-installed shutoff valves. When the Liebert units are included in a leak test, use of fluid for pressure testing is recommended. When pressurized gas is used for leak testing the Liebert unit, the maximum recommended pressure is 30 psig (2 bars) and tightness of the unit should be verified by pressure decay over time, (<2 psig/hour [0.3 bars/hour]) or sensing a tracer gas with suitable instrumentation. Dry seals in fluid valves and pumps may not hold a high gas pressure.

7.2 Refrigeration Piping

WARNING

Risk of explosive discharge from high-pressure refrigerant. Can cause injury or death.

This unit contains fluids and/or gases under high pressure.

Relieve pressure before working with piping.

WARNING

Risk of refrigerant system rupture or explosion from over pressurization. Can cause equipment damage, injury or death.

If a pressure relief device is not provided with the condenser unit, the system installer must provide and install a discharge pressure relief valve rated for a maximum of 500 psig (34bar) in the high side refrigerant circuit. Do not install a shutoff valve between the compressor and the field installed relief valve.

One or more additional pressure relief valves are required downstream of any and all field-installed isolation valves as shown in **Figures 32** and **33**. Do not isolate any refrigerant circuits from overpressurization protection.

For systems requiring EU CE compliance (50Hz), the pressure relief valve must be CE certified to the EU Pressure Equipment Directive by an EU "Notified Body."

CAUTION

Risk of oil contamination with water. Can cause equipment damage.

Some Liebert DS Systems require the use of POE (polyolester) oil. See **11.7.1 - Compressor Oil** for requirements. POE oil absorbs water at a much faster rate when exposed to air than previously used oils. Because water is the enemy of a reliable refrigeration system, extreme care must be used when opening systems during installation or service. If water is absorbed into the POE oil, it will not be easily removed and will not be removed through the normal evacuation process. If the oil is too wet, it may require an oil change. POE oils also have a property that makes them act as a solvent in a refrigeration system. Maintaining system cleanliness is extremely important because the oil will tend to bring any foreign matter back to the compressor.

NOTE

A pressure relief valve is provided with Liebert Lee-Temp condensers. A fusible plug is provided on Liebert Fan Speed Control condensers. The Liebert indoor cooling unit has a factory-installed high pressure safety switch in the high side refrigerant circuit.

7.2.1 Piping Guidelines—Air-Cooled Units

- Indoor unit ships with a nitrogen holding charge; do not vent the evaporator until all refrigerant piping is in place, ready for connection to the unit and condenser
- Use copper piping with high temperature brazed joints
- Isolate piping from building using vibration-isolating supports
- Refer to **Table 20** for piping sizes
- Refer to condenser installation manual for charging information
- Install traps on hot gas (discharge) lines at the base of vertical risers and every 25 feet (7.6m) of vertical rise.
- Consult factory if condenser is installed more than 15 feet (4.6m) below the evaporator
- Consult factory if piping run exceeds 150 feet (46m) equivalent length
- Keep piping clean and dry, especially on units with R-407C refrigerant
- Avoid piping runs through noise-sensitive areas
- Do not run piping directly in front of airstream
- Refrigerant oil – do not mix oil types (see **11.7.1 - Compressor Oil**)

Refer to ASHRAE Refrigeration Handbook for general good-practice refrigeration piping.

Table 20 Recommended refrigerant line sizes - OD copper (inches)*

Standard Scroll Models (Non-Digital Scroll)														
Model	**028**		**035**		**042**		**053**		**070**		**077**		**105**	
Equivalent Length	**Hot Gas Line**	**Liquid Line**	**Hot Gas Line**	**Liquid Line**	**Hot Gas Line**	**Liquid Line**	**Hot Gas Line**	**Liquid Line**	**Hot Gas Line**	**Liquid Line**	**Hot Gas Line**	**Liquid Line**	**Hot Gas Line**	**Liquid Line**
50 ft (15m)	7/8	1/2	7/8	1/2	7/8	1/2	7/8	5/8	1-1/8	7/8	1-1/8	7/8	1-3/8	7/8
100 ft (30m)	7/8	5/8	7/8	5/8	7/8	5/8	1-1/8	7/8	1-1/8	7/8	1-1/8	7/8	1-3/8	7/8
150 ft (45 m)	7/8	5/8	7/8	5/8	7/8	5/8	1-1/8	7/8	1-1/8	7/8	1-1/8	7/8	1-3/8	1-1/8
4-Step Semi-Hermetic and Digital Scroll Models														
Model	**028**		**035**		**042**		**053**		**070**		**077**		**105**	
Equivalent Length	**Hot Gas Line**	**Liquid Line**	**Hot Gas Line**	**Liquid Line**	**Hot Gas Line**	**Liquid Line**	**Hot Gas Line**	**Liquid Line**	**Hot Gas Line**	**Liquid Line**	**Hot Gas Line**	**Liquid Line**	**Hot Gas Line**	**Liquid Line**
50 ft (15m)	3/4	1/2	3/4	1/2	7/8	5/8	7/8	7/8	1-1/8*	7/8	1-1/8	7/8	1-3/8	7/8
100 ft (30m)	3/4	5/8	7/8	5/8	7/8	5/8	1-1/8*	7/8	1-1/8	7/8	1-1/8	7/8	1-3/8	7/8
150 ft (45 m)	7/8	5/8	7/8	5/8	1-1/8*	5/8	1-1/8	7/8	1-1/8	7/8	1-1/8	7/8	1-3/8	1-1/8

* Downsize vertical riser one trade size (1-1/8" to 7/8")

Table 21 Indoor unit approximate refrigerant charge for R-22 or R-407C

System Type	Model	R-22 Charge per Circuit, lb (kg)	R-407C Charge per Circuit, lb (kg)
Air Cooled	028, 035, 042	6.5 (3.0)	5.5 (2.5)
	053, 070, 077	9.5 (5.0)	8.0 (3.6)
	105	11.0 (5.0)	9.5 (4.3)
Water, Glycol/GLYCOOL	028, 035, 042	13.0 (5.9)	12.2 (5.6)
	053, 070, 077	18.5 (8.4)	17.0 (7.8)
	105	24.0 (10.9)	22.5 (10.3)

Table 22 Line charges - refrigerant per 100 ft (30m) of Type “L” copper tube

O.D.	Liquid Line, lb (kg)
1/2"	7.3 (3.3)
5/8"	11.7 (5.3)
7/8"	24.4 (11.1)
1-1/8"	41.6 (18.9)

Table 23 Outdoor condenser approximate refrigerant charge lb (kg) per circuit

Model	Fan Speed	Lee-Temp (includes receiver)
165	5 (2.3)	27 (12.3)
205	7 (3.2)	38 (17.2)
251	10 (4.6)	38 (17.20
308	11 (5.0)	58 (26.3)
415	15 (6.8)	75 (34.0)
510	30 (13.6)	149 (67.6)
143	17 (8)	64 (29)
214	23 (10	81 (37)
286	29 (13)	98 (44)
409	36 (16)	129 (59)
477	24 (11)	80 (36)
572	57 (26)	196 (89)

7.3 Dehydration/Leak Test and Charging Procedures for R-407C and R-22

7.3.1 Air Cooled Condenser with Fan Speed Head Pressure Control System

The Fan Speed Control system uses a pressure activated electronic fan speed control system and remotely located thermostat(s) to ensure operation at ambient temperatures as low as 0°F (-18°C).

Fan Speed Control Piping

Two discharge lines and two liquid lines must be field-installed between the indoor unit and the outdoor condenser. See **Figures 32** and **34** for details.

Fan Speed Control Materials Supplied

- Built-in, pre-wired condenser control box
- Air cooled condenser
- Piping access cover to be reinstalled when piping is complete
- Bolts—four per leg (3/8" x 5/8")
- Terminal block for two-wire, 24V interlock connection between unit and condenser
- Condenser legs—four with 1-fan, 2-fan and 3-fan models; six with 4-fan models

Fan Speed Control Leak Check and Evacuation Procedure

Proper leak check and evacuation can be accomplished only with all system solenoid valves open and check valves accounted for.

NOTE
*Systems with scroll or digital scroll compressors include a factory-installed check valve and an additional downstream Schrader valve with core in the compressor discharge line. Proper evacuation of the condenser side of the compressor can be accomplished only using the downstream Schrader valve. See piping schematic (**Figures 32** and **34**).*

1. If unit power is available, open the unit liquid line solenoid valves using the evacuation function for System #1 and System #2 in the diagnostic section of the iCOM control (refer to the iCOM user manual, SL-18835). If unit power is not available, a field-supplied 24VAC / 75VA power source must be directly connected to each of the unit solenoid valves.
2. For semi-hermetic compressors, connect refrigeration gauges to the suction and discharge service valves of both compressors.
3. For scroll and digital scroll compressors, connect refrigerant gauges to the suction rotalock valves and discharge line Schrader valves (see **Note** above) on both compressors.
4. Starting with Circuit #1, open the service valves and place a 150 PSIG (1034 kPa) of dry nitrogen with a tracer of refrigerant. Check system for leaks with a suitable leak detector.
5. With pressure still in Circuit #1, open the compressor service valves in Circuit #2. If pressure increases in Circuit #2, the system is cross-circuited and must be rechecked for proper piping. If there is no pressure increase, repeat the leak check procedure for Circuit #2.
6. After completion of leak testing, release the test pressure (per local code) and pull an initial deep vacuum on the system with a suitable pump.
7. After four hours, check the pressure readings and, if they have not changed, break vacuum with dry nitrogen. Pull a second (R-407C and R-22) and third (R407C only) vacuum to 250 microns or less. Recheck the pressure after two hours. After completing this step, proceed to **Fan Speed Charging**.

Fan Speed Charging

1. Check unit nameplate for refrigerant type to be used. Unit control configurations differ depending on refrigerant type.
2. Refrigerant charging requires unit operation. Refer to **9.0 - Checklist for Completed Installation**.
3. Calculate the amount of charge for the system. Refer to the unit, condenser and refrigerant line charge data in **Tables 21**, **22** and **23**.
4. Weigh in as much of the system charge as possible before starting the unit.

CAUTION

Risk of improper refrigerant charging. Can cause equipment damage.

Refrigerant R407C is a blend of three components and must be introduced and charged from the cylinder only as a liquid.

When adding liquid refrigerant to an operating system, it may be necessary to add the refrigerant through the compressor suction service valve. Care must be exercised to avoid damage to the compressor. Liebert recommends connecting a sight glass between the charging hose and the compressor suction service valve. This will permit adjustment of the cylinder hand valve so that liquid can leave the cylinder while allowing vapor to enter the compressor.

5. Turn on unit disconnect switch. Operate the unit for 30 minutes using the charging function for System #1 and System #2 in the diagnostic section of the iCOM control (see iCOM user manual, SL-18835). The charging function operates the compressor at full capacity and energizes the blower motor and the liquid line solenoid valve. The reheat and humidifier are disabled. A minimum 20psig (138kPa) must be established and maintained for the compressor to operate. The charging function can be reset as many times as required to complete unit charging.

Table 24 Fan speed suction pressure transducer settings

Function	R-22		R-407C	
	Gauge (Sea Level)	Absolute	Gauge (Sea Level)	Absolute
	psiG (kPa)	psiA (kPa)	psiG (kPa)	psiA (kPa)
Pump-Down Cutout	20 (138)	35 (241)	20 (138)	35 (241)
Pump-Down Reset	65 (448)	80 (552)	65 (448)	80 (552)
Minimum to Start Cooling	35 (241)	50 (344)	35 (241)	50 (344)
Low-Pressure Cutout (DX only)	48 (331)	63 (434)	52 (358)	67 (461)

6. Charge the unit until the liquid line sight glass becomes clear. Then add one additional pound (2.2kg) of refrigerant.

NOTE

A digital scroll compressor will have a clear sight glass only when operating at 100% capacity. When operating below 100%, the sight glass may show bubbles with each 15-second unloading cycle.

7. As head pressure builds, the fan speed controlled condenser fan begins rotating. The fan will run at full speed when sufficient head pressure is developed—fan starts to rotate at 190 psig (1310 kPA) and is full speed at 250 psig (1724 kPA).

7.3.2 Air Cooled Condenser with Lee-Temp "Flooded Condenser" Head Pressure Control System

The Lee-Temp system consists of a modulating type head pressure control valve and insulated receivers with heater pads to ensure operation at ambient temperatures as low as -30°F (-34.4°C).

Lee-Temp Piping

Two discharge lines and two liquid lines must be field-installed between the indoor unit and the outdoor condenser. See **Figures 32** and **34** for details.

Lee-Temp Controlled Materials Supplied

- Built-in, pre-wired condenser control box
- Air cooled condenser
- Piping access cover to be reinstalled when piping is complete
- Bolts—four per leg (3/8" x 5/8")
- Terminal block for two-wire, 24V interlock connection between unit and condenser
- Condensate legs—four with 1-fan, six on two-and three-fan models and eight on four-fan models
- Bolts—six per receiver (3/8" x 1")
- Lee-Temp system:
  - Insulated storage receiver—one per circuit
  - Head pressure control valve with integral check valve - one per circuit
  - Service valve—one per circuit
  - Pressure relief valve—one per circuit
  - Liquid level sight glass—two per circuit
  - Check valve—one per circuit

NOTE
Lee-Temp heater pads require a separate, continuous electrical source. See nameplate on unit for proper voltage.

Lee-Temp Leak Check and Evacuation Procedure

Proper leak check and evacuation can be accomplished only with all system solenoid valves open and check valves accounted for.

NOTE
*Systems with scroll or digital scroll compressors include a factory-installed check valve and an additional downstream Schrader valve with core in the compressor discharge line. Proper evacuation of the condenser side of the compressor can be accomplished only using the downstream Schrader valve. See piping schematic (**Figure 34**).*

1. If unit power is available, open the unit liquid line solenoid valves using the evacuation function for System #1 and System #2 in the diagnostic section of the iCOM control. If unit power is not available, a field-supplied 24VAC / 75VA power source must be directly connected to each of the unit solenoid valves.
2. Attach a jumper hose from the service valve fitting on the outlet of the receiver and the Schrader fitting on the discharge header of the condenser. Front seat the service valve approximately two (2) turns.
3. For semi-hermetic compressors, connect refrigeration gauges to the suction and discharge service valves of both compressors.
4. For scroll and digital scroll compressors, connect refrigerant gauges to the suction rotalock valves and discharge line Schrader valves (see **Note** above) on both compressors.
5. Starting with Circuit #1, open the service valves and place a 150 PSIG (1034 kPa) of dry nitrogen with a tracer of refrigerant. Check system for leaks with a suitable leak detector.
6. With pressure still in Circuit #1, open the compressor service valves in Circuit #2. If pressure increases in Circuit #2, the system is cross-circuited and must be rechecked for proper piping. If there is no pressure increase, repeat the leak check procedure for Circuit #2.
7. After completion of leak testing, release the test pressure (per local code) and pull an initial deep vacuum on the system with a suitable pump.

8. After four hours, check the pressure readings and, if they have not changed, break vacuum with dry nitrogen. Pull a second (R-407C and R-22) and third (R407C only) vacuum to 250 microns or less. Recheck the pressure after two hours. After completing this step, proceed to **Fan Speed Charging on page 46**.
9. Remove the jumper hose installed previously from between the service valve fitting and the condenser. After completing this step, proceed to **Lee-Temp Charging**.

Lee-Temp Charging

1. Check unit nameplate for refrigerant type to be used. Unit control configurations differ depending on refrigerant type.
2. Refrigerant charging requires unit operation. Refer to **9.0 - Checklist for Completed Installation**.
3. Calculate the amount of charge for the system. Refer to the unit, condenser and refrigerant line charge data in **Tables 21** and **22**.
4. Weigh in as much of the system charge as possible before starting the unit.

CAUTION

Risk of improper refrigerant charging. Can cause equipment damage.

Refrigerant R407C is a blend of three components and must be introduced and charged from the cylinder only as a liquid.

When adding liquid refrigerant to an operating system, it may be necessary to add the refrigerant through the compressor suction service valve. Care must be exercised to avoid damage to the compressor. Liebert recommends connecting a sight glass between the charging hose and the compressor suction service valve. This will permit adjustment of the cylinder hand valve so that liquid can leave the cylinder while allowing vapor to enter the compressor.

5. Turn on unit disconnect switch. Operate the unit for 30 minutes using the charging function for System # 1 and System # 2 in the diagnostic section of the iCOM control. The charging function operates the compressor at full capacity and energizes the blower motor and liquid line solenoid valve. The reheat and humidifier are disabled. A minimum 20psig (138kPa) must established and maintained for the compressor to operate. The charging function can be reset as many times as required to complete unit charging.

Table 25 Lee-Temp suction pressure transducer settings

Function	R-22		R-407C	
	Gauge Reading (Sea Level)	Absolute	Gauge Reading (Sea Level)	Absolute
	psiG (kPa)	psiA (kPa)	psiG (kPa)	psiA (kPa)
Pump-Down Cutout	20 (138)	35 (241)	20 (138)	35 (241)
Pump-Down Reset	65 (448)	80 (552)	65 (448)	80 (552)
Minimum to Start Cooling	60 (414)	75 (517)	60 (414)	75 (517)
Low-Pressure Cutout (DX only)	48 (331)	63 (434)	52 (358)	67 (461)

6. Charge the unit until the liquid line sight glass becomes clear. Then add one additional pound (2.2 kg) of refrigerant.

NOTE

A digital scroll compressor will have a clear sight glass only when operating at 100% capacity. When operating below 100%, the sight glass may show bubbles with each 15-second unloading cycle.

Lee-Temp Receiver Refrigerant Level

On each receiver at the condenser are two refrigerant-level sight glasses. Refrigerant level will vary with outside temperature.

Check refrigerant level after the unit has been on for at least 15 minutes.

Sight Glass Levels

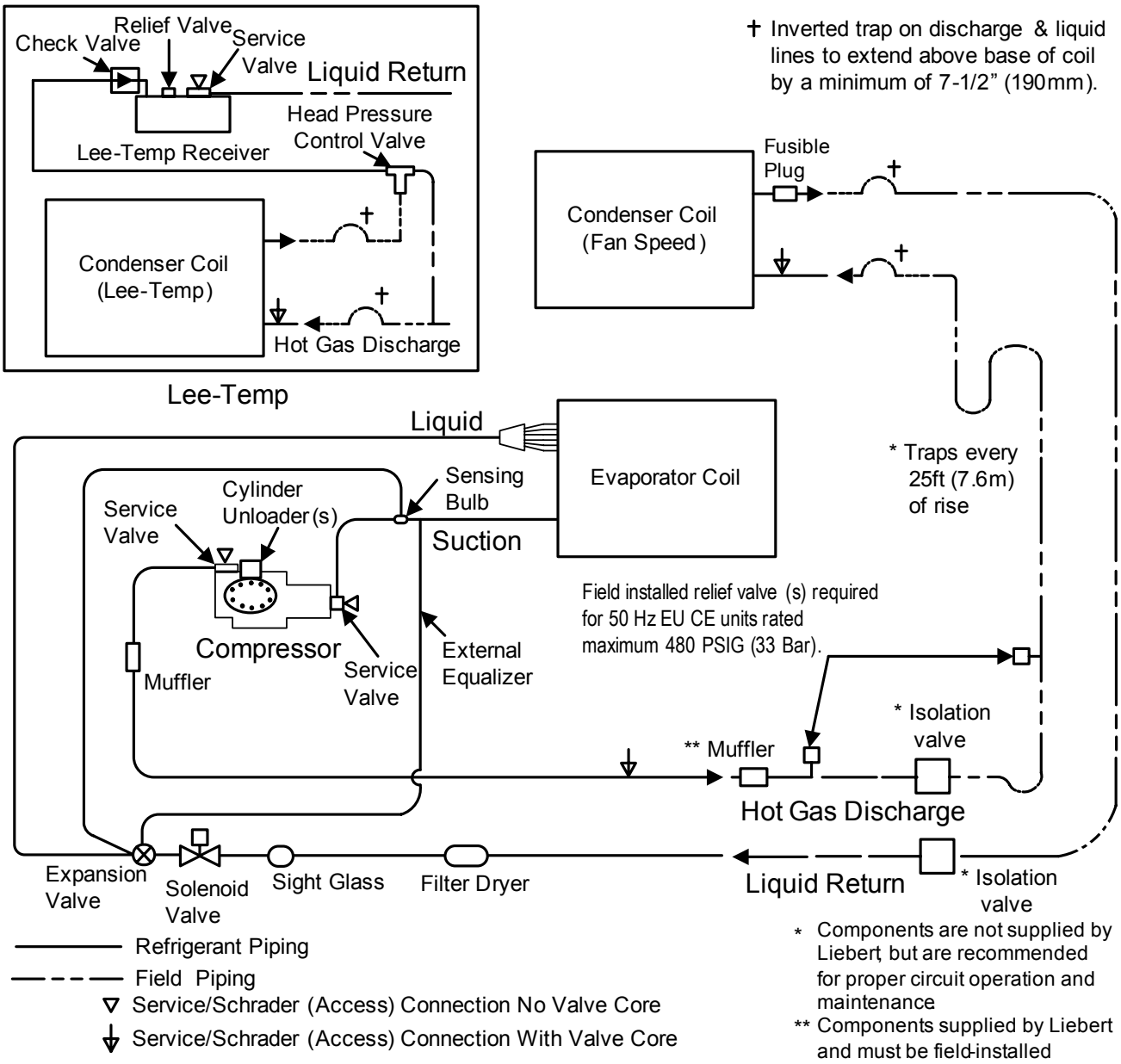
40°F (4.5°C) and lower—bottom sight glass is 3/4 full

40 to 60°F (4.5 to 15.5°C)—bottom sight glass is full

60°F (15.5°C) and higher—top sight glass is 3/4 full.

8.0 PIPING SCHEMATICS

Figure 32 Piping schematic—air cooled, semi-hermetic compressor models



Note: Schematic representation shown . Do not use for specific connection locations . Two refrigeration circuits provided . Single refrigeration circuit shown for clarity .

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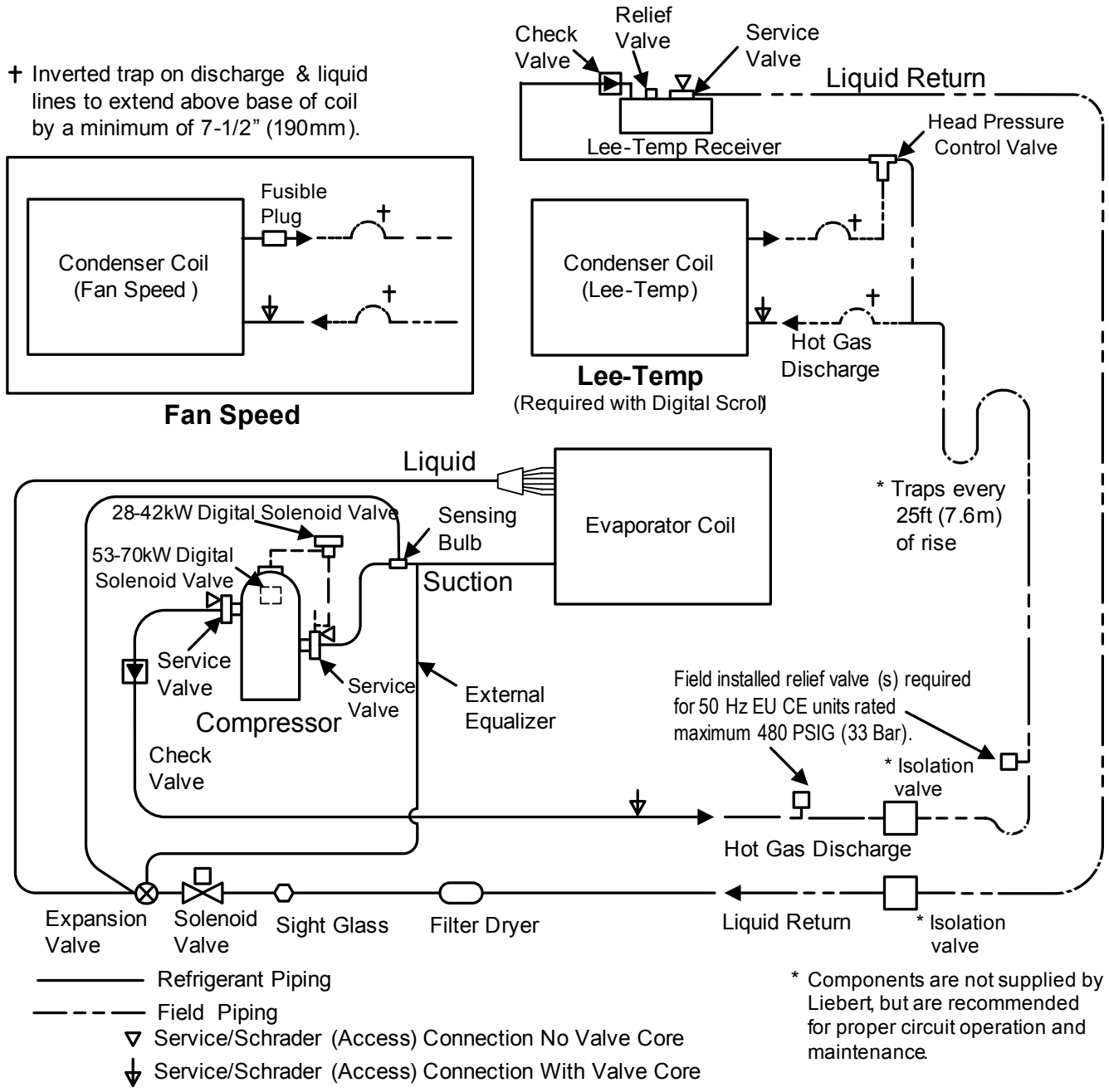
Figure 33 Piping schematic—air cooled, scroll compressor models



Note: Schematic representation shown . Do not use for specific connection locations . Two refrigeration circuits provided . Single refrigeration circuit shown for clarity .

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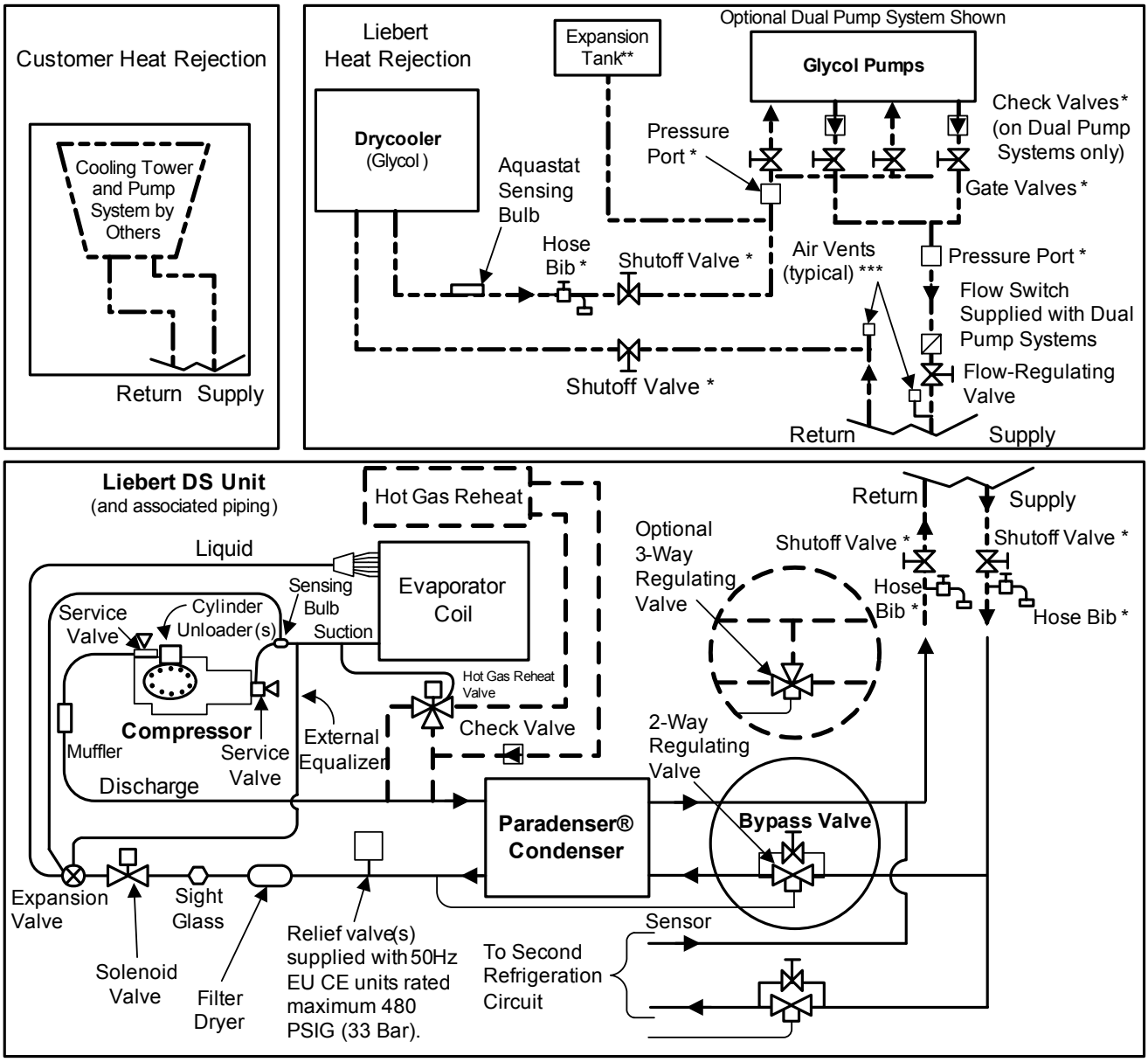
Figure 34 Piping schematic—water/glycol, semi-hermetic compressor models



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

* Components are not supplied by Liebert, but are recommended for proper circuit operation and maintenance
** Field-installed at highest point In system on return line to pumps
*** Locate at tops of all risers and any intermediate system high points

Note: Schematic representation shown This schematic does not imply or define elevations and component location unless specifically noted ..
Two refrigeration circuits provided Single refrigeration circuit shown for clarity

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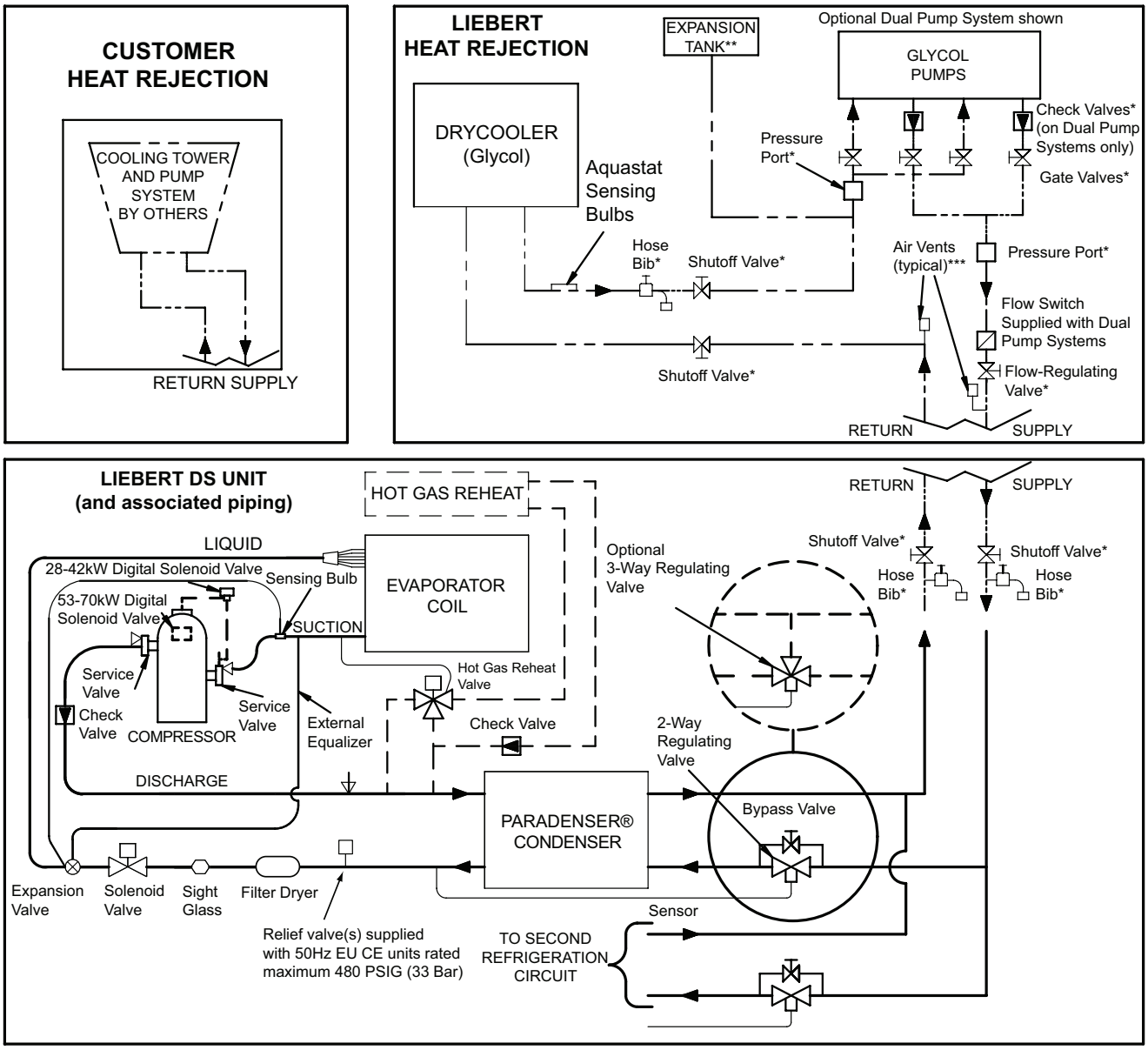
Figure 35 Piping schematic—water/glycol with scroll compressor models



Factory Piping

Field Piping

Optional Factory Piping

Service/Schrader (Access) Connection No Valve Core

Service/Schrader (Access) Connections With Valve Core

* Components are not supplied by Liebert but are recommended for proper circuit operation and maintenance

** Field installed at highest point in system on return line to pumps

*** Locate at tops of all risers and any intermediate system high points

Note: Schematic representation shown. This schematic does not imply or define elevations and component location unless specifically noted.
Two refrigeration circuits provided. Single refrigeration circuit shown for clarity.

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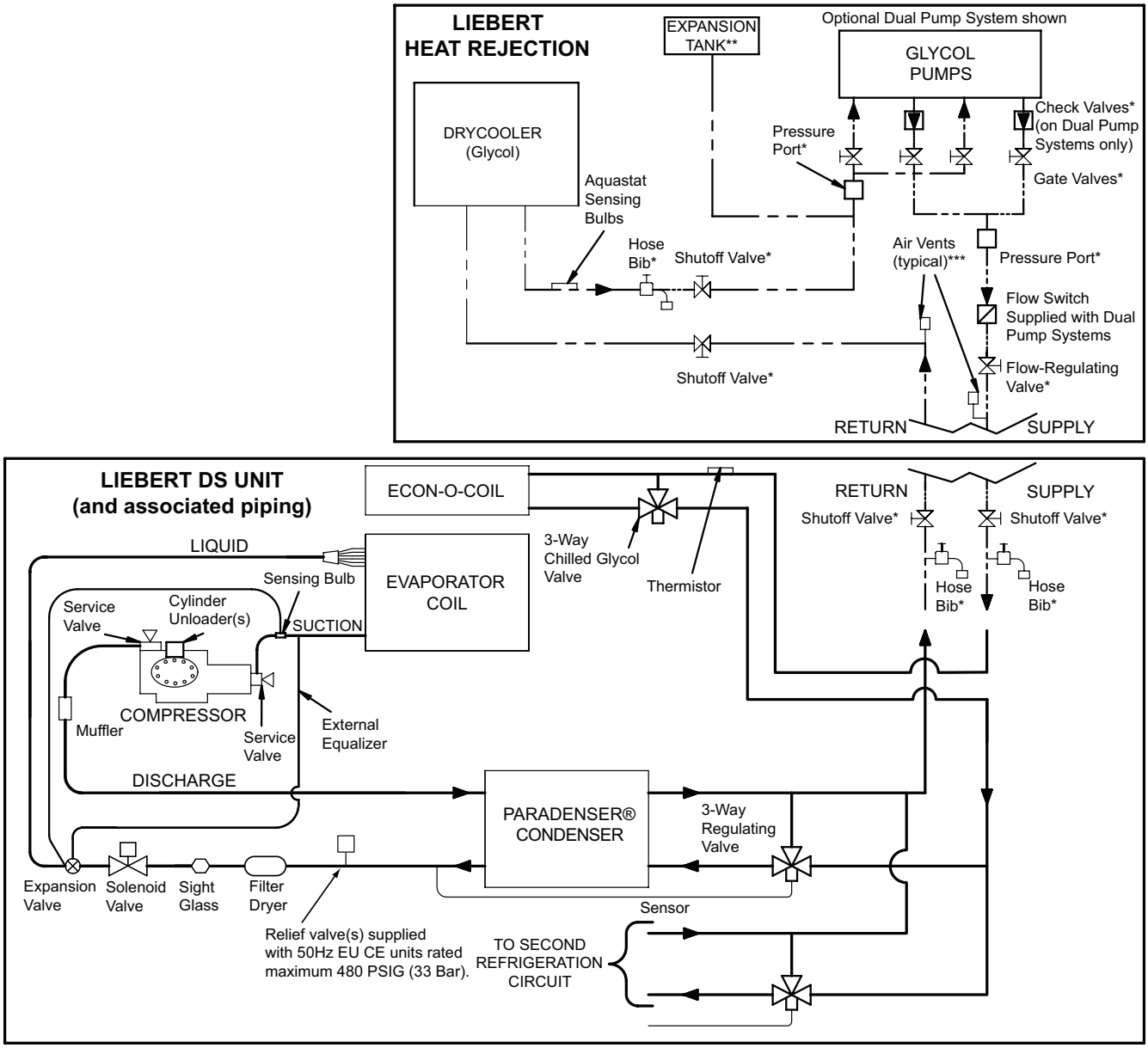
REV 1

Figure 36 Piping schematic—GLYCOOL semi-hermetic compressor models



Factory Piping

Field Piping

▽ Service/Schrader (Access) Connection No Valve Core

⩛ Service/Schrader (Access) Connections With Valve Core

* Components are not supplied by Liebert but are recommended for proper circuit operation and maintenance

** Field-installed at highest point in system on return line to pumps

*** Locate at tops of all risers and any intermediate system high points

Notes: Schematic representation shown. This schematic does not imply or define elevations and component location unless specifically noted.

Two refrigeration circuits provided. Single refrigeration circuit shown for clarity

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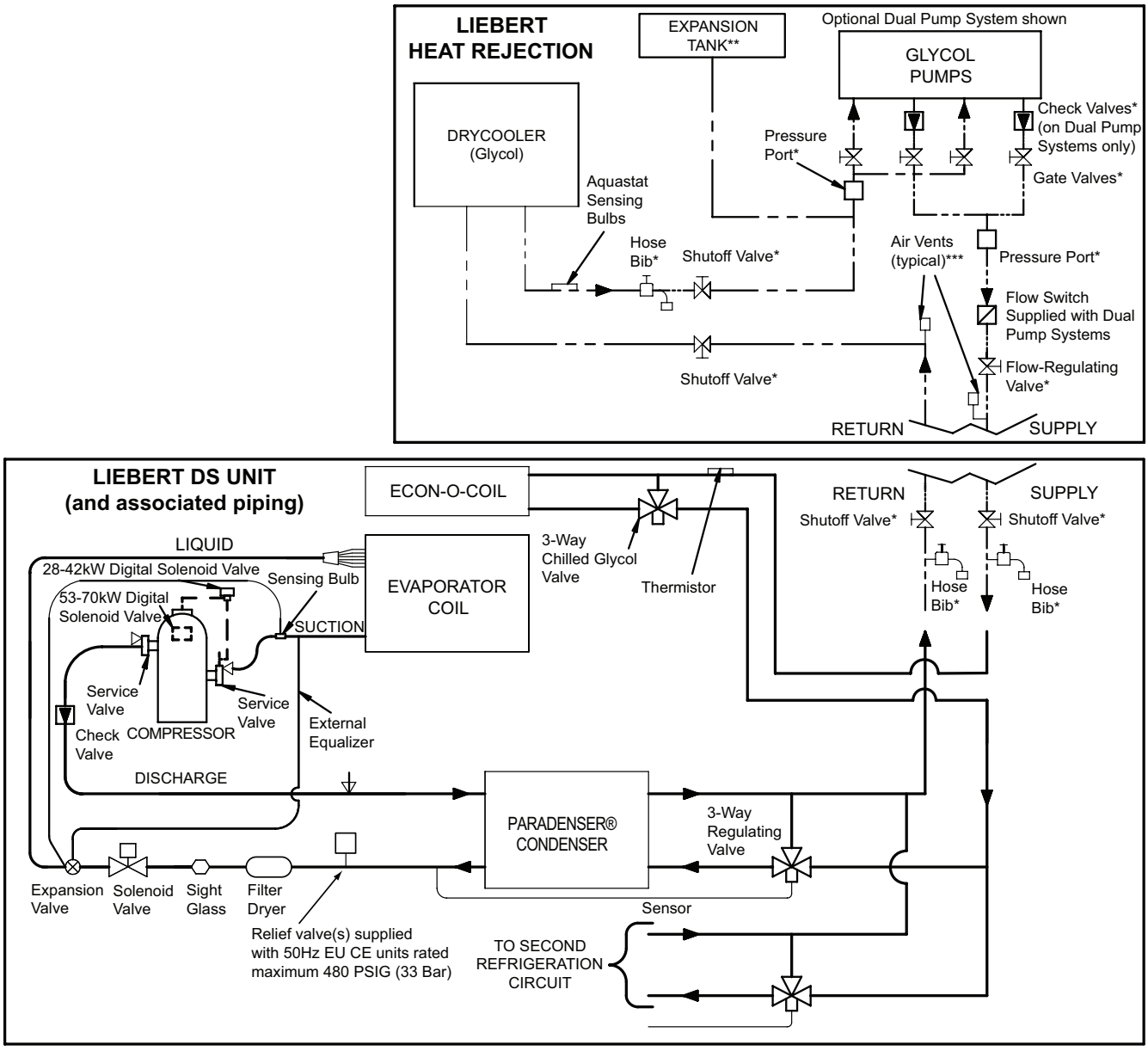
REV 1

Figure 37 Piping schematic—GLYCOOL with scroll compressor models



Factory Piping

Field Piping

▽ Service/schrader (Access) Connection No Valve Core

▽ Service/schrader (Access) Connections With Valve Core

* Components are not supplied by Liebert but are recommended for proper circuit operation and maintenance

** Field-installed at highest point in system on return line to pumps

*** Locate at tops of all risers and any intermediate system high points

Note: Schematic representation shown. This schematic does not imply or define elevations and Component location, unless specifically noted.
Two refrigeration circuits provided. Single refrigeration circuit shown for clarity.

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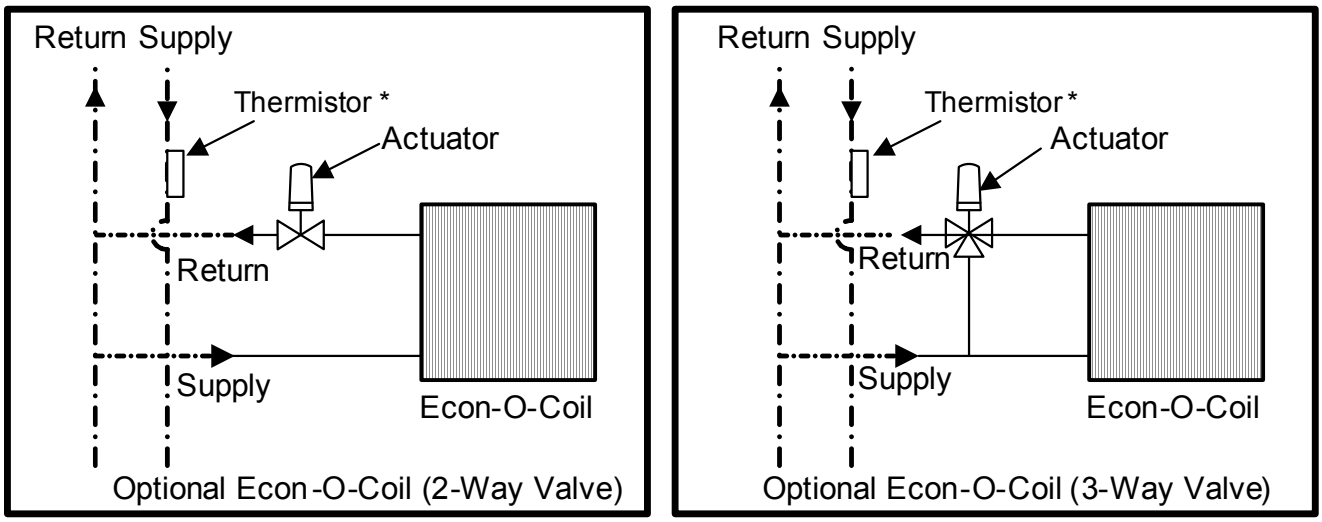
Figure 38 Optional piping schematic for Econ-O-Coil



——— Factory Piping
-·-·-·- Field Piping

* Supplied with 10 feet (3m) extra thermistor wire for installation on field supply line

Note: 1. Place thermistor in location where flow is always present
2. Thermistor must be located out of the supply air stream

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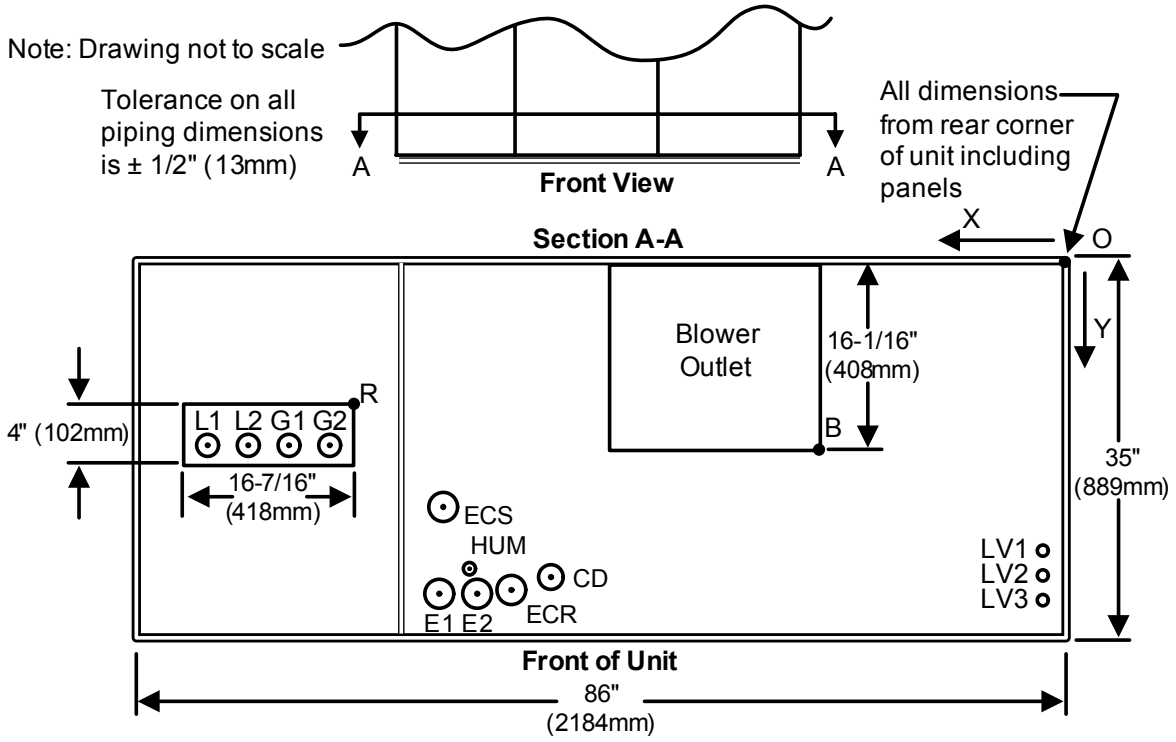
Figure 39 Primary connection locations—downflow, air cooled, 28-42kW (8-12 tons), semi-hermetic compressor models

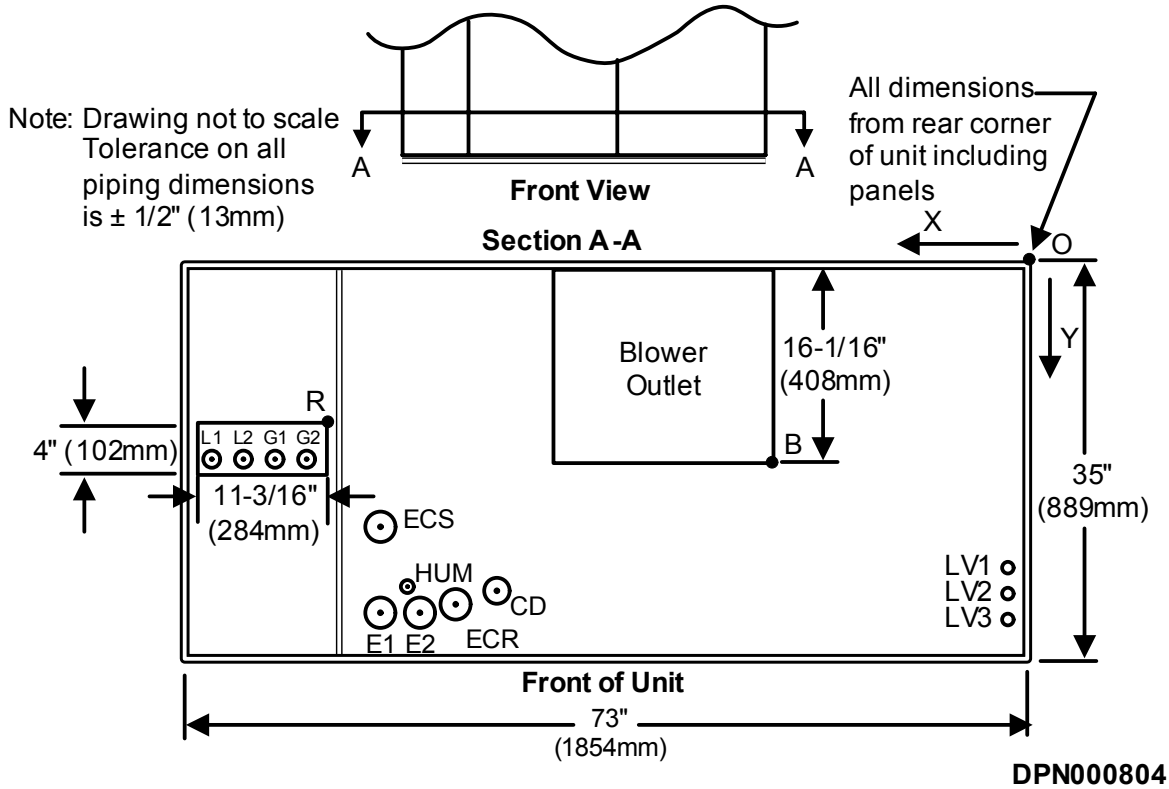


DPN000803
Rev. 2

Point	Description	X inches (mm)	Y inches (mm)	Connection Size / Opening inches (mm)
R	Refrigerant Access	63 (1600)	12-13/16 (325)	16-7/16 x 4 (418 x 102)
L1	Liquid Line System 1	79-3/16 (2011)	15-3/4 (400)	1/2" Cu Sweat
L2	Liquid Line System 2	76-1/2 (1943)	15-3/4 (400)	1/2" Cu Sweat
G1	Hot Gas Discharge 1	73-7/8 (1876)	15-3/4 (400)	5/8" Cu Sweat
G2	Hot Gas Discharge 2	70-1/8 (1780)	15-3/4 (400)	5/8" Cu Sweat
CD	Condensate Drain*	46 (1168)	28-1/2 (724)	3/4" FPT
	W/ Optional Pump	46 (1168)	28-1/2 (724)	1/2" Cu Sweat
HUM	Humidifier Supply Line	53-1/2 (1359)	28 (711)	1/4" Cu Sweat
ECS	Econ-O-Coil Supply	54-7/8 (1394)	21-9/16 (547)	1-5/8" Cu Sweat
ECR	Econ-O-Coil Return	49-3/8 (1254)	29-3/4 (756)	1-5/8" Cu Sweat
HS	Hot Water Reheat Supply	Consult factory		
HR	Hot Water Reheat Return	Consult factory		
E1	Electrical Conn. (High Volt)	55-1/2 (1410)	30-1/4 (768)	2-1/2"
E2	Electrical Conn. (High Volt)	52-7/16 (1332)	30-1/4 (768)	2-1/2"
LV1	Electrical Conn. (Low Volt)	2-1/4 (57)	26 (660)	7/8"
LV2	Electrical Conn. (Low Volt)	2-1/4 (57)	28 (711)	7/8"
LV3	Electrical Conn. (Low Volt)	2-1/4 (57)	30 (762)	7/8"
B	Blower Outlet	21-15/16 (558)	17-1/16 (433)	18-3/4 x 16-1/16 (476 x 408)

* Field-pitch condensate drain line a minimum of 1/8" (3.2mm) per foot (305mm). All units contain a factory-installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with all local codes.

Figure 40 Primary connection locations—downflow, air cooled, 28-42kW (8-12 tons) with scroll compressor models

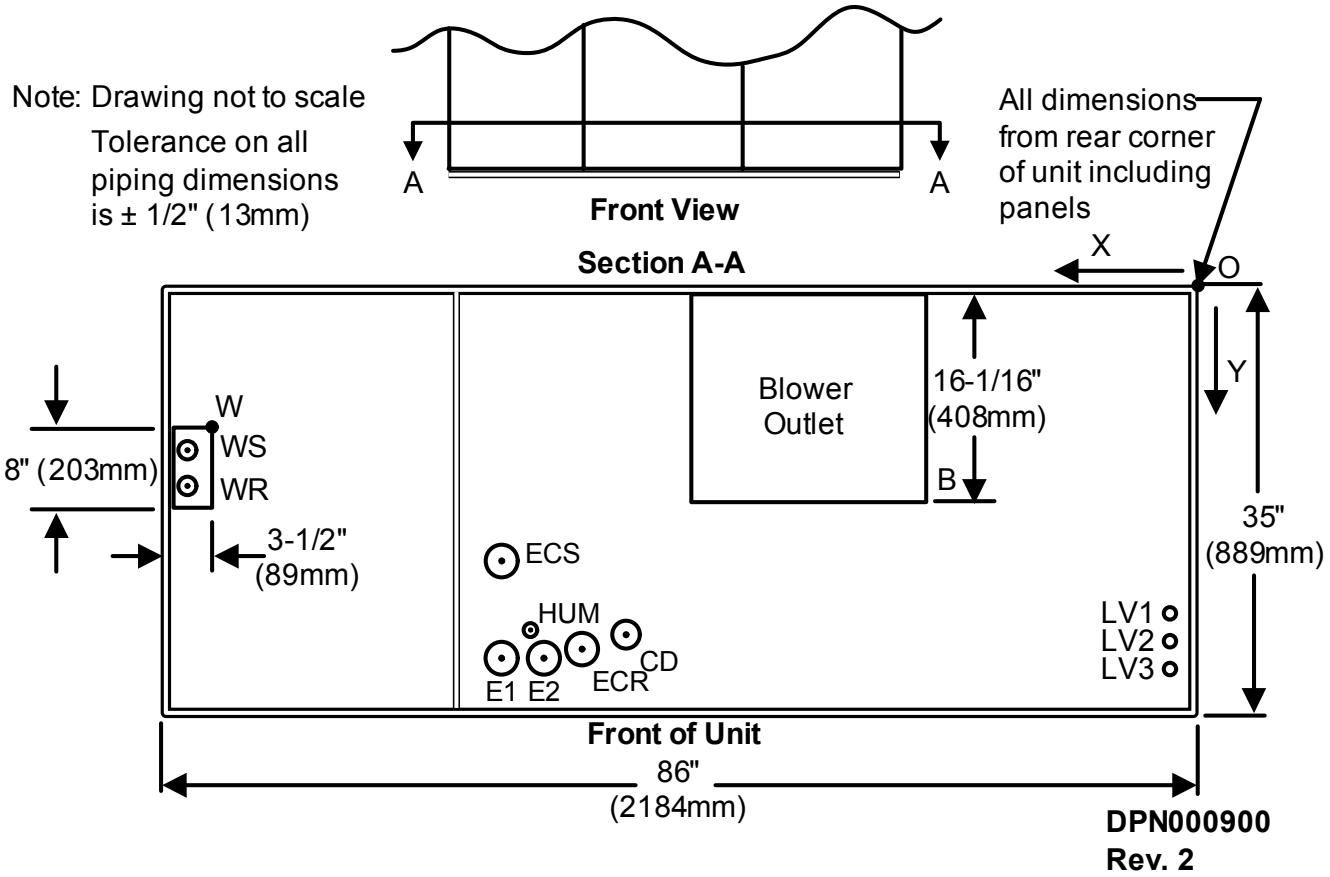


DPN000804
Rev. 2

Point	Description	X inches (mm)	Y inches (mm)	Connection Size / Opening inches (mm)
R	Refrigerant Access	59-5/16 (1507)	13-3/4 (349)	11-3/16 x 4 (284 x 102)
L1	Liquid Line System 1	69-15/16 (1776)	15-13/16 (402)	1/2" Cu Sweat
L2	Liquid Line System 2	67-5/8 (1718)	15-13/16 (402)	1/2" Cu Sweat
G1	Hot Gas Discharge 1	65-1/2 (1664)	15-13/16 (402)	5/8" Cu Sweat
G2	Hot Gas Discharge 2	62-7/16 (1586)	15-13/16 (402)	5/8" Cu Sweat
CD	Condensate Drain*	46 (1168)	28-1/2 (724)	3/4" FPT
	W/ Optional Pump	46 (1168)	28-1/2 (724)	1/2" Cu Sweat
HUM	Humidifier Supply Line	53-1/2 (1359)	28 (711)	1/4" Cu Sweat
ECS	Econ-O-Coil Supply	54-7/8 (1394)	21-9/16 (548)	1-5/8" Cu Sweat
ECR	Econ-O-Coil Return	49-3/8 (1254)	29-3/4 (756)	1-5/8" Cu Sweat
HS	Hot Water Reheat Supply	Consult factory		
HR	Hot Water Reheat Return	Consult factory		
E1	Electrical Conn. (High Volt)	55-1/2 (1410)	30-1/4 (768)	2-1/2"
E2	Electrical Conn. (High Volt)	52-7/16 (1332)	30-1/4 (768)	2-1/2"
LV1	Electrical Conn. (Low Volt)	2-1/4 (57)	26 (660)	7/8"
LV2	Electrical Conn. (Low Volt)	2-1/4 (57)	28 (711)	7/8"
LV3	Electrical Conn. (Low Volt)	2-1/4 (57)	30 (762)	7/8"
B	Blower Outlet	21-15/16 (557)	17-1/16 (433)	18-3/4 x 16-1/16 (476 x 408)

* Field-pitch condensate drain line a minimum of 1/8" (3.2mm) per foot (305mm). All units contain a factory-installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with all local codes.

Figure 41 Primary connection locations—downflow water/glycol/GLYCOOL 28-42kW (8-12 tons), all compressor models

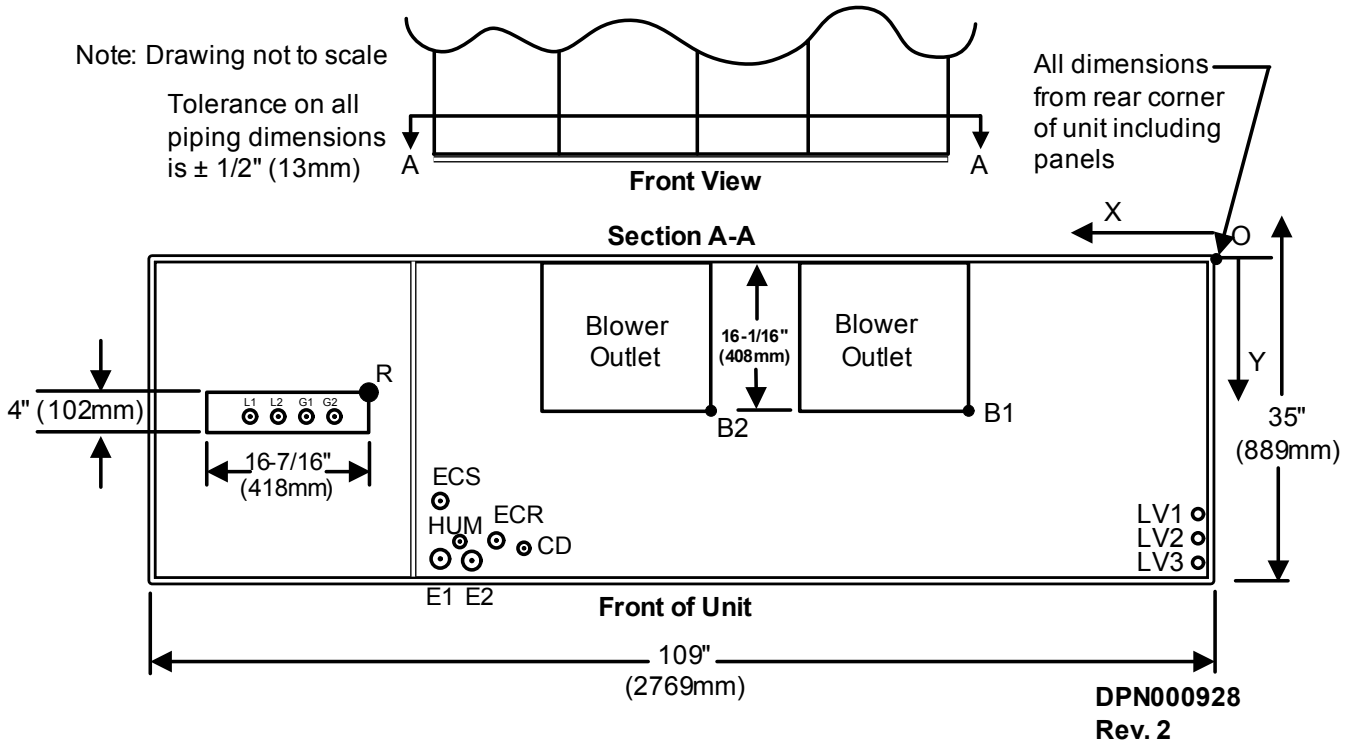


Point	Description	X inches (mm)	Y inches (mm)	Connection Size / Opening inches (mm)
W	Water/Glycol/GLYCOOL Access	79-15/16 (2030)	8-1/16 (205)	3-1/2 x 8 (89 x 203)
WS	Water/Glycol/GLYCOOL Supply	82-15/16 (2107)	9-15/16 (252)	1-5/8" Cu Sweat
WR	Water/Glycol/GLYCOOL Return	82-15/16 (2107)	13-1/16" (332)	1-5/8" Cu Sweat
CD	Condensate Drain *	46 (1168)	28-1/2 (724)	3/4" FPT
	W/ Optional Pump	46 (1168)	28-1/2 (724)	1/2" Cu Sweat
HUM	Humidifier Supply Line	53-1/2 (1359)	28 (711)	1/4" Cu Sweat
ECS	Econ-O-Coil Supply **	54-7/8 (1394)	21-9/16 (548)	1-5/8" Cu Sweat
ECR	Econ-O-Coil Return **	49-13/16 (1265)	27-1/2 (699)	1-5/8" Cu Sweat
HS	Hot Water Reheat Supply	Consult Factory		
HR	Hot Water Reheat Return	Consult Factory		
E1	Electrical Conn. (High Volt)	55-1/2 (1410)	30-1/4 (768)	2-1/2"
E2	Electrical Conn. (High Volt)	52-7/16 (1332)	30-1/4 (768)	2-1/2"
LV1	Electrical Conn. (Low Volt)	2-1/4 (57)	26 (660)	7/8"
LV2	Electrical Conn. (Low Volt)	2-1/4 (57)	28 (711)	7/8"
LV3	Electrical Conn. (Low Volt)	2-1/4 (57)	30 (762)	7/8"
B	Blower Outlet	21-15/16 (557)	17-1/16 (433)	18-3/4 x 16-1/16 (476 x 408)

* Field-pitch condensate drain line a minimum of 1/8" (3.2mm) per foot (305mm). All units contain a factory-installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with all local codes.

** Supplied on Dual Cool Systems only (4-pipe system)

Figure 42 Primary connection locations—downflow, air cooled, 53-77kW (15-22 tons), semi-hermetic compressor models

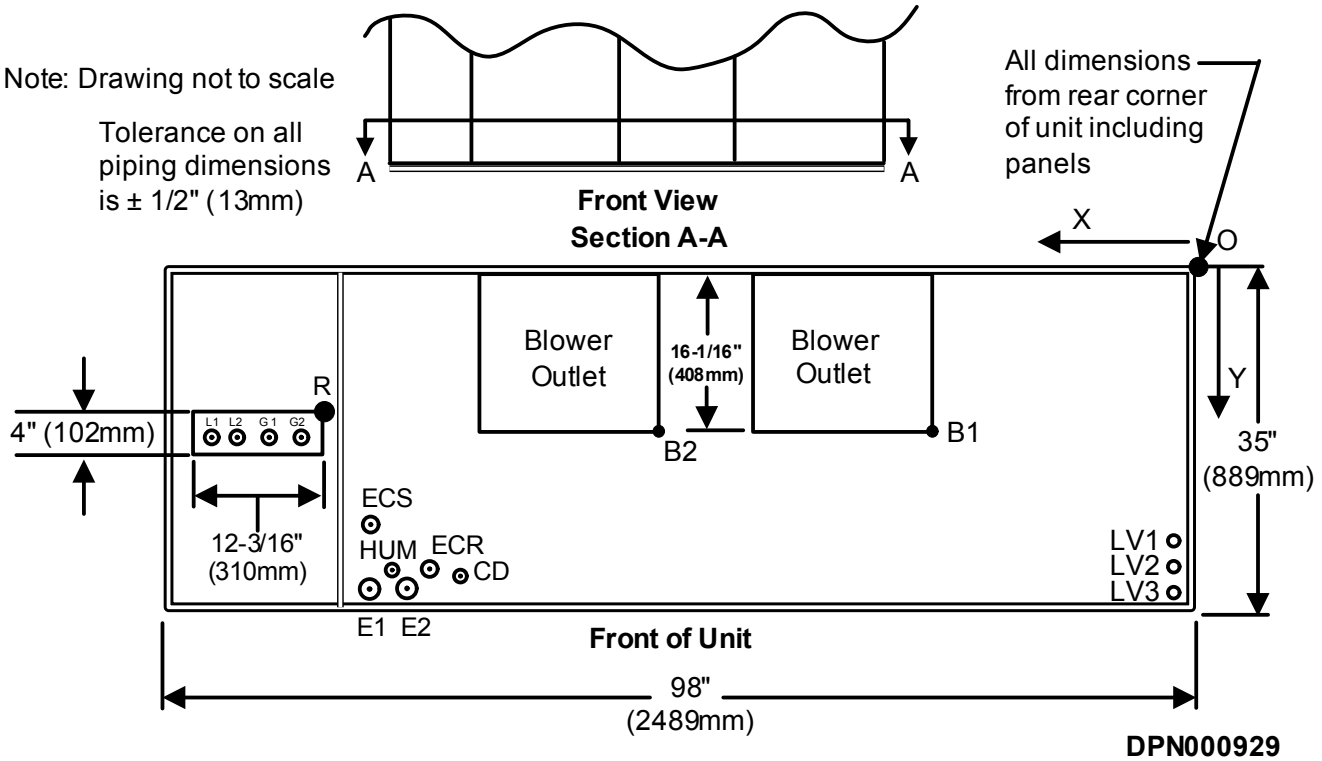


Point	Description	X inches (mm)	Y inches (mm)	Connection Size/Opening inches (mm)
R	Refrigerant Access	86 (2184)	12-7/8 (327)	16-7/16 x 4 (418 x 102)
L1	Liquid Line System 1	97 (2464)	15-7/8 (403)	5/8" Cu Sweat
L2	Liquid Line System 2	93-5/16 (2370)	15-7/8 (403)	5/8" Cu Sweat
G1	Hot Gas Discharge 1	90-5/8 (2302)	15-5/8 (397)	1-1/8" Cu Sweat
G2	Hot Gas Discharge 2	88 (2235)	15-5/8 (397)	1-1/8" Cu Sweat
CD	Condensate Drain *	68-1/4 (1734)	29 (737)	3/4" FPT
	W/ Optional Pump	68-1/4 (1734)	29 (737)	1/2" Cu Sweat
HUM	Humidifier Supply Line	75-1/2 (1918)	28 (711)	1/4" Cu Sweat
ECS**	Econ-O-Coil Supply	77-5/8 (1972)	23-5/8 (600)	2-1/8" Cu Sweat
ECR**	Econ-O-Coil Return	70-15/16 (1802)	23-5/8 (600)	2-1/8" Cu Sweat
HS	Hot Water Reheat Supply	Consult Factory		
HR	Hot Water Reheat Return	Consult Factory		
E1	Electrical Conn. (High Volt)	77-5/8 (1972)	30-1/8 (765)	2-1/2"
E2	Electrical Conn. (High Volt)	74-3/8 (1889)	30-1/8 (765)	2-1/2"
LV1	Electrical Conn. (Low Volt)	2-1/4 (57)	26 (660)	7/8"
LV2	Electrical Conn. (Low Volt)	2-1/4 (57)	28 (711)	7/8"
LV3	Electrical Conn. (Low Volt)	2-1/4 (57)	30 (762)	7/8"
B1	Blower Outlet	26-1/16 (662)	23-5/8 (600)	18-3/4 x 16-1/16 (476 x 408)
B2	Blower Outlet	48-7/8 (1241)	23-5/8 (600)	18-3/4 x 16-1/16 (476 x 408)

* Field-pitch condensate drain line a minimum of 1/8" (3.2mm) per foot (305mm). All units contain a factory-installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with all local codes.

** Supplied on Dual Cool Systems only (4-pipe system)

Figure 43 Primary connection locations—downflow, air cooled, 53-77kW (15-22 tons) with scroll compressor models

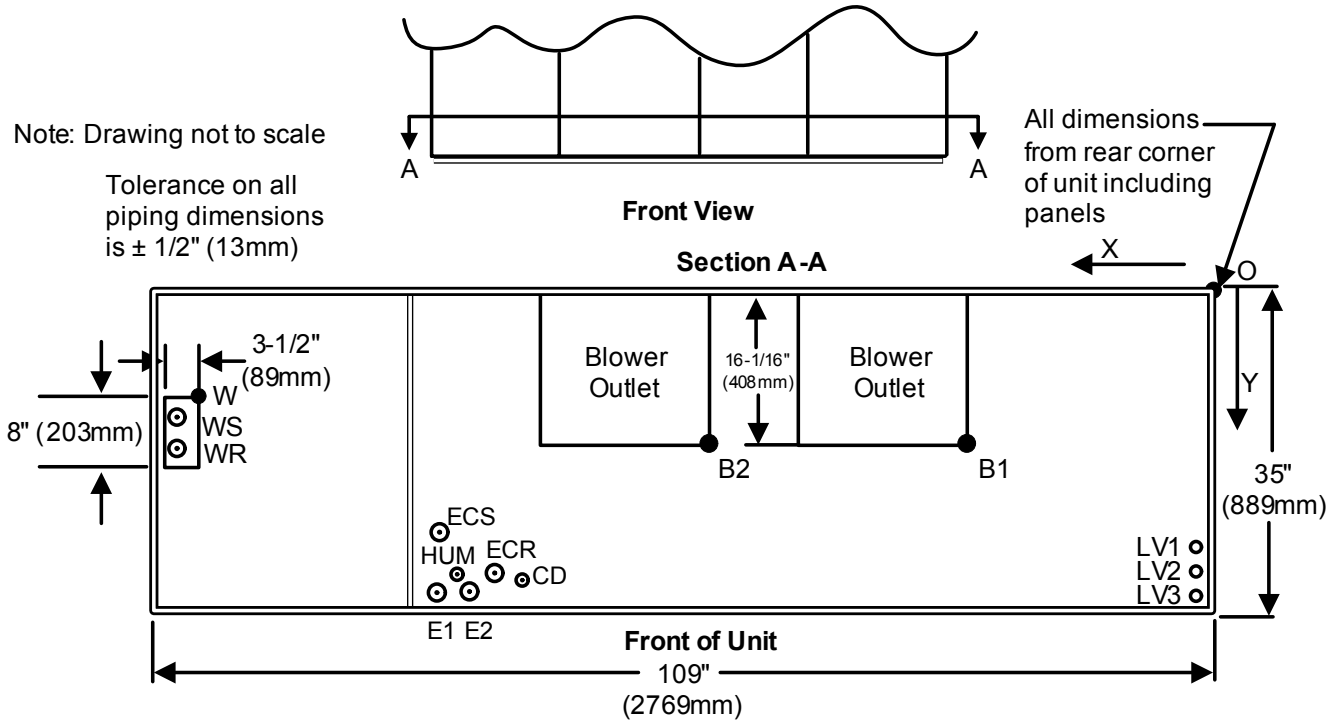


Point	Description	X inches (mm)	Y inches (mm)	Connection Size / Opening inches (mm)
R	Refrigerant Access	81-3/4 (2076)	13-3/4 (349)	12-3/16 x 4 (310 x 102)
L1	Liquid Line System 1	94-11/16 (2405)	15-3/4 (400)	5/8" Cu Sweat
L2	Liquid Line System 2	91-7/8 (2334)	15-3/4 (400)	5/8" Cu Sweat
G1	Hot Gas Discharge 1	88-3/4 (2254)	15-3/8 (391)	1-1/8" Cu Sweat
G2	Hot Gas Discharge 2	85-9/16 (2173)	15-3/8 (391)	1-1/8" Cu Sweat
CD	Condensate Drain *	68-1/4 (1734)	29 (737)	3/4" FPT
	W/ Optional Pump	68-1/4 (1734)	29 (737)	1/2" Cu Sweat
HUM	Humidifier Supply Line	75-1/2 (1918)	28 (711)	1/4" Cu Sweat
ECS**	Econ-O-Coil Supply	77-5/8 (1972)	23-5/8 (600)	2-1/8" Cu Sweat
ECR**	Econ-O-Coil Return	70-15/16 (1802)	23-5/8 (600)	2-1/8" Cu Sweat
HS	Hot Water Reheat Supply	Consult Factory		
HR	Hot Water Reheat Return	Consult Factory		
E1	Electrical Conn. (High Volt)	77-5/8 (1972)	30-1/8 (765)	2-1/2"
E2	Electrical Conn. (High Volt)	74-3/8 (1889)	30-1/8 (765)	2-1/2"
LV1	Electrical Conn. (Low Volt)	2-1/4 (57)	26 (660)	7/8"
LV2	Electrical Conn. (Low Volt)	2-1/4 (57)	28 (711)	7/8"
LV3	Electrical Conn. (Low Volt)	2-1/4 (57)	30 (762)	7/8"
B1	Blower Outlet	26-1/16 (662)	23-5/8 (600)	18-3/4 x 16-1/16 (476 x 408)
B2	Blower Outlet	48-7/8 (1241)	23-5/8 (600)	18-3/4 x 16-1/16 (476 x 408)

* Field-pitch condensate drain line a minimum of 1/8" (3.2mm) per foot (305mm). All units contain a factory-installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with all local codes.

** Supplied on Dual Cool Systems only (4-pipe system).

Figure 44 Primary connection locations—downflow, water/glycol/GLYCOO,L 53-77kW (15-22 tons), all compressor models



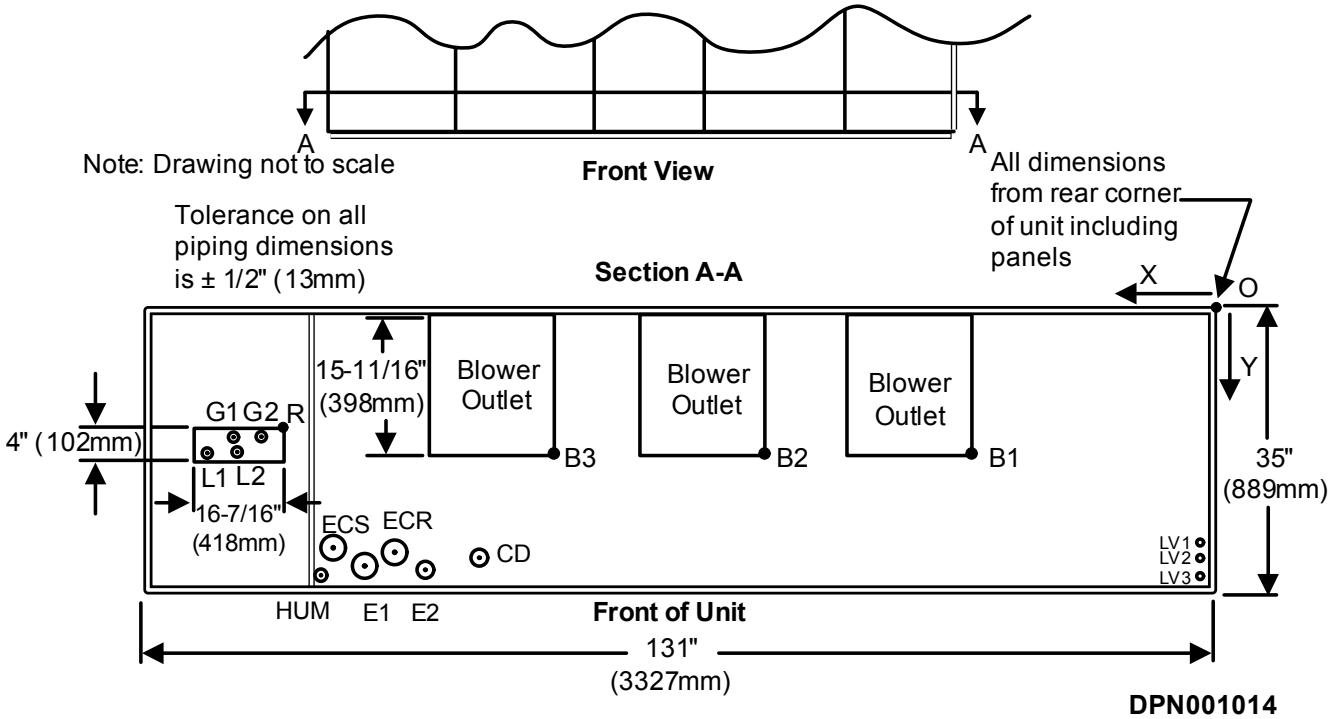
DPN000933
Rev. 2

Point	Description	X inches (mm)	Y inches (mm)	Connection Size / Opening inches (mm)
W	Water/Glycol/GLYCOOL Access	101-15/16 (2589)	8-1/16 (205)	3-1/2 x 8 (89 x 203)
WS	Water/Glycol/GLYCOOL Supply	103-11/16 (2634)	10-1/4 (260)	2-1/8" Cu Sweat
WR	Water/Glycol/GLYCOOL Return	103-11/16 (2634)	12-3/4 (324)	2-1/8" Cu Sweat
CD	Condensate Drain *	68-1/4 (1734)	29 (737)	3/4" Cu Sweat
	W/ Optional Pump	68-1/4 (1734)	29 (737)	1/2" Cu Sweat
HUM	Humidifier Supply Line	75-1/2 (1918)	28 (711)	1/4" Cu Sweat
ECS**	Econ-O-Coil Supply	78-5/8 (1997)	21-1/4 (540)	2-1/8" Cu Sweat
ECR**	Econ-O-Coil Return	71-15/16 (1827)	27-1/2 (699)	2-1/8" Cu Sweat
HS	Hot Water Reheat Supply	Consult Factory		
HR	Hot Water Reheat Return	Consult Factory		
E1	Electrical Conn. (High Volt)	77-5/8 (1972)	30-1/8 (765)	2-1/2"
E2	Electrical Conn. (High Volt)	74-3/8 (1889)	30-1/8 (765)	2-1/2"
LV1	Electrical Conn. (Low Volt)	2-1/4 (57)	26 (660)	7/8"
LV2	Electrical Conn. (Low Volt)	2-1/4 (57)	28 (711)	7/8"
LV3	Electrical Conn. (Low Volt)	2-1/4 (57)	30 (762)	7/8"
B1	Blower Outlet	26-1/16 (662)	23-5/8 (600)	18-3/4 x 16-1/16 (476 x 408)
B2	Blower Outlet	48-7/8 (1241)	23-5/8 (600)	18-3/4 x 16-1/16 (476 x 408)

* Field-pitch condensate drain line a minimum of 1/8" (3.2mm) per foot (305mm). All units contain a factory-installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with all local codes.

** Supplied on Dual Cool Systems only (4-pipe system)

Figure 45 Primary connection locations—downflow, air cooled, 105kW (30 tons), all compressor models



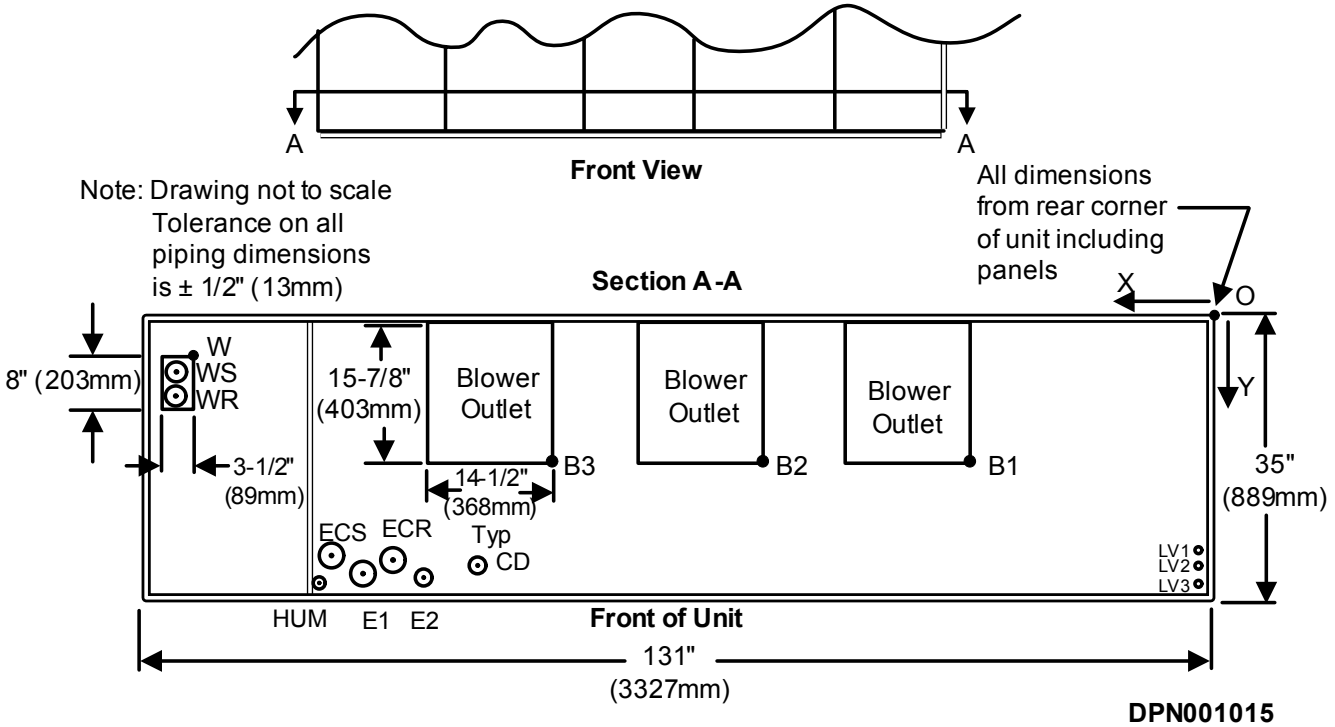
DPN001014
Rev. 2

Point)	Description)	X inches (mm)	Y inches (mm)	Connection Size / Opening inches (mm)
R	Refrigerant Access	109" (2769mm)	14-3/4" (375mm)	5/8" Cu Sweat
L1	Liquid Line System 1	121-3/4" (3092mm)	15-3/4" (400mm)	5/8" Cu Sweat
L2	Liquid Line System 2	118-1/8" (3000mm)	15-3/4" (400mm)	1-1/8" Cu Sweat
G1	Hot Gas Discharge 1	118-1/4" (3004mm)	13-1/4" (337mm)	1-1/8" Cu Sweat
G2	Hot Gas Discharge 2	115-5/8" (2937mm)	13-1/4" (337mm)	2-1/8" Cu Sweat
CD	Condensate Drain *	83-13/16" (2129mm)	29" (737mm)	3/4" FPT
	W/ Optional Pump	83-13/16" (2129mm)	29" (737mm)	1/2" Cu Sweat
HUM	Humidifier Supply Line	102-3/4" (2610mm)	30-3/4" (781mm)	1/4" Cu Sweat
ECS**	Econ-O-Coil Supply	101-7/8" (2588mm)	28" (711mm)	2-5/8" Cu Sweat
ECR**	Econ-O-Coil Return	94-9/16" (2402mm)	28" (711mm)	2-5/8" Cu Sweat
HS	Hot Water Reheat Supply	Consult Factory		
HR	Hot Water Reheat Return	Consult Factory		
E1	Electrical Conn. (High Volt)	98-1/8" (2492mm)	30-1/4" (768mm)	2-1/2"
E2	Electrical Conn. (High Volt)	91" (2311mm)	30-1/4" (768mm)	2-1/2"
LV1	Electrical Conn. (Low Volt)	2" (51mm)	27-1/4" (698mm)	7/8"
LV2	Electrical Conn. (Low Volt)	2" (51mm)	29-1/4" (742mm)	7/8"
LV3	Electrical Conn. (Low Volt)	2" (51mm)	31" (787mm)	7/8"
B1	Blower Outlet	27-7/8" (708mm)	17" (432mm)	14-1/2" x 15-11/16" (368 x 398mm)
B2	Blower Outlet	52-1/16" (1322mm)	17" (432mm)	14-1/2" x 15-11/16" (368 x 398mm)
B3	Blower Outlet	76-1/4" (1937mm)	17" (432mm)	14-1/2" x 15-11/16" (368 x 398mm)

* Field-pitch condensate drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with all local codes.

** Supplied on Dual Cool Systems only (4-pipe system).

Figure 46 Primary connection locations—downflow, air cooled, 105kW (30 tons), all compressor models



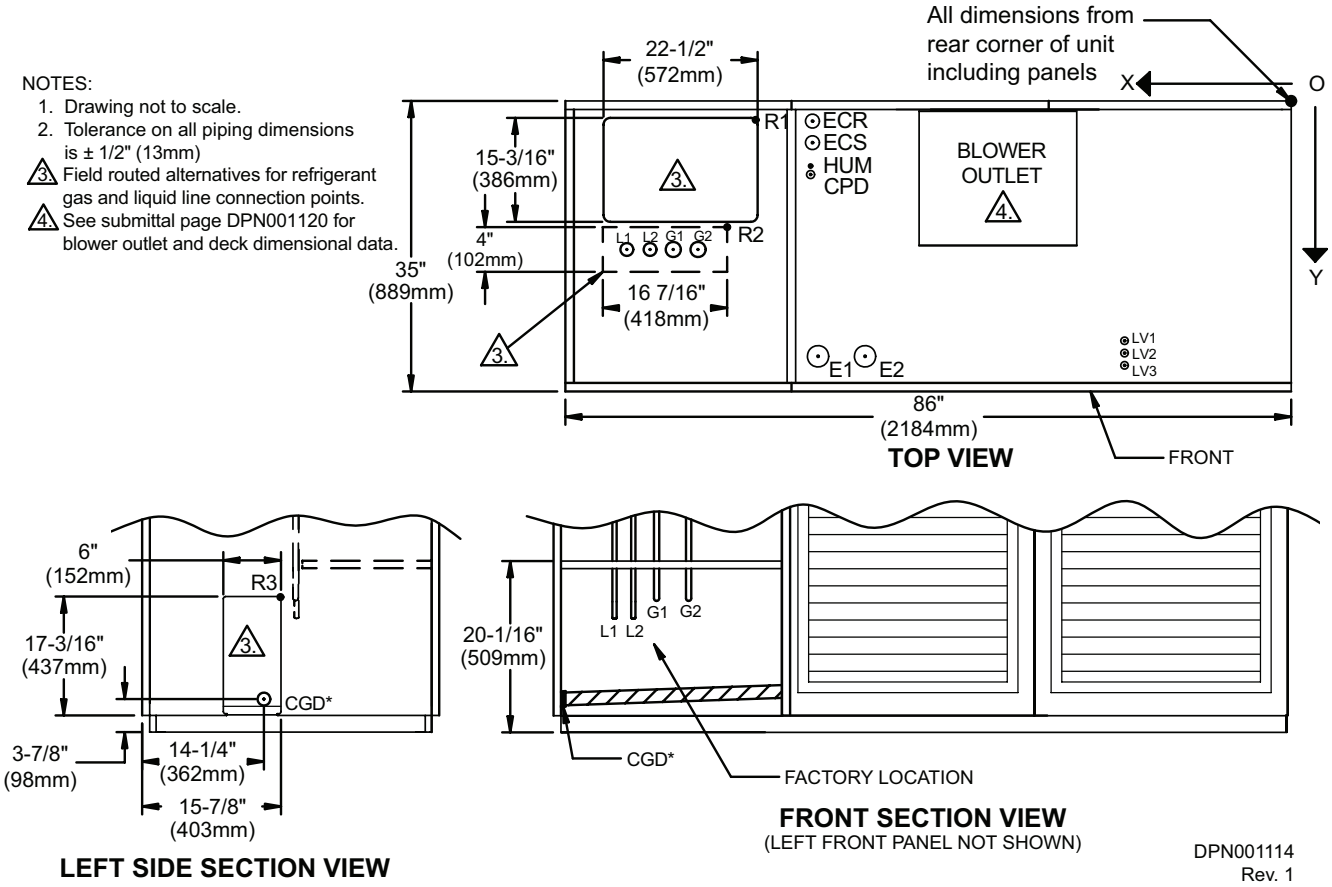
DPN001015
Rev. 2

Point	Description)	X inches (mm)	Y inches (mm)	Connection Size / Opening inches (mm)
W	Water/Glycol/GLYCOOL Access	125-15/16 (3199)	7-15/16 (202)	3-1/2 (89) X 8 (203)
WS	Water/Glycol/GLYCOOL Supply	127-7/8 (3248)	9-1/16 (230)	2-1/8 Cu Sweat
WR	Water/Glycol/GLYCOOL Return	127-7/8 (3248)	12-1/4 (311)	2-1/8 Cu Sweat
CD	Condensate Drain *	83-13/16 (2129)	29 (737)	3/4 FPT
	W/ Optional Pump	83-13/16 (2129)	29 (737)	1/2 Cu Sweat
HUM	Humidifier Supply Line	102-3/4 (2610)	30-3/4 (781)	1/4 Cu Sweat
ECS	Econ-O-Coil Supply	101-7/8 (2588)	28 (711)	2-5/8 Cu Sweat
ECR	Econ-O-Coil Return	94-9/16 (2402)	28 (711)	2-5/8 Cu Sweat
HS	Hot Water Reheat Supply	Consult Factory		
HR	Hot Water Reheat Return	Consult Factory		
E1	Electrical Conn. (High Volt)	98-1/8 (2492)	30-1/4 (768)	2-1/2
E2	Electrical Conn. (High Volt)	91 (2311)	30-1/4 (768)	2-1/2
LV1	Electrical Conn. (Low Volt)	2 (51)	27-1/4 (698)	7/8
LV2	Electrical Conn. (Low Volt)	2 (51)	29-1/4 (742)	7/8
LV3	Electrical Conn. (Low Volt)	2 (51)	31 (787)	7/8
B1	Blower Outlet	27-7/8 (708)	17 (432)	14-1/2 x 15-11/16 (368 x 398)
B2	Blower Outlet	52-1/16 (1322)	17 (432)	14-1/2 x 15-11/16 (368 x 398)
B3	Blower Outlet	76-1/4 (1937)	17 (432)	14-1/2 x 15-11/16 (368 x 398)

* Field-pitch condensate drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with all local codes.

** Supplied on Dual Cool Systems only (4-pipe system)

Figure 47 Primary connection locations—upflow, air cooled, 28-42kw (8-12 tons), semi-hermetic compressor models

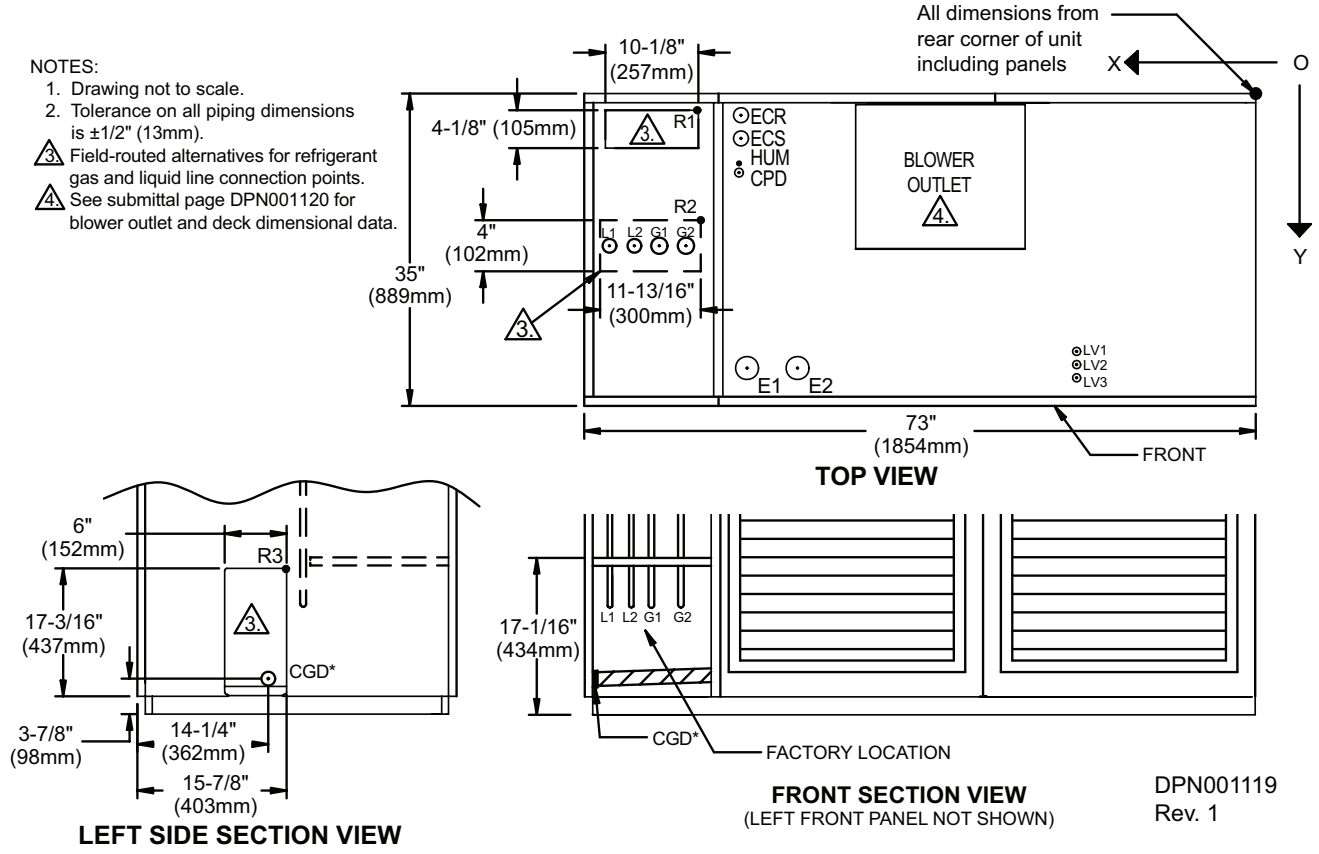


Point	Description	X inches (mm)	Y inches (mm)	Connection Size / Opening inches (mm)
R1 △3	Refrigerant Access (Top)	60-11/16 (1542)	1-7/8 (48)	22-1/2 x 15-3/16 (572 x 386)
R2 △3	Refrigerant Access (Bottom)	63 (1600)	13-13/16 (351)	16-7/16 x 4 (418 x 102)
L1	Liquid Line System 1	79-3/16 (2011)	16-3/4 (425)	1/2 Cu Sweat
L2	Liquid Line System 2	76-1/2 (1943)	16-3/4 (425)	1/2 Cu Sweat
G1	Hot Gas Discharge 1	73-7/8 (1876)	16-3/4 (425)	5/8 Cu Sweat
G2	Hot Gas Discharge 2	70-1/8 (1780)	16-3/4 (425)	5/8 Cu Sweat
R3 △3	Refrigerant Access (Side)	-	-	6 x 17-3/16 (152 x 437)
CGD*	Condensate Gravity Drain	-	-	3/4 FPT
CPD	Condensate Pump Discharge (Opt)	56-1/4 (1429)	11-1/8 (283)	1/2 Cu Sweat
HUM	Humidifier Supply Line	56-1/4 (1429)	9-1/8 (233)	1/4 Cu Sweat
ECS**	Econ-O-Coil Supply	56 (1423)	7-5/16 (186)	1-5/8 Cu Sweat
ECR**	Econ-O-Coil Return	56 (1423)	4-1/2 (114)	1-5/8 Cu Sweat
E1	Electrical Connection (High Voltage)	52-3/8 (1330)	30 (762)	2-1/2
E2	Electrical Connection (High Voltage)	46-7/8 (1191)	30 (762)	2-1/2
LV1	Electrical Connection (Low Voltage)	19-1/2 (495)	29-1/16 (738)	7/8
LV2	Electrical Connection (Low Voltage)	19-1/2 (495)	30-1/2 (775)	7/8
LV3	Electrical Connection (Low Voltage)	19-1/2 (495)	31-15/16 (811)	7/8

* Field-pitch condensate drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with all local codes.

** Supplied on Dual Cool Systems only (4-pipe system)

Figure 48 Primary connection locations—upflow, air cooled, 28-42kW (8-12 tons), semi-hermetic compressor models



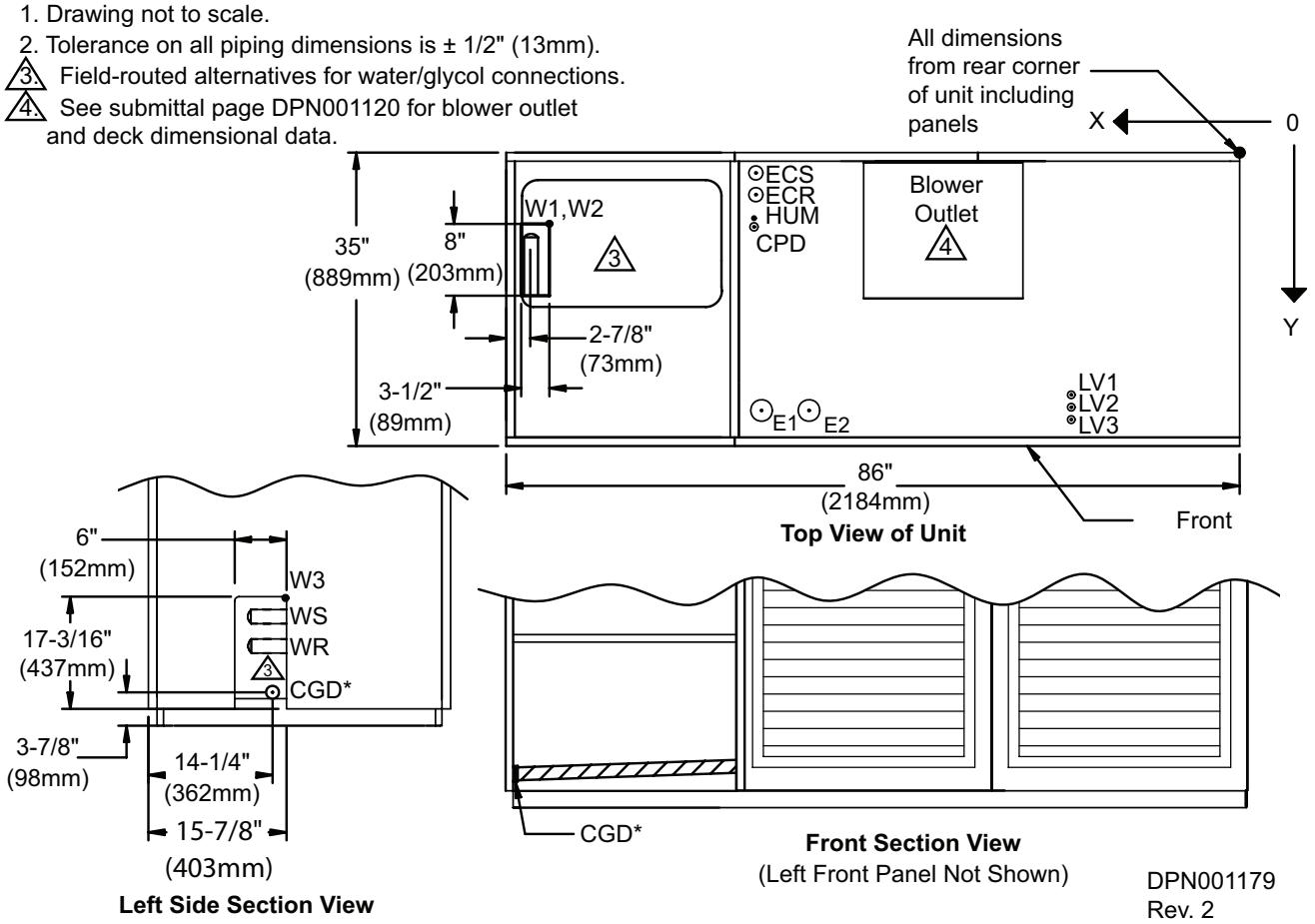
Point	Description	X inches (mm)	Y inches (mm)	Connection Size / Opening inches (mm)
R1 3	Refrigerant Access (Top)	60-5/8 (1539)	2-13/16 (71)	10-1/8 x 4-1/8 (257 x 105)
R2 3	Refrigerant Access (Bottom)	63 (1600)	13-13/16 (351)	16-7/16 x 4 (418 x 102)
L1	Liquid Line System 1	79-3/16 (2011)	16-3/4 (425)	1/2 Cu Sweat
L2	Liquid Line System 2	76-1/2 (1943)	16-3/4 (425)	1/2 Cu Sweat
G1	Hot Gas Discharge 1	73-7/8 (1876)	16-5/8 (422)	5/8 Cu Sweat
G2	Hot Gas Discharge 2	70-1/8 (1780)	16-5/8 (422)	5/8 Cu Sweat
R3 3	Refrigerant Access (Side)	-	-	6 x 17-3/16 (152 x 437)
CGD*	Condensate Gravity Drain	-	-	3/4 FPT
CPD	Condensate Pump Discharge (Opt)	56-1/4 (1429)	11-1/8 (283)	1/2 Cu Sweat
HUM	Humidifier Supply Line	56-1/4 (1429)	9-1/8 (233)	1/4 Cu Sweat
ECS**	Econ-O-Coil Supply	56 (1423)	7-5/16 (186)	1-5/8 Cu Sweat
ECR**	Econ-O-Coil Return	56 (1423)	4-1/2 (114)	1-5/8 Cu Sweat
E1	Electrical Connection (High Voltage)	52-3/8 (1330)	30 (762)	2-1/2
E2	Electrical Connection (High Voltage)	46-7/8 (1191)	30 (762)	2-1/2
LV1	Electrical Connection (Low Voltage)	19-1/2 (495)	29-1/16 (738)	7/8
LV2	Electrical Connection (Low Voltage)	19-1/2 (495)	30-1/2 (775)	7/8
LV3	Electrical Connection (Low Voltage)	19-1/2 (495)	31-15/16 (811)	7/8

* Field-pitch condensate drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with all local codes.

** Supplied on Dual Cool Systems only (4-pipe system)

Figure 49 Primary connection locations—upflow, water/glycol/GLYCOOL, 28-42kW (8-12 tons), all compressor models

NOTES:
1. Drawing not to scale.
2. Tolerance on all piping dimensions is ± 1/2" (13mm).
3. Field-routed alternatives for water/glycol connections.
4. See submittal page DPN001120 for blower outlet and deck dimensional data.



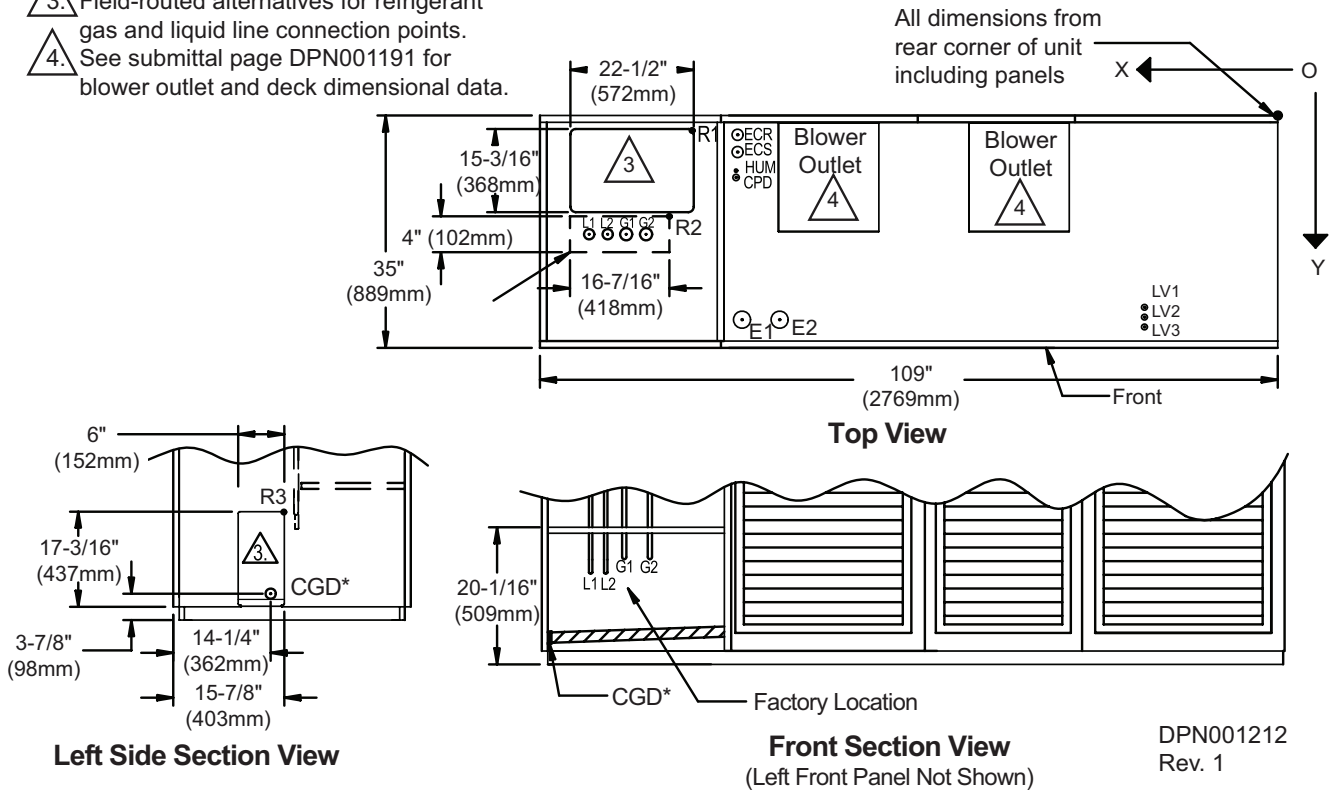
Point	Description	X in. (mm)	Y in. (mm)	Connection Size / Opening in. (mm)
W1 3	Water/Glycol/GLYCOOL Access (Bottom)	79-15/16 (2030)	9 (229)	3-1/2 x 8 (89 x 203)
W2 3	Water/Glycol/GLYCOOL Access (Top)	79-15/16 (2030)	9 (229)	3-1/2 x 8 (89 x 203)
W3 3	Water/Glycol/GLYCOOL Access (Side)	—	—	6 x 17-3/16 (152 x 437)
WS 3	Water/Glycol/GLYCOOL Supply	—	—	1-5/8" Cu Sweat
WR 3	Water/Glycol/GLYCOOL Return	—	—	1-5/8" Cu Sweat
CGD	Condensate Gravity Drain	—	—	3/4" FPT
CPD	Condensate Pump Discharge (Opt)	56-1/4 (1429)	11-1/8 (282)	1/2" Cu Sweat
HUM	Humidifier Supply Line	56-1/4 (1429)	9-1/8 (232)	1/4" Cu Sweat
ECS**	Econ-O-Coil Supply	56 (1423)	7-5/16 (186)	1-5/8" Cu Sweat
ECR**	Econ-O-Coil Return	56 (1423)	4-1/2 (114)	1-5/8" Cu Sweat
E1	Electrical Connection (High Voltage)	52-3/8 (1330)	30-7/8 (784)	2-1/2"
E2	Electrical Connection (High Voltage)	46-7/8 (1191)	30-7/8 (784)	2-1/2
LV1	Electrical Connection (Low Voltage)	19-1/2 (495)	29-1/16 (738)	7/8"
LV2	Electrical Connection (Low Voltage)	19-1/2 (495)	30-1/2 (775)	7/8"
LV3	Electrical Connection (Low Voltage)	19-1/2 (495)	31-15/16 (811)	7/8"

* Field-pitch condensate drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with all local codes.

** Supplied on Dual Cool Systems only (4-pipe system)

Figure 50 Primary connection locations—upflow, air cooled, 53-77kW (15-22 tons), semi-hermetic compressor models

NOTE
1. Drawing not to scale.
2. Tolerance on all piping dimensions is ± 1/2" (13mm).
3. Field-routed alternatives for refrigerant gas and liquid line connection points.
4. See submittal page DPN001191 for blower outlet and deck dimensional data.



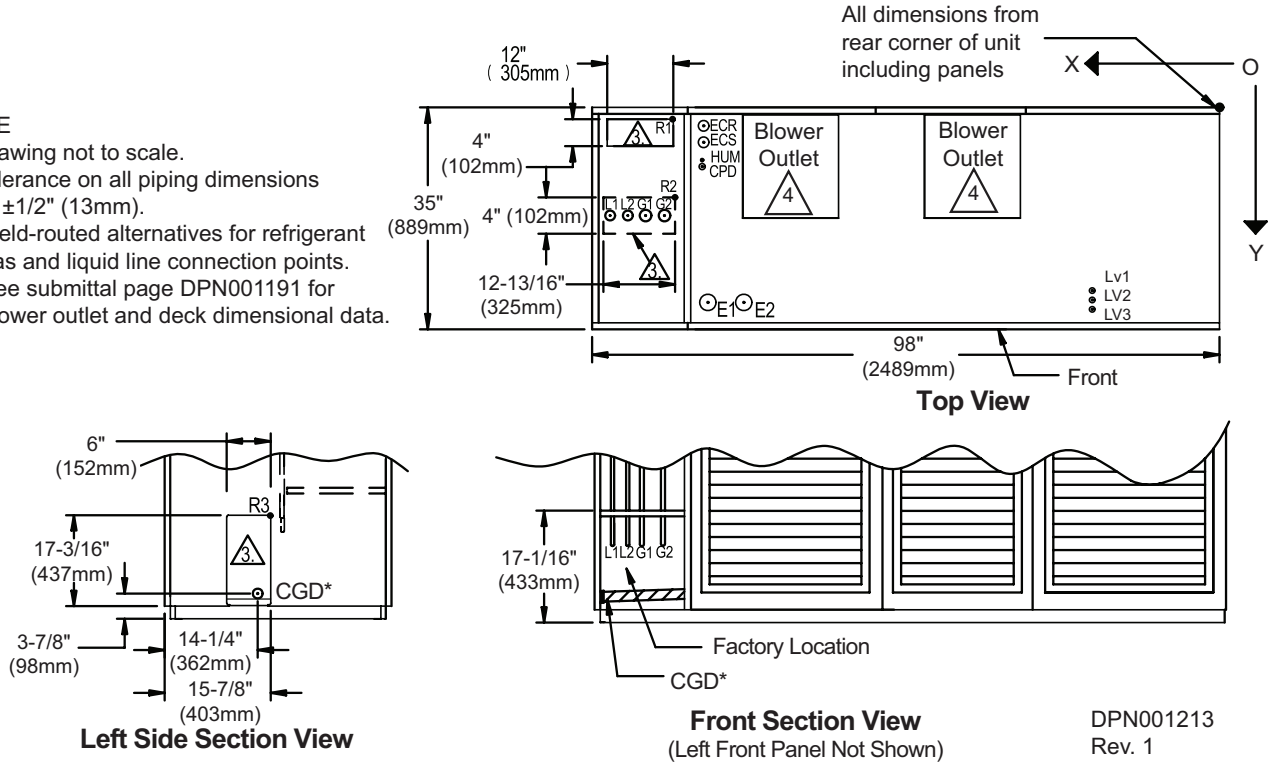
Point	Description	X inches (mm)	Y inches (mm)	Connection Size / Opening inches (mm)
R1 3	Refrigerant Access (Top)	83-3/4 (2127)	1-7/8 (48)	22-1/2 x 15-3/16 (572 x 386)
R2 3	Refrigerant Access (Bottom)	86 (2184)	13-7/8 (352)	16-7/16 x 4 (418 x 102)
				53kW (15 tons)/70 & 77kW (20 & 22 tons)
L1	Liquid Line System 1	97 (2464)	16-3/4 (425)	1/2 / 5/8 Cu Sweat
L2	Liquid Line System 2	93-5/16 (2370)	16-3/4 (425)	1/2 / 5/8 Cu Sweat
G1	Hot Gas Discharge 1	90-5/8 (2302)	16-5/8 (422)	7/8 / 1-1/8 Cu Sweat
G2	Hot Gas Discharge 2	88 (2235)	16-5/8 (422)	7/8 / 1-1/8 Cu Sweat
R3 3	Refrigerant Access (Side)	-	-	6 x 17-3/16 (152 x 437)
CGD*	Condensate Gravity Drain	-	-	3/4 FPT
CPD	Condensate Pump Discharge (Opt)	79-5/16 (2015)	11-7/8 (302)	1/2 Cu Sweat
HUM	Humidifier Supply Line	79-5-16 (2015)	9-7/8 (251)	1/4 Cu Sweat
ECS**	Econ-O-Coil Supply	78-5/8 (1998)	7-7/8 (200)	2-1/8 Cu Sweat
ECR**	Econ-O-Coil Return	78-5/8 (1998)	4-5/8 (117)	2-1/8 Cu Sweat
E1	Electrical Connection (High Voltage)	75-3/8 (1915)	30 (762)	2-1/2
E2	Electrical Connection (High Voltage)	69-7/8 (1775)	30 (762)	2-1/2
LV1	Electrical Connection (Low Voltage)	19-1/2 (495)	29-1/16 (738)	7/8
LV2	Electrical Connection (Low Voltage)	19-1/2 (495)	30-1/2 (775)	7/8
LV3	Electrical Connection (Low Voltage)	19-1/2 (495)	31-15/16 (811)	7/8

* Field-pitch condensate drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). All units contain a factory-installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with all local codes.

** Supplied on Dual Cool Systems only (4-pipe system)

Figure 51 Primary connection locations—upflow, air cooled, 53-77kW (15-22 tons), scroll compressor models

NOTE
1. Drawing not to scale.
2. Tolerance on all piping dimensions is ±1/2" (13mm).
3. Field-routed alternatives for refrigerant gas and liquid line connection points.
4. See submittal page DPN001191 for blower outlet and deck dimensional data.



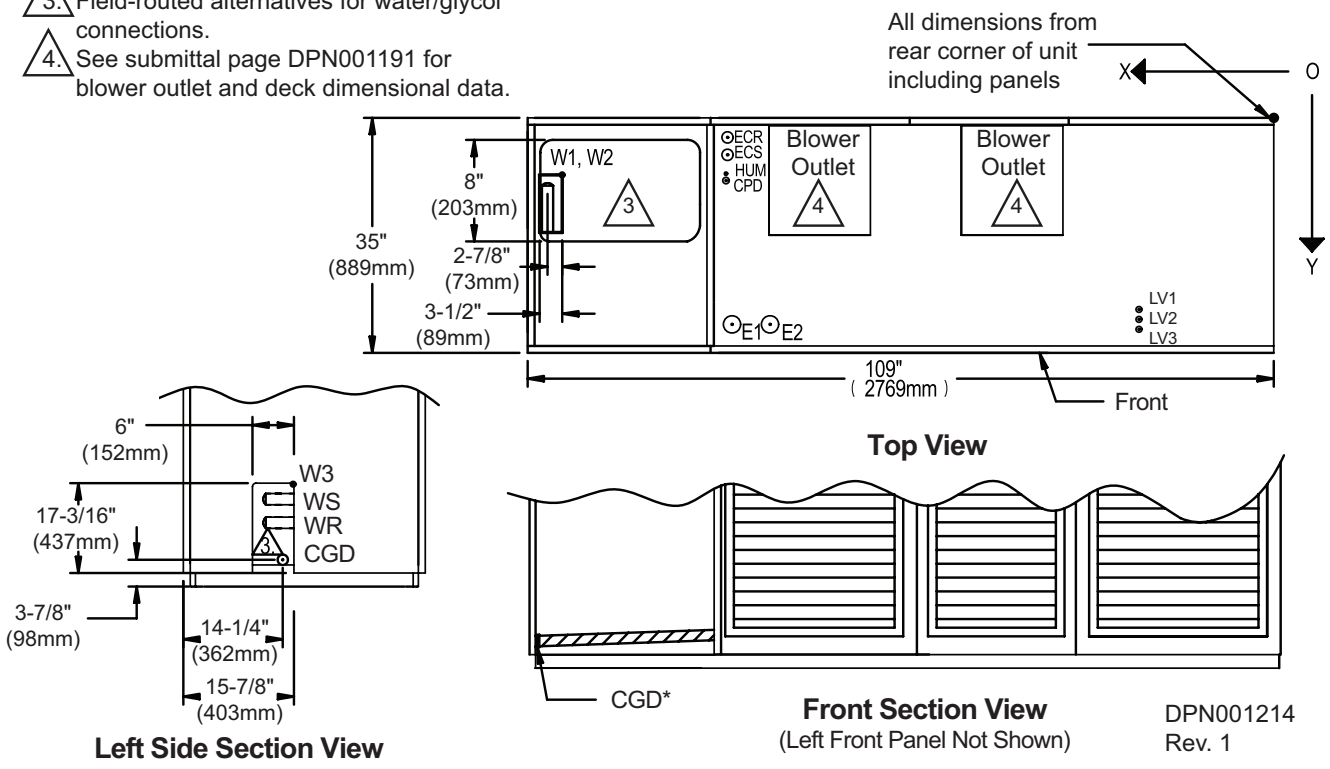
Point	Description	X inches (mm)	Y inches (mm)	Connection Size / Opening inches (mm)
R1 3	Refrigerant Access (Top)	83-5/8 (2124)	2 (51)	12 x 4 (305 x 102)
R2 3	Refrigerant Access (Bottom)	82-3/4 (2102)	14-3/4 (374)	12-3/16 x 4 (310 x 102)
				53kW (15 tons)/70 & 77kW (20 & 22 tons)
L1	Liquid Line System 1	94-11/16 (2405)	16-3/4 (425)	1/2 / 5/8 Cu Sweat
L2	Liquid Line System 2	91-7/8 (2334)	16-3/4 (425)	1/2 / 5/8 Cu Sweat
G1	Hot Gas Discharge 1	88-3/4 (2254)	16-3/8 (416)	7/8 / 1-1/8 Cu Sweat
G2	Hot Gas Discharge 2	85-9/16 (2173)	16-3/8 (416)	7/8 / 1-1/8 Cu Sweat
R3 3	Refrigerant Access (Side)	-	-	6 x 17-3/16 (152 x 437)
CGD*	Condensate Gravity Drain	-	-	3/4 FPT
CPD	Condensate Pump Discharge (Opt)	79-5/16 (2015)	11-7/8 (302)	1/2 Cu Sweat
HUM	Humidifier Supply Line	79-5/16 (2015)	9-7/8 (251)	1/4 Cu Sweat
ECS**	Econ-O-Coil Supply	78-5/8 (1998)	7-7/8 (200)	2-1/8 Cu Sweat
ECR**	Econ-O-Coil Return	78-5/8 (1998)	4-5/8 (117)	2-1/8 Cu Sweat
E1	Electrical Connection (High Voltage)	75-3/8 (1915)	30 (762)	2-1/2
E2	Electrical Connection (High Voltage)	69-7/8" (1775)	30 (762)	2-1/2
LV1	Electrical Connection (Low Voltage)	19-1/2 (495)	29-1/16 (738)	7/8
LV2	Electrical Connection (Low Voltage)	19-1/2 (495)	30-1/2 (775)	7/8
LV3	Electrical Connection (Low Voltage)	19-1/2 (495)	31-15/16 (811)	7/8

* Field-pitch condensate drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). All units contain a factory-installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with all local codes.

** Supplied on Dual Cool Systems only (4-pipe system)

Figure 52 Primary connection locations—upflow, water/glycol/GLYCOOL, 53-77kW (15-22 tons), all compressor models

NOTE
1. Drawing not to scale.
2. Tolerance on all piping dimensions is ±1/2" (13mm).
3. Field-routed alternatives for water/glycol connections.
4. See submittal page DPN001191 for blower outlet and deck dimensional data.



Point	Description	X inches (mm)	Y inches (mm)	Connection Size / Opening inches (mm)
W1 3	Water/Glycol/GLYCOOL Access (Bottom)	102-15/16 (2615)	9 (229)	3-1/2 x 8 (89 x 203)
W2 3	Water/Glycol/GLYCOOL Access (Top)	102-15/16 (2615)	9 (229)	3-1/2 x 8 (89 x 203)
W3 3	Water/Glycol/GLYCOOL Access (Side)	-	-	6 x 17-3/16 (152 x 437)
WS 3	Water/Glycol/GLYCOOL Supply	-	-	2-1/8 Cu Sweat
WR 3	Water/Glycol/GLYCOOL Return	-	-	2-1/8 Cu Sweat
CGD*	Condensate Gravity Drain	-	-	3/4 FPT
CPD	Condensate Pump Discharge (Option)	79-5/16 (2015)	11-7/8 (302)	1/2 Cu Sweat
HUM	Humidifier Supply Line	79-5/16 (2015)	9-7/8 (251)	1/4 Cu Sweat
ECS**	Econ-O-Coil Supply	78-5/8 (1998)	7-7/8 (200)	2-1/8 Cu Sweat
ECR**	Econ-O-Coil Return	78-5/8 (1998)	4-5/8 (117)	2-1/8 Cu Sweat
E1	Electrical Connection (High Voltage)	75-3/8 (1915)	30 (762)	2-1/2
E2	Electrical Connection (High Voltage)	69-7/8" (1775mm)	30 (762)	2-1/2
LV1	Electrical Connection (Low Voltage)	19-1/2 (495)	29-1/16 (738)	7/8
LV2	Electrical Connection (Low Voltage)	19-1/2 (495)	30-1/2 (775)	7/8
LV3	Electrical Connection (Low Voltage)	19-1/2 (495)	31-15/16 (811)	7/8

* Field-pitch condensate drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). All units contain a factory-installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with all local codes.

** Supplied on Dual Cool Systems only (4-pipe system)

9.0 CHECKLIST FOR COMPLETED INSTALLATION

9.1 Moving and Placing Equipment

___ 1. Unpack and check received material.

___ 2. Proper clearance for service access has been maintained around the equipment.

___ 3. Equipment is level and mounting fasteners are tight.

___ 4. If the equipment has been disassembled for installation, unit must be reassembled per instructions.

9.2 Electrical

___ 1. Supply voltage and phase matches equipment nameplate.

___ 2. Wiring connections completed between disconnect switch, evaporator unit and heat rejection equipment

___ 3. Power line circuit breakers or fuses have proper ratings for equipment installed.

___ 4. Control wiring connections completed between indoor evaporator and heat rejection equipment.

___ 5. All internal and external high and low voltage wiring connections are tight.

___ 6. Confirm that unit is properly grounded to an earth ground.

___ 7. Control transformer setting matches incoming power.

___ 8. Electrical service conforms to national and local codes.

___ 9. Check blowers and compressors (scroll only) for proper rotation.

___ 10. Upflow units only: Field installed low volt wiring routed with loop to allow electric box to swing.

9.3 Piping

___ 1. Piping completed to refrigerant or coolant loop (if required).

___ 2. Piping had been leak-checked, evacuated and charged (if required).

___ 3. Piping is properly sized, sloped, trapped as shown in the piping schematics

___ 4. Check piping inside and outside of equipment for proper support.

___ 5. Ensure that factory clamps have been reinstalled

___ 6. Drain line connected and pitched per local code.

___ 7. Water supply line connected to humidifier

9.4 Other

___ 1. Ducting complete (if required), maintain access to filters

___ 2. Filters installed

___ 3. Check fasteners that secure compressors, reheats, humidifier and motors—some may have become loose during shipment

___ 4. Verify water detection is properly installed around all units (recommended)

___ 5. Control panel DIP switches are set based on user requirements

___ 6. Blower drive system rotates freely and belts are properly aligned and tensioned

___ 7. Compressor shipping blocks removed and springs adjusted (see **5.3 - Semi-Hermetic Compressor Spring Isolation System**).

___ 8. Remove rubber band from float in optional infrared humidifier.

___ 9. Installation materials and tools have been removed from equipment (literature, shipping materials, construction materials, tools, etc.)

___ 10. Locate blank startup sheet, ready for completion by installer or startup technician.

10.0 INITIAL STARTUP CHECKS AND COMMISSIONING PROCEDURE FOR WARRANTY INSPECTION

WARNING

Risk of electric shock. Can cause injury or death

Disconnect local and remote power supplies before working within.

Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power.

Follow all local codes.

WARNING

Risk of improper wiring, piping, moving, lifting and/or handling. Can cause equipment damage, injury or death.

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

Read all installation, operating and safety instructions before proceeding.

Read and follow all warnings on page 1 and elsewhere in this manual.

WARNING

Risk of fire suppression and alarm system activation. Can cause injury during building evacuation and mobilization of emergency fire and rescue services.

Startup operation of optional electric reheat elements may activate facility alarm and fire suppression system. Prepare and take appropriate steps to manage this possibility. Activating reheat during initial startup may burn-off particulate from electric reheat elements.

Before beginning initial startup checks, make certain that unit was installed according to the instructions in this manual. All exterior panels must be in place.

- Confirm that all items on **9.0 - Checklist for Completed Installation** have been done.
- Locate "Liebert DS Warranty Inspection Check Sheet" in unit electric panel. (Document number SAFM-8542-29)
- Complete "Liebert DS Warranty Inspection Check Sheet" during startup. (Document number SAFM-8542-29) **This information must be completed and forwarded to Liebert to validate warranty.**
- Forward the completed "Liebert DS Warranty Inspection Check Sheet" to your local Liebert sales office.
- Contact your local Liebert sales representative or Liebert Air Product Support if you have any questions or problems during unit startup and commissioning.
- Local Liebert Sales offices and Liebert Air Product Support contacts can be found at **www.liebert.com** or by calling 1-800-LIEBERT.

Liebert DS Warranty startup procedure includes the following steps. These steps must be completed to validate warranty.

10.1 Information for Warranty Inspection—Remove Power From Unit Disconnect

Complete the following items on the warranty inspection form:

- Installer and address
- Owner and address
- Site Contact name and phone
- Installation date
- Indoor unit model and serial number
- Outdoor unit (condenser or drycooler) model and serial number
- Condition of unit when received
- Is there a freight damage claim in process?
- Have manuals been kept with unit?
- Is the air product connected to site monitoring or switchover controls?
- Provide model and serial of connected controls for switchover controls

10.2 Startup Checks Inspection With Panels Removed and Disconnect Off

1. Check all internal piping clamps and tighten or secure if needed.
2. Check field piping for proper support
3. Check unit belts for correct tension and alignment.
4. Check unit electrical connections and tighten or secure if needed. Check control plugs and Mate N' Loc connections to the control boards and components.
5. Check all major components such as compressors, reheats, humidifiers and motors that may have loosened during shipping.
6. Remove shipping blocks from compressor(s) / adjust spring tension.
7. Remove all debris, tools and documents from unit area.
8. Record main fan horsepower and voltage from nameplate, record belt size, motor sheave and fan pulley.
9. Record filter size and quantity
10. Record piping size for discharge and liquid lines,.
11. Check piping for proper traps including inverted traps on condensers.
12. Record total equivalent length for discharge and liquid piping.
13. Record compressor(s) model and serial number.
14. Record unit configuration and verify with the startup document.

10.3 Commissioning Procedure With Panels On

1. Disconnect all power to the environmental control unit and check.
2. Remove all line voltage fuses except the main fan fuses and the control voltage fuses in the electric panel. (Use iCOM to activate loads).
3. Turn on power to the unit and check line voltage on main unit disconnect switch. Line voltage must be within 10% of nameplate voltage.
4. Turn ON the main unit disconnect switch and check secondary voltage at transformer T1. Voltage at T1 must be 24VAC ±2.5VAC (check at TB1-1 and TB1-5). T1 voltage must not exceed 28VAC. Change primary tap if necessary.
5. Push the ON button. Blower will start and ON lamp will light. Check fan rotation if not correct make necessary changes to the line side of the unit disconnect with power OFF. **(The unit is phased from the factory.)**
6. Your unit will operate at the factory set configuration for all component operations the operator may set the values for Temperature and Humidity setpoints, the Proportional Band, the Deadband. The USER Menu may used to set the alarms and other control functions. Refer to iCOM User manual, SL-18835, for large or small display operation and settings.
7. Turn OFF the unit by the ON-OFF button and then remove power from main unit disconnect and main breaker and check with a meter.
8. Replace all fuses you removed in **Step 2**.
9. Restore power to unit; turn ON the main unit disconnect switch, press the on button.
10. Check and record the current draw on all line voltage components and match with serial tag.

NOTE
Electric Reheat. See ***Warning on page 71****. Activate for a minimum of five (5) minutes.*

11. Check for unusual noises and vibration. Note on warranty inspection form's comments section.
12. Check all refrigerant and water lines for leaks. Note on warranty inspection form's comments section.
13. Record all of the following on the warranty inspection form:
    a. All component voltages and current draws
    b. All air / water temperatures indoor and outdoor
    c. All refrigerant and water / glycol pressures,
    d. All levels of refrigerant and oil in sight glasses
    e. Record refrigerant pressure switch settings and operating pressures
    f. Record superheat and sub-cooling. Note: unit superheat cannot be adjusted but should be in the range of 10 to 20 degrees.
14. Test all control sequences and functions of your unit for proper operation. Use iCOM User Manual for guide to system control operations.
15. Complete the warranty inspection form with sign-off data.

Return Completed Startup Form to Your Local Liebert Sales Office

Local Liebert sales offices and air product support contacts can be found on the Liebert Web site: **www.liebert.com** or call 1-800-LIEBERT for Air Product Support.

11.0 MAINTENANCE

WARNING

Risk of electric shock. Can cause injury or death.

Disconnect local and remote power supplies before working within.

Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power.

Follow all local codes.

WARNING

Risk of improper wiring, piping, moving, lifting and handling. Can cause equipment damage, injury or death.

Only qualified service personnel should work on this equipment.

Read all installation, operating and safety instructions before proceeding.

Read and follow all warnings in this manual

The Liebert DS product is a single component in the facility heat removal system. The system includes air distribution (raised floors, duct systems), outdoor heat rejection (condensers, pumps, dry-coolers, cooling towers, piping, heat rejection fluid, ambient temperature, etc.) and indoor cooling and humidity loads (equipment load, location, outside air infiltration). Proper application and maintenance of the entire system is critical to the life and reliability of the Liebert DS.

- Good maintenance practices are essential to minimizing operation costs and maximizing product life.
- Read and follow monthly and semi-annual maintenance schedules included in this manual. These MINIMUM maintenance intervals may need to be more frequent based on site-specific conditions.
- See the iCom user manual, SL-18835, for instructions on how to utilize the unit controller to predict some service maintenance intervals.
- Liebert recommends the use of trained and authorized service personnel, extended service contracts and factory-specified replacement parts. Contact your local Liebert representative.

11.1 Filters

CAUTION

Risk of improper filter installation and filter collapse. Can cause equipment damage.

Pleat direction is non-standard. Use only short-pleat filters (see **Figure 53**). Long-pleat filters are subject to collapse at high airflows.

To maximize the performance and reliability of Liebert DS equipment, use only Liebert filters. Contact your local Liebert representative to order replacement filters.

Table 26 Filter quantities, downflow units

Unit Size	Filter Size Width x Length	Filter Quantities	
		4" Filter Option Merv 8 or Merv 11	2" Primary / 2" Pre-Filter Option Merv 11 Primary Filter / Merv 7 Pre-Filter
DS 028, 035, 042	16 x 25	5	5/5
DS 053, 070, 077		7	7/7
DS 105		9	9/9

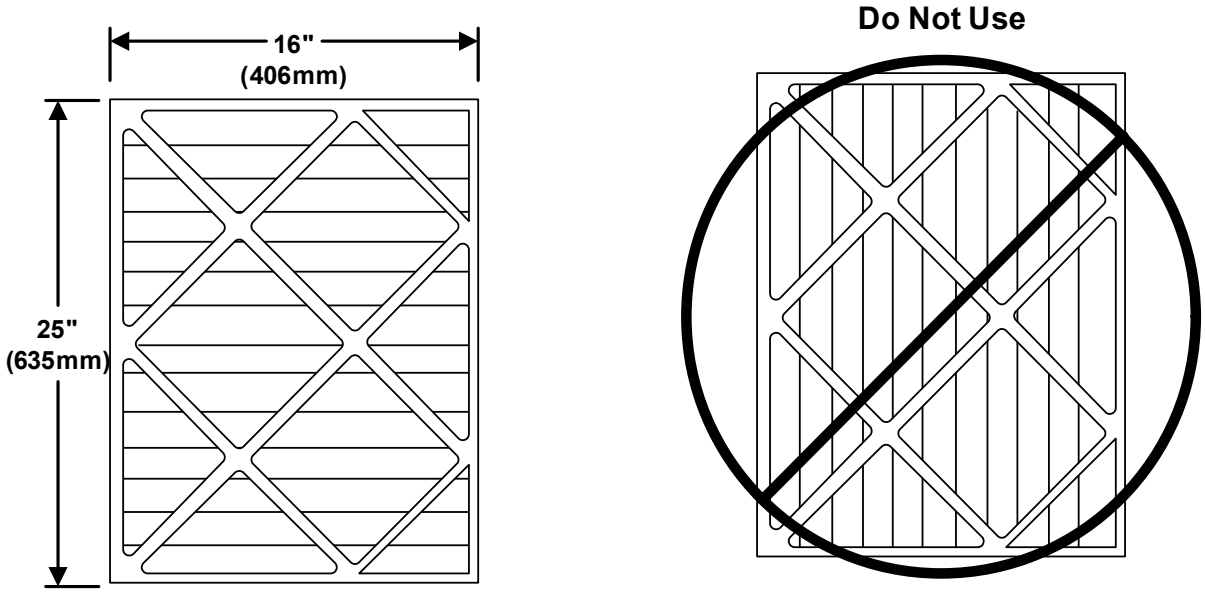
Table 27 Filter quantities, upflow units

Upflow Models	Filter Size Width x Length	Filter Quantities	
		4" Filter Option Merv 8 or Merv 11	2" Primary/2" Pre-Filter Option Merv 11 Primary/Merv 7 Pre-Filter
VS025, 035, 042	25 x 20"	4	4/4
VS053, 070, 077		6	6/6
VS105		8	8/8

11.1.1 Filter Replacement Procedure

1. Disconnect power to unit.
2. Using a stepladder, remove used filters from the top of the unit. The optional Liebert DS downflow return air plenum includes a filter access door.
3. Replace with new filters (install filters in proper direction of airflow).
4. Test the operation of the filter clog switch
   The unit panels must be in place and closed to accurately find this point).
5. Operate the blower and set the switch counterclockwise until the alarm is energized.
6. Turn the adjusting knob one turn clockwise or to the desired filter change point.

Figure 53 Proper filter pleat direction



11.2 Blower Drive System

Blower drive system components that are part of the maintenance schedule include the blower wheel(s) drive shaft, bearings, pulley, belts, sheave, motor auto-tension base and motor. See **Blower Section on page 83**.

WARNING

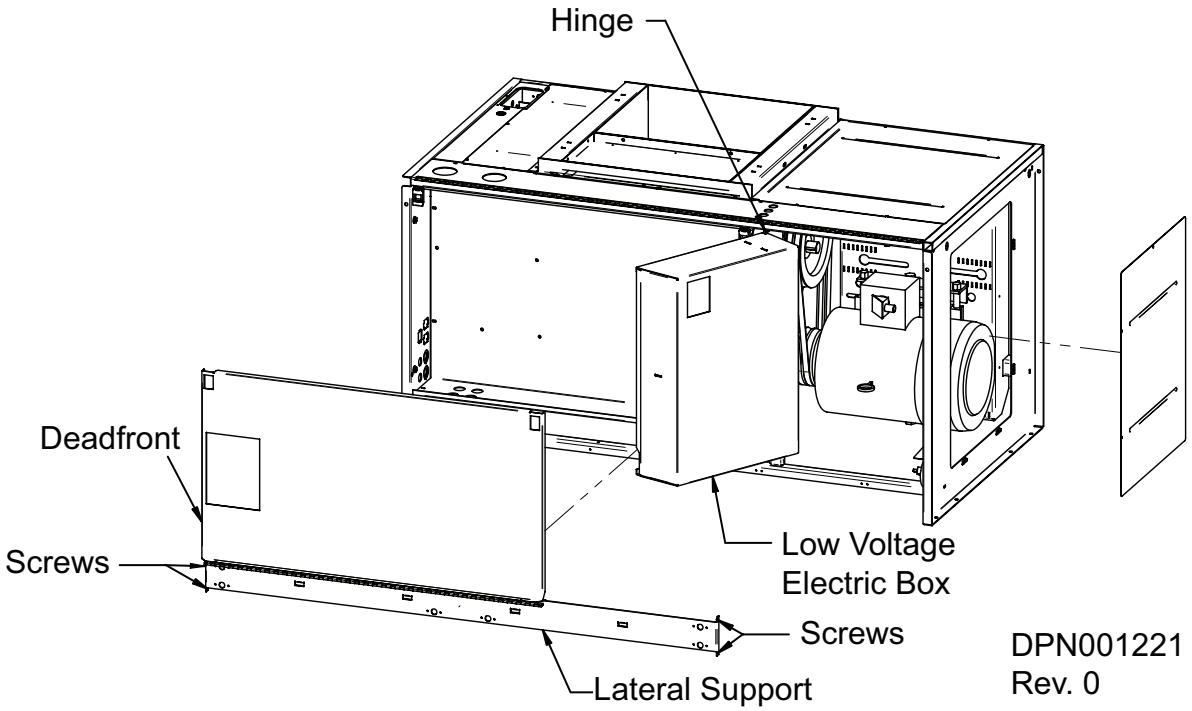
Risk of crushing and pinching action from spring-loaded motor base. Can cause serious injury to hands and fingers.

Improper drive belt removal may cause the motor base to slam down suddenly. Read the directions in this manual and on the unit instruction labels before servicing the belts, motors or pulleys. Follow all directions when servicing the unit.

11.2.1 Upflow Motor Access

1. Remove the lateral support (sheet metal channel) under electric box by removing two screws at each end.
2. Removed the hinged deadfront panel.
3. Remove two screws on the right side of the low voltage electric box that secure the low volt electric box to the sheet metal shoulder.
4. Swing open low voltage electric box to gain access to the motor.

Figure 54 Upflow motor access



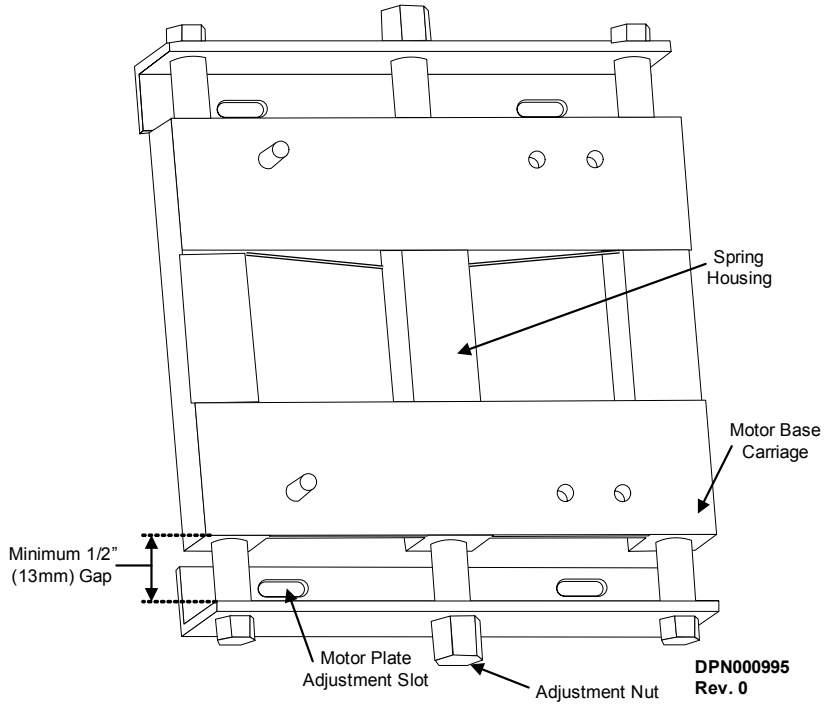
11.2.2 Belt Removal

1. Disconnect power to unit.
   Do not pry the belts off sheave or pulley.
2. Refer to instruction labels on unit near motor base.
3. Turn adjustment nut (see **Figure 55**) counterclockwise (left) to loosen belts and bring motor base internal spring out of compression.
4. Remove belts.

11.2.3 Belt Installation and Tensioning

1. Select the appropriate replacement of belts (matched set) and position on drive package.
   To maximize performance and reliability of Liebert DS equipment, use only Liebert belts. Contact your local Liebert representative for replacement belts.
2. Ensure pulley grooves are properly aligned. If adjustment is required, loosen (do not remove) four nuts in adjustment slots (see **Figure 55**) holding motor base to unit frame and slide motor base assembly into alignment.
3. Tension belts by turning adjustment nut clockwise (right) **until motor base carriage stops moving downward.**
4. Ensure minimum 1/2" (12.7mm) clearance exists from motor base carriage to base front flange (see **Figure 55**). If the clearance is less than 1/2" (12.7mm), select shorter belts.
5. Mark the adjustment nut and rotate clockwise (right) five additional full turns. This sets internal spring for proper belt tension, no readjustments necessary.

Figure 55 Auto-belt tensioning motor base



Blower Bearing Maintenance

- Field lubrication is NOT required for the life of the bearing.
- Bearings are permanently sealed and self-lubricating and cannot be greased.

Blower Bearing Inspection

1. Disconnect power to unit.
2. Remove drive belts (see **11.2.2 - Belt Removal**).
3. Inspect bearing for tightness of set screws and mounting bolts.
4. Rotate fan wheel by hand.
5. Listen for *unusual* noise and look for signs of *unusual* play.

Blower Bearing Replacement

1. To maximize performance and reliability of Liebert DS equipment, use only SealMaster Reduced Maintenance pillow block bearing with tapered lands race and double lock set screws. Contact local Liebert Representative to order replacement bearings.
2. Properly mount and align bearings on shaft. Tighten set-screws in proper sequence and to proper torque using a torque wrench in accordance with the manufacturer's instructions.

Blower Motor

Inspect motor at regular intervals. Keep motor clean and ventilation openings clear of dust, dirt and other debris.

Blower Motor Lubrication

- Motor comes pre-lubricated from factory and does NOT require initial lubrication.
- Liebert recommends a 5-year lubrication interval for motor bearings that have grease fittings.
- Greases of different bases may not be compatible when mixed.
- Contact specific motor manufacturer to determine type of grease to be used.

Blower Wheel

Check to see if wheel(s) are tightly mounted on fan shaft. Rotate wheel(s) and make sure they do not rub against fan housing. The wheel(s) should be periodically cleaned of dirt and debris.

11.3 Humidifier

11.3.1 Infrared Humidifier

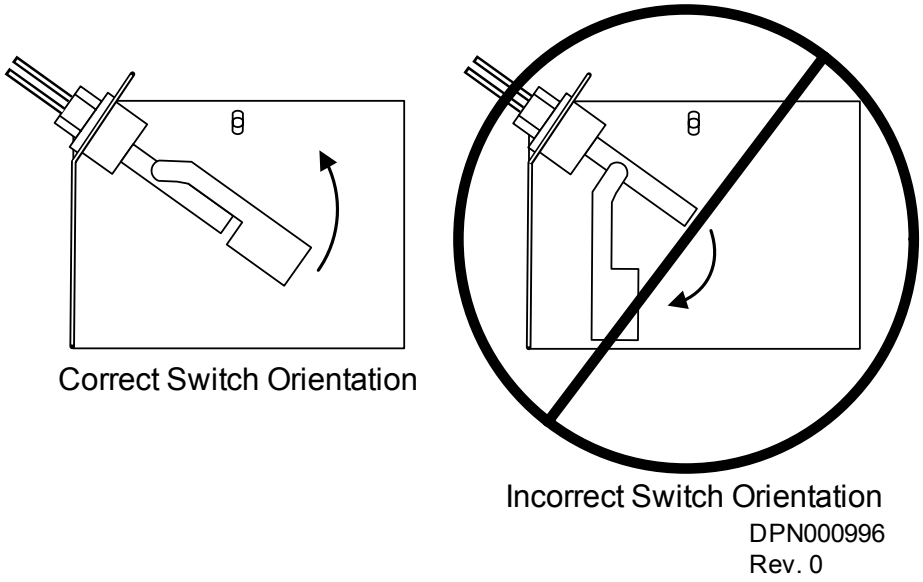
During normal humidifier operation, deposits of mineral solids will collect in humidifier pan and on the float switch. These must be cleaned periodically to ensure proper operation. Frequency of cleaning must be locally established since it is dependant on humidifier usage and local water quality. A spare pan is recommended to reduce maintenance time at unit. The Liebert autoflush system can greatly increase the time between cleanings, but does not eliminate the need for periodic checks and maintenance (see iCOM user manual SL-18835 for autoflush setup). To help reduce excessive scaling in locations with difficult water quality, the use of Vapure is recommended (contact your local Liebert representative).

11.3.2 Cleaning Humidifier Pan and Float Switch

Before turning off unit:

1. With unit operating, remove call for humidification at iCOM control.
2. Let blower operate 5 minutes to allow humidifier and water to cool.
3. If unit has a condensate pump, turn unit OFF at iCOM control.
4. Pull out humidifier standpipe in pan.
5. Inspect O-ring (replace if necessary).
6. Let pan drain and condensate pump operate (if applicable).
7. Disconnect power from unit.
8. Disconnect drain coupling from bottom of pan.
9. Remove thermostat from bottom of pan and retaining screws from sides of pan.
10. Slide pan out.
11. Loosen scale on side and bottom of pan with a stiff nylon brush or plastic scraper.
12. Flush with water
13. Carefully clean scale on float switch (make sure to reinstall correctly (see **Figure 56**).
14. Reinstall pan, thermostat, standpipe, drain coupling and screws into humidifier.
15. Operate humidifier and check for leaks.

Figure 56 Correct orientation of float switch

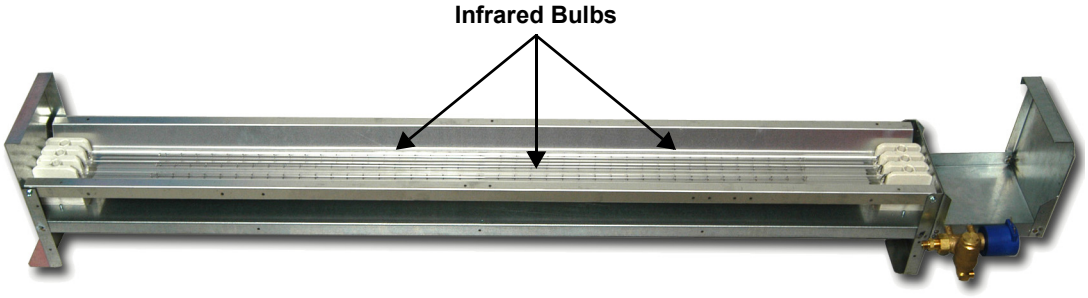


11.3.3 Changing Humidifier Lamps

NOTE
Touching quartz lamps with bare hands will severely shorten bulb life. Skin oils create hot spots on lamp surface. Wear clean cotton gloves when handling lamps.

1. Remove humidifier pan (see **11.3.2 - Cleaning Humidifier Pan and Float Switch**, **Steps 1** through **10**).
2. Disconnect power from unit.
3. At humidifier, remove screws and cover from high voltage compartment.
4. Disconnect one end of purple jumper wires.
5. Using a continuity meter, locate burned out lamp.
6. Remove lamp brackets under lamps.
7. Loosen two screws securing lamp lead wires to junction block.
8. Pull bulb straight down and discard.
9. Wrap lead wires once around new lamp's metal ends. This will support lamp and allow for thermal expansion. Insert lead wires into junction block and torque screws to 30 in-lb.
10. Reassemble by reversing **Steps 1** through **9**.

Figure 9 Infrared humidifier lamps



11.4 Condensate Drain and Condensate Pump Systems

11.4.1 Condensate Drain

Check and clear obstructions in tubing during routine maintenance.

11.4.2 Condensate Pump

- Disconnect power to unit using disconnect switch.

WARNING
Risk of electric shock. Can cause injury or death.

The iCOM microprocessor does not isolate power from the unit, even in the "Unit Off" mode. Some internal components require and receive power even during the "unit off" mode of iCOM control.

Disconnect local and remote power supplies before working within.

- Check and clear obstructions in gravity lines leading to condensate pump.
- Remove sump and clean with a stiff nylon brush and flush with water.
- Inspect and clear clogs in discharge check valve and float mechanism.
- Reassemble and check for leaks.

11.5 Air Cooled Condenser and Drycoolers

- Clear coil surface of all debris that will inhibit airflow.
- Check for bent or damaged coil fins and correct.
- Do not permit snow to accumulate around or under outdoor unit.
- Periodically consider commercial cleaning of coil surface
- Inspect fans, motors and controls for proper operation.
- Check all piping and capillaries for proper support.
- Inspect for leaks.

11.6 Reheat—Electric Reheat (Three-Stage and SCR)

- Inspect and clean reheat elements.
- Inspect and tighten support hardware.

11.7 Compressor

11.7.1 Compressor Oil

CAUTION

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

Failure to use oil types, viscosities and quantities recommended by the compressor manufacturer may reduce compressor life and void the compressor warranty. See oil types specified in **Table 28**.

- Do NOT mix polyolester (POE) and mineral-based oils.
- Do NOT mix oils of different viscosities.

Consult Liebert or the compressor manufacturer if you have questions.

Table 28 Compressor oil types

Compressor Type	Refrigerant Type	
	R-22	R-407c
Carlyle Semi-Hermetic	Mineral Oil [1]	POE Oil - ISO 68 Viscosity [2]
Copeland Scroll and Digital Scroll	POE Oil - ISO 22 Viscosity [3]	

1. Use Carlyle Mineral Oil Totaline P903-2001, Witco Suniso 3GS or other Carlyle-approved oils.
2. Use Carlyle POE Oil Totaline P903-1001, Castrol SW68 or other Carlyle-approved oils.
3. Use Copeland POE Oil ULTRA 22CC, Mobil EAL Arctic 22CC or other Copeland-approved oils.

11.7.2 Semi-Hermetic Compressors

Oil level can be viewed at the sight glass on semi-hermetic compressors. Normal operating oil level is 1/4 to 3/4 up the sight glass.

After a compressor has been idle for an extended length of time, foaming will usually be present when compressor first starts. Wait until compressor has been operating for at least five minutes before viewing the oil level.

If oil level is low, the cause must be corrected and oil level returned to its proper level.

11.7.3 Scroll and Digital Scroll Compressors

Hermetic scroll and digital scroll compressors do not have an oil sight glass.

11.8 Compressor Replacement

Replacement compressors are available through your local Liebert office. Compressors are shipped in reusable packaging. If unit is under warranty, complete and include Liebert Service Credit Application (LSCA) with compressor that is being returned. The original compressor should be returned in same packaging.

11.8.1 Compressor Motor Burnout

If a burn-out has occurred, a full system clean-out is required or continued compressor and system problems will be experienced.

For clean out warnings and procedures see Copeland Application Engineering Bulletin 24-1105 "Principles of Cleaning Refrigeration Systems" or Carlyle Service Guide, Literature # 020-611.

11.8.2 Digital Compressor Unloading Solenoid(s)

Models 028, 035 and 042

When replacing a digital scroll compressor, digital solenoid valve and coil must be replaced. Compressor and valve kit are shipped separately. Valve kit must be field-brazed to top of compressor in proper orientation and supported with original factory bracket.

Models 053, 070 and 077

When replacing a digital scroll compressor, digital solenoid coil must be replaced. Compressor and coil kit are shipped separately.

11.8.3 Compressor Replacement Procedure

1. Disconnect power and follow all warnings at front of this manual.
2. Attach suction and discharge gauges to access fittings.
3. Front seat service valves to isolate compressor. Reclaim charge from compressor.
4. Remove marked pressure transducer and discharge pressure switch. Disconnect all electrical connections.
5. Detach service valves from compressor.
6. Remove failed compressor.
7. If required, follow compressor manufacturer's suggested clean-out procedures.
8. Install replacement compressor and make all connections. Replace gaskets or seals on service valves. Replace unloading solenoid.
9. Evacuate, charge and operate per **7.3 - Dehydration/Leak Test and Charging Procedures for R-407C and R-22**.
10. Semi-hermetic only: see **5.3 - Semi-Hermetic Compressor Spring Isolation System** for compressor spring adjustment.

CAUTION

Risk of improper component reinstallation. Can cause equipment damage.

Identify and mark location of suction pressure transducer and discharge pressure switch. These devices look similar and they must be reinstalled in their original location.

11.9 Facility Fluid and Piping Maintenance

Facility water and glycol quality remain a requirement throughout the life of the piping system. Fluid and piping system maintenance schedules must be established and performed. A local fluid maintenance program must be established that will evaluate fluid chemistry and apply necessary treatment. A periodic leak inspection of facility and unit fluid piping is recommended. Refer to **7.1.3 - Requirements of Systems Using Water or Glycol**.

11.10 Paradenser—Water Cooled Condenser

During normal Paradenser operation, deposits will collect on inside wall of condenser tubes. It must be cleaned periodically to ensure proper operation. Frequency of cleaning must be locally established because it varies according to Paradenser usage and local fluid quality. See **11.9 - Facility Fluid and Piping Maintenance**.

11.10.1 Cleaning Instructions

Refer to **Figure 1 - Downflow model component locations**.

1. Disconnect power to unit.
2. Close field-installed isolation valves to isolate this unit's condenser system from facility water or glycol circuit.
3. Remove access panel from front of compressor section.
4. Locate the 1/2" NPT drain plugs located at lower front of compressor section and provide means to collect fluid drained from system
5. Remove the 1/2" drain plugs using two wrenches to prevent damage to drain lines.
6. Locate and remove the 3" diameter clean out plugs on top of shell assemblies (use Craftsman™ 1-3/16" drag link socket, Sears item # 00944514000 or similar).
7. Brush and flush each of the nominal 5/8" inner diameter, rifled copper tubes. Recommend using John R. Robinson, Inc. or similar:
   - Motorized Tube Cleaner, Model JR3800-1200
   - Nylon brush 9/16" diameter, Model JRRB211N-916
   - Flexible shaft, Model JRRFS702-25
8. Reinstall 1/2" drain plugs 6 to 7 turns using Loctite 567 PST Thread Sealant as instructed by the manufacturer.
9. Wipe clean the machine threads and sealing surfaces of 3" diameter clean out plugs.
10. Remove and install new O-rings (Liebert part number 180750P1) on the 3" diameter clean out plugs. (Do not use thread sealant).
11. Hand tighten 3" diameter clean out plugs and torque using drag link socket to 25 ft-lb.
12. Leak check fluid system (refer to **Leak Checking of Unit and Field Piping on page 42**).
13. Bleed system using Schrader ports near the top of the Paradenser.
14. Ensure that condensing fluid isolation valves are fully open.
15. Unit is ready to be put on-line.

12.0 HVAC MAINTENANCE CHECKLIST

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

Filters

___ 1. Check/replace filters
___ 2. Grille area unrestricted
___ 3. Wipe section clean
___ 4. Coil clean

Blower Section

___ 1. Blower wheels free of debris
___ 2. Check belt tension and condition (replace if needed)
___ 3. Check/lube bearings
___ 4. Check sheave/pulley (replace if worn)
___ 5. Check motor mount
___ 6. Motor amp draw L1_____ L2 _____ L3_____
____Compare to nameplate amps

Reheat

___ 1. Inspect elements
___ 2. Check wire connections (inside reheat box)
___ 3. Reheat amp draw
#1 _____
#2 _____
#3 _____

Steam Generating Humidifier

___ 1. Check drain valve/drain lines/trap for clogs
___ 2. Check water make-up valve and all hoses for leaks
___ 3. Clean strainer
___ 4. Replace humidifier bottle if necessary
___ 5. Check operation of humidifier
___ 6. Humidifier amp draw L1 _____ L2 _____L3_____

Infrared Humidifier

___ 1. Check drain lines and trap for clogs
___ 2. Check/clean pan for mineral deposits
___ 3. Clean reflector
___ 4. Check water make-up valve for leaks
___ 5. Check humidifier lamps (replace if burnt out)
___ 6. Check wire connections (inside humidifier box)
___ 7. Humidifier amp draw L1 _____ L2 _____L3_____

Condensate Pump

___ 1. Check for debris in sump

___ 2. Check operation of float(s) (free movement)

Refrigeration Piping

___ 1. Check refrigerant lines (clamps secure/no rubbing/leaks)

___ 2. Check for moisture (sight glass)

Water Cooled Condensers

___ 1. Check water regulating valve operation

___ 2. Cap tubes (not rubbing)

___ 3. Check for water/glycol leaks

___ 4. Entering water temperature _____ °

___ 5. Leaving water

Compressor Section

___ 1. Check oil level

___ 2. Check for oil leaks

___ 3. Check compressor mounts (springs/bushings)

___ 4. Cap tubes (not rubbing)

___ 5. Check wire connections (inside compressor box)

___ 6. Compressor operation (vibration/noise)

___ 7. Suction Pressure Circuit#1 _____ Circuit#2_____

___ 8. Discharge Pressure Circuit#1 _____ Circuit#2_____

___ 9. Superheat Circuit#1 _____ Circuit#2_____

___ 10. Low pressure switch cut out Circuit#1 _____Circuit#2_____

___ 11. Low pressure cut in Circuit#1 _____Circuit#2_____

___ 12. High pressure cut out Circuit#1 _____Circuit#2_____

___ 13. Amp draw

____Circuit #1

L1 _____ L2 _____ L3_____

____Circuit #2

L1 _____ L2 _____ L3_____

Electrical Panel

___ 1. Check fuses

___ 2. Check contactors for pitting

___ 3. Check wire connections

Controls

___ 1. Check/Verify Control Operation (Sequence)

___ 2. Check humidifier high water alarm operation

___ 3. Check operation of the air safety switch

___ 4. Check setting/operation of the filter clog switch

___ 5. Check/test changeover device(s)

___ 6. Check/test water detection device(s)

Air Cooled Condenser / Drycooler

___ 1. Coil clean
___ 2. Motor mounts tight
___ 3. Bearings in good condition (motor)
___ 4. Piping support/clamps secure
___ 5. Check wire connections
___ 6. Stat settings
___ 7. Refrigerant level (Lee-Temp)
___ 8. Glycol level
___ 9. Glycol solution_____ %
___ 10. Fan speed control operation
___ 11. Motor amp draw

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

Glycol Pump

___ 1. Check pump rotation
___ 2. Check for glycol leaks
___ 3. Pump pressures

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

___ 4. Amp Draw

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

___ 5. Pump changeover (if multiple pumps)

Notes _____

_____

_____

Signature _____

Company _____

Make photocopies for your records. Compare readings / information to previous maintenance worksheet. To locate your local Liebert Representative for Liebert engineered parts, check the Liebert Web site: **www.liebert.com** or call 1-800-LIEBERT.

NOTES

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