

DISCONTINUED
PRODUCT

Precision Cooling
For Business-Critical Continuity™

Liebert® Challenger™ ITR

Installation Manual - Nominal Capacities 23 or 33 kW, 50 & 60Hz



TABLE OF CONTENTS

IMPORTANT SAFETY INSTRUCTIONS	1
1.0 INTRODUCTION	3
1.1 System Descriptions	3
1.1.1 Self-Contained Systems	3
1.1.2 Chilled Water Models	3
1.1.3 Split Systems	4
2.0 INSTALLATION (APPLICABLE TO ALL MODELS)	5
2.1 Room Preparation	5
2.2 Equipment Inspection	5
2.3 Location Considerations	5
2.4 Equipment Handling	5
2.4.1 Handling With Skid	6
2.4.2 Removal of Skid	6
2.5 Piping Considerations	8
2.5.1 Drain Line	9
2.5.2 Humidifier Supply Water—Optional Infrared	14
2.6 Facility Fluid and Piping Maintenance	14
2.7 Electrical Connections	14
2.8 Balancing the Air Distribution	17
2.8.1 Ducted Applications	17
2.8.2 Plenum Installation	17
2.9 Checklist for Completed Installation	17
3.0 AIR-COOLED MODELS—SELF-CONTAINED COMPRESSOR	18
3.1 Condenser Location	18
3.2 Electrical Connections	18
3.2.1 Line Voltage	18
3.2.2 Low Voltage	18
3.2.3 Liebert Lee-Temp/Flood Back Head Pressure Control Condensers	18
3.3 Refrigerant Piping	20
3.4 Fan Speed Control Systems	21
3.5 Air-Cooled Condenser with Liebert Lee-Temp “Flooded Condenser” Head Pressure Control System	26
4.0 WATER-COOLED MODELS—SELF-CONTAINED COMPRESSOR	30
4.1 Piping Considerations	30
4.2 Condenser	30
4.3 Water Regulating Valve	33
4.3.1 Standard Valve - 150psig (1034kPa) System, High Pressure Valve - 350psig (2413kPa) System	33
4.4 Motorized Ball Valve—Digital Scroll Compressors	34
4.4.1 Control	34
4.4.2 Adjustment	34
4.4.3 Startup	34
4.4.4 Location	34
4.4.5 Manual Control	34
5.0 GLYCOL/GLYCOOL-COOLED MODELS—SELF-CONTAINED COMPRESSOR	35

5.1	Drycooler Location	35
5.2	Drycooler Installation	35
5.3	Electrical Connections	35
5.3.1	Line Voltage	35
5.3.2	Low Voltage	35
5.3.3	Pump and Drycooler	35
5.4	Glycol Piping	36
5.4.1	Expansion Tanks, Fluid Relief Valves and Other Devices	37
5.5	Filling Instructions	38
5.5.1	Preparing the System for Filling	38
5.5.2	Glycol Solutions	38
5.5.3	Filling the System	40
5.5.4	Motor Ball Valve—Digital Scroll Compressors	47
5.6	Condenser	47
5.7	Glycol Regulating Valve	47
5.7.1	Standard Valve - 150psig (1034kPa) System, High Pressure Valve - 350psig (2413kPa) System	47
5.7.2	Testing Valve Function	47
6.0	CHILLED WATER MODELS	48
6.1	Piping Considerations	48
7.0	SPLIT SYSTEM MODELS	49
7.1	Location Considerations	49
7.1.1	Air-Cooled Condensing Units	49
7.1.2	Water/Glycol-Cooled Condensing Units	49
7.2	Electrical Connections	49
7.2.1	Line Voltage	49
7.2.2	Low Voltage	50
7.3	Piping Considerations	50
7.3.1	Refrigerant Loop	50
7.3.2	Quick Connect Fittings	52
7.4	Outdoor Air-Cooled Condensing Units	52
7.5	Centrifugal Air-Cooled Condensing Units	57
7.5.1	Installing the Indoor Condensing Unit	57
7.5.2	Ducting	58
7.6	Water and Glycol-Cooled Condensing Units	62
7.6.1	Piping Considerations	62
7.6.2	Condenser Water Requirements	62
7.6.3	Regulating Valve	62
7.6.4	Glycol Systems	63
8.0	R407C REFRIGERANT	65
8.1	Calculating Subcooling	66

FIGURES

Figure 1	Removing the Liebert Challenger ITR from skid	6
Figure 2	Cabinet dimensions.	7
Figure 3	Optional floor stand dimensions	8
Figure 4	Piping connections for air-cooled units	10
Figure 5	Piping connections for split system fan coil units	11
Figure 6	Piping connections for water/glycol and GLYCOOL units	12
Figure 7	Piping connections for chilled water self-contained units	13
Figure 8	Electrical connections	15
Figure 9	Electrical field connections for Liebert iCOM	16
Figure 10	Air-cooled condensers	19
Figure 11	General arrangement—Air-cooled models with fan speed control.	24
Figure 12	General arrangement—Air-cooled models with digital scroll and fan speed control	25
Figure 13	General arrangement—Air-cooled models with Liebert Lee-Temp	28
Figure 14	General arrangement—Air-cooled models with digital scroll and Liebert Lee-Temp	29
Figure 15	General arrangement—Water-cooled models with scroll compressor	31
Figure 16	General arrangement diagram—Water-cooled models with digital scroll	32
Figure 17	Johnson Controls valve adjustment.	33
Figure 18	Drycoolers and pump packages	41
Figure 19	Pump packages—expansion tank	42
Figure 20	General arrangement—Glycol-cooled models with scroll compressor	43
Figure 21	General arrangement—Glycol-cooled models with digital scroll	44
Figure 22	General arrangement—GLYCOOL models with scroll compressor.	45
Figure 23	General arrangement—GLYCOOL models with digital scroll compressor.	46
Figure 24	Chilled water general arrangement.	48
Figure 25	Refrigerant piping diagram	52
Figure 26	Outdoor air-cooled condensing unit—horizontal air discharge models	53
Figure 27	Outdoor air-cooled condensing unit—top air discharge models.	54
Figure 28	Electrical field connections, prop fan condensing module	56
Figure 29	Detail of ceiling hanging bracket	58
Figure 30	Centrifugal air-cooled condensing unit dimensional data	59
Figure 31	Centrifugal air-cooled condensing unit dimensional data (con't.)	60
Figure 32	Split systems general arrangement.	61
Figure 33	Water/glycol-cooled condensing unit dimensional data	63
Figure 34	Water/glycol-cooled condensing unit (con't.)	64

TABLES

Table 1	Unit shipping weights.	6
Table 2	Piping connection size.	9
Table 3	Air-cooled condenser statistics.	19
Table 4	Recommended line sizes—OD copper (inches)*	20
Table 5	Equivalent lengths (feet) for various pipe fittings	21
Table 6	Indoor unit refrigerant charge lb (kg)	21
Table 7	Line charges - refrigerant per 100ft. (30m) of Type “L” copper tube	21
Table 8	Condenser refrigerant (per serial tag)	21
Table 9	Fan speed suction pressure transducer settings.	23
Table 10	Liebert Lee-Temp suction pressure transducer settings	27
Table 11	Room dew point temperatures	37
Table 12	Indoor unit glycol volume approximate gallons (liters) max.	38
Table 13	Volume in standard Type “L” copper piping	38
Table 14	Ethylene glycol concentrations.	39
Table 15	Mounting hole dimensional data	42
Table 16	Drycooler data	42
Table 17	Glycol pump data*	42
Table 18	Refrigerant control settings psi (kPa)	47
Table 19	Unit refrigerant charge	51
Table 20	Line charges - refrigerant per 100ft. (30m) of Type “L” copper tube	51
Table 21	Recommended refrigerant lines (R407C) sizes OD copper	51
Table 22	Line coupling sizes	51
Table 23	Equivalent lengths (feet) for various pipe fittings	51
Table 24	Horizontal air discharge cabinet and floor planning dimensional data.	52
Table 25	Horizontal air discharge piping and electrical connection data.	52
Table 26	Cabinet and floor planning dimensional data - prop fan condensing modules, top air discharge	55
Table 27	Piping and electrical connections - top air discharge	55
Table 28	Indoor centrifugal condensing unit	57
Table 29	Airflow	58
Table 30	Water and glycol-cooled condensing unit data	62
Table 31	R407C pressure/temperature chart for operation and superheat (discharge/hot gas and suction gas)	65
Table 32	R407C pressure/temperature chart for subcooling only (liquid measurements).	66

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important safety instructions that should be followed during the installation and maintenance of the Liebert Challenger™ ITR. 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 Liebert 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 Liebert iCOM control.

The factory-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.

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.

Do not operate upflow units without installing a plenum, ductwork or guard over the blower opening(s) on the top surface of the unit cabinet.

Ductwork must be connected to the blower(s), or a plenum must be installed on the blower deck for protection from rotating blower wheel(s) on upflow units.



CAUTION

Risk of contact with hot surfaces. Can cause injury.

The compressor, 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.

NOTICE

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.

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

1.0 INTRODUCTION

1.1 System Descriptions

Liebert Challenger ITR environmental control systems are available in three main system configurations:

- self-contained system with a scroll compressor in the room unit
- self-contained chilled water system
- split system with an evaporator section and a remote condensing unit

All three types are available in horizontal configurations. All models require three-phase power. Units are available in 208, 230, 460, or 575V, 60Hz; and 200, 230 or 380/415V, 50Hz.

The following features are included as standard in all room units regardless of the type of system: Liebert iCOM control, V-frame coil, infrared humidifier, finned tubular stainless steel electric reheat, 2" filter, individual high voltage fused protection and fan assembly.

1.1.1 Self-Contained Systems

Air-Cooled Models

Complete refrigeration system including hot gas bypass and crankcase heater with standard scroll compressor, standard condenser and fan speed control for 95°F (35°C) ambient at sea level. Optional Digital scroll compressor with unloading solenoid valve is also available. Digital scroll compressor systems do not include hot gas bypass.

Water-Cooled Models

Complete refrigeration system including hot gas bypass with standard scroll compressor, water/glycol-cooled condenser and two-way water regulating valve with bypass. Optional digital scroll compressor with unloading solenoid valve is also available. Digital scroll compressor systems use a 2-way motorized ball valve in lieu of the regulating valve; they do not include hot gas bypass.

Glycol-Cooled Models

The water-cooled model as described above plus pump package and 95°F (35°C) design ambient dry-cooler.

GLYCOOL Models

Complete refrigeration system including hot gas bypass with standard scroll compressor, glycol condenser and three-way water regulating valve plus an integrally piped Econ-O-Coil with three-way modulating control valve. Optional digital scroll compressor with unloading solenoid valve is also available. Digital scroll compressor systems use a 3-way motorized ball valve in lieu of the regulating valve; they do not include hot gas bypass.

1.1.2 Chilled Water Models

Chilled Water models include chilled water piping, three-way modulating valve, and actuator assembly.

1.1.3 Split Systems

Each air-cooled split system consists of an evaporator section and one of the following condensing units.

Prop Fan Air-Cooled Models

Prop Fan units include scroll compressor, condenser coil, prop fan, high pressure switch, hot gas bypass and Liebert Lee-Temp head pressure control. Unit is designed for outdoor location.

Centrifugal Fan Air-Cooled Models

Centrifugal Fan units include scroll compressor, condenser coil, centrifugal blower assembly, high-pressure switch, hot gas bypass and Liebert Lee-Temp head pressure control. Unit must be mounted indoors. Duct flanges are optional.

Water-Cooled Models

Each water-cooled split system consists of an evaporator section and a water/glycol condensing unit, which includes scroll compressor, coaxial condenser, water regulating valve, hot gas bypass and high-pressure switch. Design pressure is 150 psi (1034 kPa) as standard and 350 psi (2413 kPa) as optional.

Glycol-Cooled Models

Each glycol-cooled split system consists of an evaporator section, a water/glycol condensing unit (as described above), a pump package, and a 95°F (35°C) design ambient drycooler.

2.0 INSTALLATION (APPLICABLE TO ALL MODELS)

2.1 Room Preparation

The room should be well insulated and must have a sealed vapor barrier. The vapor barrier in the ceiling can be a polyethylene film type. Use a rubber or plastic base paint on concrete walls and floors. Doors should not be undercut or have grilles in them.

Outside (or fresh) air should be kept to an absolute minimum. Outside air adds to the heating, cooling, humidifying and dehumidifying loads of the site. It is recommended that outside air be kept below 5% of the total air circulated in the room and be preconditioned.

2.2 Equipment Inspection

Upon arrival of the unit, inspect all items for visible and concealed damage. Damage should be immediately reported to the carrier and a damage claim filed with a copy sent to Liebert or to your sales representative.

2.3 Location Considerations

The unit can sit on top of an accessible elevated flooring system. It may be necessary to furnish additional pedestal support below the unit to ensure maximum structural support (see **Table 1**). A separate floor stand for the unit may be used as support, independent of the elevated floor and installed prior to the flooring system.

Provide approximately 34" (864 mm) service clearance on the front of the unit.



NOTE

GLYCOOL units require 34" (864 mm) service clearance on the right side of the unit in addition to front service clearance.

The unit can be installed between equipment racks or at the end of a row of racks. Consideration should be given before installing refrigerant and liquid lines next to, under or above electronic equipment. Avoid placing the Liebert Challenger ITR in an alcove. Placing units too close together will reduce the effectiveness of the air distribution.



NOTE

Locate and remove shipping screw on fan motor base.

2.4 Equipment Handling



WARNING

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

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

The instructions below are to be adhered to when handling this unit with or without the skid. There is the potential for this unit to tip over if it is handled improperly.

2.4.1 Handling With Skid

- Always keep the unit upright, indoors and protected from damage.
- Do not use the extended rear door frame to lift the unit.
- If possible, transport the unit using a fork lift; otherwise, use a crane with belts or cables, avoiding pressing on the top edges of the packaging.
- If using a fork lift, make sure the forks, if adjustable, are spread to the widest allowable distance to still fit under the skid.

NOTICE

Risk of improper handling. Can cause unit damage.

Do not attempt to lift the Liebert Challenger ITR with the extended rear door frame. Attempting to do so will damage the unit. Lift the unit only from its main base.

NOTICE

Risk of overhead interference. Can cause unit and/or structure damage. Refer to the installation plans prior to moving the unit to verify clearances.

While on the skid, the unit is too tall to fit through a standard height doorway (83 inches or 2108 mm tall). Any attempt to move the unit, while on the skid, through a standard doorway will cause damage to the unit.

2.4.2 Removal of Skid

- Remove the plywood skirting that keeps the skid and unit in place.
- Raise the Liebert Challenger ITR off the skid. **Liebert recommends using a fork lift (see Figure 1) or similar machine to ensure that the unit is lifted properly.**



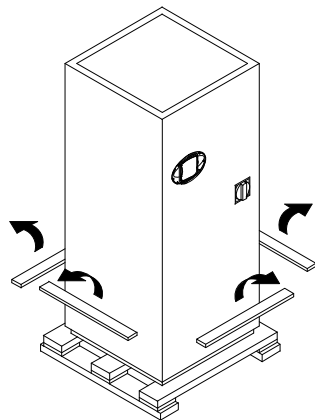
NOTE

Lift the Liebert Challenger ITR only from its main base. Do not use the extended rear door frame to lift the unit.

- Once the unit is raised, the skid can be removed.

Figure 1 Removing the Liebert Challenger ITR from skid

Remove plywood skirting holding unit and skid in place.



Raise unit with fork lift or similar machine.

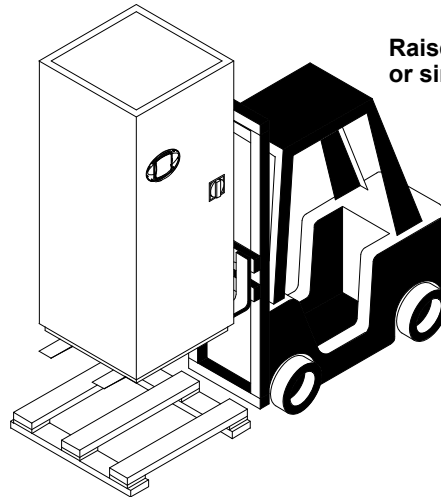


Table 1 Unit shipping weights

Model	Domestic	Export	Model	Domestic	Export
	lb (kg)	lb (kg)		lb (kg)	lb (kg)
50Hz Models			60Hz Models		
BR059E	650 (295)	750 (340)	BR060E	650 (295)	750 (340)
BR065A	745 (340)	845 (385)	BR067A	745 (340)	845 (385)
BR070WG	815 (370)	915 (415)	BR071WG	815 (370)	915 (415)
BM058G	855 (390)	955 (435)	BM061G	855 (390)	955 (435)
BR101C	660 (300)	760 (345)	BR102C	660 (300)	760 (345)

Figure 2 Cabinet dimensions

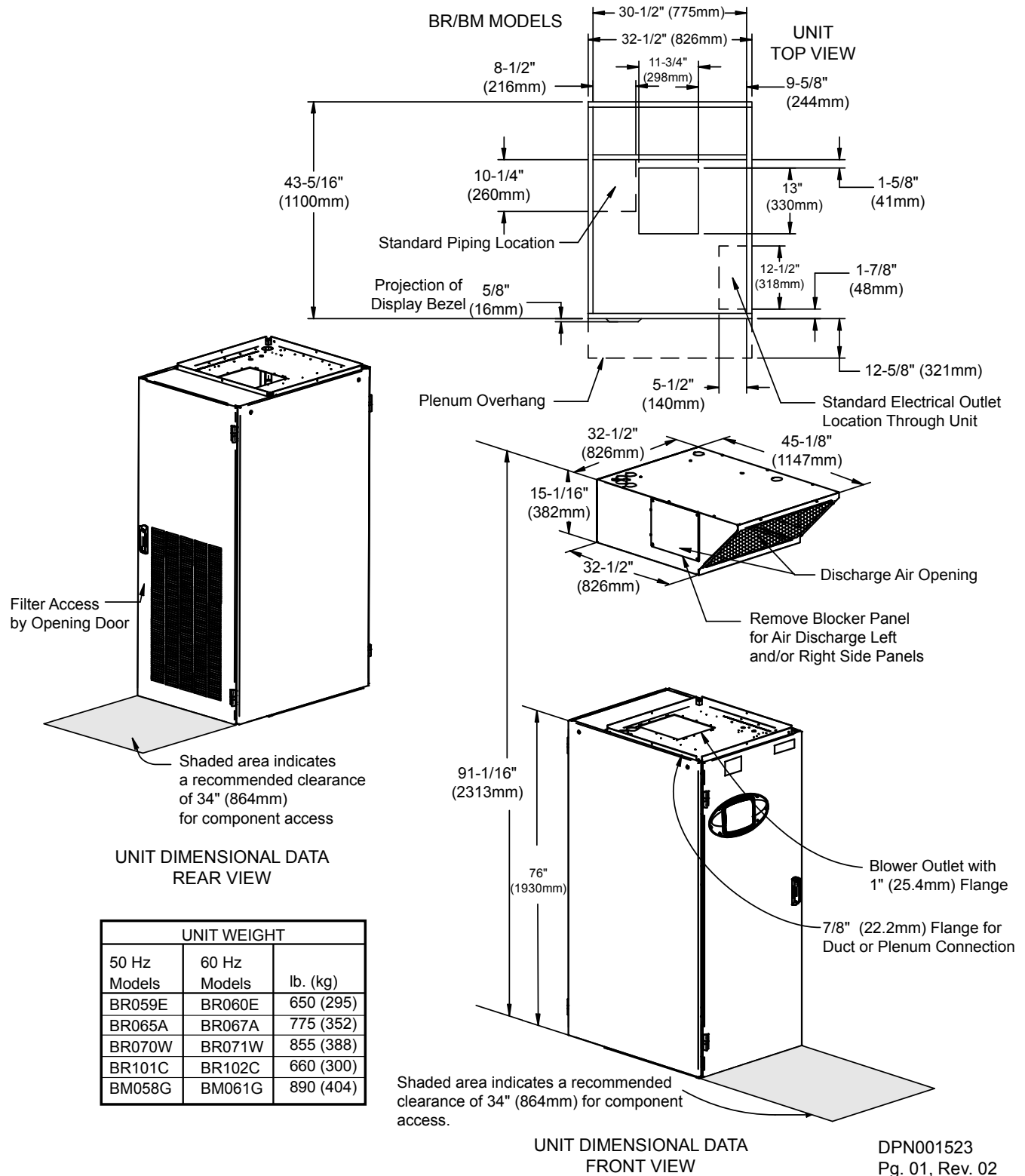
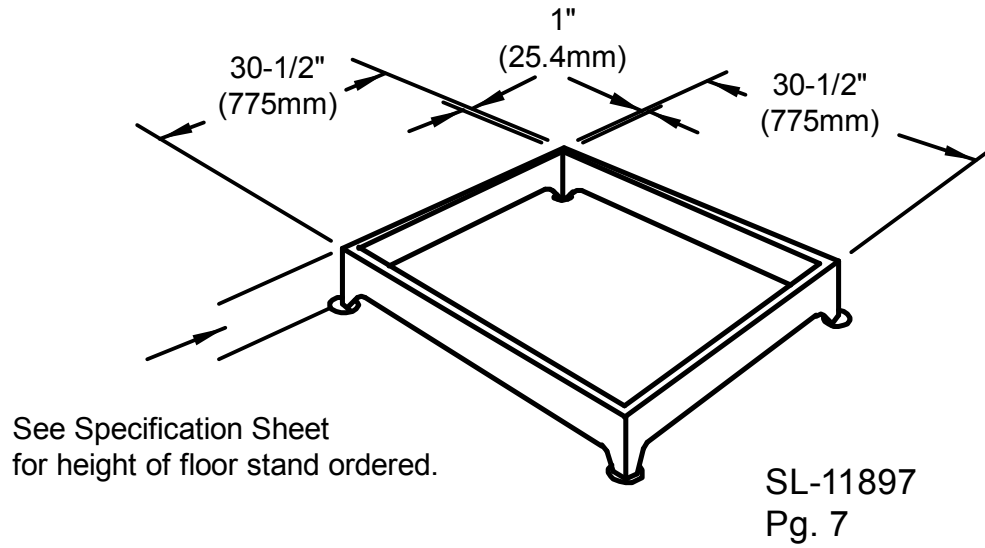


Figure 3 Optional floor stand dimensions



2.5 Piping Considerations

Consideration should be given before installing refrigerant and liquid lines next to, under or above electronic equipment.

2.5.1 Drain Line

A 3/4" (19.1 mm) female pipe thread (FPT) connection is provided for the evaporator coil condensate drain. This drain line also drains the humidifier, if applicable. The drain line must be located so it will not be exposed to freezing temperatures. The drain should be at least the full size of the drain connection and pitched a minimum of 1/8" per ft. (11 mm per meter).



NOTE

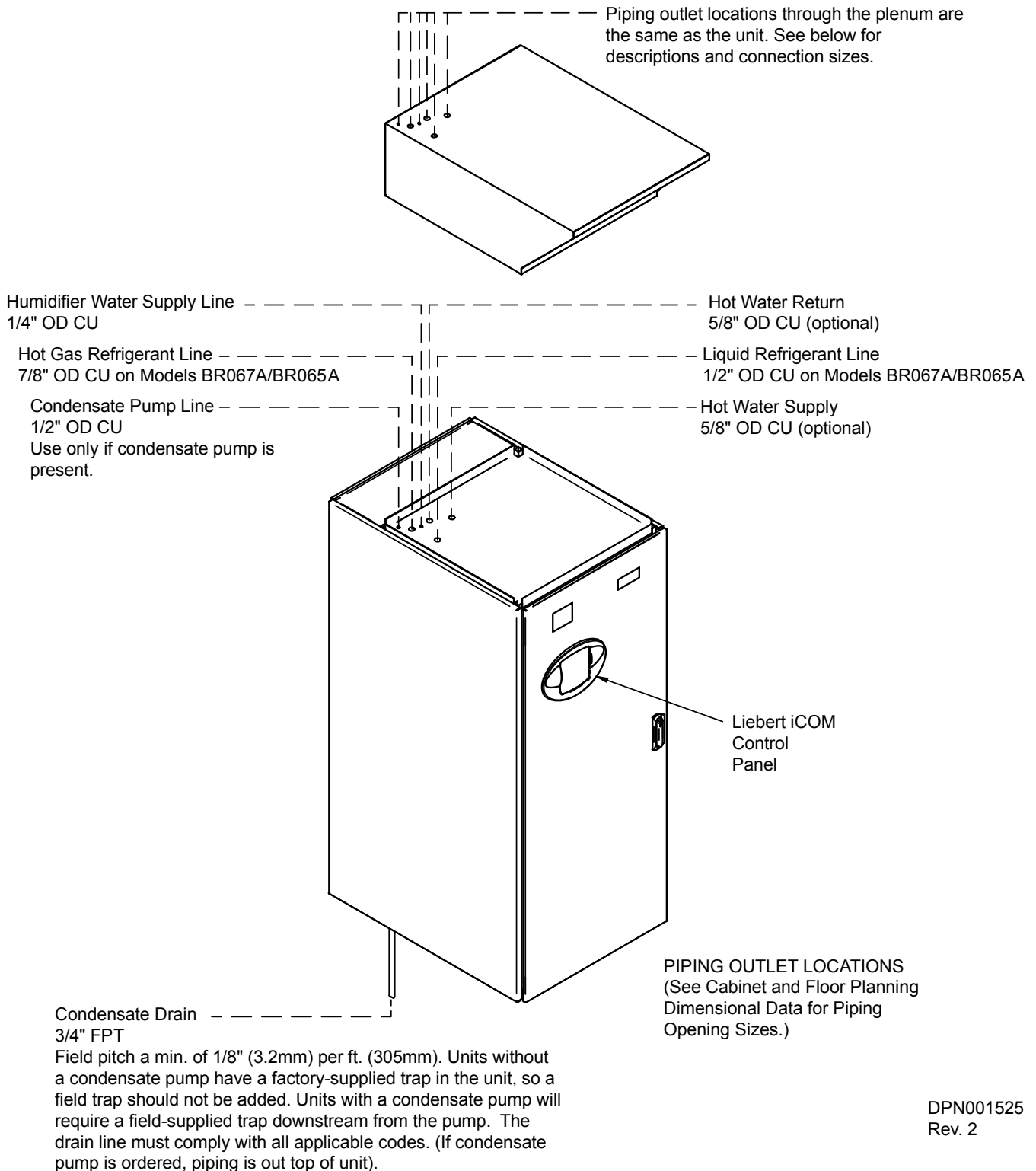
This line may contain boiling water. Select appropriate drain system materials.

Units come standard with a condensate pump and require a field-supplied trap downstream from the pump. The drain line must comply with all applicable codes.

Table 2 Piping connection size

Air-Cooled Unit Connection Sizes—in.				
Model No. BR/BM 60Hz (50Hz)	Liquid Line O.D. Copper L	Hot Gas Line O.D. Copper HG		
067A (065A)	1/2	7/8		
Split System Fan Coil Unit Connection Sizes—in.				
Model No. BR/BM 60Hz (50 Hz)	Liquid Line L	Suction Line SC		
060E (059E)	1/2 O.D. Cu	1-1/8 O.D. Cu		
All Units: Connection Sizes—in.				
Humidifier Line O.D. Copper H	Condensate Drain Line C	Condensate Pump Line O.D. Copper P	Hot Water Reheat O.D. Copper	
1/4	1/2 OD Cu	1/2	Supply HWS	Return HWR
			5/8	5/8
Water/Glycol-Cooled Unit Connection Sizes—in.				
Model No. BR/BM 60Hz (50 Hz)	Supply Line S	Return Line R		
071WG (070WG)	1-1/8	1-1/8		
GLYCOOL Unit Connection Sizes—in.				
Model No. BR/BM 60Hz (50 Hz)	Supply Line S	Return Line R		
061G (058G)	1-1/8	1-1/8		
Chilled Water Unit Connection Sizes—in.				
Model No. BR/BM 60Hz (50 Hz)	Supply Line CWS	Return Line CWR		
102C (101C)	1-1/8	1-1/8		

Figure 4 Piping connections for air-cooled units



DPN001525
Rev. 2

Figure 5 Piping connections for split system fan coil units

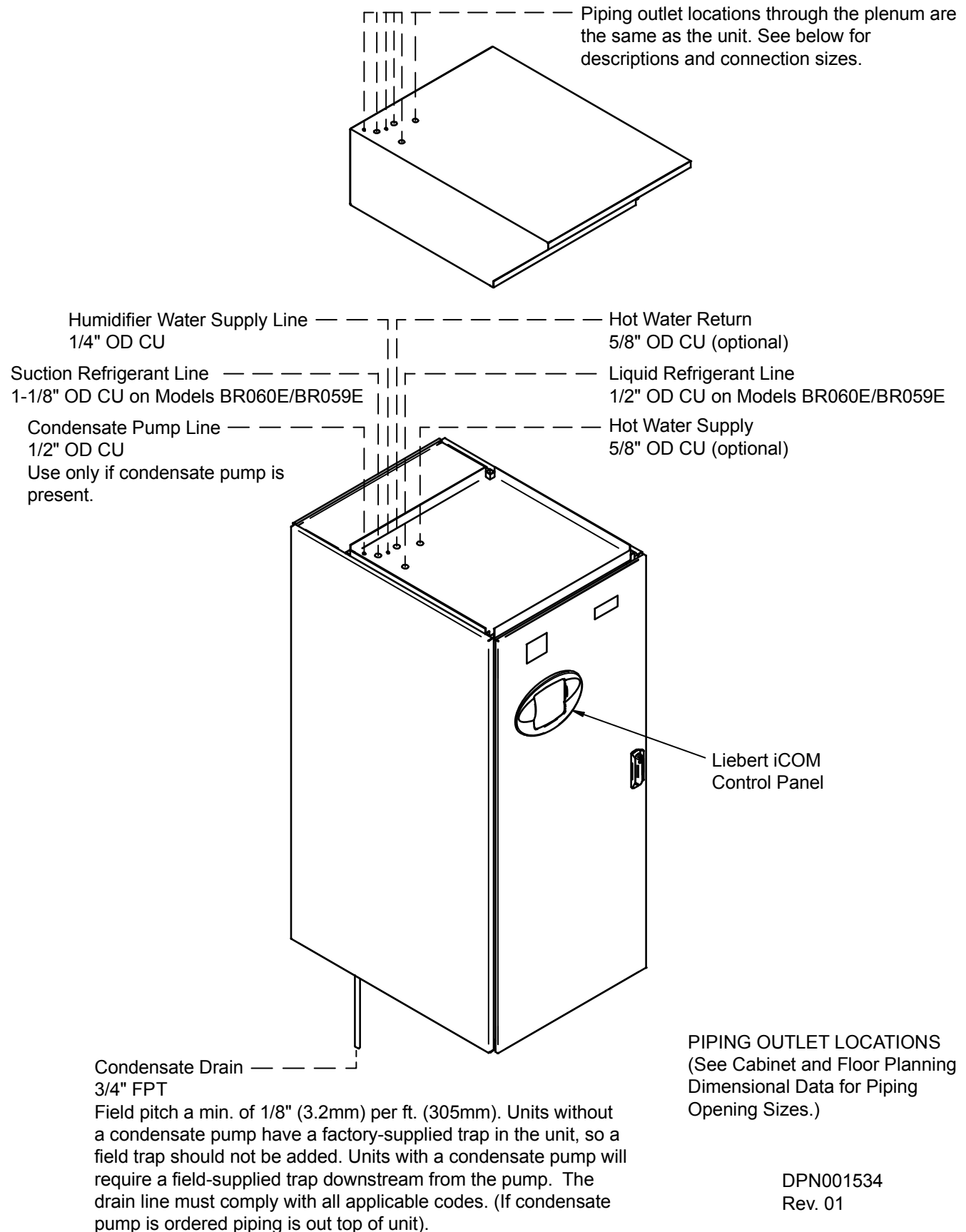
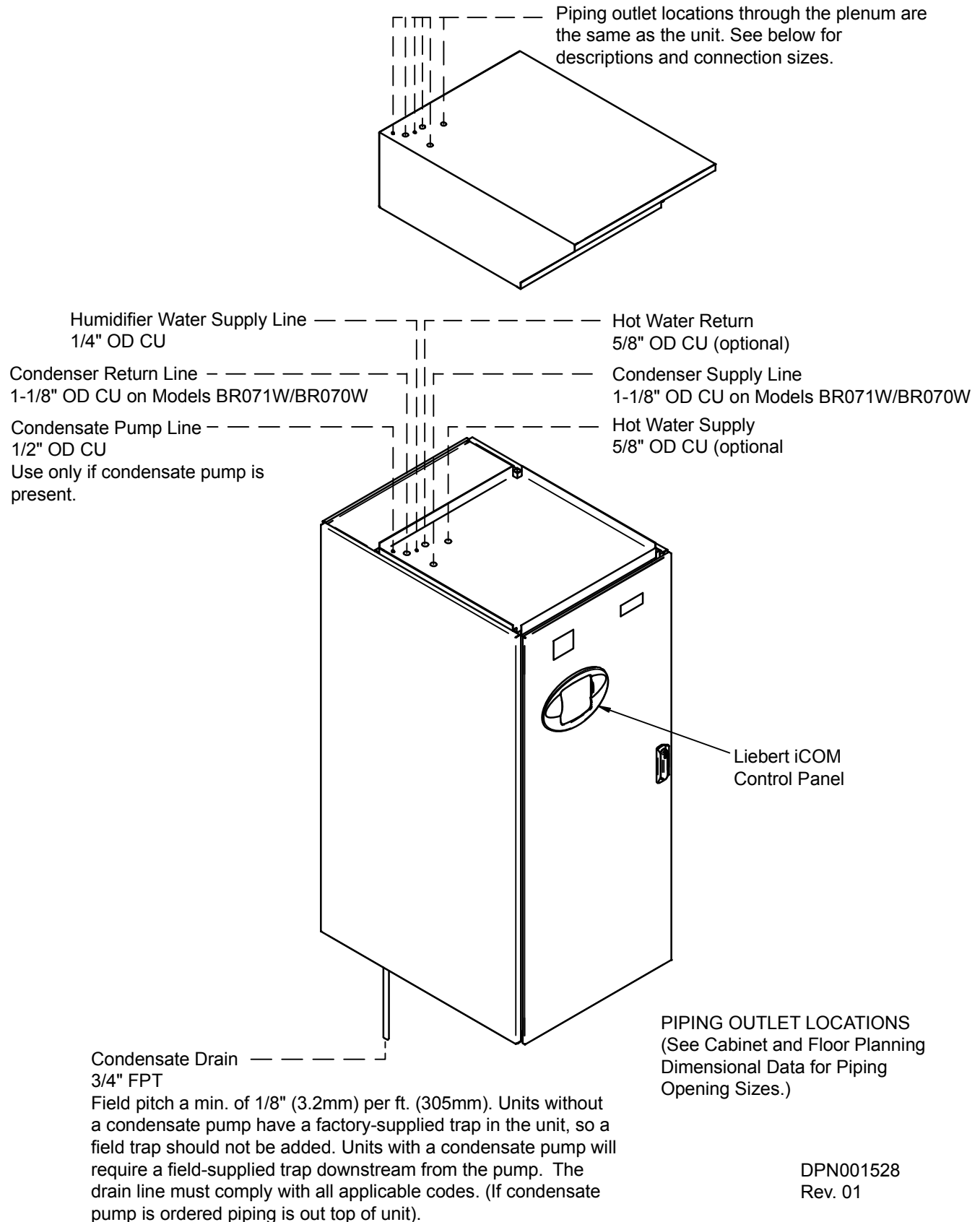
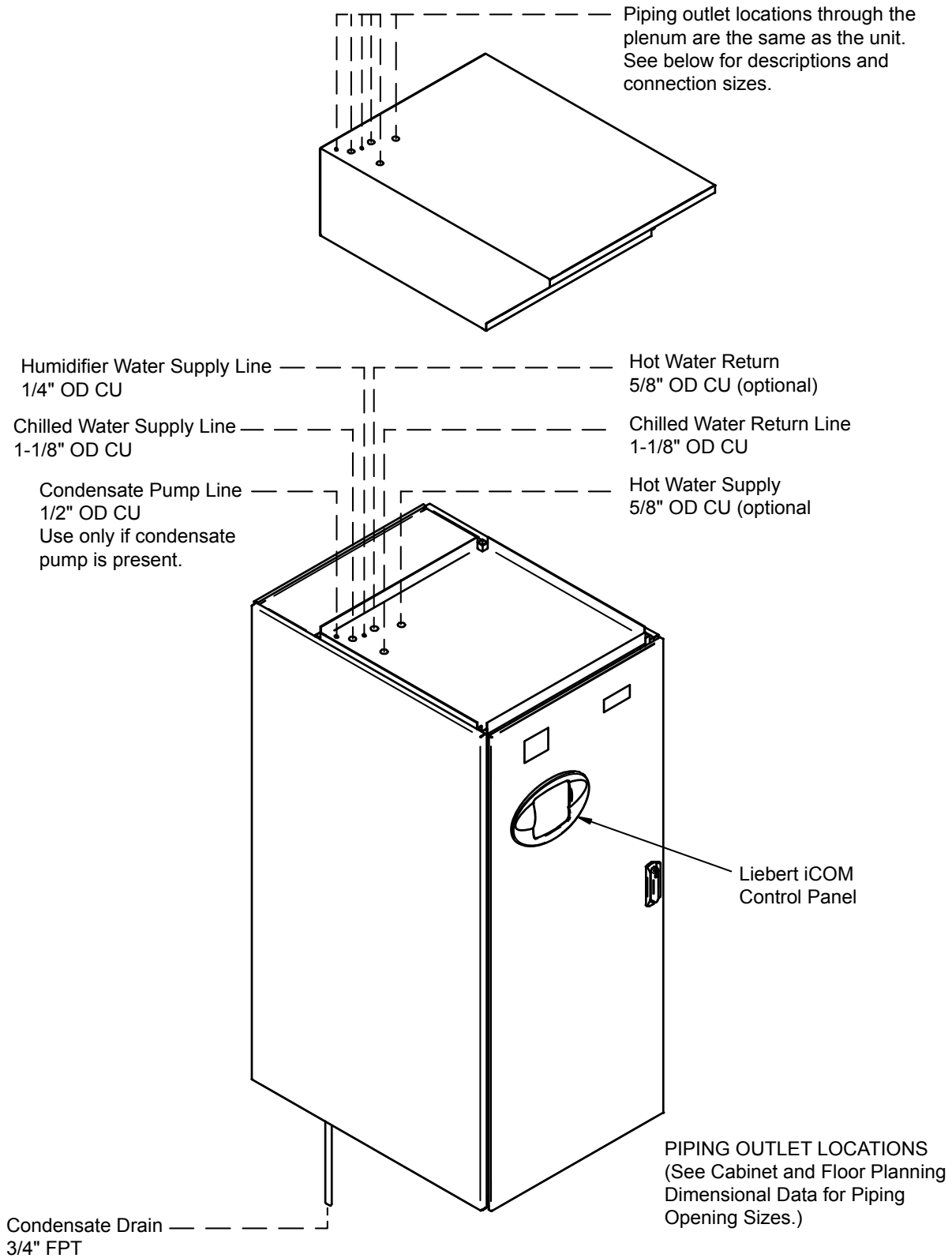


Figure 6 Piping connections for water/glycol and GLYCOOL units



DPN001528
Rev. 01

Figure 7 Piping connections for chilled water self-contained units



DPN001531
Rev. 01

2.5.2 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

2.6 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 **5.4 - Glycol Piping**.

2.7 Electrical Connections

Three-phase electrical service is required for all models in either 208, 230, 460, or 575 V, 60 Hz; or 200, 230, or 380/415 V, 50 Hz. Electrical service shall 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.

A manual electrical disconnect switch should be installed within 5 feet (1.6m) of the unit in accordance with codes, or a factory-supplied disconnect switch may be factory mounted within the unit accessible from the exterior.



WARNING

Risk of electric shock. Can cause injury or death.

Potentially lethal voltages exist within this equipment during operation. Observe all cautions and warnings on unit and in this manual.

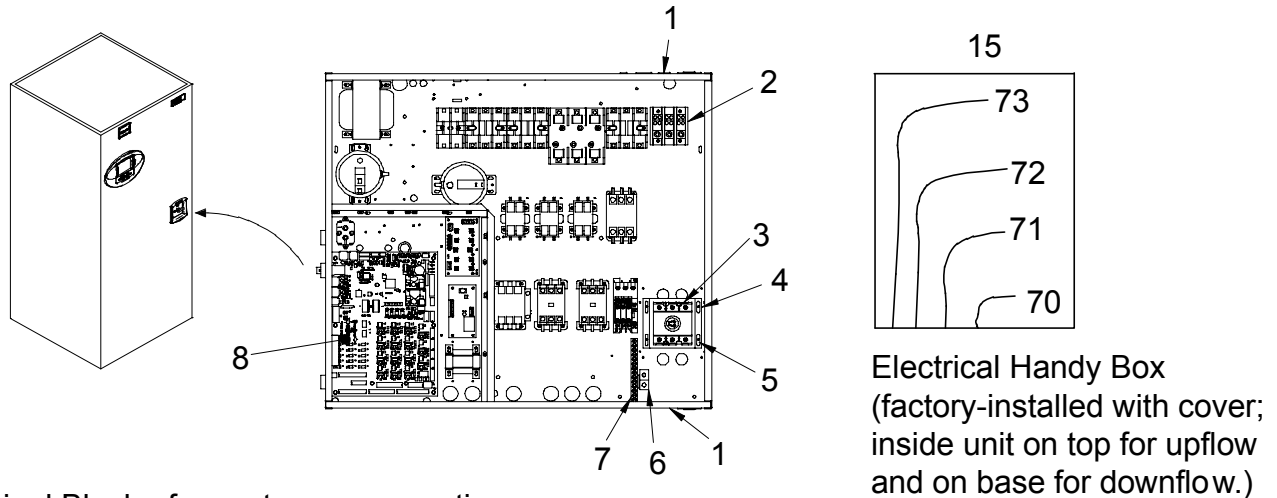
The Liebert iCOM microprocessor does not isolate power from the unit, even in the “Unit Off” mode. The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic.

NOTICE

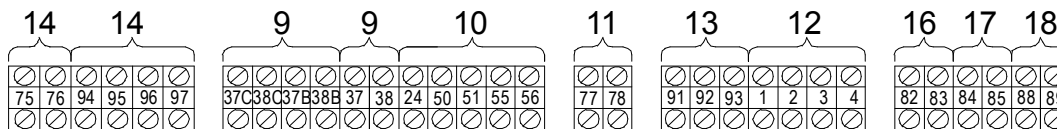
Risk of improper scroll compressor installation. Could cause poor performance and compressor damage.

Three-phase power must be connected to the unit line voltage terminals in the proper sequence so that the scroll compressor rotates in the proper direction. Rotation in the wrong direction will result in poor performance and compressor damage. Use a phase sequence and motor rotation sensor to ensure that the three-phase power is correctly connected and the compressor is rotating properly.

Figure 8 Electrical connections



Terminal Block - for customer connections



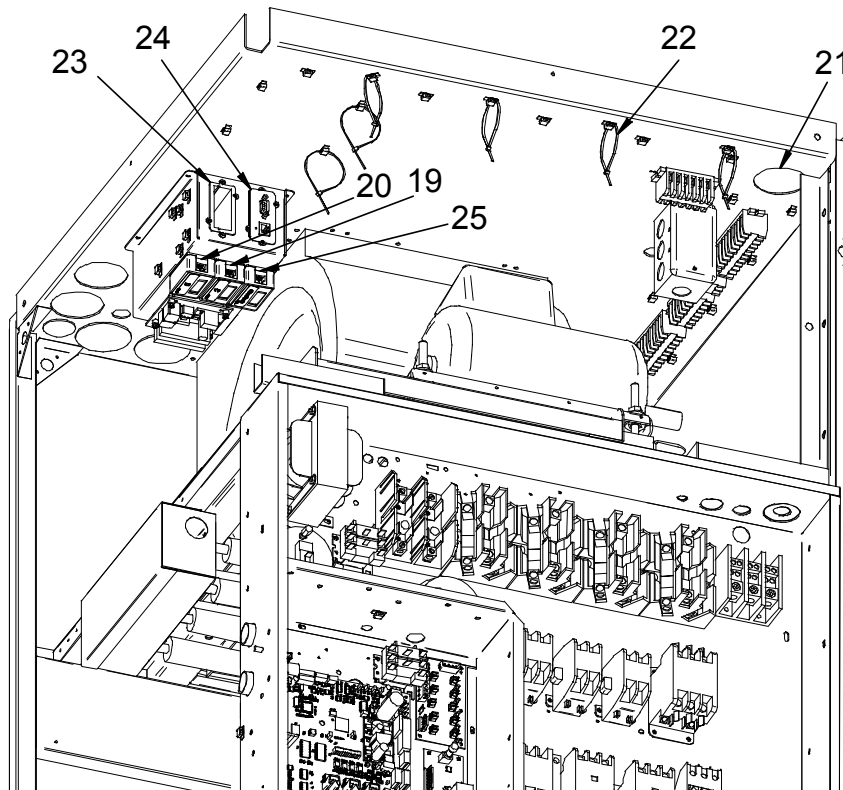
DPN000354
Rev. 01

1. **Electric conduit knockouts** on top and bottom of electric box. Knockout size 1-3/4" (44.5mm).
2. **Three-phase connection.** Electric service connection terminals when factory disconnect is NOT supplied.
3. **Three-phase connection.** Electric service connection terminals when factory disconnect switch is supplied.
4. **Factory-installed disconnect switch.** (Optional).
5. **Three-phase electric service** field-supplied.
6. **Earth ground connection** (50/60Hz). Connection terminal for field-supplied earth grounding wire.
7. **Earth ground bar** (50Hz only). Connection terminals with factory ground from each high voltage component for field supplied earth grounding wire.
8. **Control and monitoring section** of electric box.
9. **Remote unit shutdown.** Replace existing jumper between Terminals 37 + 38 with normally closed switch having a minimum 75VA, 24VAC rating. Use field-supplied Class 1 wiring. Two additional contact pairs available as an option (labeled as 37B & 38B, 37C & 38C). Replace existing jumper for appropriate pair as done for 37 & 38.
10. **Special alarm connections.** Field-supplied 24V Class 1 wiring for special alarm. Connection made by adding normally open contacts between terminals 24 + 50. Special alarm connections may be factory-wired or field-wired. See schematic for factory wired special alarms. For field-wired special alarms, use 24V Class 1 wiring to connect normally open contacts between Terminals 24 & 50, 24 & 51, 24 & 55, or 24 & 56.
11. **SiteScan connection.** Terminals 77 (-) and 78 (+) are for connection of a 2-wire, twisted pair, communication cable (available from Liebert or others) to optional Liebert SiteScan[®].
12. **Remote condensing unit connection.** Field-supplied 24V Class 1 wiring to remote condensing unit Terminals 1, 2, 3, & 4 from (R2) relay (split system only).
13. **Smoke detector alarm connections.** Field-supplied 24V Class 1 wiring to remote alarm circuits. Factory-wired contacts from optional smoke detector are #91-comm., #92-NO, and #93-NC.
14. **Common alarm connection.** Field-supplied 24V. Class 1 wiring to common alarm Terminals 75 + 76 (and optional 94 + 95, and 96 + 97), which are factory-connected to common alarm relay (R3).

15. **Heat rejection connection.** Field-supplied 24V Class 1 wiring to interlock heat rejection from pigtails 70 + 71 which are factory-connected to compressor side switch (self-contained units only) or to GLYCOOL relay (K11, GLYCOOL units only). On Dual Cool units only, pigtails 72 + 73 connect auxiliary cooling source to GLYCOOL relay K11.
16. **Reheat and Humidifier Lockout.** Optional emergency power lockout of reheat and/or humidifier: connections provided for remote 24V AC source.
17. **Main Fan Auxiliary Switch.** Optional main fan auxiliary side switch. Terminals located in field wiring compartment for remote indication that the evaporator fan motor/unit is On. Field to connect 24V maximum.
18. **Optional Condensate Alarm** (Dual Float Condensate Pump only). Relay terminals located in field wiring compartment for remote indication.

Refer to specification sheet for full load amp. and wire size amp. ratings.

Figure 9 Electrical field connections for Liebert iCOM



DPN001733
Rev. 0

19. **Network Cable "C" Connection.** Eight-wire Ethernet cable from U2U networking switch.
20. **Network Cable "D" connection.** Eight-wire Ethernet cable from U2U networking switch. Cable "D" connection supplied on units with large Liebert iCOM display only.
21. **Opening for Field Wiring.** Suggested entry point for all field wiring to unit. Hole size Ø2.5" (63.5mm)
22. **Loose Wire Ties.** To secure field-supplied network cables. Tighten after all field-supplied wires have been installed.
23. **Vacant Liebert IntelliSlot®.** May contain optional Liebert IntelliSlot cards.
24. **Populated Liebert IntelliSlot.** Optional Liebert IntelliSlot cards may be placed in either of the two supplied Liebert IntelliSlot locations.
25. **Remote Temperature / Humidity Sensor Connection.** Six-wire CAN cable supplied with optional remote T/H sensor

2.8 Balancing the Air Distribution

2.8.1 Ducted Applications

For ducted applications, the duct work may be attached to the top perimeter of the Liebert Challenger ITR (see **Figure 2**).

The duct work on upflow units must allow access to the motors/blowers for maintenance. The duct work on upflow units must be designed within the capacity of the unit, otherwise air flow and performance will be compromised.

2.8.2 Plenum Installation

A plenum with discharge grille(s) may be installed. The plenum and instructions for its installation ship separately from the unit.

2.9 Checklist for Completed Installation

- ☐ 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. Piping completed to refrigerant or coolant loop (if required). Piping has been leak checked, evacuated and charged (if required).
- ☐ 5. Check piping within the unit & outside of the unit. Remove potential of rub-through or chaffing.
- ☐ 6. Condensate pump installed.
- ☐ 7. Drain line connected.
- ☐ 8. Water supply line connected to humidifier (if required).
- ☐ 9. Field provided pan with drain installed under all ceiling mounted fluid condensing units (if installed).
- ☐ 10. Ducting completed (if applicable).
- ☐ 11. Filter(s) installed.
- ☐ 12. Line voltage to power wiring matches equipment serial tag.
- ☐ 13. Power wiring connections completed between disconnect switch, evaporator and condensing unit, including earth ground.
- ☐ 14. Power line circuit breakers or fuses have proper ratings for equipment installed.
- ☐ 15. Control wiring connections completed to evaporator and condensing unit.
- ☐ 16. Verify water detection is properly installed around all units (if installed).
- ☐ 17. All wiring connections are tight.
- ☐ 18. Control panel DIP switches set based on customer requirements.
- ☐ 19. Foreign materials have been removed from, in and around all equipment installed (literature, shipping materials, construction materials, tools, etc.).
- ☐ 20. Fans and blowers rotate freely.
- ☐ 21. Inspect all piping connections for leaks during initial operations. Correct as needed.
- ☐ 22. Verify that a blank startup sheet has been sent with the unit(s) and is ready to be completed by the installer.

3.0 AIR-COOLED MODELS—SELF-CONTAINED COMPRESSOR

3.1 Condenser Location

The air-cooled condenser should be located for maximum security and maintenance accessibility. Avoid ground level sites with public access or areas that contribute to heavy snow or ice accumulations. Utilize centrifugal condensers whenever interior building locations must be used. To assure adequate air supply, it is recommended that condensers be located in a clean air area, away from loose dirt and foreign matter that may clog the coil. In addition, condensers should not be located in the vicinity of steam, hot air, or fume exhausts. Also, condensers should be located no closer than three feet (1 meter) from a wall, obstruction, or adjacent unit.



NOTE

If the condenser is located below the level of the room unit, the factory should be consulted.

Install condensers in a level position to assure proper refrigerant flow and oil return. For roof installation, mount condensers on steel supports in accordance with local codes. To minimize sound and vibration transmission, mount steel supports across load bearing walls. For ground installation, a concrete pad will provide adequate support. Condenser legs have mounting holes for securing the condenser to the steel supports or concrete pad.

3.2 Electrical Connections

Refer to equipment nameplate regarding wire size and circuit protection requirements. Refer to electrical schematic when making connections. Make all wiring and electrical connection in accordance with local and national codes.



WARNING

Risk of electric shock. Can cause injury or death.

Potentially lethal voltages exist within this equipment during operation. Observe all cautions and warnings on unit and in this manual.

The Liebert iCOM microprocessor does not isolate power from the unit, even in the “Unit Off” mode. 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.

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

3.2.1 Line Voltage

Line voltage electrical service is required for all air-cooled condensers at the location of the condenser. This power supply does not have to be the same voltage as the indoor unit. This separate power source may be 208, 230, 460, or 575 V, 60 Hz; or 200, 230, or 380/415 V, 50 Hz. The disconnect switch may be factory-supplied and mounted in the electrical panel or field-supplied and mounted per local and national codes.

3.2.2 Low Voltage

A control interlock between the condenser and the indoor unit is required and is connected between 70 and 71 in the handy box of the indoor unit and the electric panel of the air-cooled condenser. NEC Class 1 wiring is required.

3.2.3 Liebert Lee-Temp/Flood Back Head Pressure Control Condensers

Liebert Lee-Temp condensers require a separate power supply for the heated receivers. This power supply is connected to the electrical connection box on the end of the receiver.

Figure 10 Air-cooled condensers

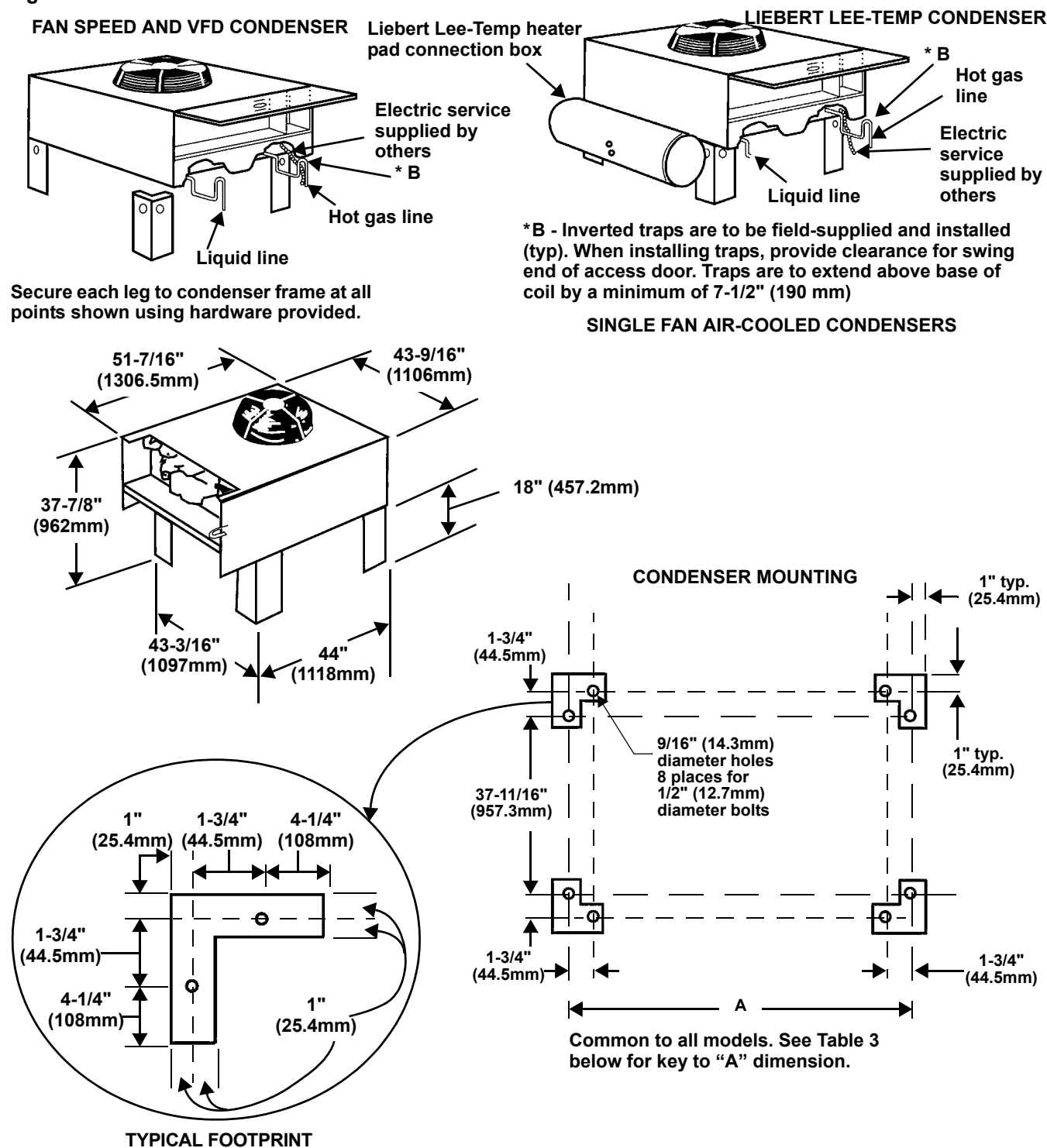


Table 3 Air-cooled condenser statistics

Model	Number of Fans	Connection Sizes (OD Copper)		Net Weight lb (kg)	"A" Dimension in (mm)
		Hot Gas (in.)	Liquid (in.)		
083	1	7/8	5/8	295 (133.8)	42 (1067)
104	1	1-1/8	5/8	315 (142.8)	42 (1067)
165	2	1-1/8	7/8	425 (193)	82 (2083)

3.3 Refrigerant Piping

All refrigeration piping should be installed with high temperature brazed joints. Prevailing good refrigeration practices should be employed for piping supports, leak testing, dehydration and charging of the refrigeration circuits.

Unit refrigeration components and piping are shipped from the factory with a nitrogen holding charge.

NOTICE

Risk of improper installation. Can cause equipment and property damage.

The refrigeration piping should be isolated from the building by the use of vibration isolating supports.

When installing field piping, care must be taken to protect all refrigerant lines from the atmosphere, especially when using refrigerants with POE oils. Do not allow the piping to stand open to air for more than 15 minutes. Units designed for R407C have a compressor that contains POE oil that is very hygroscopic; that is, it quickly absorbs water from the air. The longer the compressor piping is left open to air, the harder it will be to fully evacuate. If left open too long, the POE oil may need to be replaced before achieving the required vacuum level.

Keep the evaporator unit and condenser closed with their factory charge of dry nitrogen while all field piping is installed. Keep the field piping clean and dry during installation, and do not allow it to stand open to the atmosphere. When all the field interconnecting piping is in place, vent the condenser dry nitrogen charge and connect to the field piping. Finally, vent the evaporator unit dry nitrogen charge and make its piping connections last.

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



NOTE

Piping, including inverted trap(s), must be routed to allow unobstructed access to the panel per the NEC.

Traps should be installed in the hot gas line on vertical risers at the base and every 25 feet (7.6 meters) in elevation. These traps will collect condensed refrigerant and refrigerant oil during the Off cycle of the unit and ensure flow of refrigerant oil during operation.

A check valve is factory-supplied with the unit to be field-installed on the discharge side of the scroll compressor. Be sure to install the check valve with the refrigerant flow in the proper direction. When soldering or brazing the valve, it is very important to protect the internal parts by wrapping the valve with a damp cloth to keep the valve temperature below 250°F (121°C).

Approval is required whenever:

- a refrigerant piping run exceeds 150 ft. (46m) equivalent length
- an R407C system condenser must be located below the level of the cooling coil.

Total discharge line pressure drop must not exceed 10 PSIG (69 kPa).

Consult your local Liebert representative when considering installations outside these guidelines.

Table 4 Recommended line sizes—OD copper (inches)*

Equivalent Length ft. (m)	067A (065A)	
	Hot Gas Line	Liquid Line
50 (15)	7/8	1/2
100 (30)	7/8	5/8
150 (45)	7/8	5/8

* Recommended vertical line sizes must be used for proper oil return at all cooling and dehumidification steps.

Table 5 Equivalent lengths (feet) for various pipe fittings

Copper Pipe O.D. in.	90 Degree Elbow Copper	90 Degree Elbow Cast	45 Degree Elbow	Tee	Gate Valve	Globe Valve	Angle Valve
1/2	0.8	1.3	0.4	2.5	0.26	7.0	4.0
5/8	0.9	1.4	0.5	2.5	0.28	9.5	5.0
3/4	1.0	1.5	0.6	2.5	0.3	12.0	6.5
7/8	1.45	1.8	0.8	3.6	0.36	17.2	9.5
1-1/8	1.85	2.2	1.0	4.6	0.48	22.5	12.0
1-3/8	2.4	2.9	1.3	6.4	0.65	32.0	16.0
1-5/8	2.9	3.5	1.6	7.2	0.72	36.0	19.5

Refrigerant trap = 4 times equivalent length of pipe per this table.

Table 6 Indoor unit refrigerant charge lb (kg)

Model	R407C
	Approximate Charge lb (kg)
67A/65A	1.4 (0.6)

Table 7 Line charges - refrigerant per 100ft. (30m) of Type “L” copper tube

O.D.	R407C	
	Liquid Line lb (kg)	Hot Gas Line lb (kg)
1/2"	7.3 (3.3)	1.3 (0.6)
5/8"	11.7 (5.3)	2.1 (1.0)
3/4"	16.6 (7.5)	3.0 (1.4)
7/8"	24.4 (11.1)	4.4 (2.0)

Table 8 Condenser refrigerant (per serial tag)

Model	R407C	
	Approximate Charge lb (kg)	
	Fan Speed	Liebert Lee-Temp*
083	8 (3)	25 (12)
104	9 (4)	37 (17)
165	15 (6.8)	50 (22.7)

* Charge includes the receiver charge.

3.4 Fan Speed Control Systems

The Variable Fan Speed Control systems (FSC & VFD) uses pressure-activated electronic fan speed control systems and remotely located thermostat(s) to ensure operation at ambient temperatures as low as 0°F (-18°C). For this ambient temperature range, the VFD Control Condenser must be used with digital scroll indoor units and can be used for energy savings with any Liebert Challenger ITR unit.

Variable Fan Speed Control Piping

A discharge line and a liquid line must be field-installed between the indoor unit and the outdoor condenser. See **Figures 11** and **12** for details.

Variable 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

Variable 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 a scroll or digital scroll compressor 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 11 and 12**).*

1. If unit power is available, open the unit liquid line solenoid valves using the evacuation function in the diagnostic section of the Liebert iCOM control (refer to the Liebert 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 scroll and digital scroll compressors, connect refrigerant gauges to the suction rotalock valves and discharge line Schrader valves (see **Note** above) on the compressor.
3. 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.
4. 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.
5. After four hours, check the pressure readings and, if they have not changed, break vacuum with dry nitrogen. Pull a second and third vacuum to 250 microns or less. Recheck the pressure after two hours. After completing this step, proceed to **Variable Fan Speed Charging on page 23**.

Variable 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 **2.9 - 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 5, 6, 7 and 8**.
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. Emerson 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 the system in the diagnostic section of the Liebert iCOM control (see Liebert 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 9 Fan speed suction pressure transducer settings

Function	R-407C	
	Gauge (Sea Level)	Absolute
	psiG (kPa)	psiA (kPa)
Pump-Down Cutout	20 (138)	35 (241)
Pump-Down Reset	65 (448)	80 (552)
Minimum to Start-Cooling	35 (241)	50 (344)
Low-Pressure Cutout (DX only)	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 variable 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).

Figure 11 General arrangement—Air-cooled models with fan speed control

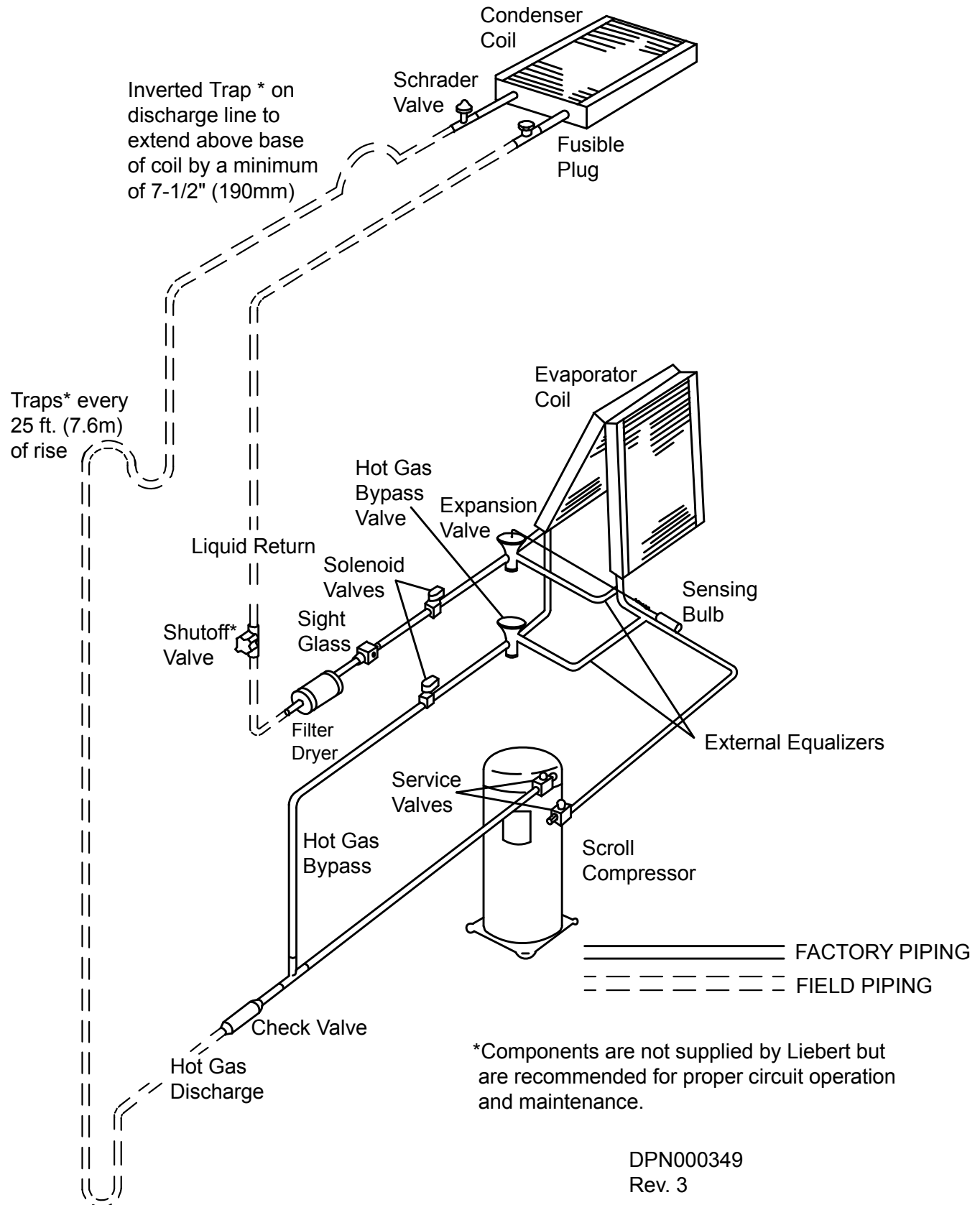
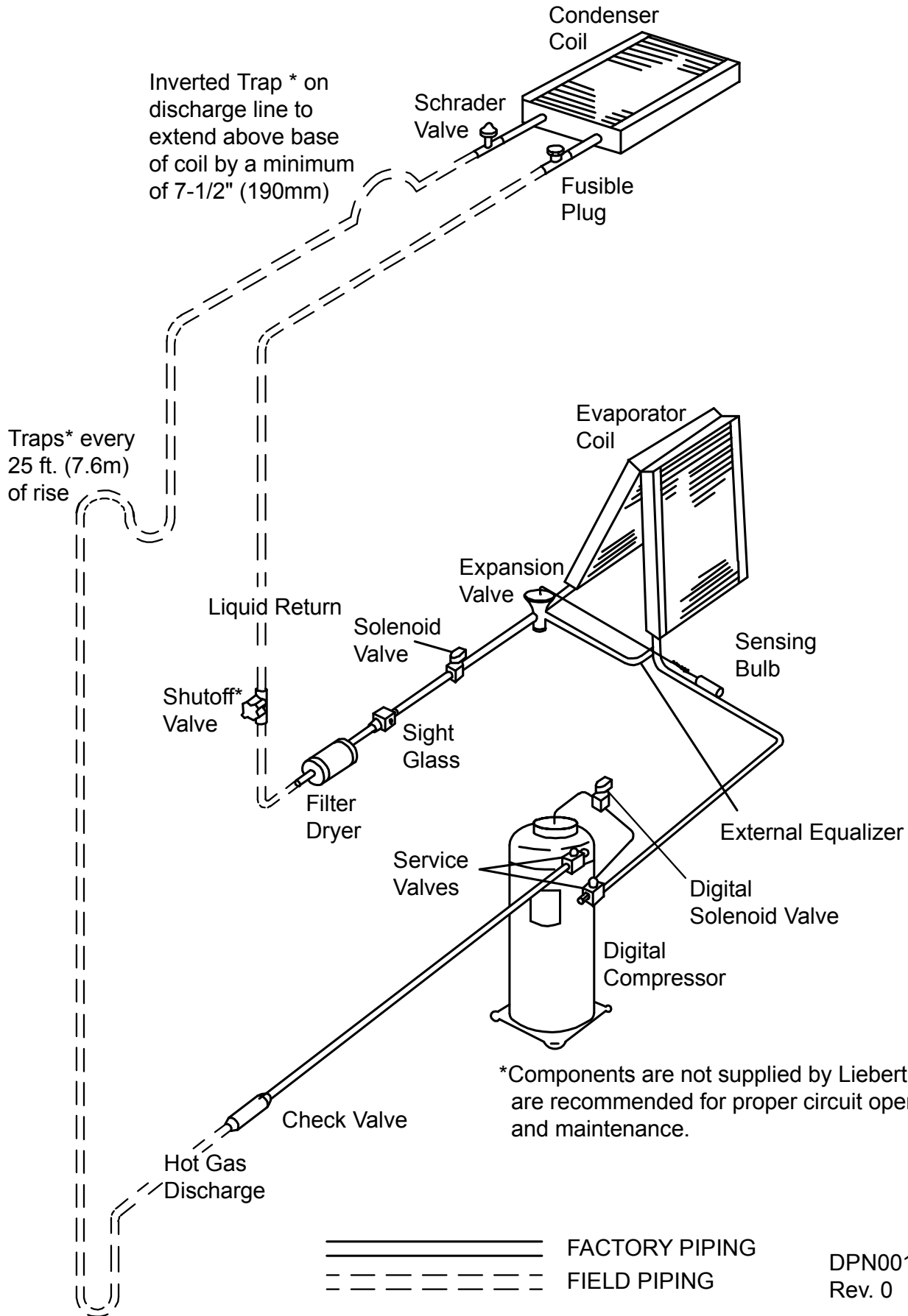


Figure 12 General arrangement—Air-cooled models with digital scroll and fan speed control



DPN001726
Rev. 0

3.5 Air-Cooled Condenser with Liebert Lee-Temp “Flooded Condenser” Head Pressure Control System

The Liebert 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). The Liebert Lee-Temp system can be used with any compressor choice.

Liebert Lee-Temp Piping

A discharge line and a liquid line must be field-installed between the indoor unit and the outdoor condenser. See **Figures 13** and **14** for details.

Liebert 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 (models with one to four fans only)
- 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, six on two-, three- and six-fan models and eight on four- and eight-fan models
- Bolts—six per receiver (3/8" x 1")
- Liebert Lee-Temp system:
 - Insulated storage receiver
 - Head pressure control valve with integral check valve
 - Service valve
 - Pressure relief valve
 - Liquid level sight glass
 - Check valve



NOTE

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

Liebert 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 14**).*

1. If unit power is available, open the unit liquid line solenoid valves using the evacuation function in the diagnostic section of the Liebert 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 scroll and digital scroll compressors, connect refrigerant gauges to the suction rotalock valves and discharge line Schrader valves (see **Note** above).
4. 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. 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.
6. After four hours, check the pressure readings and, if they have not changed, break vacuum with dry nitrogen. Pull a second and third vacuum to 250 microns or less. Recheck the pressure after two hours.
7. Remove the jumper hose installed previously from between the service valve fitting and the condenser. After completing this step, proceed to **Liebert Lee-Temp Charging**.

Liebert 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 **2.9 - 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 5, 6, 7 and 8**.
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. Emerson 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 the system in the diagnostic section of the Liebert 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 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 10 Liebert Lee-Temp suction pressure transducer settings

Function	R-407C	
	Gauge Reading (Sea Level)	Absolute
	psiG (kPa)	psiA (kPa)
Pump-Down Cutout	20 (138)	35 (241)
Pump-Down Reset	65 (448)	80 (552)
Minimum to Start-Cooling	50 (345)	65 (448)
Low-Pressure Cutout (DX only)	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.

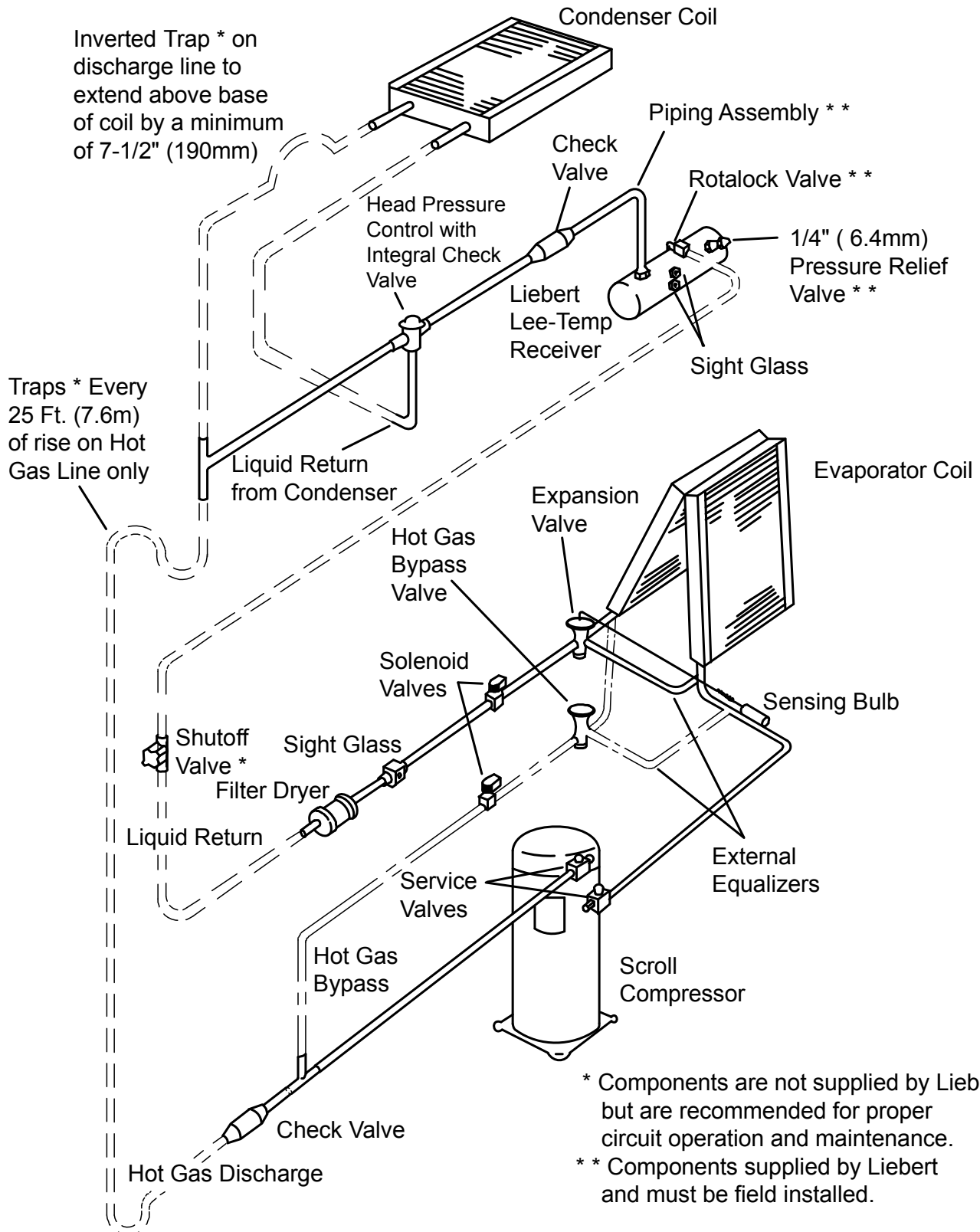
Liebert Lee-Temp Receiver Refrigerant Level

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.

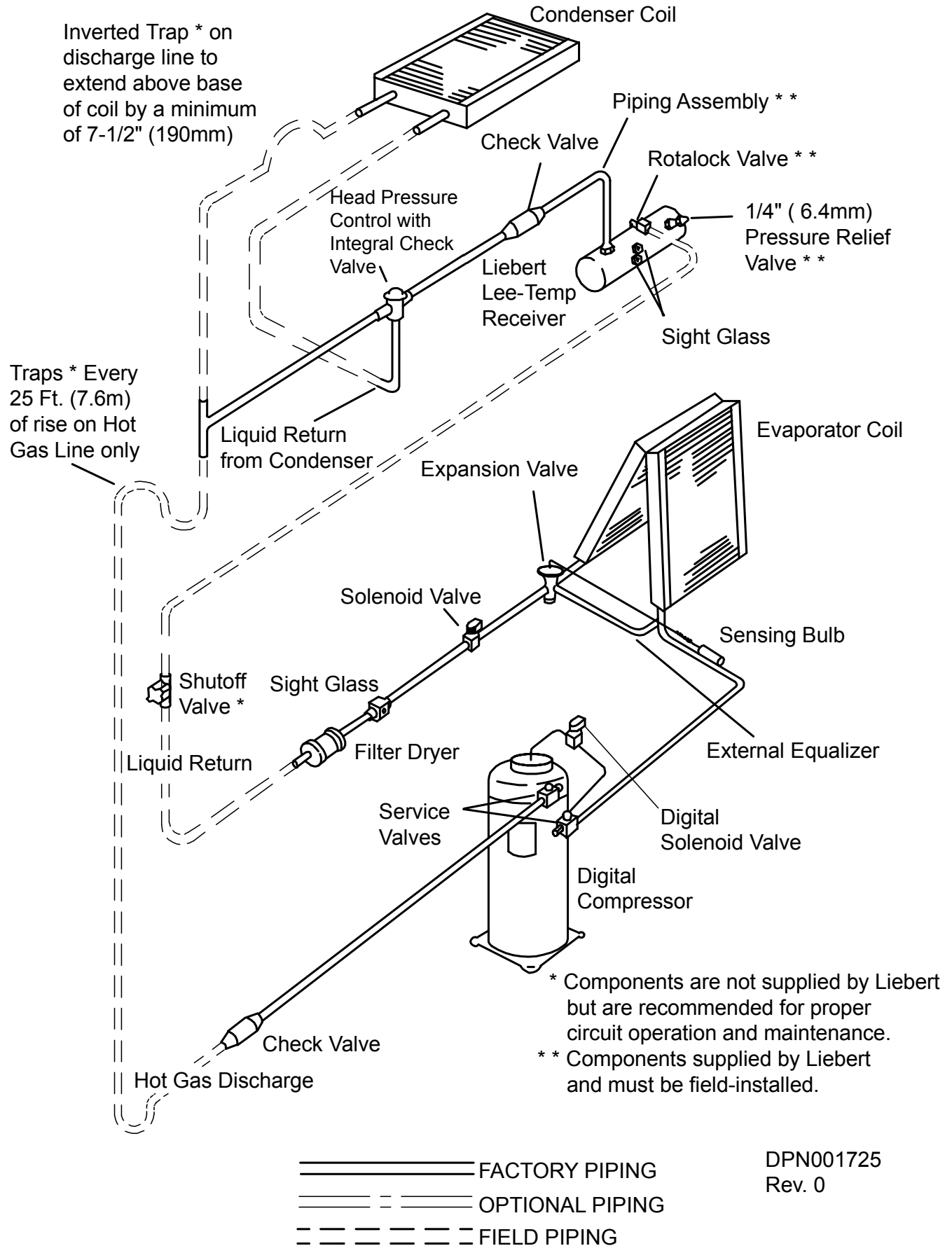
Figure 13 General arrangement—Air-cooled models with Liebert Lee-Temp



===== FACTORY PIPING
 ===== OPTIONAL PIPING
 - - - - - FIELD PIPING

DPN000674
 Rev. 02

Figure 14 General arrangement—Air-cooled models with digital scroll and Liebert Lee-Temp



4.0 WATER-COOLED MODELS—SELF-CONTAINED COMPRESSOR

4.1 Piping Considerations

Manual shutoff valves should be installed at the supply and return lines of each unit. This will provide for routine maintenance or emergency isolation of the unit.

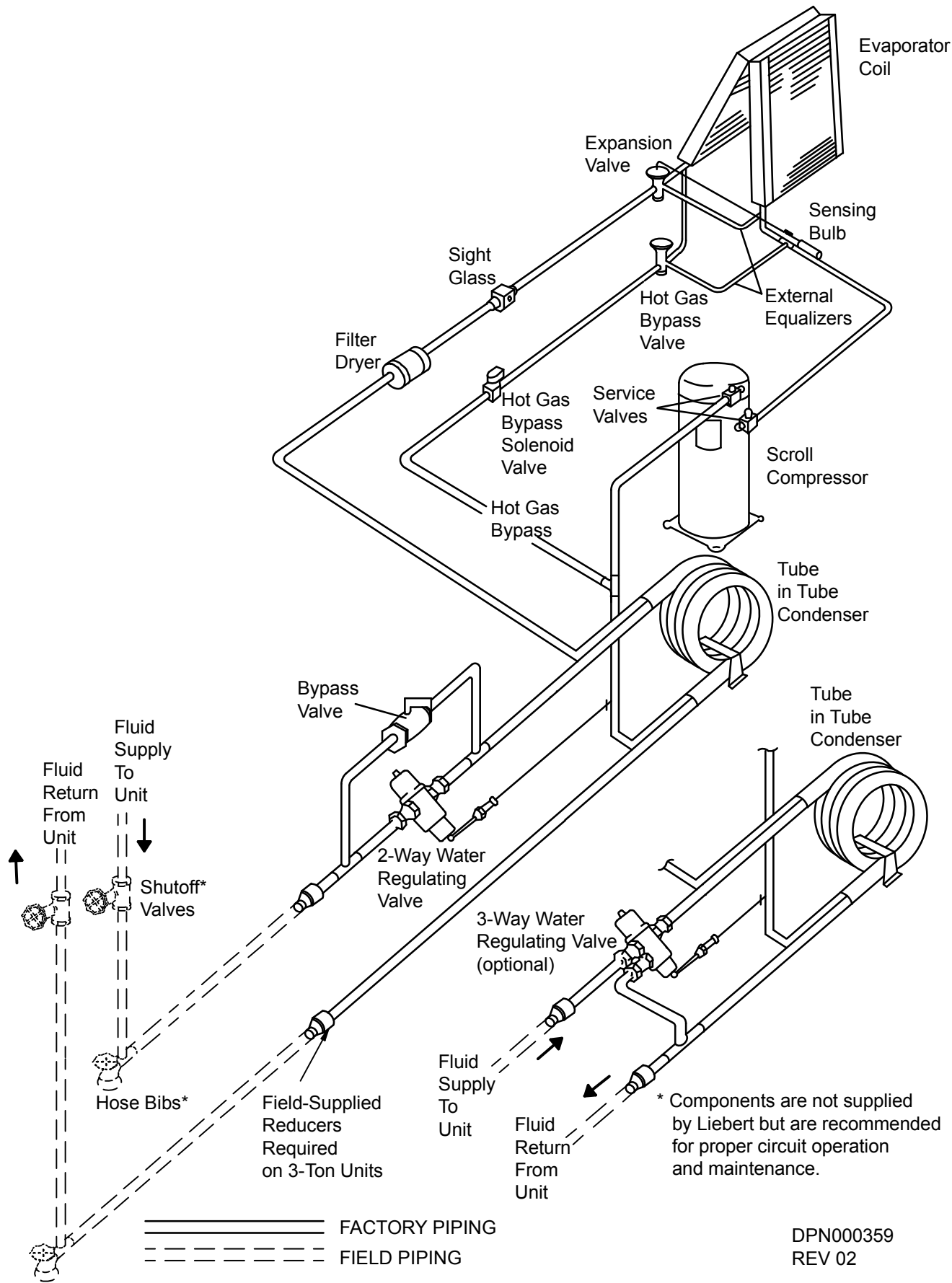
When the water source for the condenser is of poor quality, it is good practice to provide cleanable filters in the supply line. These filters will trap the particles in the water supply and extend the service life of the water-cooled condenser.

To provide for the emergency of water leaks and the consequences of sub-floor flooding, floor drains should be provided with wet traps or a water detection system such as a Liebert Liqui-tect™ sensor that is installed near the base of the unit or below the elevated floor.

4.2 Condenser

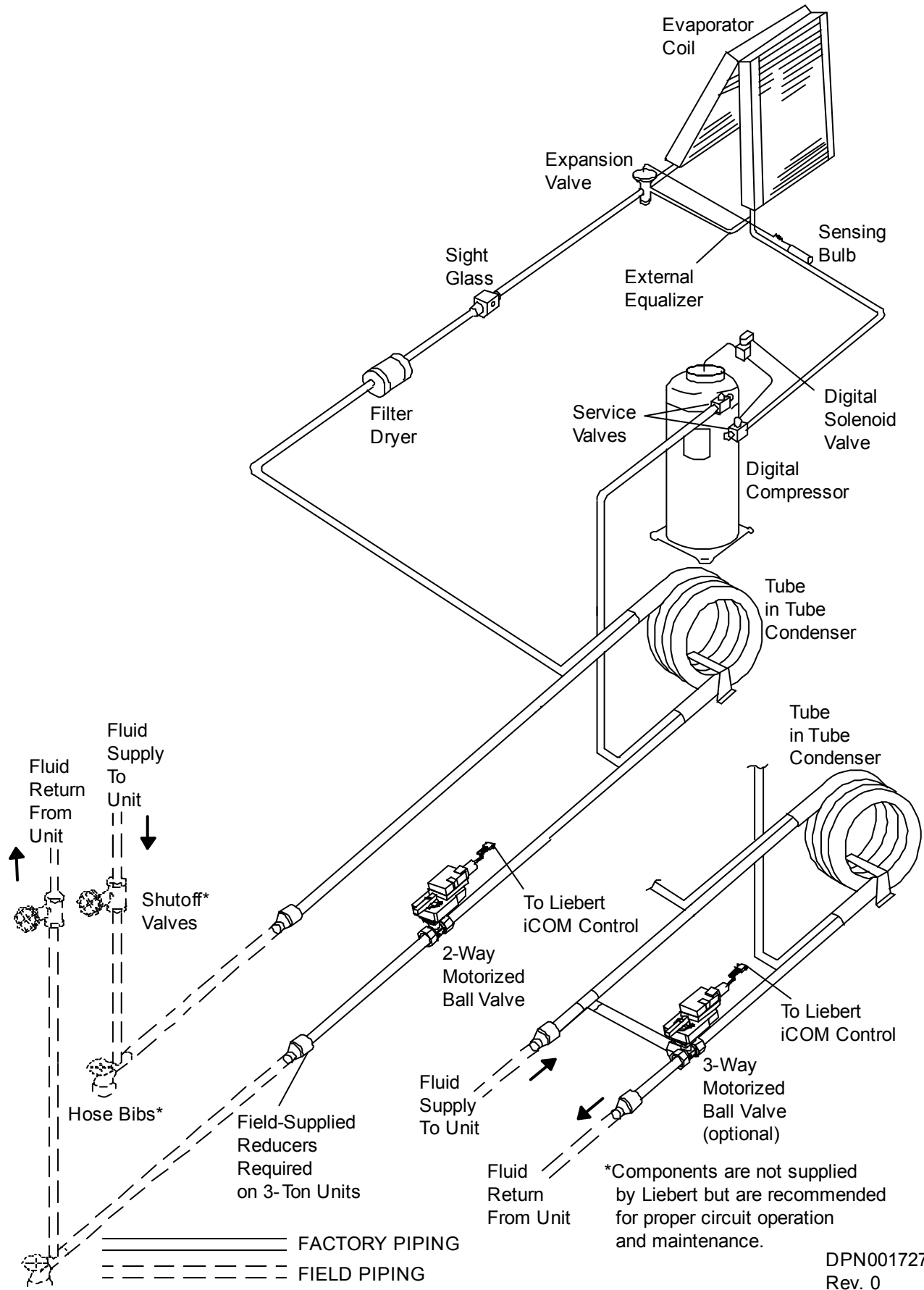
The condenser is designed to operate in conjunction with either a cooling tower or city water. The maximum water pressure is 150 psig (1034 kPa). A high pressure system rated at 350 psig (2413 kPa) is available as an option.

Figure 15 General arrangement—Water-cooled models with scroll compressor



DPN000359
REV 02

Figure 16 General arrangement diagram—Water-cooled models with digital scroll



DPN001727
Rev. 0

4.3 Water Regulating Valve

The water regulating valve automatically regulates the amount of fluid necessary to remove the heat from the refrigeration system, permitting more fluid to flow when load conditions are high and less fluid to flow when load conditions are low. The valve consists of a brass body, balance spring, valve seat, valve disc holders, capillary tube to discharge pressure, and adjusting screw.

4.3.1 Standard Valve - 150psig (1034kPa) System, High Pressure Valve - 350psig (2413kPa) System

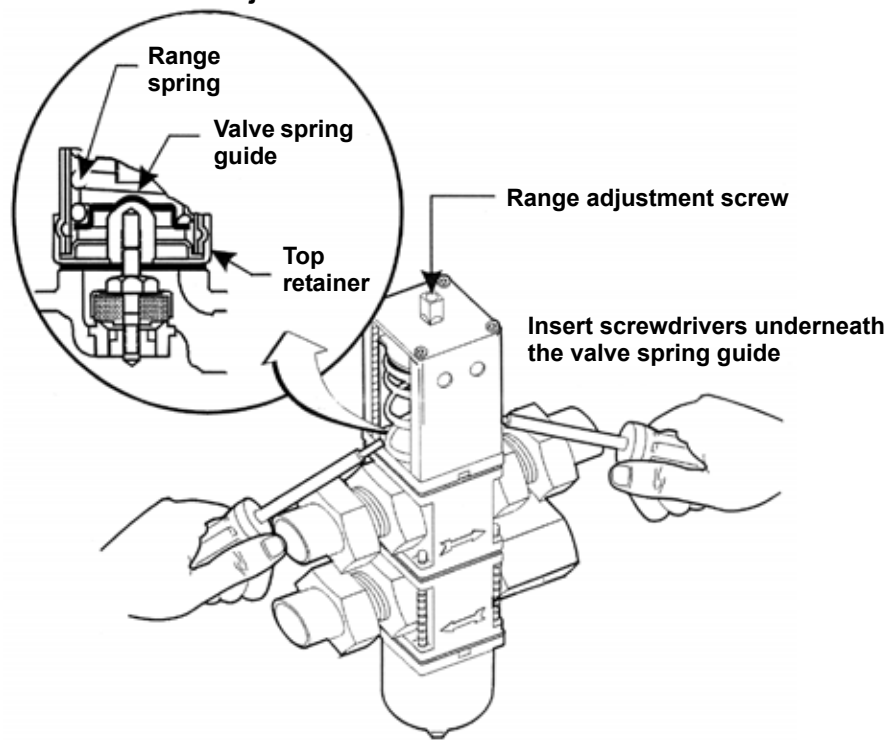
Adjustment

The valve may be adjusted with a standard refrigeration service valve wrench or screw driver.

To lower the head pressure setting, turn the square adjusting screw clockwise until the high pressure gauge indicates the desired setting.

To raise the head pressure setting, turn the adjusting screw counterclockwise until the desired setting is obtained.

Figure 17 Johnson Controls valve adjustment



4.4 Motorized Ball Valve—Digital Scroll Compressors

On digital scroll units, discharge pressure is controlled by a motorized ball valve. During unloaded operation, the pressure changes during each digital cycle could cause excessive repositions with a pressure-operated water regulating valve. The control algorithm for the motorized ball valve uses an intelligent sampling rate and adjustable pressure thresholds to reduce valve repositions. The valve assembly consists of the brass valve, linkage and actuator.

4.4.1 Control

The valve actuator operates on 24VAC power and is controlled by a 2-10VDC proportional control signal. The valve will move from fully open to fully closed in 60 seconds. At 2VDC, the valve is closed; at 10VDC, the valve is fully open. There is a 20-second delay to position the motorized ball valve before starting the compressor.

Control Method

The control utilizes an upper and lower pressure threshold with a 35psi (241kPa) deadband to reduce valve movement. If the liquid pressure is between the upper and lower threshold, the valve remains at the current position. If the liquid pressure exceeds the upper threshold the valve opens, and if the pressure falls below the lower threshold the valve closes. There are multiple adjustment bands to ease discharge pressure back into control range.

4.4.2 Adjustment

Both pressure thresholds can be shifted simultaneously over a 50psi (345kPa) range (the 35psi [241kPa] differential remains constant). The ball valve setpoint offset parameter in the Liebert iCOM Service menu can be adjusted from 0 to 50 PSI (345 kPa) to raise or lower the control band similar to the pressure adjustment on a water regulating valve. Changing the setpoint offset will adjust the pressure thresholds for both circuits. Units are factory-set at a 30psi (207 kPa) setpoint offset (30psi [207 kPa] above minimum). This results in a 220psiA (1517kPa) lower threshold and a 255psiA (1758kPa) upper threshold pressure.

4.4.3 Startup

The setpoint offset is adjusted to the minimum value during startup, then changes to the set value once the compressor reaches normal operating pressures. Changes in fluid temperature could cause pressure changes that do not result in valve movement within the deadband. Fan cycling stats should be set to prevent continuous fluid temperature swings greater than 10°F (5.6°C).

4.4.4 Location

The motorized ball valve is located in the condenser fluid return line. Three-way valves are piped in a mixing arrangement with the common port at the valve outlet.

4.4.5 Manual Control

The valve can be manually set by disconnecting AC power, depressing the manual override button on the valve actuator and adjusting the valve position with the handle. The motorized ball also can be controlled through the Liebert iCOM's Service menu using manual mode to override the normal control.

5.0 GLYCOL/GLYCOOL-COOLED MODELS—SELF-CONTAINED COMPRESSOR

5.1 Drycooler Location

The drycooler should be located for maximum security and maintenance accessibility. Avoid ground-level sites with public access or areas which contribute to heavy snow or ice accumulations. To assure adequate air supply, it is recommended that drycoolers be located in a clean air area, away from loose dirt and foreign matter that may clog the coil. In addition, drycoolers should not be located in the vicinity of steam, hot air or fume exhausts. Also, drycoolers should not be located closer than 3 feet (1 meter) from a wall, obstruction or adjacent unit.

5.2 Drycooler Installation

For roof installation, mount drycoolers on steel supports in accordance with local codes. To minimize sound and vibration transmission, mount steel supports across load bearing walls. For ground installation, a concrete pad will provide adequate support. Drycooler legs have mounting holes for securing the drycooler to steel supports or concrete pad.

5.3 Electrical Connections

Refer to equipment nameplate regarding wire size and circuit protection requirements. Refer to electrical schematic when making connections. Make all wiring and electrical connections in accordance with local and national codes.



WARNING

Risk of electric shock. Can cause injury or death.

Potentially lethal voltages exist within this equipment during operation. Observe all cautions and warnings on unit and in this manual.

The Liebert iCOM microprocessor does not isolate power from the unit, even in the “Unit Off” mode. 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.

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

5.3.1 Line Voltage

Line voltage electrical service is required for all drycoolers at the location of the drycooler. This power supply does not have to be the same voltage as the indoor unit. This separate power source may be 208, 230, 460, or 575 V, 60 Hz; or 200, 230, or 380/415 V, 50 Hz. The disconnect switch is factory-supplied and mounted in the electric panel.

5.3.2 Low Voltage

A control interlock between the drycooler and the indoor unit is required and is connected between 70 and 71 in the handy box of the indoor unit and the pump and drycooler control box of the drycooler. NEC Class 1 wiring is required.

5.3.3 Pump and Drycooler

All wiring to the pump and drycooler from the control box should be done in accordance with the electrical schematic on the inside lid of the drycooler control box and with local and national codes.

5.4 Glycol Piping

These guidelines apply to the field leak checking and fluid requirements for field piping systems.

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.

NOTICE

Risk of debris or precipitate clogging pipes. Can cause equipment damage.

Galvanized pipe must not be used in or with systems or units that contain glycol. The phosphates in the inhibitor can react with the zinc in the galvanized pipe, precipitating an insoluble material that can eventually foul the system.

Fluid-cooled condensers have small internal flow passages. To avoid clogging and other resulting system operation problems, install a 16-20 mesh filter in the fluid supply line to the indoor unit. The filter should be located where it can be easily serviced or replaced.

Do not install unit on open loop systems. Debris carried by the fluid will clog the brazed plate condenser.

NOTICE

Risk of improper installation. Can cause equipment or structural damage.

Supply and return lines must be supported in a way that keeps their weight from bearing on the piping of the unit, drycooler or pumps. Failure to support piping can strain the equipment's structural integrity.

A relief valve must be installed in the system to avoid the possibility of burst pipes. This valve may be obtained from the supplier as an option or obtained from another vendor.

Emerson recommends installing manual service shutoff valves at the supply and return connections to each unit. This enables routine service and/or emergency isolation of the unit. In addition, multiple pump packages require a check valve at the discharge of each pump to prevent back flow through the standby pump(s).

To facilitate filling, Emerson recommends installing hose bibs at the lowest point of the system.

Consideration of the minimum glycol temperature to be supplied from the drycooler will determine if the need exists to insulate the glycol supply and return lines. Insulation will prevent condensation on the glycol lines in low ambient conditions.

All fluid piping must comply with local codes. Care in sizing pipes will help reduce pumping power and operating costs.

Table 11 Room dew point temperatures

Dry Bulb °F (°C)	Wet Bulb °F (°C)	Relative Humidity	Dew Point* °F (°C)
70 (21.1)	57.2 (14.0)	45	48.0 (8.9)
70 (21.1)	58.5 (14.7)	50	50.5 (10.3)
72 (22.2)	58.9 (24.9)	45	50.0 (10.0)
72 (22.2)	60.0 (15.5)	50	52.4 (11.3)
75 (23.8)	61.2 (16.2)	45	52.4 (11.3)
75 (23.8)	62.5 (16.9)	50	55.0 (12.7)

* Minimum glycol temperature before condensation will occur.

5.4.1 Expansion Tanks, Fluid Relief Valves and Other Devices

An expansion tank must be provided for expansion and contraction of the fluid due to temperature change in this closed system. Vents are required at system high points to vent trapped air when filling the system. A relief valve is also a necessary piping component.

Depending on the complexity of the system, various other devices may be specified. Pressure gauges, flow switches, automatic air separator, tempering valves, standby pumps, sensors for electrical controls, and flow switches are just a few of these devices.

NOTICE

Risk of freezing temperatures. Can cause equipment and piping damage.

Immediately following the use of water for leak testing or system cleaning, charge the tested system with the proper percentage of glycol and water for your coldest design ambient.

Complete system drain-down cannot be assured and damage to the system could result from freezing of residual water.

5.5 Filling Instructions

5.5.1 Preparing the System for Filling

It is important to remove any dirt, oil or metal filings that may contaminate the cooling system piping in order to prevent contamination of the fresh glycol solution and fouling of the drycooler piping. The system should be flushed thoroughly using a mild cleaning solution or high-quality water and then completely drained before charging with glycol. Cleaning new systems is just as important as cleaning old ones. New systems can be coated with oil or a protective film; dirt and scale are also common. Any residual contaminants could adversely affect the heat transfer stability and performance of your system. In many cases, in both old and new systems, special cleaners are needed to remove scale, rust and hydrocarbon foulants from pipes, manifolds and passages. Clean heat transfer surfaces are important in maintaining the integrity of the heating/cooling system. For more information on cleaners and degreasers, contact your sales representative. Follow the manufacturer's instructions when using these products.

Calculate the internal volume of the system as closely as possible. See **Table 12** and **Table 14** for unit volumes. Use volume in **Table 13** for glycol piping volumes.

Table 12 Indoor unit glycol volume approximate gallons (liters) max.

Model (50 Hz)	Glycol-Cooled	GLYCOOL
071WG/(070WG)	2.0 (7.5)	—
061G/(058G)	—	4.0 (15.1)

Table 13 Volume in standard Type “L” copper piping

Diameter (in.)		Volume	
Outside	Inside	Gal/Ft	L/M
1/2	0.123	0.008	0.01
5/8	0.555	0.012	0.15
3/4	0.666	0.018	0.22
7/8	0.785	0.025	0.31
1-1/8	1.025	0.043	0.53

5.5.2 Glycol Solutions



NOTE

Glycol solutions should be considered for protection of the coil. When it is not used, damage can occur from either freezing or corrosion from water.

When considering the use of any glycol products in a particular application, you should review the latest Material Safety Data Sheets and ensure that the use you intend can be accomplished safely. For Material Safety Data Sheets and other product safety information, contact the supplier nearest you. Before handling any other products mentioned in the text, you should obtain available product safety information and take necessary steps to ensure safety of use.

NOTICE

Risk of improper handling of glycol. Can cause environmental damage and violate national, regional and local laws.

When mishandled, glycol products pose a threat to the environment. Before using any glycol products, review the latest Material Safety Data Sheets and ensure that you can use the product safely.

Glycol manufacturers request that the customer read, understand and comply with the information on the product packaging and in the current Material Safety Data Sheets. Make this information available to anyone responsible for operation, maintenance and repair of the drycooler and related equipment.

No chemical should be used as or in a food, drug, medical device or cosmetic or in a product or process in which it may contact a food, drug, medical device, or cosmetic until the user has determined the

suitability and legality of the use. Since government regulations and use conditions are subject to change, it is the user's responsibility to determine that this information is appropriate and suitable under current, applicable laws and regulations.

NOTICE

Risk of using improper cooling agent. Can cause reduced cooling performance and damage to equipment and piping.

Proper formulations of inhibited formula ethylene glycol and propylene glycol must be used in the Liebert Challenger ITR system. Automotive antifreeze is unacceptable and must NOT be used.

Typical inhibited formula ethylene glycol and propylene glycol manufacturers and suppliers are Union Carbide (Ucartherm) or Dow Chemical (Dowtherm SR-1, Dowfrost). These glycols are supplied with corrosion inhibitors and do not contain a silicone anti-leak formula. Commercial ethylene glycol, when pure, is generally less corrosive to the common metals of construction than water itself. Aqueous solutions of these glycols, however, assume the corrosivity of the water from which they are prepared and may become increasingly corrosive with use if not properly inhibited.

There are two basic types of additives: corrosion inhibitors and environmental stabilizers. The corrosion inhibitors function by forming a surface barrier that protects the metals from attack. Environmental stabilizers, while not corrosion inhibitors in the strictest sense of the word, decrease corrosion by stabilizing or favorably altering the overall environment. An alkaline buffer such as borax is a simple example of an environmental stabilizer since its prime purpose is to maintain an alkaline condition (pH above 7).

The percentage of glycol to water must be determined by using the lowest design outdoor temperature in which the system is operating. **Table 14** indicates the solution freeze point at several concentration levels of ethylene glycol. Propylene glycol concentrations should be 1% higher than the ethylene glycol table values to find the freeze point. For example, 41% propylene glycol freezes at -10°F.

Table 14 Ethylene glycol concentrations

% Glycol by Volume	0 *	10	20	30	40	50
Freezing Point °F (°C)	32 (0)	25 (-3.9)	16 (-8.9)	5 (-15.0)	-10 (-23.3)	-32 (-35.5)
Apparent Specific Gravity @ 50°F (10°C)	1	1.014	1.028	1.042	1.057	1.071

* A minimal amount of glycol should be considered for inhibitive coil protection.

NOTICE

Risk of corrosion from water impurities. Can cause equipment damage.

The quality of water used for dilution must be considered because water may contain corrosive elements which reduce the effectiveness of the inhibited formulation. Water that is classified as soft (low in chloride and sulfate ion content less than 100 parts per million each) should be used.

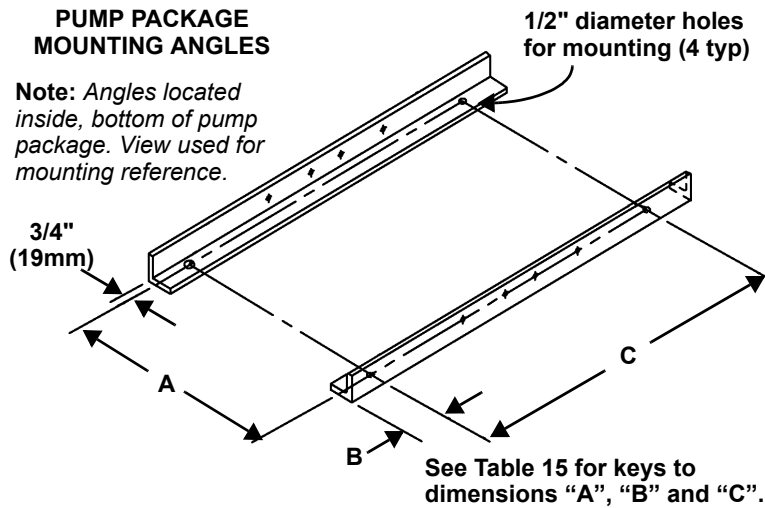
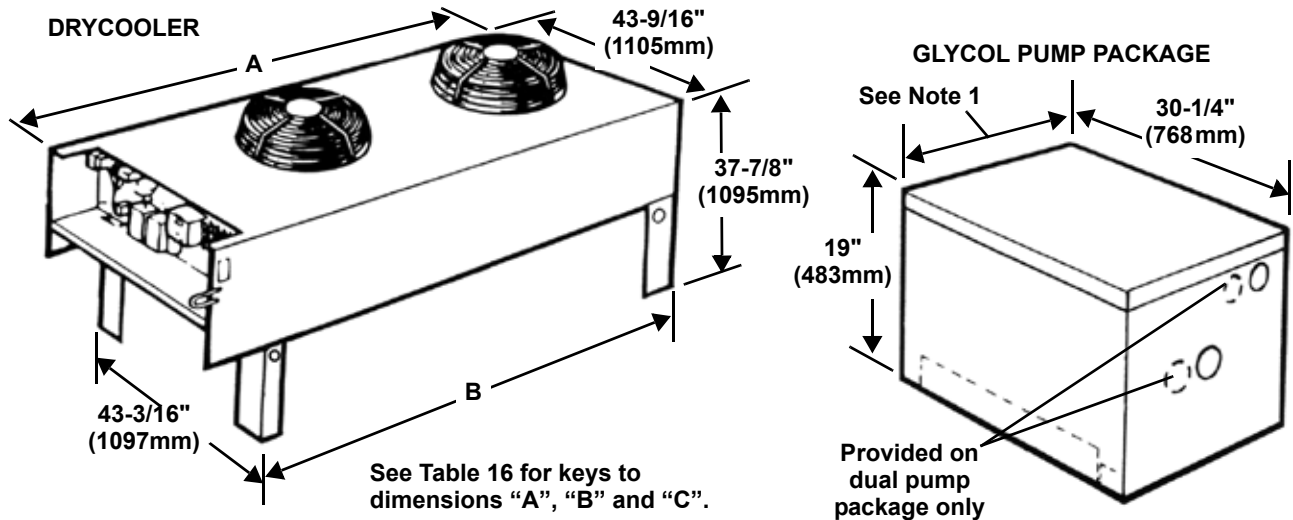
5.5.3 Filling the System

Installation of hose bibs at the lowest point of the system is recommended. When filling a glycol system keep air to a minimum. Air in glycol turns to foam and is difficult and time-consuming to remove. (Anti-foam additives are available and may be considered.) Open all operating systems to the loop. With the top vent(s) open, fill the system from the bottom of the loop. This will allow the glycol to push the air out of the top of the system, minimizing trapped air. Fill to approximately 80% of calculated capacity. Fill slowly from this point, checking fluid levels until full.

**NOTE**

For glycol solution preparation and periodic testing, follow manufacturer's recommendations. Do not mix products of different manufacturers.

Figure 18 Drycoolers and pump packages



Notes

1. Single pump packages are 17-1/4" (438 mm) wide. Dual pump packages are 32-1/4" (819 mm) wide.
2. Mounting holes are 15-1/4" (387 mm) apart on single pump packages and 30-1/4" (768 mm) apart on dual pump packages.
3. Connection sizes apply to primary pump supplier.

For expansion tank dimensions, see Figure 19 on page -42.

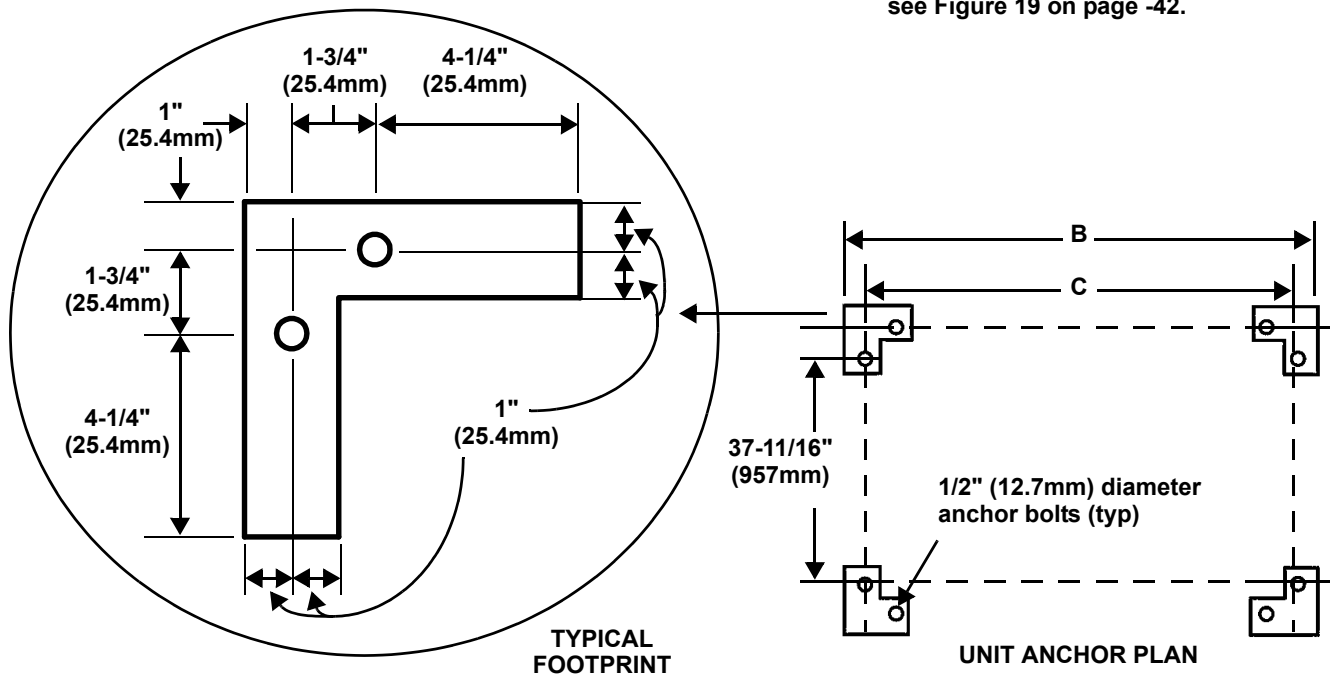
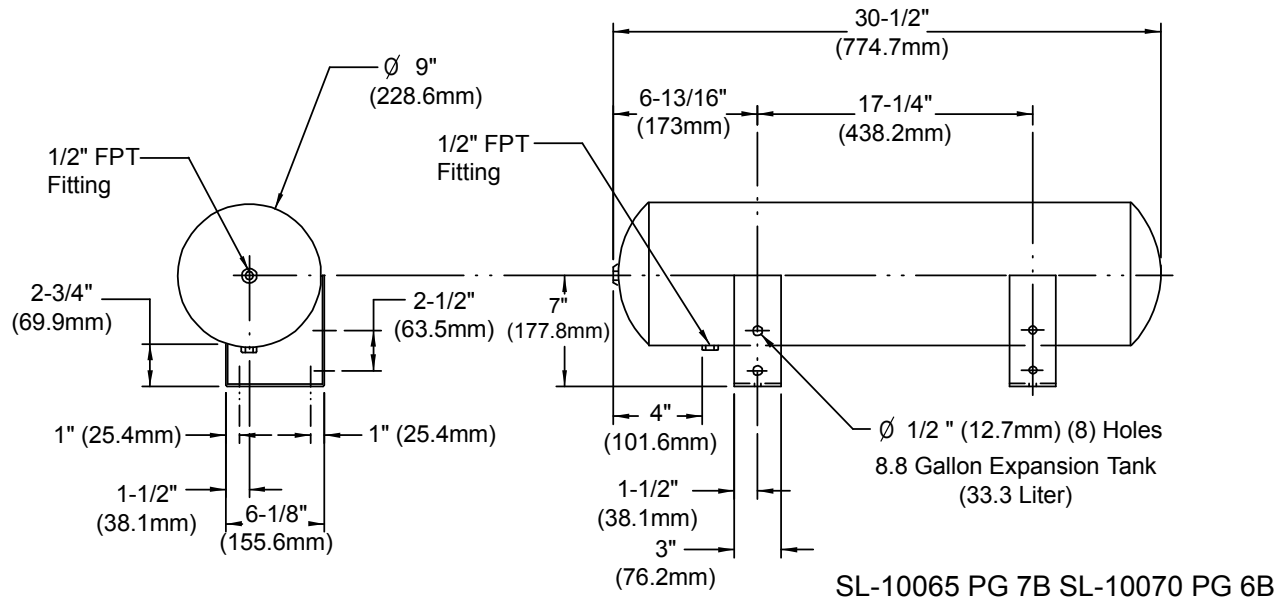


Figure 19 Pump packages—expansion tank

Table 15 Mounting hole dimensional data

PUMP PACKAGE	A in (mm)	B in (mm)	C in (mm)
SINGLE (0.75 - 7.5 hp)	15-1/4 (387.4)	2-1/2 (63.5)	22-1/2 (571.5)
DUAL (0.75 - 5 hp)	30-1/4 (768.4)	2-1/2 (63.5)	22-1/2 (571.5)

Table 16 Drycooler data

Model No.	No. of Fans	Weight lb (kg)	Drycooler Conn. Sizes (Suct. & Disc.) in.	"A" Dimension in. (mm)	"B" Dimension in. (mm)	"C" Dimension in. (mm)	Coil Internal Volume gal. (l)
-069	1	410 (186)	1-1/4	51-1/2 (1308)	44 (1118)	42 (1067)	2.4 (9.2)
-092	1	430 (195)	1-1/2	51-1/2 (1308)	44 (1118)	42 (1067)	3.7 (13.9)
-109	1	450 (204)	2	51-1/2 (1308)	44 (1118)	42 (1067)	4.9 (18.6)
-112	1	470 (213)	2	51-1/2 (1308)	44 (1118)	42 (1067)	5.8 (22.0)
-139	2	565 (256)	2	91-1/2 (2324)	84 (2134)	82 (2083)	4.8 (18.2)
-197	2	605 (274)	2	91-1/2 (2324)	84 (2134)	82 (2083)	9.0 (34.1)

Table 17 Glycol pump data*

Pump		Pump Suction Connection in.	Pump Discharge Connection in.
Hp	Hz		
3/4	60	1-1/4	3/4
1-1/2	60	1-1/4	3/4
2	60	1-1/4	3/4
3	60	1-1/2	1
5	60	1-1/2	1-1/4
3/4	50	1-1/4	3/4
1	50	1-1/4	3/4
1-1/2	50	1-1/4	3/4
2	50	1-1/4	3/4
3	50	1-1/2	1-1/4

* Connection sizes apply to primary pump supplier

Figure 20 General arrangement—Glycol-cooled models with scroll compressor

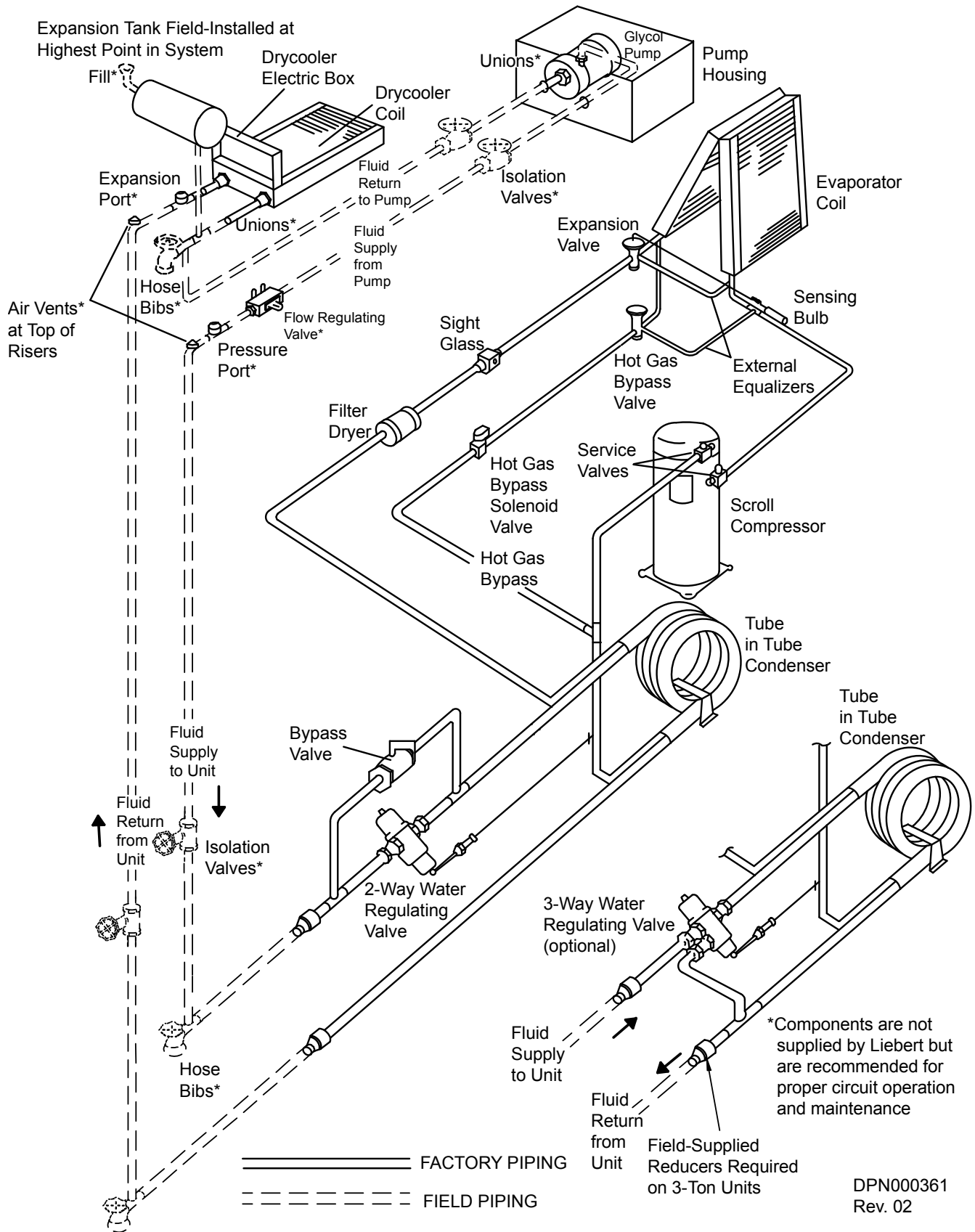


Figure 21 General arrangement—Glycol-cooled models with digital scroll

Expansion Tank Field-Installed at Highest Point in System.

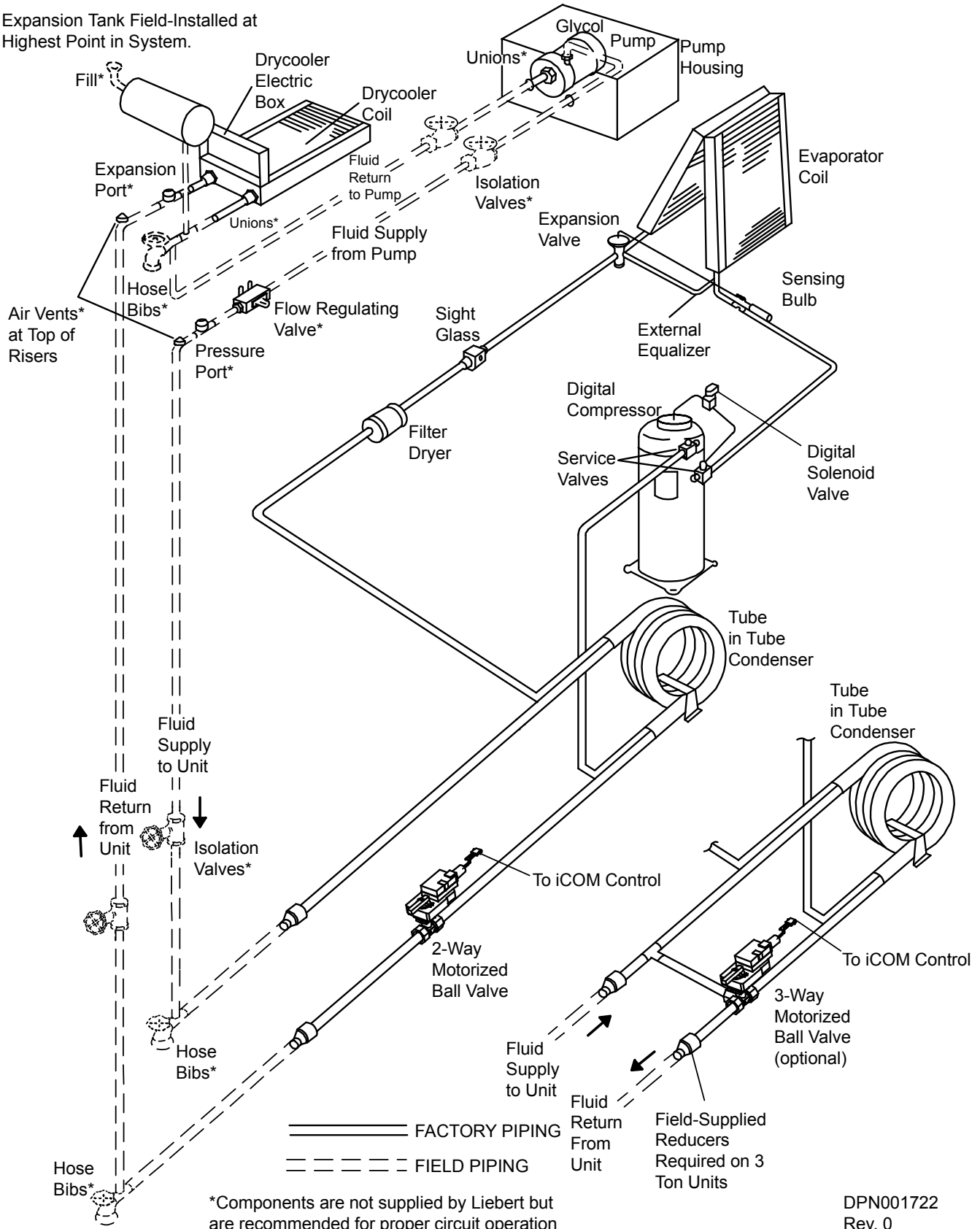


Figure 22 General arrangement—GLYCOOL models with scroll compressor

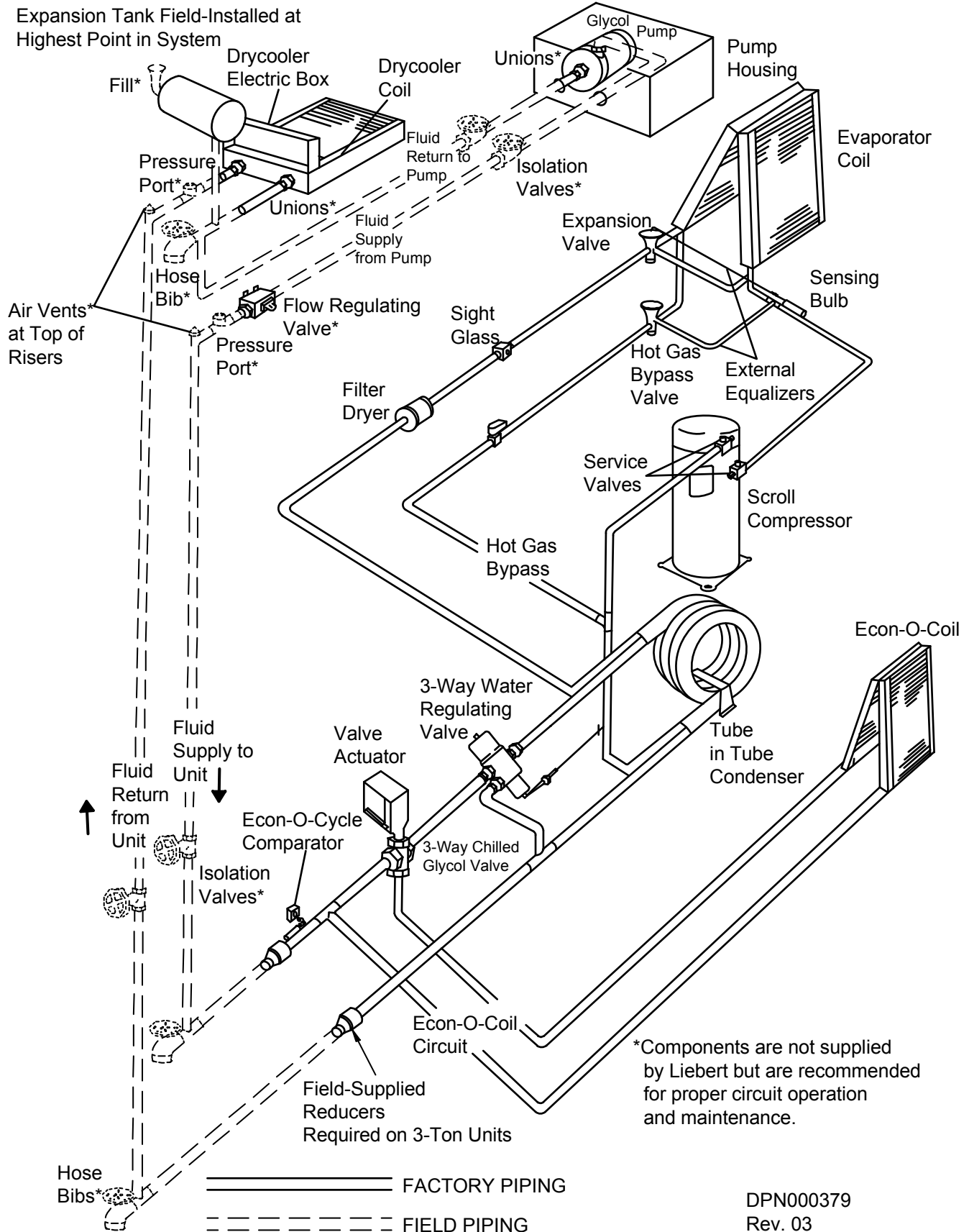
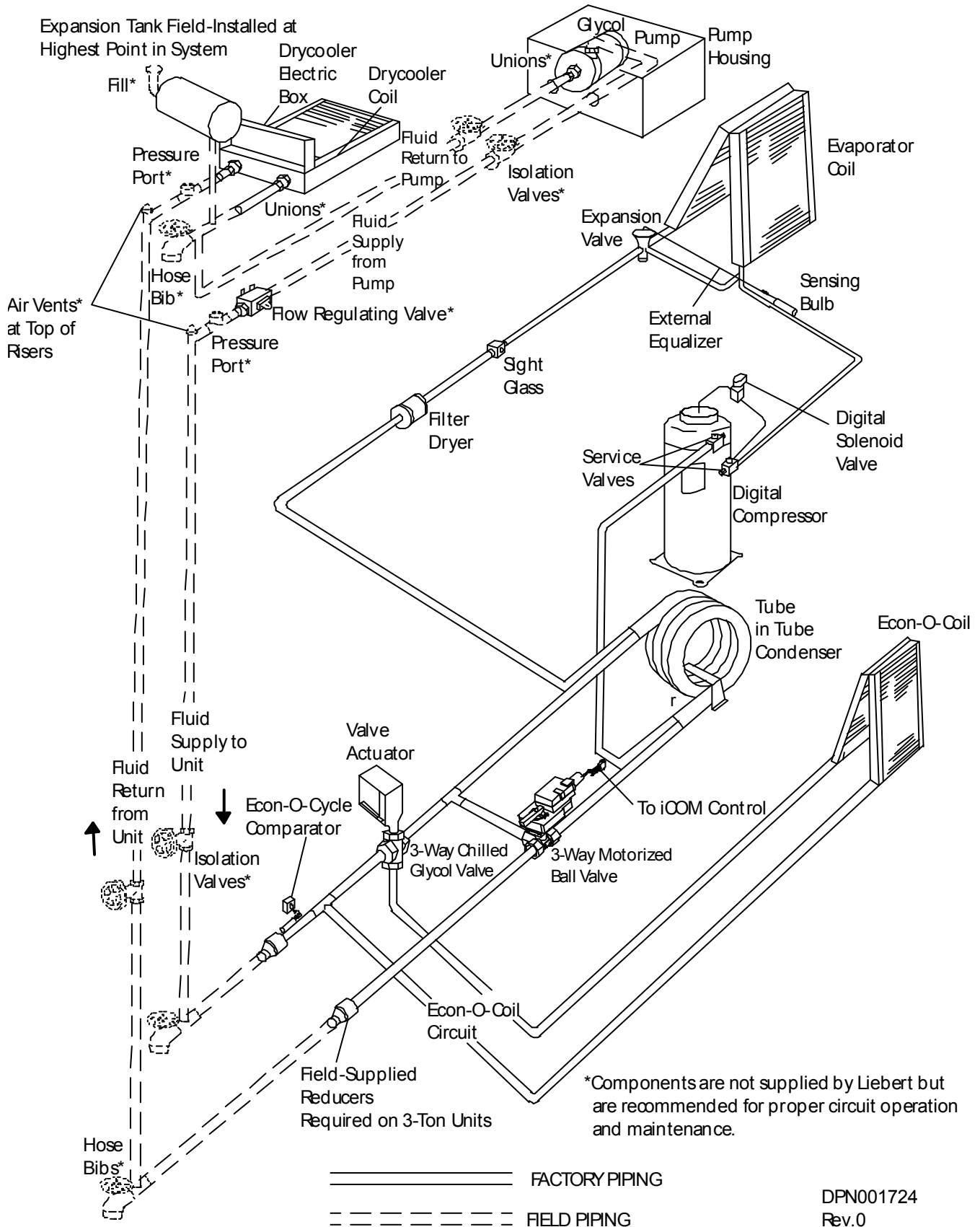


Figure 23 General arrangement—GLYCOOL models with digital scroll compressor



5.5.4 Motor Ball Valve—Digital Scroll Compressors

Refer to 4.4 - Motorized Ball Valve—Digital Scroll Compressors for details on the motorized ball valve.

5.6 Condenser

The condenser is designed to operate in conjunction with a drycooler. The maximum coolant pressure is 350 psig (2413 kPa).

5.7 Glycol Regulating Valve

The glycol regulating valve automatically regulates the amount of coolant necessary to remove the heat from the refrigeration system, permitting more fluid to flow when load conditions are high and less fluid to flow when load conditions are low. The valve consists of a brass body, balance spring, valve seat, valve disc holders, capillary tube to discharge pressure, and adjusting screw.

5.7.1 Standard Valve - 150psig (1034kPa) System, High Pressure Valve - 350psig (2413kPa) System

For details, refer to 4.3.1 - Standard Valve - 150psig (1034kPa) System, High Pressure Valve - 350psig (2413kPa) System.

5.7.2 Testing Valve Function

When the refrigeration system has been Off for approximately 10-15 minutes, the coolant flow should stop.

Should the coolant continue to flow, the valve is either improperly adjusted (head pressure is too low) or the pressure sensing capillary is not connected properly to the condenser.

Table 18 Refrigerant control settings psi (kPa)

Low Pressure Cut Out	Low Pressure Cut In	High Pressure Cut Out
20 (137.9)	65 (448.2)	400 (2758)

6.0 CHILLED WATER MODELS

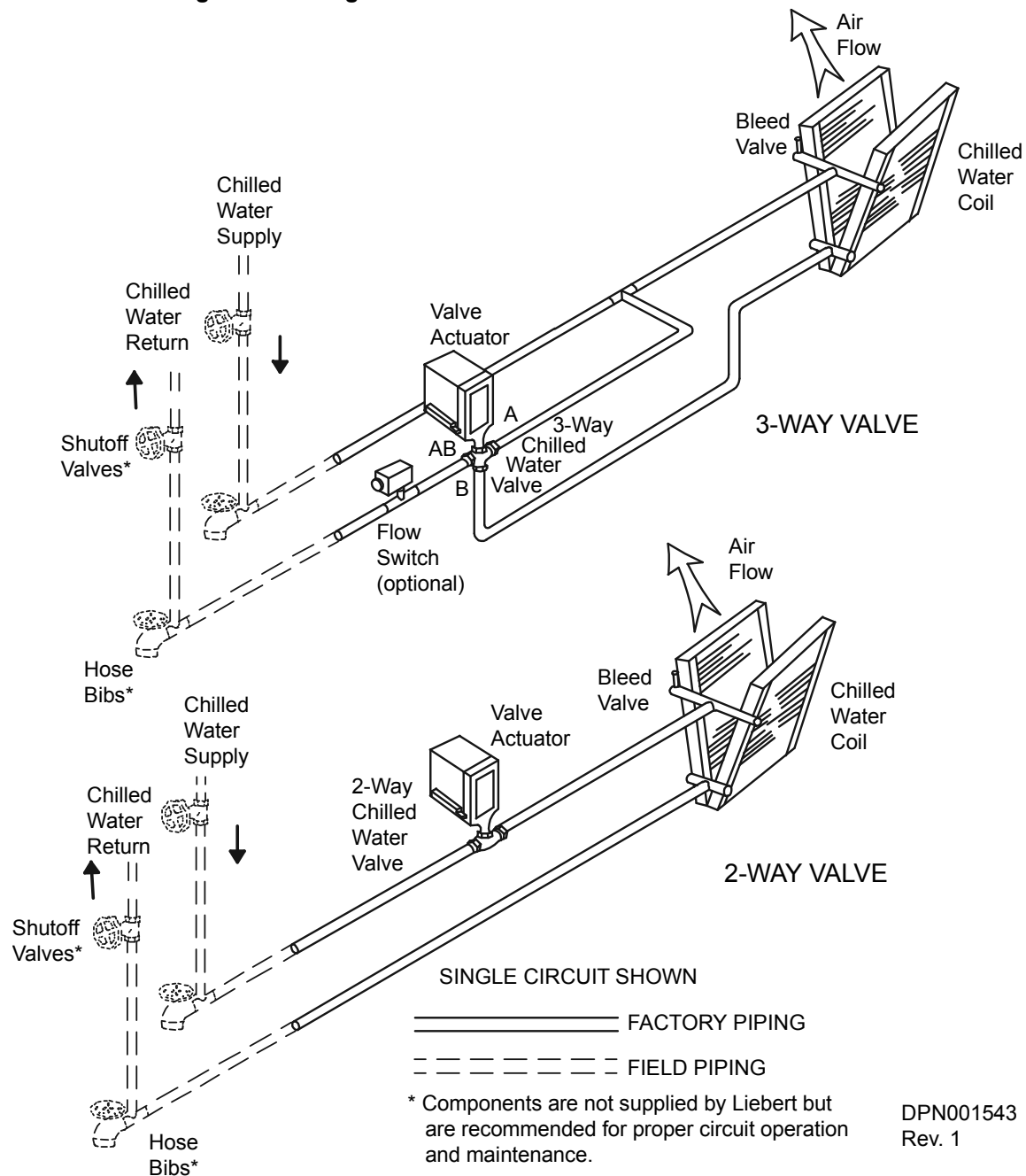
6.1 Piping Considerations

Manual shutoff valves should be installed at the supply and return lines to each unit. This will provide for routine service and emergency isolation of the unit.

Consideration of the minimum water temperature to be supplied from the chiller will determine if the need exists to insulate supply and return lines. Insulation will prevent condensation on the supply and return lines.

To provide for the emergency of water leaks and the consequences of sub-floor flooding, floor drains should be provided with wet traps or a water detection system, such as a Liebert Liqui-tect, that is installed near the base of the unit or below the elevated floor.

Figure 24 Chilled water general arrangement



DPN001543
Rev. 1

7.0 SPLIT SYSTEM MODELS

Three condensing unit styles are available: two air-cooled and one water/glycol-cooled condensing unit.

7.1 Location Considerations

7.1.1 Air-Cooled Condensing Units

To assure an adequate air supply, it is recommended that all condensing units be located in a clean air area, away from loose dirt and foreign matter that may clog the coil.

The outdoor condensing unit must not be located in the vicinity of steam, hot air, or fume exhausts or closer than 18" from a wall, obstruction, or adjacent unit.

The outdoor condensing unit should be located for maximum security and maintenance accessibility. Avoid ground-level sites with public access or areas that will contribute to heavy snow accumulations. Do not allow the discharge air to blow into another condensing unit.

The outdoor condensing unit must be located at the same level or above the indoor Liebert Challenger ITR unit. It must NOT be located below the indoor unit.

A solid base, capable of supporting the weight of the condenser and at least 2" (51 mm) higher than the surrounding grade and at least 2" (51 mm) larger than the condensing unit base dimensions, should be installed at the pre-determined location. In snow areas, a base of sufficient height to clear snow accumulation must be installed.

The centrifugal fan air-cooled condensing unit may be located above the dropped ceiling or any remote indoor area. If noise is of concern, the condensing unit should be located away from personnel. Normal operating sound may be objectionable if the condensing unit is placed near quiet work areas.

To mount the unit in the ceiling, refer to **7.5.1 - Installing the Indoor Condensing Unit** for hanging guidelines and to **Figure 29 - Detail of ceiling hanging bracket** for dimensional data.

7.1.2 Water/Glycol-Cooled Condensing Units

The condensing unit may be located above the dropped ceiling or any remote indoor area. If noise is of concern, the condensing unit should be located away from personnel. Normal operating sound may be objectionable if the condensing unit is placed near quiet work areas. To mount the unit in ceiling, refer to **7.5.1 - Installing the Indoor Condensing Unit**.

7.2 Electrical Connections

Refer to equipment nameplate regarding wire size and circuit protection requirements. Refer to electrical schematic when making connections. Make all wiring and electrical connections in accordance with local and national codes.



WARNING

Risk of electric shock. Can cause injury or death.

Potentially lethal voltages exist within this equipment during operation. Observe all cautions and warnings on unit and in this manual.

The Liebert iCOM microprocessor does not isolate power from the unit, even in the "Unit Off" mode. 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.

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

7.2.1 Line Voltage

Line voltage electrical service is required for all condensing units at the location of the condensing unit. This power supply does not have to be the same voltage as the indoor unit. This separate power source may be 208, 230, 460 or 575V, 60 Hz; or 200, 230, or 380/415V, 50 Hz. A disconnect switch is required and must be mounted per local and national codes to isolate the unit for maintenance.

7.2.2 Low Voltage

The control cable between the condensing unit and the evaporator unit is connected between terminals 1,2 and 3 on the terminal strip in the evaporator unit and the condensing unit control box. A fourth wire is required on systems with hot gas bypass. NEC Class 1 wiring is required. Glycol-cooled units also require a two-wire control connection to the drycooler and pump package.

7.3 Piping Considerations

7.3.1 Refrigerant Loop

NOTICE

Risk of improper refrigerant charge. Risk of equipment damage, environmental degradation and violation of national, state and local law.

Follow all applicable codes for handling refrigerant.

R407C refrigerant must be introduced and charged from the cylinder only as a liquid.

NOTICE

Risk of improper piping installation. Can cause contamination of hygroscopic oil with water. When installing field piping, care must be taken to protect all refrigerant lines from the atmosphere, especially when using refrigerants, such as R407C which requires use of polyol ester oils. Do not allow the piping to stand open to air for more than 15 minutes. Units designed for R407C have a compressor that contains polyol ester oil, which is very hygroscopic; that is, it quickly absorbs water from the air. The longer the compressor piping is left open to air, the harder it will be to fully evacuate. If left open too long, the polyol ester oil may need to be replaced before achieving the required vacuum level.



NOTE

Complete all piping and evacuate lines before connecting quick connects when using an optional sweat adapter kit and field installed hard piping.

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

All split systems require two refrigerant lines (an insulated copper suction line and a copper liquid line) between the evaporator and the condensing unit.

Installing the copper suction and liquid lines requires the use of a Sweat Adapter Kit and hard piping between the two units.

All refrigeration piping should be installed with high temperature brazed joints. Prevailing good refrigeration practices should be employed for piping supports, leak testing, evacuation, dehydration, and charging of the refrigeration circuits. The refrigeration piping should be isolated from the building by the use of vibration isolating supports.

To prevent tube damage when sealing openings in walls and to reduce vibration transmission, use a soft flexible material to pack around the tubes.

When installing remote condensing units mounted above the evaporator, the suction gas line should be trapped at the evaporator. This trap will retain refrigerant oil in the Off cycle. When the unit starts, oil in the trap is carried up the vertical riser and returns to the compressor.

Refrigerant charge requirements: Total refrigerant charge will be required only if units are evacuated during installation or maintenance. Total refrigerant charge = evaporator + lines + condensing unit.



NOTE

*All condensing units are fully charged with refrigerant. All 5 ton evaporator units include a nitrogen holding charge only. See **Table 19** for field charge required. If field-supplied refrigerant piping is installed, refrigerant must be added to the system.*

Once all piping is complete, check for leaks and dehydrate the field piping as follows:

1. Pressurize the field piping to 150 PSIG (1034 kPa) using dry nitrogen with a trace of refrigerant. Check system for leaks with a suitable leak detector.
2. After completion of leak testing, release the test pressure (per local code) and pull a deep vacuum on the field piping with a suitable pump.
3. After 15 minutes, check the pressure readings and, if they have not changed, break vacuum with dry nitrogen. Pull a second vacuum to 250 microns or less. Recheck the pressure after 15 minutes.

Table 19 Unit refrigerant charge

Model	R407C Charge
	lb (kg)
060E	0.8 (0.4)
059E	0.8 (0.4)
MC_65/64A	26.1 (11.8)
PF_067A-_L	25.8 (11.7)
PF_066A-_L	25.8 (11.7)
PF_Z67A-_L	50.1 (22.7)
PF_Z66A-_L	50.1 (22.7)
PF_067A-_H	50.1 (22.7)
PF_066A-_H	50.1 (22.7)
MC_69/68W	5.9 (2.7)

Table 20 Line charges - refrigerant per 100ft. (30m) of Type "L" copper tube

O.D.	R407C	
	Liquid Line lb (kg)	Suction Line lb (kg)
1/2"	7.3 (3.3)	-
5/8"	11.7 (5.3)	0.4 (0.2)
7/8"	24.4 (11.1)	1.0 (0.4)
1-1/8"	41.6 (18.9)	1.7 (0.7)
1-3/8"	63.3 (28.7)	2.7 (1.1)

Table 21 Recommended refrigerant lines (R407C) sizes OD copper

Equivalent Feet (m)	060E (059E)	
	Suction	Liquid
0-50 (0-15)	1-1/8"	1/2"
51-100 (16-30)	1-1/8"	5/8"
101-150 (31-45)	1-3/8"	5/8"

Table 22 Line coupling sizes

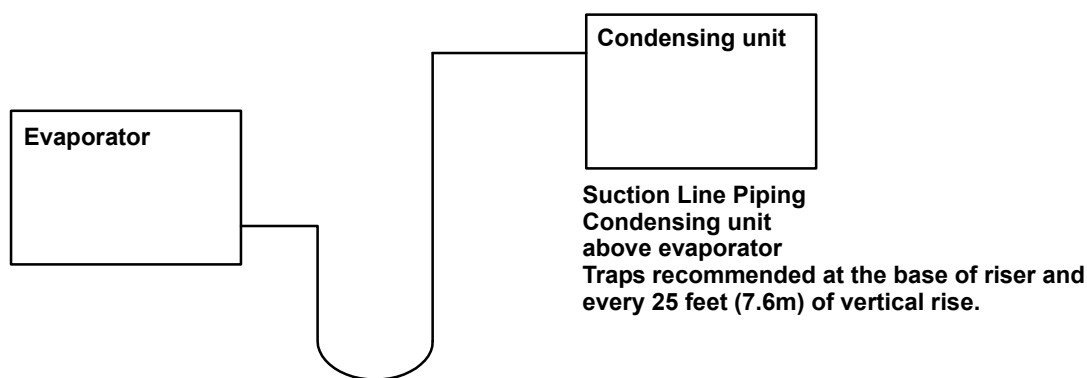
Line Size OD Cu, in.	Coupling Size	Torque lb-ft.
1/2 & 5/8	#10	35-45
1-1/8	#12	50-65

Table 23 Equivalent lengths (feet) for various pipe fittings

Copper Pipe OD in.	90 Degree Elbow Copper	90 Degree Elbow Cast	45 Degree Elbow	Tee	Gate Valve	Globe Valve	Angle Valve
1/2	0.8	1.3	0.4	2.5	0.26	7.0	4.0
5/8	0.9	1.4	0.5	2.5	0.28	9.5	5.0
3/4	1.0	1.5	0.6	2.5	0.3	12.0	6.5
7/8	1.45	1.8	0.8	3.6	0.36	17.2	9.5
1-1/8	1.85	2.2	1.0	4.6	0.48	22.5	12.0
1-3/8	2.4	2.9	1.3	6.4	0.65	32.0	16.0
1-5/8	2.9	3.5	1.6	7.2	0.72	36.0	19.5

Refrigerant trap = 4 times equivalent length of pipe per this table

Figure 25 Refrigerant piping diagram



7.3.2 Quick Connect Fittings



NOTE

When hard piping is used, complete all piping and evacuate lines before connecting quick connects.

Be especially careful when connecting the quick connect fittings. Read through the following steps before making the connections.

1. Remove protector caps and plugs.
2. Carefully wipe coupling seats and threaded surfaces with a clean cloth.
3. Lubricate the male diaphragm and synthetic rubber seal with refrigerant oil.
4. Thread the coupling halves together by hand to ensure that the threads mate properly.
5. Tighten the coupling body hex nut and union nut with the proper sized wrench until the coupling bodies “bottom out” or until a definite resistance is felt.
6. Using a marker or pen, make a line lengthwise from the coupling union nut to the bulkhead.
7. Tighten the nuts an additional quarter turn; the misalignment of the lines shows how much the coupling has been tightened. This final quarter turn is necessary to ensure that the joint will not leak. Refer to **Table 22** for torque requirements.
8. Add charge for the additional piping (refer to **Table 20**).

7.4 Outdoor Air-Cooled Condensing Units

Table 24 Horizontal air discharge cabinet and floor planning dimensional data

Model Numbers		Dimensional Data in. (mm)			Module Weight lb (kg) net
60 Hz	50 Hz	A	B	C	
PFH067A-_L	PFH066A-_L	53 (1343)	36-1/4 (918)	18 (457)	351 (159)

Table 25 Horizontal air discharge piping and electrical connection data

Model Numbers		Dimensional Data in. (mm)			Piping Connections in. (mm)			
60 Hz	50 Hz	A	B	C	D	E	F	G
PFH067A-_L	PFH066A-_L	2 (51)	6 (152)	8-1/2 (216)	4-3/4 (121)	7-3/4 (197)	—	8-1/2 (216)

Figure 26 Outdoor air-cooled condensing unit—horizontal air discharge models

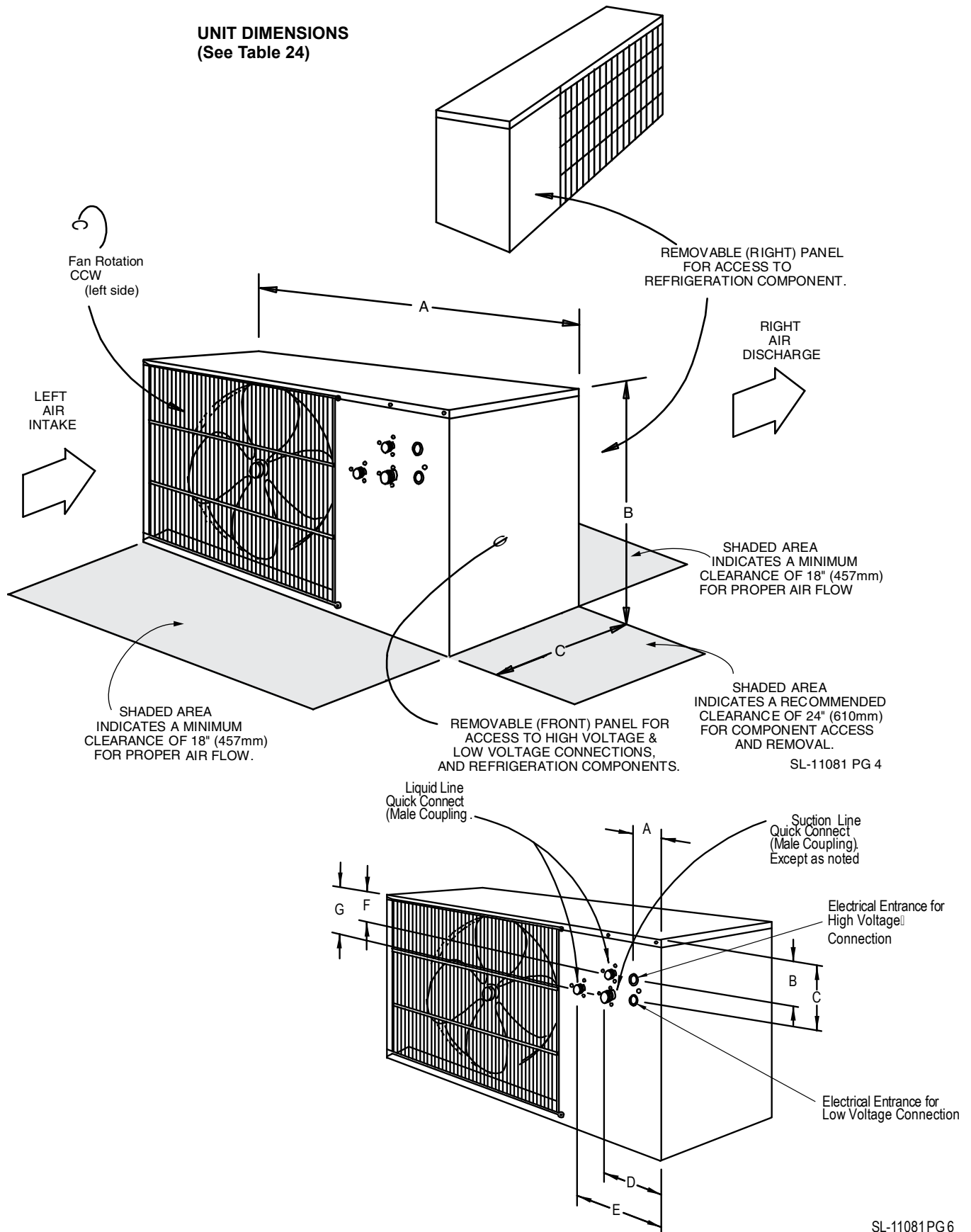


Figure 27 Outdoor air-cooled condensing unit—top air discharge models

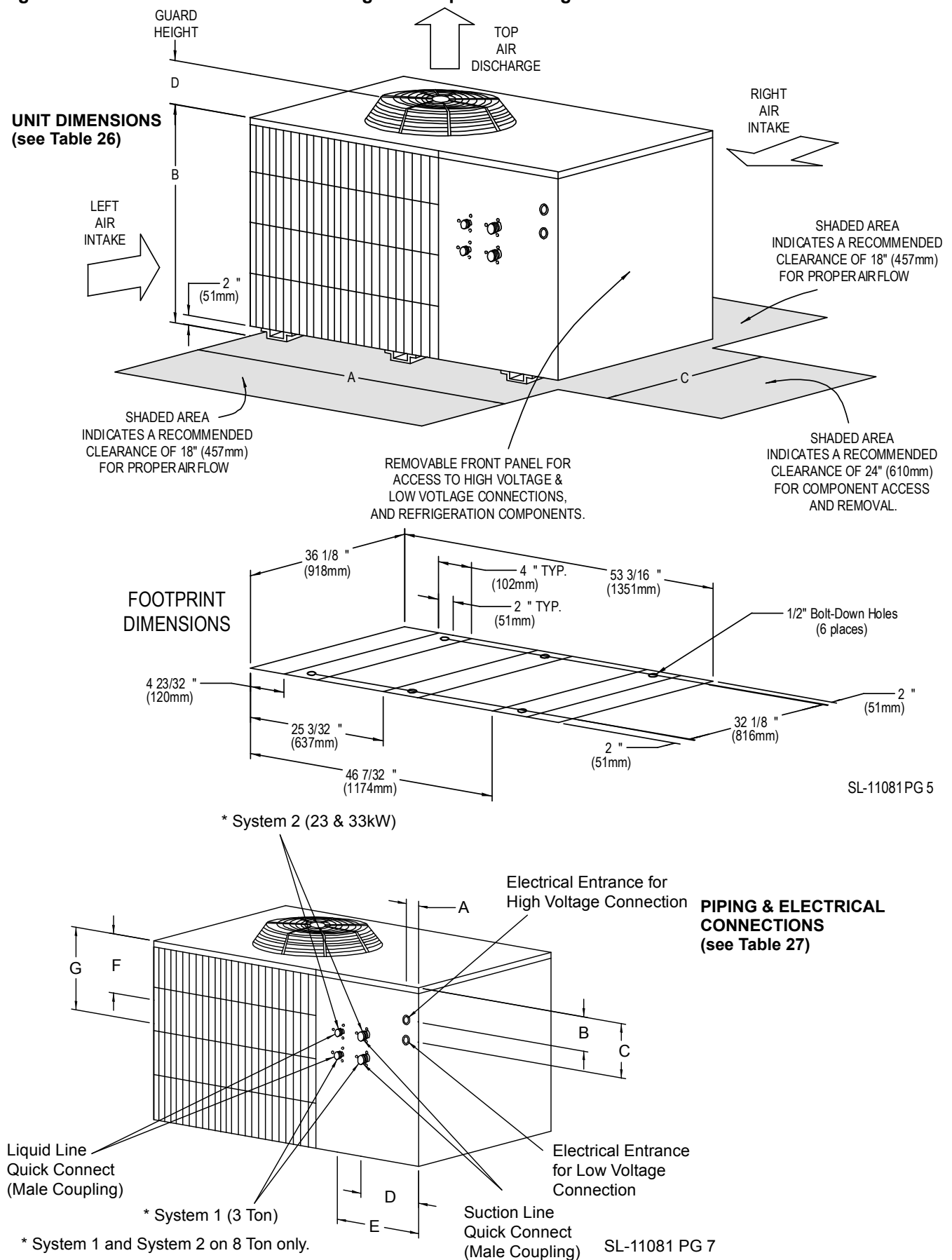


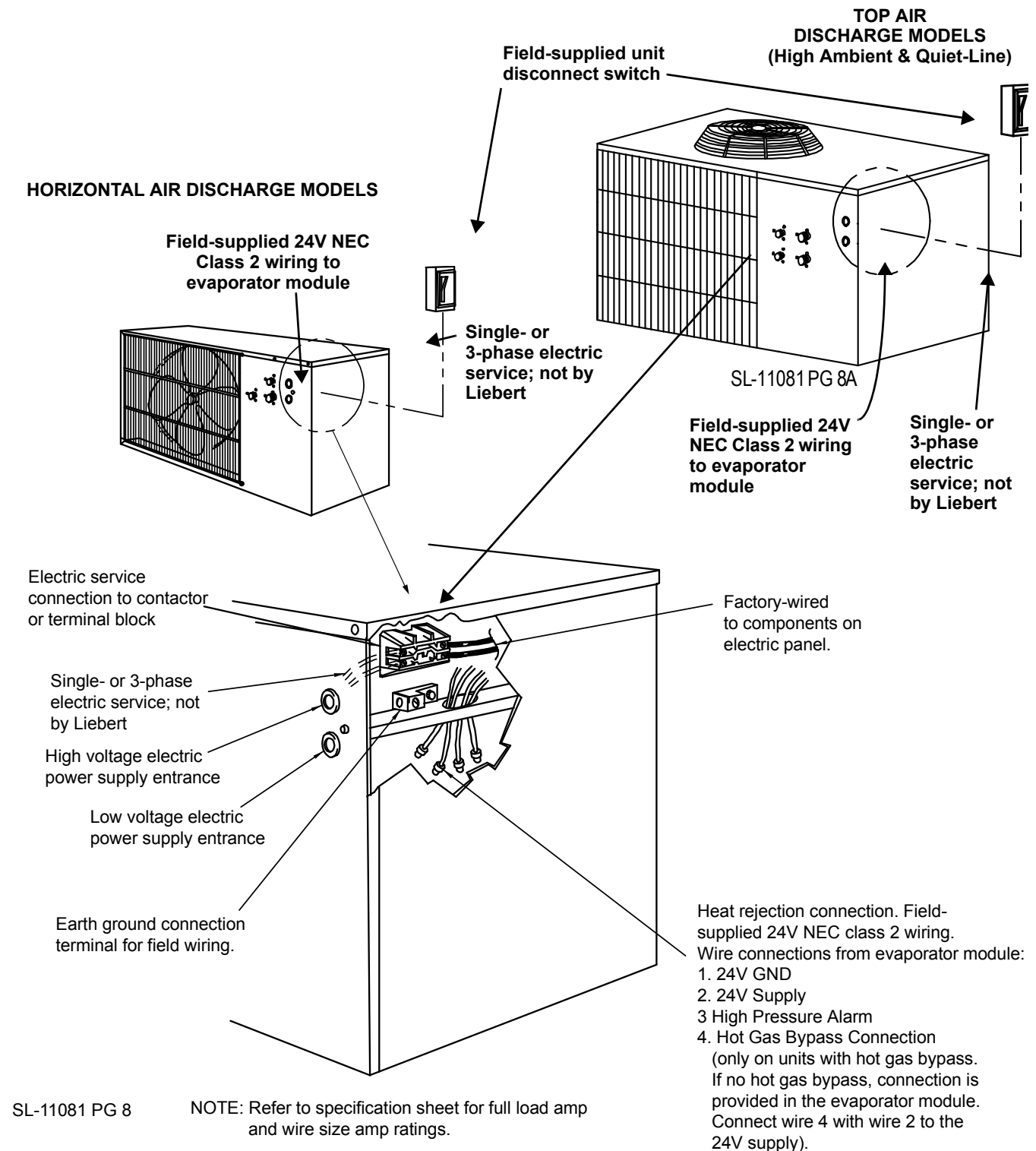
Table 26 Cabinet and floor planning dimensional data - prop fan condensing modules, top air discharge

Model Numbers		Dimensional Data in. (mm)				Module Weight lb (kg) net
60 Hz	50 Hz	A	B	C	D	
PFH067A-_H	PFH066A-_H	53 (1343)	36-1/4 (918)	38-1/2 (978)	5-1/2 (140)	488 (222)
PFHZ67A-_L	PFHZ66A-_L					

Table 27 Piping and electrical connections - top air discharge

Model Numbers		Dimensional Data in. (mm)			Piping Connections in. (mm)		
60 Hz	50 Hz	A	B	C	D	E	F
PFH067A-_H	PFH066A-_H	2 (51)	6 (152)	8-1/2 (216)	4-3/4 (121)	7-3/4 (197)	8-1/2 (216)
PFHZ67A-_L	PFHZ66A-_L						

Figure 28 Electrical field connections, prop fan condensing module



7.5 Centrifugal Air-Cooled Condensing Units

7.5.1 Installing the Indoor Condensing Unit

Refer to drawings for unit dimensions and component locations.



WARNING

Risk of heavy unit falling from supports. Can cause equipment and building damage, injury and death.

Be sure the supporting roof structure is capable of supporting the weight of the unit(s) and the accessories during installation and service. (See **Table 28 - Indoor centrifugal condensing unit.**)

Be sure to securely anchor the top ends of the suspension rods. Make sure all nuts are tight.

The indoor condensing unit is usually mounted above the ceiling and must be securely mounted to the roof structure. The ceiling and ceiling supports of existing buildings may require reinforcements. Be sure to follow all applicable codes. Use field-supplied threaded suspension rods and 3/8"-16 factory hardware kit.

The indoor condensing unit must be located at the same level or above the Liebert Challenger ITR unit. It must NOT be located below the Liebert Challenger ITR.

Recommended clearance between ceiling grids and building structural members is unit height plus three inches.

Install the four field-supplied rods by suspending them from suitable building structural members. Locate the rods so that they will align with the four mounting holes in the flanges that are part of the unit base.

Using a suitable lifting device, raise the unit up and pass the threaded rods through the four mounting holes in the flanges that are part of the unit base.

Attach the threaded rods to the unit flanges using the supplied nuts and grommets. (See **Figure 29 - Detail of ceiling hanging bracket**, Threaded Rod and Hardware Kit Installation). The rubber grommets provide vibration isolation.

1. Use the plain nuts to hold unit in place. Adjust these nuts so that the weight of the unit is supported evenly by the four rods, does not rest on the ceiling grid and is level.



NOTE

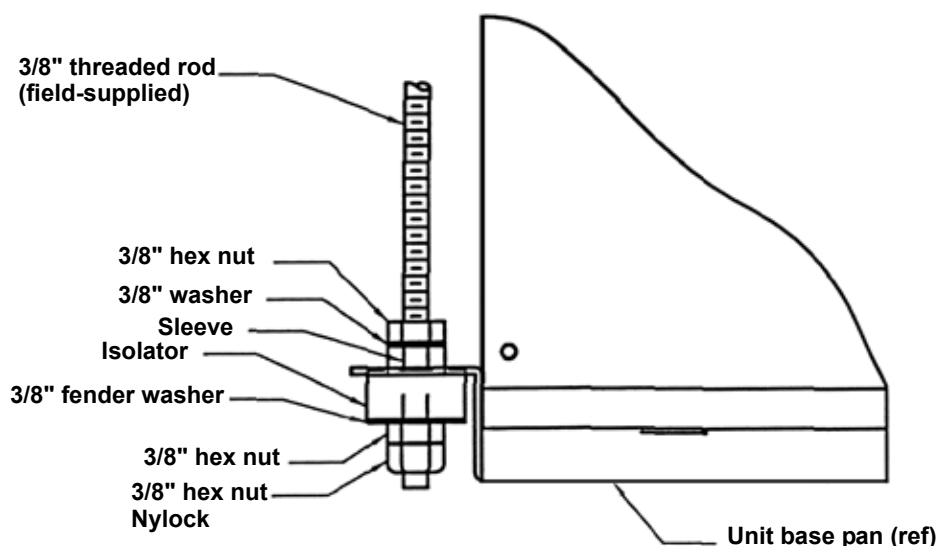
The units must be level in order to operate properly.

2. Use the Nylock nuts to “jam” the plain nuts.

Table 28 Indoor centrifugal condensing unit

Model		Net Weight lb (kg)
60 Hz	50 Hz	
MC_65A	MC_64A	449 (204)

Figure 29 Detail of ceiling hanging bracket



7.5.2 Ducting

The total external static pressure for the inlet and outlet ducts, including grille, must not exceed 0.5 inches of H₂O. Hood intake dimensions should be the same as the condensing unit duct dimensions.

If the condensing unit is located close to the outside of the building, rain hoods must be installed. In addition, install a triple layer bird screen over rain hood openings to eliminate the possibility of insects, birds, water, or debris entering the unit.

Use flexible ductwork or nonflammable cloth collars to attach ductwork to the unit and to control vibration transmission to the building. Attach the ductwork to the unit using the flanges provided. Locate the unit and ductwork so that the return air does not short circuit to the supply air inlet.

Avoid directing the hot exhaust air toward adjacent doors or windows.

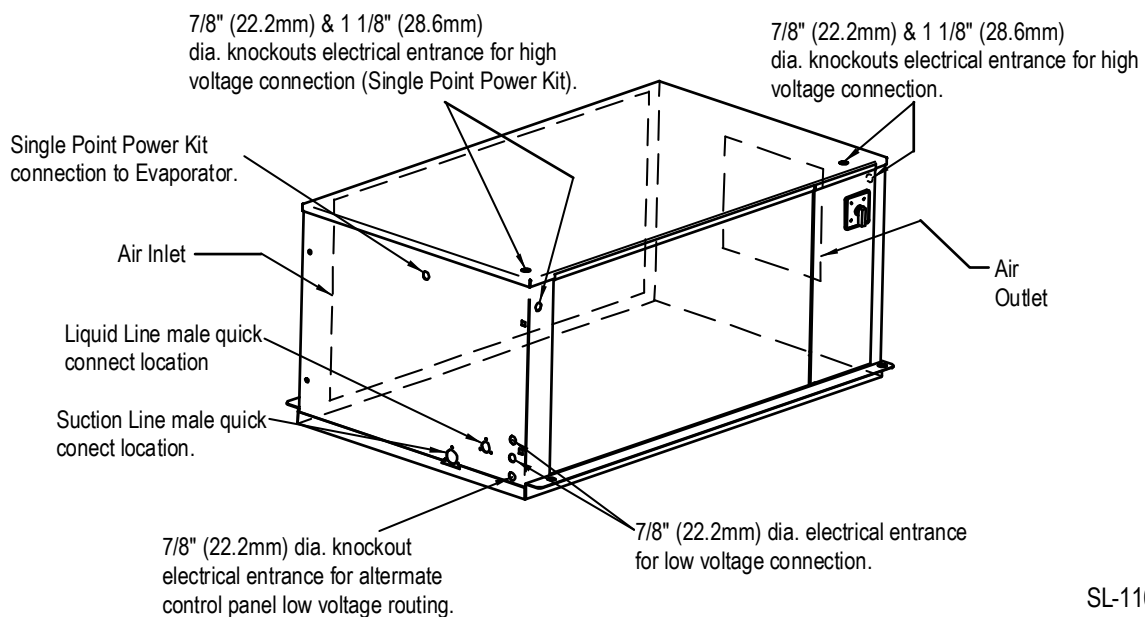
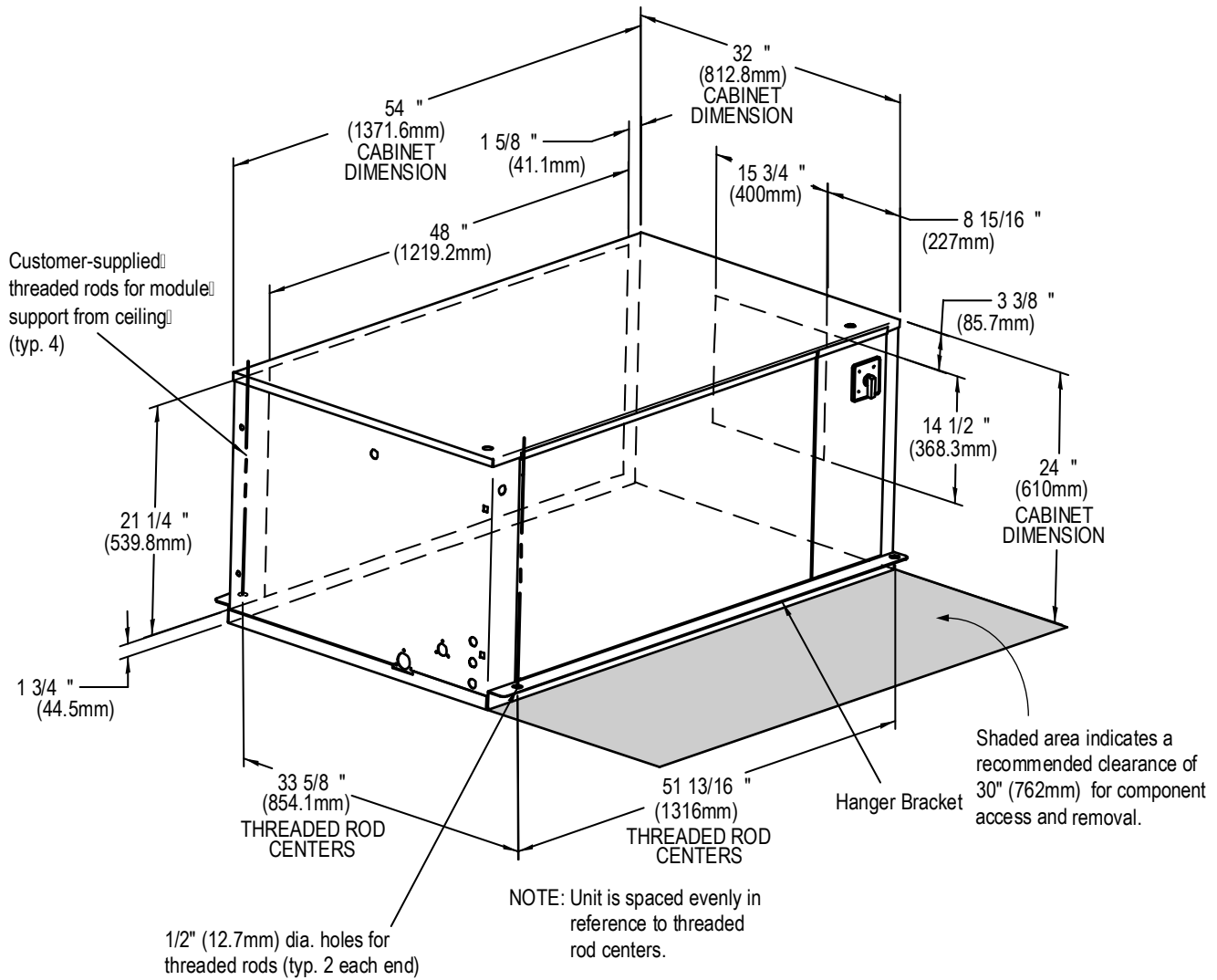
Normal operating sound may be objectionable if the condensing unit is placed directly over quiet work areas. Ductwork that runs through a conditioned space or is exposed to areas where condensation may occur must be insulated. Whenever possible, ductwork should be suspended using flexible hangers. Ductwork should not be fastened directly to the building structure. In applications where the ceiling plenum is used as the heat rejection domain, the discharge air must be directed away from the condensing unit air inlet and a screen must be added to the end of the discharge duct to protect service personnel.

For multiple unit installations, space the units so that the hot condensing unit exhaust air is not directed toward the air inlet of an adjacent unit.

Table 29 Airflow

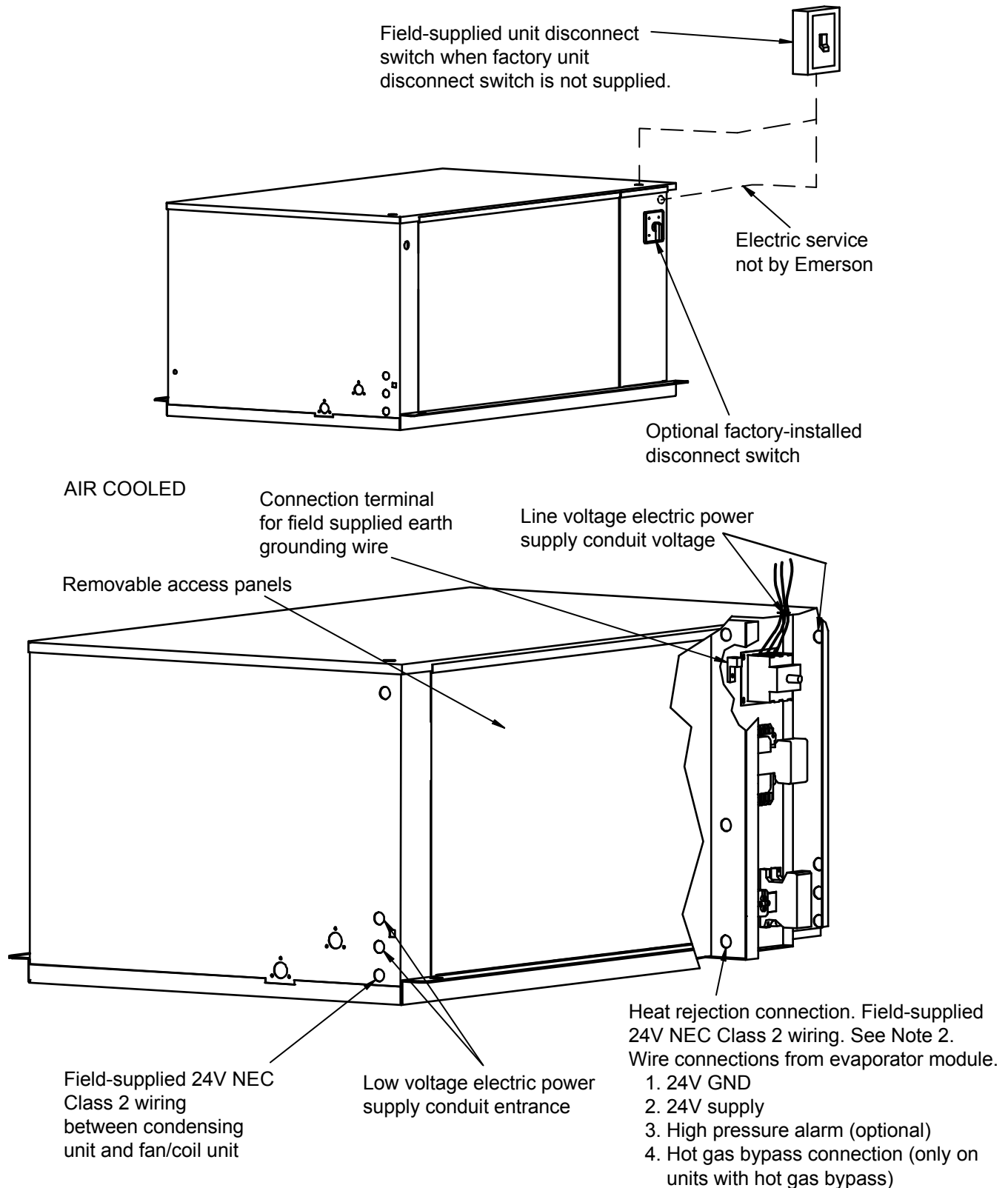
Model Frequency	Airflow CFM (CMH)
60 Hz	3500 (5947)
50 Hz	3500 (5947)

Figure 30 Centrifugal air-cooled condensing unit dimensional data



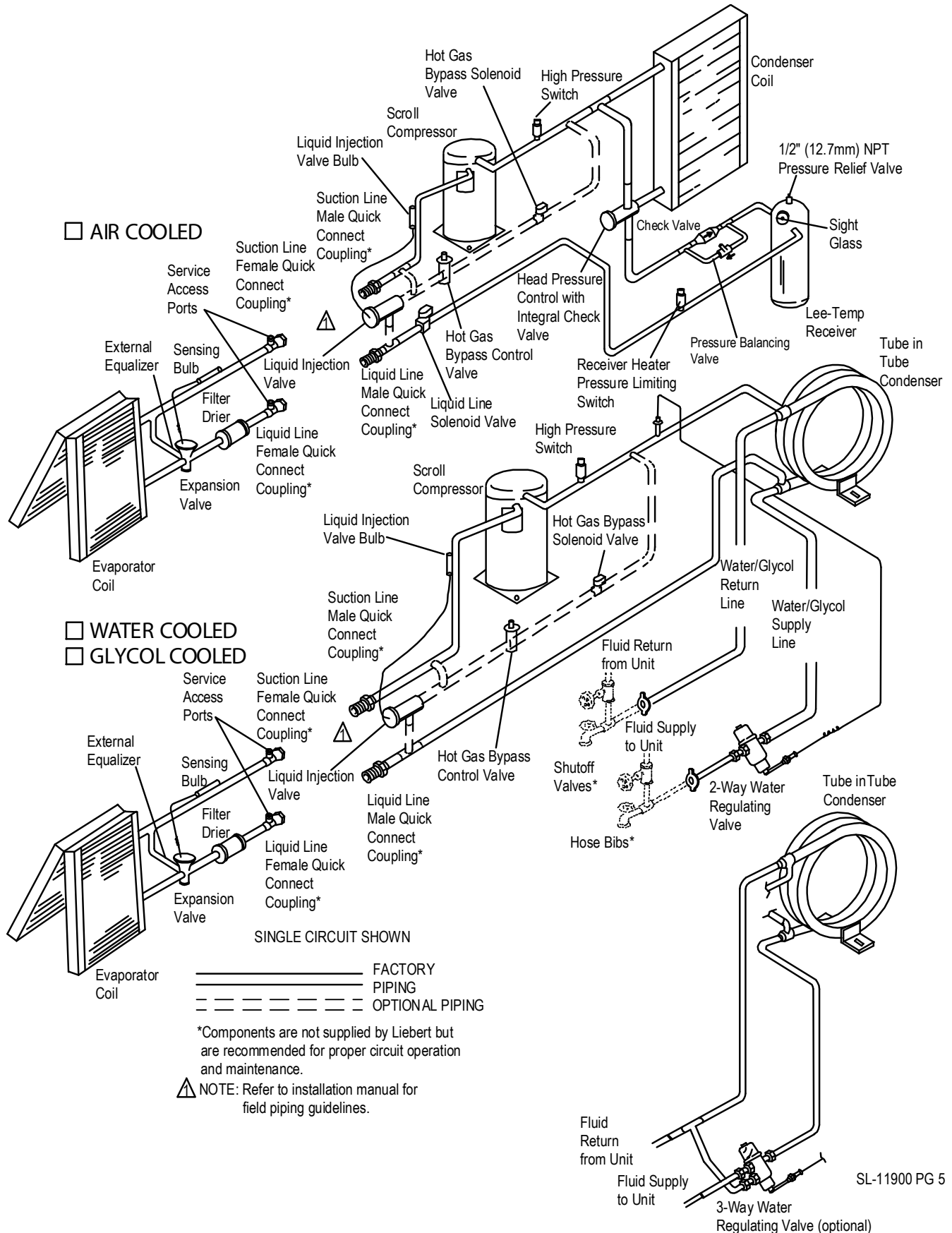
SL-11087PG 4

Figure 31 Centrifugal air-cooled condensing unit dimensional data (con't.)



DPN000226
Rev. 0

Figure 32 Split systems general arrangement



SL-11900 PG 5

7.6 Water and Glycol-Cooled Condensing Units

For installation guidelines, refer to **Installing the Indoor Condensing Unit on page 57.**

7.6.1 Piping Considerations

It is recommended that manual service shutoff valves be installed at the supply and return line to each unit. This will provide for routine service or emergency isolation of the unit.

When the water source for the condenser is of poor quality, it is good practice to provide cleanable filters in the supply line. These filters will trap the particles in the water supply and extend the service life of the water-cooled condenser.

Connection Sizes

Condenser Water Inlet: 1-1/8" OD Cu

Condenser Water Outlet : 1-1/8" OD Cu

Suction Line: 1-7/16" - 16 male #12 quick connect

Liquid Line: 1-1/16" - 12 male #10 quick connect

Table 30 Water and glycol-cooled condensing unit data

Model	Net Weight, lb (kg)	Glycol Volume, gal (l)
MC_69W MC_68W	282 (128)	2.0 (7.6)

7.6.2 Condenser Water Requirements

The standard maximum water pressure is 150 psig (1034 kPa). For applications above this pressure, consult the factory about high pressure systems.

The system will operate in conjunction with a cooling tower, city water, or drycooler.

7.6.3 Regulating Valve

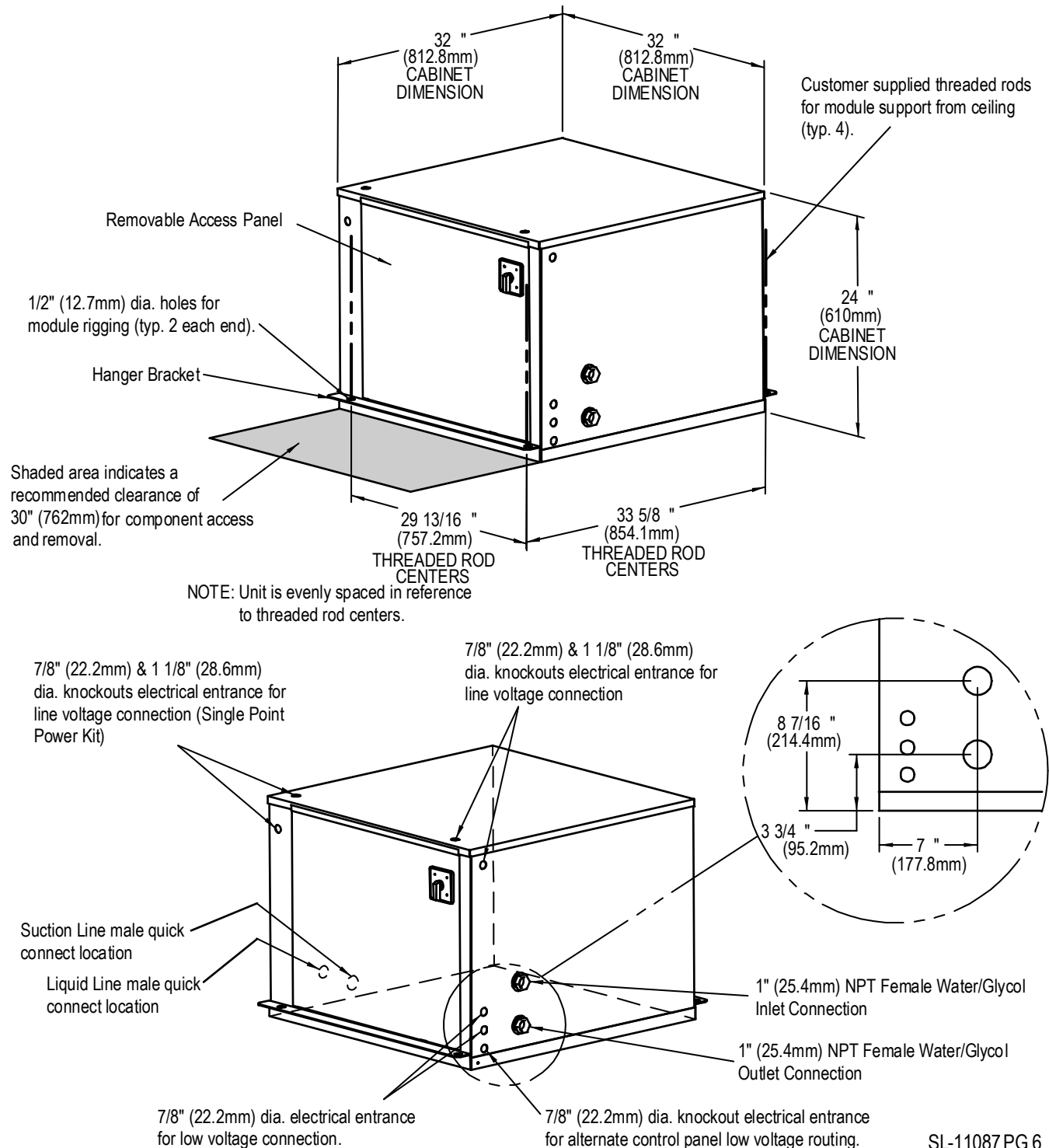
For details, refer to sections **4.3.1 - Standard Valve - 150psig (1034kPa) System, High Pressure Valve - 350psig (2413kPa) System.**

7.6.4 Glycol Systems

For split system glycol systems, use drycooler and pump data found in **5.0 - Glycol/GLYCOOL-Cooled Models—Self-Contained Compressor**. See **Table 16 - Drycooler data**.

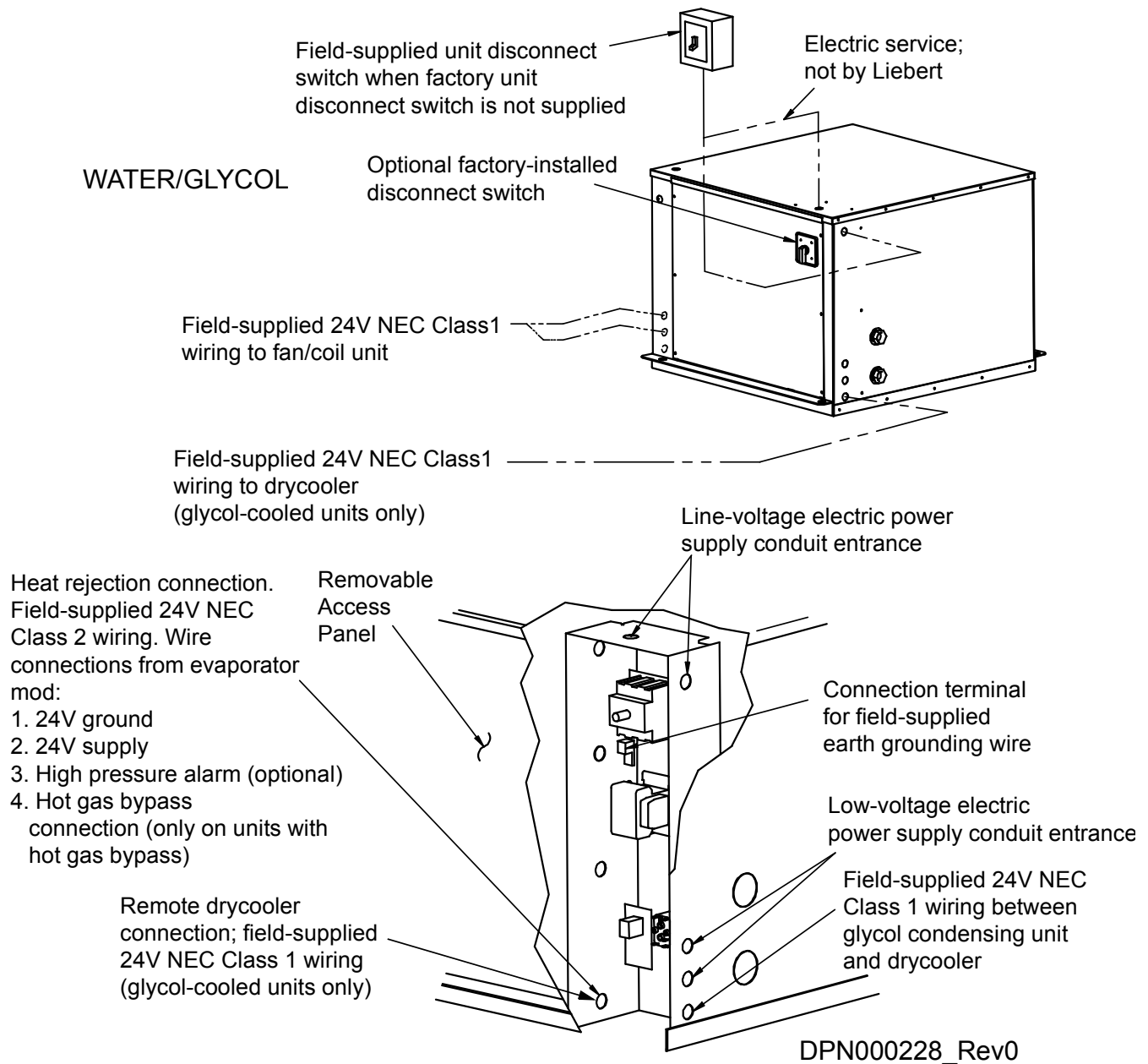
Electrical control interconnect to drycooler is wired from water/glycol condensing unit.

Figure 33 Water/glycol-cooled condensing unit dimensional data



SL-11087 PG 6

Figure 34 Water/glycol-cooled condensing unit (con't.)



8.0 R407C REFRIGERANT

Table 31 R407C pressure/temperature chart for operation and superheat (discharge/hot gas and suction gas)

Temperature		Gauge Pressure		Temperature		Gauge Pressure		Temperature		Gauge Pressure	
°F	°C	Psig	kPa	°F	°C	Psig	kPa	°F	°C	Psig	kPa
0.0	-17.8	18.9	130	35.0	1.7	54.8	378	70.0	21.1	114.9	792
1.0	-17.2	19.6	135	36.0	2.2	56.1	387	72.0	22.2	119.3	822
2.0	-16.7	20.4	141	37.0	2.8	57.5	396	74.0	23.3	124	853
3.0	-16.1	21.2	146	38.0	3.3	58.9	406	76.0	24.4	128	885
4.0	-15.6	22.0	152	39.0	3.9	60.3	415	78.0	25.6	133	917
5.0	-15.0	22.8	157	40.0	4.4	62.2	429	80.0	26.7	138	950
6.0	-14.4	23.6	163	41.0	5.0	63.1	435	82.0	27.8	143	984
7.0	-13.9	24.5	169	42.0	5.6	64.6	445	84.0	28.9	148	1019
8.0	-13.3	25.4	175	43.0	6.1	66.1	456	86.0	30.0	153	1054
9.0	-12.8	26.2	181	44.0	6.7	67.6	466	88.0	31.1	158	1091
10.0	-12.2	27.1	187	45.0	7.2	69.1	476	90.0	32.2	164	1128
11.0	-11.7	28.0	193	46.0	7.8	70.7	487	92.0	33.3	169	1167
12.0	-11.1	28.9	200	47.0	8.3	72.2	498	94.0	34.4	175	1206
13.0	-10.6	29.9	206	48.0	8.9	73.8	509	96.0	35.6	181	1246
14.0	-10.0	30.8	213	49.0	9.4	75.4	520	98.0	36.7	187	1287
15.0	-9.4	31.8	219	50.0	10.0	77.1	531	100.0	37.8	193	1329
16.0	-8.9	32.8	226	51.0	10.6	78.7	543	102.0	38.9	199	1372
17.0	-8.3	33.8	233	52.0	11.1	80.4	554	104.0	40.0	205	1416
18.0	-7.8	34.8	240	53.0	11.7	82.1	566	106.0	41.1	212	1461
19.0	-7.2	35.8	247	54.0	12.2	83.9	578	108.0	42.2	219	1507
20.0	-6.7	36.9	254	55.0	12.8	85.6	590	110.0	43.3	225	1553
21.0	-6.1	38.0	262	56.0	13.3	87.4	603	112.0	44.4	232	1601
22.0	-5.6	39.0	269	57.0	13.9	89.2	615	114.0	45.6	239	1650
23.0	-5.0	40.1	277	58.0	14.4	91.0	628	116.0	46.7	247	1701
24.0	-4.4	41.3	284	59.0	15.0	92.9	640	118.0	47.8	254	1752
25.0	-3.9	42.4	292	60.0	15.6	94.8	653	120.0	48.9	262	1804
26.0	-3.3	43.6	300	61.0	16.1	96.7	666	122.0	50.0	269	1858
27.0	-2.8	44.7	308	62.0	16.7	98.6	680	124.0	51.1	277	1912
28.0	-2.2	45.9	317	63.0	17.2	100.5	693	126.0	52.2	285	1968
29.0	-1.7	47.1	325	64.0	17.8	102.5	707	128.0	53.3	294	2025
30.0	-1.1	48.4	333	65.0	18.3	104.5	721	130.0	54.4	302	2083
31.0	-0.6	49.6	342	66.0	18.9	106.5	735	132.0	55.6	311	2143
32.0	0.0	50.9	351	67.0	19.4	108.6	749	134.0	56.7	320	2203
33.0	0.6	52.1	359	68.0	20.0	110.7	763	136.0	57.8	329	2265
34.0	1.1	53.5	369	69.0	20.6	112.8	778	138.0	58.9	338	2329
-	-	-	-	-	-	-	-	140.0	60.0	347	2393



NOTE

Use this table for superheat and for control adjustment (e.g., pressure switches). See **Table 32** for subcooling.

Table 32 R407C pressure/temperature chart for subcooling only (liquid measurements)

Temperature		Pressure Gauge		Temperature		Pressure Gauge		Temperature		Pressure Gauge	
°F	°C	Psig	kPa	°F	°C	Psig	kPa	°F	°C	Psig	kPa
36.0	2.2	73	500	59.0	15.0	114	786	94.0	34.4	203	1402
37.0	2.8	74	511	60.0	15.6	116	801	96.0	35.6	209	1444
38.0	3.3	76	522	61.0	16.1	118	815	98.0	36.7	216	1488
39.0	3.9	77	533	62.0	16.7	120	830	100.0	37.8	222	1532
40.0	4.4	79	544	63.0	17.2	123	845	102.0	38.9	229	1578
41.0	5.0	81	556	64.0	17.8	125	860	104.0	40.0	236	1624
42.0	5.6	82	567	65.0	18.3	127	875	106.0	41.1	242	1671
43.0	6.1	84	579	66.0	18.9	129	891	108.0	42.2	249	1720
44.0	6.7	86	591	67.0	19.4	131	906	110.0	43.3	257	1769
45.0	7.2	87	602	68.0	20.0	134	922	112.0	44.4	264	1819
46.0	7.8	89	615	69.0	20.6	136	938	114.0	45.6	271	1870
47.0	8.3	91	627	70.0	21.1	138	954	116.0	46.7	279	1922
48.0	8.9	93	639	72.0	22.2	143	987	118.0	47.8	287	1975
49.0	9.4	95	652	74.0	23.3	148	1021	120.0	48.9	294	2029
50.0	10.0	96	664	76.0	24.4	153	1055	122.0	50.0	302	2085
51.0	10.6	98	677	78.0	25.6	158	1090	124.0	51.1	310	2141
52.0	11.1	100	690	80.0	26.7	163	1126	126.0	52.2	319	2198
53.0	11.7	102	704	82.0	27.8	169	1163	128.0	53.3	327	2256
54.0	12.2	104	717	84.0	28.9	174	1201	130.0	54.4	336	2315
55.0	12.8	106	730	86.0	30.0	180	1239	132.0	55.6	345	2376
56.0	13.3	108	744	88.0	31.1	185	1279	134.0	56.7	354	2437
57.0	13.9	110	758	90.0	32.2	191	1319	136.0	57.8	363	2500
58.0	14.4	112	772	92.0	33.3	197	1360	138.0	58.9	372	2563
-	-	-	-	-	-	-	-	140.0	60.0	381	2628

**NOTE**

Use this table for subcooling calculation *ONLY*. See **Table 31** for superheat or control adjustment.

8.1 Calculating Subcooling

Example

Measure the liquid pressure (e.g., 200 psig). Find the liquid saturation temperature at that pressure on **Table 32** (e.g., 93°F). Measure the temperature of the liquid line (e.g., 90°F). Subtract the actual temperature from the liquid saturation temperature to obtain the subcooling (e.g., 93 – 90 = 3°F). If the actual temperature is greater than the liquid saturation temperature, then there is no subcooling, and the fluid may be a mixture of liquid and vapor.

Why There Are Two R407C Temperature and Pressure Tables

R407C is a blend of refrigerants that exhibits a temperature “glide” of approximately 8 to 12°F (4 to 7°C). This “glide” is the difference between the liquid and vapor saturation temperatures at a given pressure. Use the correct table for the saturation temperature you need. **Table 31** is for superheat or operating controls. **Table 32** is for subcooling only.

NOTES

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

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

Technical Support / Service

Web Site

www.liebert.com

Monitoring

liebert.monitoring@emerson.com

800-222-5877

Outside North America: +00800 1155 4499

Single-Phase UPS & Server Cabinets

liebert.upstech@emerson.com

800-222-5877

Outside North America: +00800 1155 4499

Three-Phase UPS & Power Systems

800-543-2378

Outside North America: 614-841-6598

Environmental Systems

800-543-2778

Outside the United States: 614-888-0246

Locations

United States

1050 Dearborn Drive

P.O. Box 29186

Columbus, OH 43229

Europe

Via Leonardo Da Vinci 8

Zona Industriale Tognana

35028 Piove Di Sacco (PD) Italy

+39 049 9719 111

Fax: +39 049 5841 257

Asia

29/F, The Orient Square Building

F. Ortigas Jr. Road, Ortigas Center

Pasig City 1605

Philippines

+63 2 687 6615

Fax: +63 2 730 9572

While every precaution has been taken to ensure the accuracy and completeness of this literature, Liebert Corporation assumes no responsibility and disclaims all liability for damages resulting from use of this information or for any errors or omissions.

© 2008 Liebert Corporation

All rights reserved throughout the world. Specifications subject to change without notice.

® Liebert is a registered trademark of Liebert Corporation.

All names referred to are trademarks or registered trademarks of their respective owners.

SL-11956_REV01_10-09

Emerson Network Power.

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

■ AC Power

■ Connectivity

■ DC Power

■ Embedded Computing

■ Embedded Power

■ Monitoring

■ Outside Plant

■ Power Switching & Controls

■ Precision Cooling

EmersonNetworkPower.com

■ Racks & Integrated Cabinets

■ Services

■ Surge Protection

Business-Critical Continuity, Emerson Network Power and the Emerson Network Power logo are trademarks and service marks of Emerson Electric Co.

©2008 Emerson Electric Co.

DISCONTINUED
PRODUCT