REFPLUS®

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

CONDENSING UNITS

TABLE OF CONTENTS

SAFETY CONSIDERATIONS

Installing, starting up, and servicing equipment can be hazardous due to system pressures, electrical components and equipment location (roofs, elevated structures, etc.). Only trained and qualified installers as well as service technicians should install, start-up and service this equipment.

When working on the equipment, observe precautions found in the literature, on the tags, stickers, and labels attached to the equipment.

Follow all safety codes. Wear safety glasses and work gloves. Keep quenched cloths and fire extinguisher nearby when brazing. Use care in handling, rigging, and setting bulky equipment. Units are factory pressurized with dry air (-40°F/C dew point) or nitrogen at approximately 40 psig. Be careful when opening the circuit. If no pressure is present, check for leaks or loose valves. Work in a well-ventilated location when using refrigerant.

WARNING! Before installation, always check to make sure main power to systems is OFF. Electrical shock can cause personal injury or death.

INTRODUCTION

These instructions describe installation, start-up and service of refrigeration duty, outdoor air cooled or indoor air or water cooled and remote condenser with hermetic, semi-hermetic or scroll compressors for high, medium or low temperature applications.

PRODUCT DESCRIPTION

Evolution condensing units are individually designed for specific jobs. Each unit includes a wiring diagram that meets the customer's requirements. The wiring diagram displays all the components with all the protections and the necessary controls.

The unit can be supplied with mechanical or electronic controls. Outdoor air-cooled models with multiple fans are supplied with a pressure actuated fan cycling. This is optional on indoor units. Units with single or multiple fans can also be provided with an optional fan speed control. Optional ECM motors can be provided for variable speed, or for the OEX and IEX with a two-speed option (50%-100%) for added energy saving.

Fluid-cooled units (water or glycol) are available with shell and tube condensers (1 to 50 HP compressors), COAX or optional special plate type condensers with separate receiver (all models). Two or three-way water regulating valves can be supplied for field mounting or can be factory installed. The pressure connectors are complete with a depressor pin. Access fittings are provided for an easy connection and replacement of controls without refrigerant loss.

The supplied receiver (over 6'' internal diameter) or shell and tube water-cooled condensers are ASME certified and/or carry a CRN number (for Canadian installation). They are supplied with a pressure relief valve set at the maximum designed working pressure.

Units supplied with small receiver (less than 6'' internal diameter) are manufactured with a cULus or equivalent certification. Those receivers come with fusible plugs.

CU NOMENCLATURE

O N S 1 5 0 1 M 4 8 Y

Options
C = Common suction unit (compressor piped in parallel)
D = Digital compressor (only one on a 2 compressors unit (normal or tandem))
H = High temp unit (high ambient range, oversized receiver and condenser)
L = Low Speed Ziehl Abegg motors
M = Multiple Digital compressor (all compressors are Digital except for tandem Digital)
T = Tandem Compressors
U = Unit with uneven compressors
Y = Ziehl Abegg motors (ON series)
Z = Ziehl Abegg motors (OM series)

Voltage
1 = 120/1/60
2 = 240/1/60
5 = 208-240/3/60
8 = 575/3/60
9 = 480/3/60

Refrigerant
1 = R-410A
2 = R-22
3 = R-134a
4 = R-404A
5 = R-407F
6 = R-407A
7 = R-407C
A = R-448A
B = R-449A
C = R-450A
D = R-513A

Application
E = Extended-medium temperature
H = High temperature
L = Low temperature
M = Medium temperature
T = 2 stages

Compressor Brand
1 = Copeland
2 = Carlyle
3 = Tecumseh
5 = Bitzer

Compressor Quantity or fractional HP*
0 = 1 compressor
2 = 2 compressors or fractional HP if below 5 HP
4 = 4 compressors
1,3,5,6,7,8,9 = fractional HP

Unit Nominal HP
02 = 2 HP
10 = 10 HP
140 = 140 HP

Compressor Type
H = Hermetic
S = Semi-Hermetic
V = Screw
Z = Scroll

Unit Series
C = Standard horizontal discharge (obsolete)
E = Small-medium horizontal discharge Evolution series
V = Standard Vertical Discharge (obsolete)
N = Large Vertical Discharge Evolution Series
M = Medium Vertical Discharge Evolution Series

Unit Type
I = Indoor Air Cooled
M = Remote Water cooled Marine Type
O = Outdoor Air Cooled
S = Remote with condenser on roof
W = Water cooled with shell & tubes condenser
X = Water cooled with coaxial condenser

* Common suction compressors are counted as 1 compressor

HANDLING AND RIGGING

Good handling and rigging practices must be followed to protect units from damage. Having proper handling equipment at the job site is most important and it should be planned.

In the US, follow OSHA 1926.251 standard for Rigging Equipment and Material Handling.

In Canada, follow your province's requirements for hoisting and rigging.

Improper rigging of a load or a rigging failure can expose riggers and other workers nearby to a variety of potential hazards.

Always lift units secured to the fork lift to prevent it from slipping off.

Fork Lift – Do not use fork lifts against sheet metal panels or coils. The compressor side of the condensing unit is the heaviest and should be facing the lift truck. Make sure forks extend the entire length of the unit and against a structural part or frame.

Crane – **The center of gravity must be identified before lifting the unit**. Holes are provided to insert bars or hooks for lifting units. Use spreader bars to protect the casing, condenser coil, electrical box, piping and wiring.

Figure 1 shows the ideal rigging of a small unit. Figure 2 shows the ideal rigging of a large unit. **These rigging methods are for reference only**. Rigging procedure will vary from one machine to another and from one site to another.

Equipment handling and rigging should be carried out by a certified rigger.

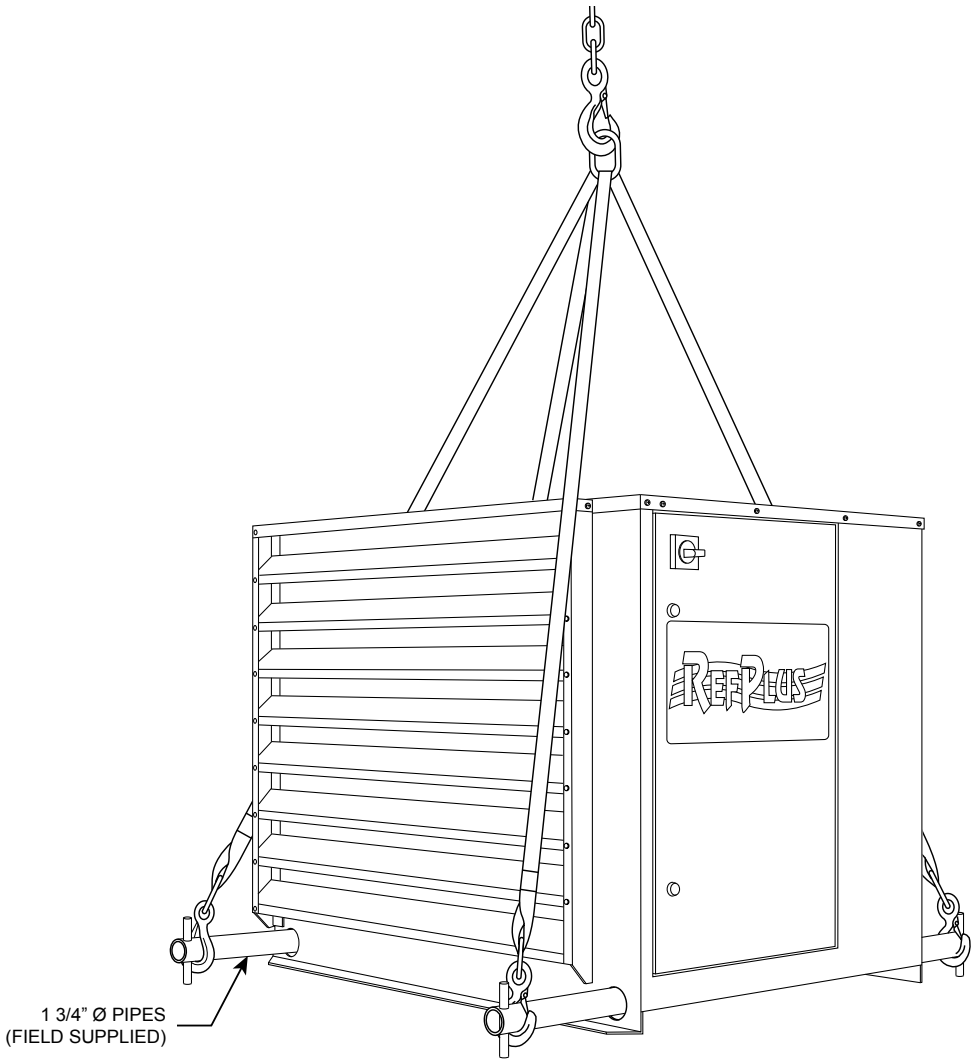

Figure 1 Small unit rigging (ideal method)

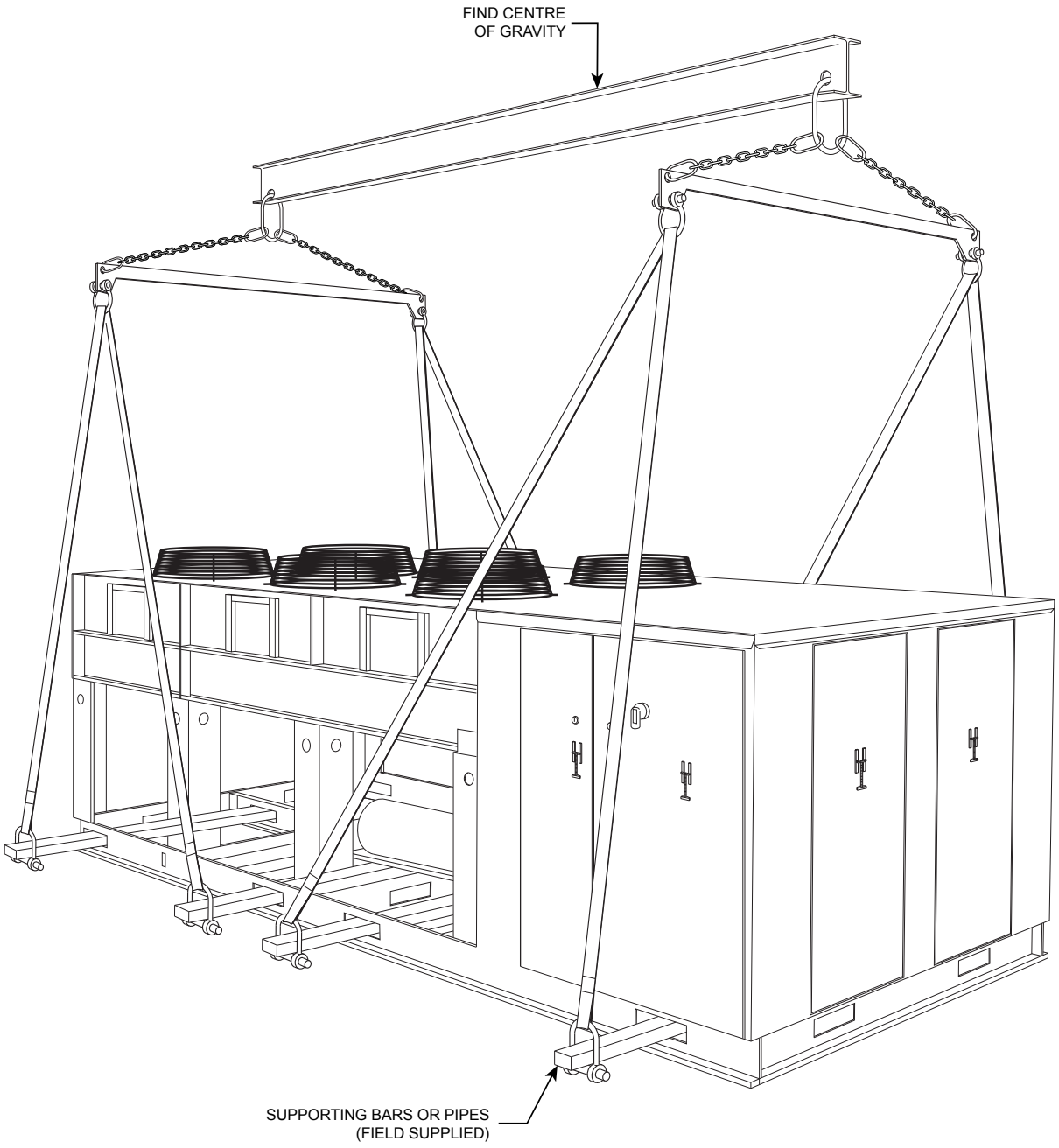

Figure 2 Large unit rigging (ideal method)

INSTALLATION

COMPLETE PRE-INSTALLATION INSPECTION

Check all items against the bill of lading to make sure all crates and boxes have been received. Check unit for possible damage incurred during shipment. Check for concealed damage. If there is any shortage or damage, file a freight claim immediately with the transport company. Do not return damaged equipment to the factory without prior approval. A Return Material Authorization (RMA) must be obtained in advance. **Items returned without an RMA label will be refused**. Verify that the nameplate electrical requirements match the available power supply.

INSTALLATION LOCATION

Outdoor condensing units:
These units are installed outside, on the roof or on the ground.

Always check the load capacity of the roof before installing the unit.

Roof-mounted units should be secured with proper size bolts to a steel frame (field supplied) to prevent the unit from shifting or changing position. Rubber pads are recommended to absorb vibration and reduce noise. The frame must be straight and level for proper unit operation.

Units should be mounted above supporting walls, over hallways, storage areas or auxiliary areas that are not sensible to noise and vibrations. **Mount all condensing units where sound level is not an important factor.** They should be mounted away from windows, doors, and other noise sensitive areas.

When selecting the location, be sure to provide enough space for adequate air circulation and avoid air recirculation. Areas with heavy polluted or corrosive vapours must be avoided. Do not locate units where air discharge from one unit will enter the air intake of others. Avoid locating units in restricted spaces where heat can build up and enter condensers. Locate the unit near the power supply and evaporators. Allow accessibility to the unit for safe maintenance. The vertical condenser coil must face local prevailing winds or be protected from the wind to avoid high condensing pressure.

If condensing units are mounted on the ground, adequate protection must be provided to avoid damages. A levelled concrete base, at least 6 inches (152 mm) above ground must be provided to protect against ground water. It will also help keep the condenser coil clean from grass, dirt and other debris.

Condensing units, piping, coil and disconnect switch **should not** be accessible to unauthorized persons. To shield the equipment from tampering and vandalism and protect people from accidental injury, a safety fence with locked access is recommended. Condensing units accessible to the public often get damages to the coil, piping, fans, or other components. Protect your equipment, your product in storage and yourself from liability. Prevent accidents and losses. The unit should be securely bolted to the base. Vibration absorbing components can be field supplied and installed to reduce noise. Proper piping vibration isolation must be provided.

Figure 3 to Figure 6 show proper mounting arrangements for OE(X) models while Figure 7 to Figure 9 show improper mounting arrangements. For OM(X) and ON(X) models, refer to Figure 10 and Figure 11 for proper mounting arrangement and Figure 12 and Figure 13 for improper mounting arrangement.

Note: For standard units, refer to the product catalogue for H and W dimensions. For non-standard units, refer to the approval drawings or to the actual unit on the jobsite.

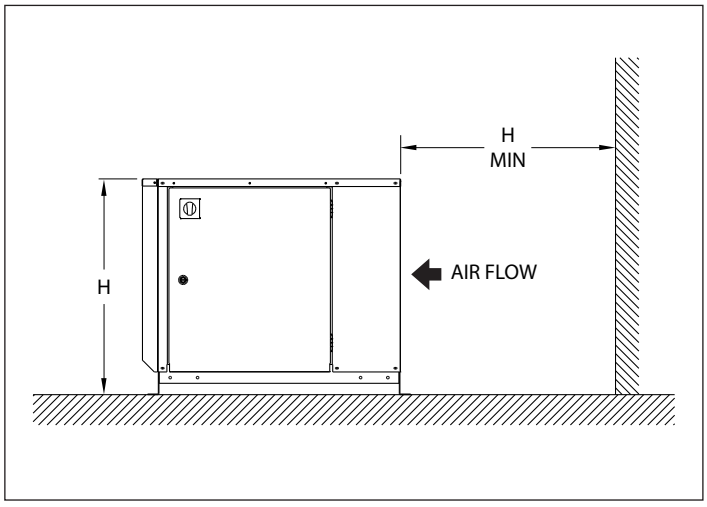

Figure 3 Proper OE(X) mounting arrangement

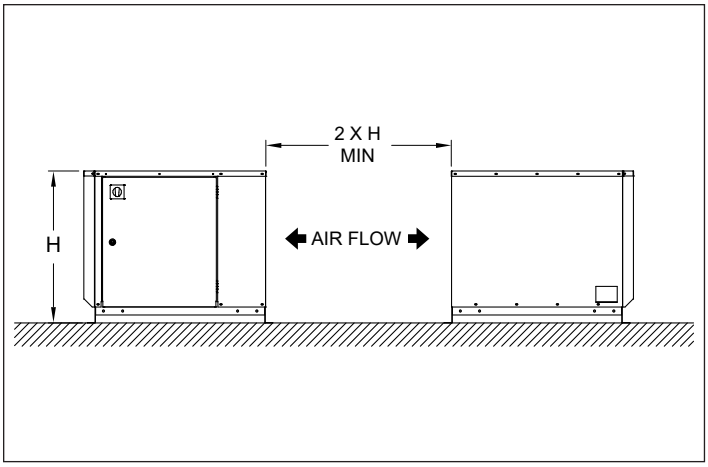

Figure 4 Proper OE(X) mounting arrangement

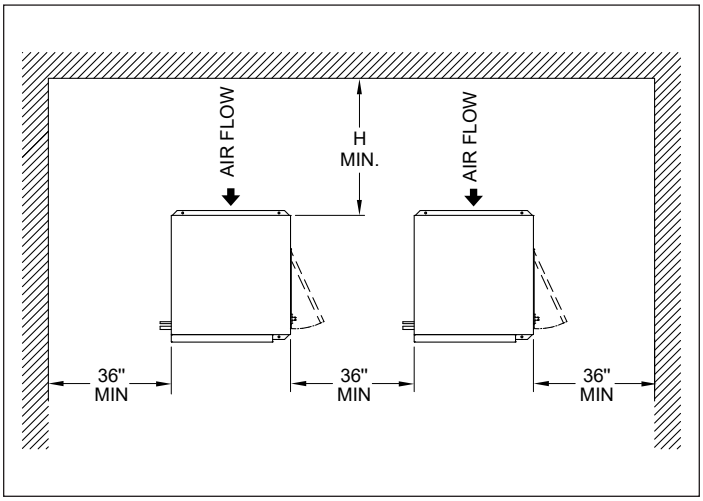

Figure 5 Proper OE(X) mounting arrangement

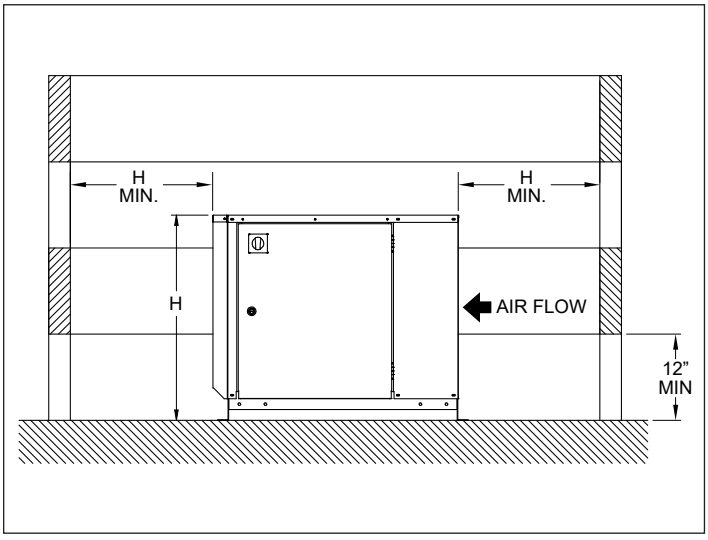

Figure 6 Proper OE(X) mounting arrangement

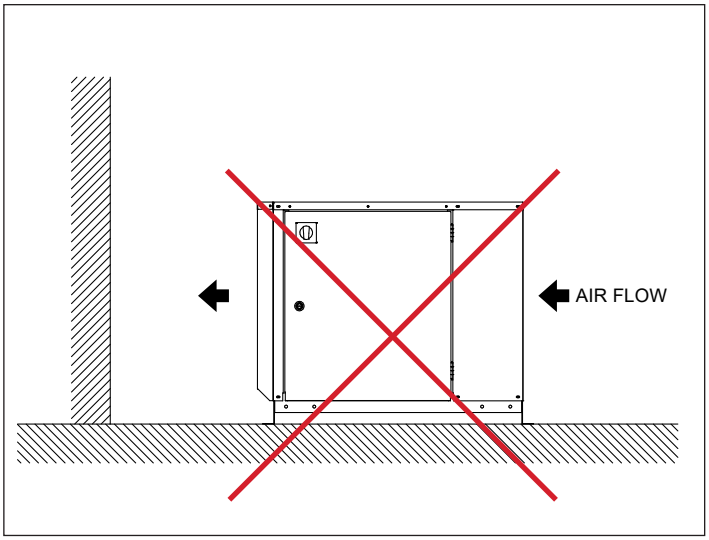

Figure 7 Improper OE(X) mounting arrangement

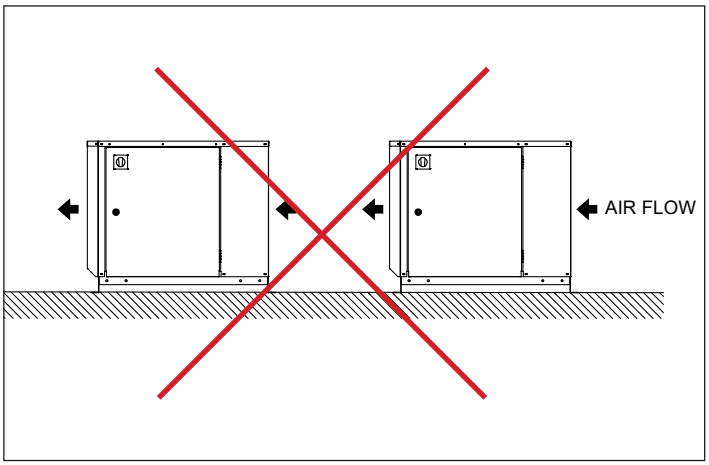

Figure 8 Improper OE(X) mounting arrangement

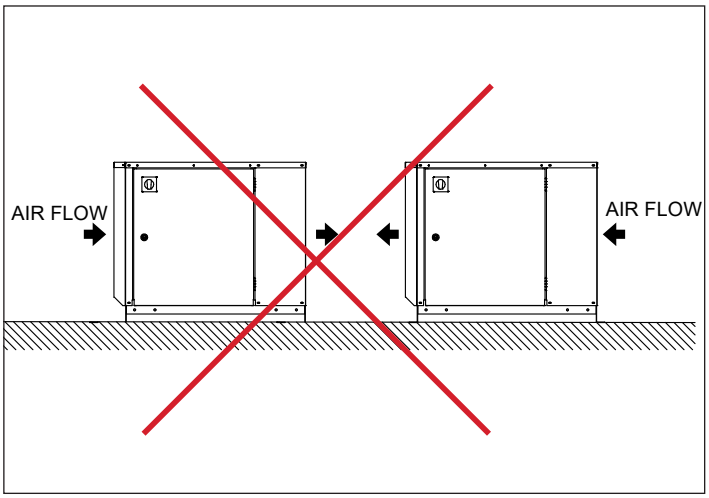

Figure 9 Improper OE(X) mounting arrangement

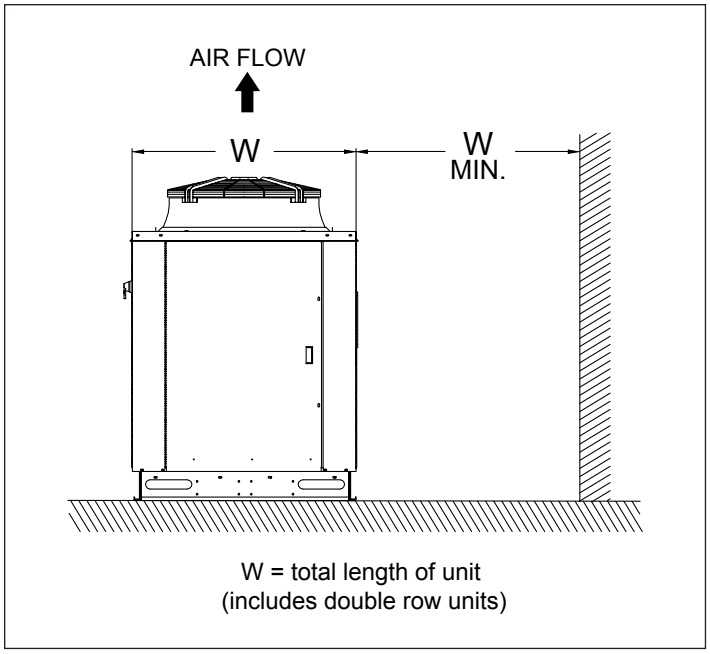

Figure 10 Proper OM(X) and ON(X) mounting arrangement

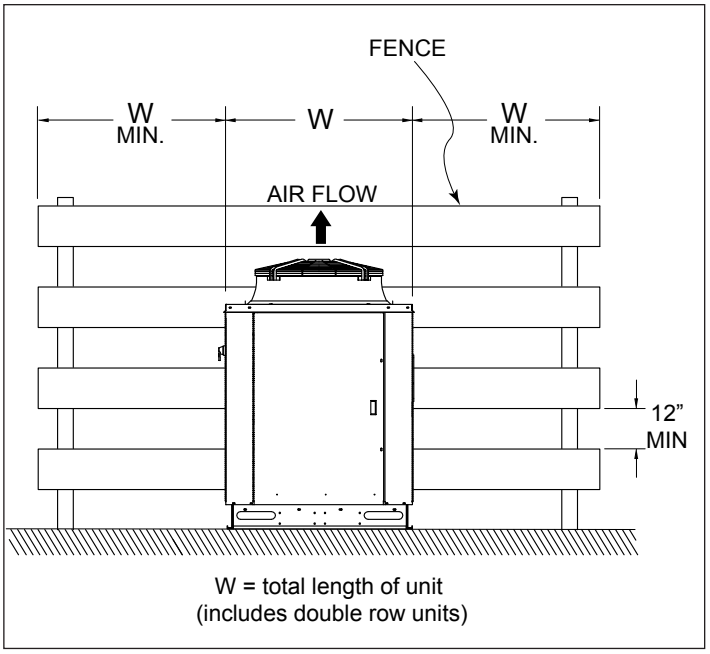

Figure 12 Proper OM(X) and ON(X) mounting arrangement

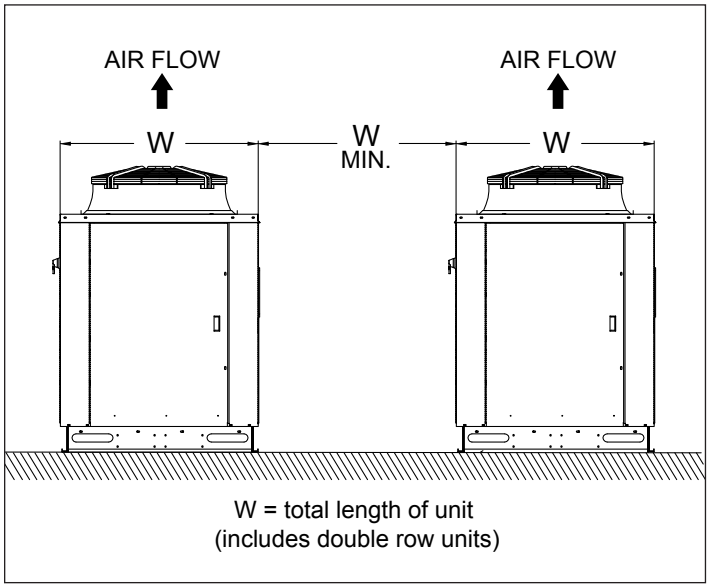

Figure 11 Proper OM(X) and ON(X) mounting arrangement

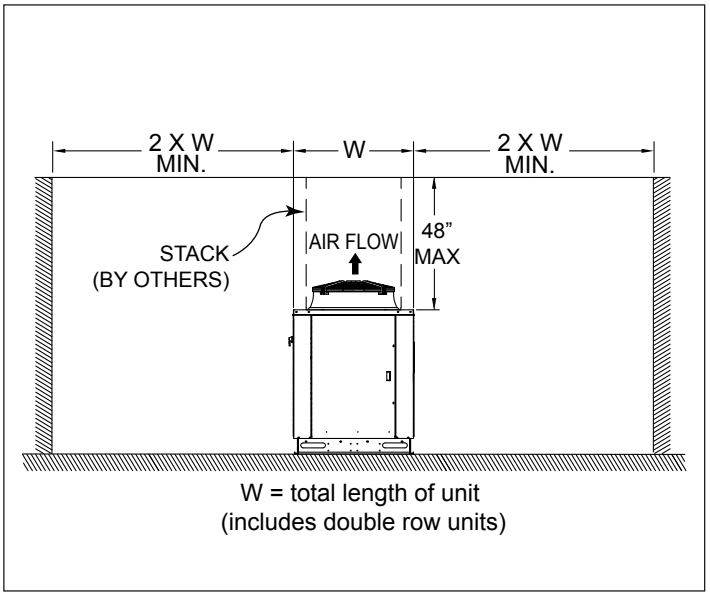

Figure 13 Proper OM(X) and ON(X) mounting arrangement

Indoor condensing units:

Adequate supply of outside air must be available. Proper ventilation must be provided to vent room air outside the building to avoid heat build-up. For air-cooled units, experience has shown that 1000 CFM (472 l/s) to 1200 CFM (566 l/s) and 2 ft² (0.19 m²) to 2.5 ft² (0.23 m²) of louvered area per compressor HP give good results. For remote condenser or water-cooled unit, between 60 CFM (28 l/s) to 100 CFM (47 l/s) per compressor HP is sufficient. Verify with local building codes for minimum ventilation safety requirements in case of a major refrigerant leak. For the required ventilation, follow ASHRAE Standard 15 and/or CSA B52. Room Temperature should be maintained between 60°F (15.6°C) and 95°F (35°C). Provide enough space for adequate air circulation and avoid air recirculation. Allow accessibility to the unit for proper maintenance, as shown in Figure 14.

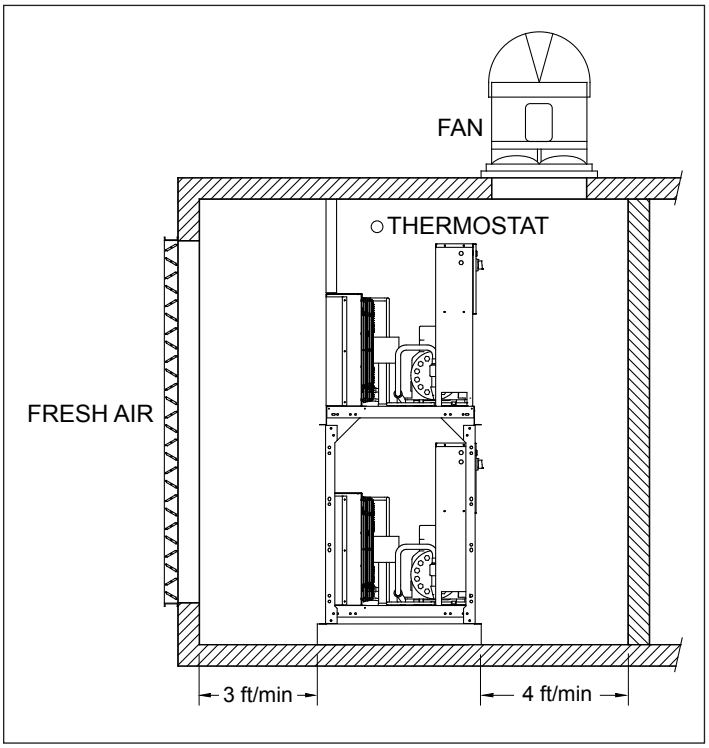

Figure 14 Typical indoor mounted air-cooled condensing unit.

REMOTE AIR-COOLED CONDENSERS AND WATER-COOLED UNITS

If the unit was specified with a remote air-cooled condenser, follow the installation and operating manual supplied with the air-cooled condenser. The condenser or condensing unit must be supplied with the necessary flooding valve and fan cycling. The fan can be mechanically or electronically controlled through the condenser's control panel.

Water-cooled condensing units are designed for cooling tower application and can be connected to city water where local code allows it. Some shell and tube condensers are provided with two methods of piping. For city water, connect the in and out, and install a plug in the middle large connection. For low-pressure cooling tower application, the in and out connection should be connected in parallel to the water supply connection and the large connection becomes the out. An optional, direct acting, field or factory installed, 2 or 3-way, water regulating valve can be provided.

Glycol-cooled condensing units are designed for closed-loop applications.

To save energy, a floating head system can be incorporated to the unit with a remote condenser. For city water or chilled water-cooled units, a constant floating head system can be provided. This will reduce the compressor size for the required capacity and save energy year-round.

Electronic water regulating valves are not recommended. These devices are too slow and may trigger high-pressure trips.

Piping must follow all applicable local and national codes.

Condensing units with spring-mounted compressors are shipped with blocks or shipping spacers under the compressor feet to keep it from shaking during transport. Unbolt or loosen the mounting nuts and remove the blocks or spacers. Insert the rubber spacers (they are tied to the compressor when required), re-install the nuts and tighten, leaving a 1/16'' (1.6 mm) gap between the nut and the rubber spacer. **Do not** tighten the mounting nuts tight against the rubber spacer or foot.

Units with rubber pads or solid mounted compressors are shipped with mounting nuts tight and they should be checked to be sure they have not loosened during transport.

UNIT WIRING

IMPORTANT: Wire connections may have come loose during transit. Check all screws for tightness prior to starting up the unit.

The unit must be grounded.

All system wiring must follow applicable local and national codes.

Internal wiring of fan motors, optional controls and contactors have been completed at the factory. Wiring connection ends on terminal blocks in the control panel and are clearly labeled.

All units are wired for continuous pump-down cycle. This prevents refrigerant migration from the evaporator to the compressor. The liquid line solenoid and thermostat must be wired properly.

REFRIGERATION PIPING

All refrigerant system components must be installed in accordance with applicable local and national codes using proper engineering practices. Refer to the ASHRAE Refrigeration Handbook chapter 1, Halocarbon Refrigeration Systems or RSES Refrigeration Piping Handbook Section 4 Piping Procedure for proper design.

Evaporators and condensing units are cleaned and dehydrated at the factory. **Care must be taken during field piping to prevent contaminants and moisture from entering the system**. Do not leave dehydrated compressors or filter-driers on the condensing units open to the atmosphere any longer than necessary.

Use only high-quality ACR type, refrigeration tubing that is capped and nitrogenized, internally free of dirt, humidity or other contaminants. **Unsealed tubing should not be used**. Use only wrought copper fitting. Long radius elbows are highly recommended. **Avoid 45º elbows** on the discharge piping. Use high-temperature brazing alloys that conform to AWS specifications for the application.

Lines must be purged with dry nitrogen while joints are brazed to avoid oxidation and carbon deposits.

Limit brazing/soldering flux to the minimum required to prevent contamination of the brazed/soldered joints internally. Flux only the male side of the connection, never the female. Remove excess flux after brazing/soldering.

The equivalent line length should not exceed 100 ft (30 m). For longer lines, contact the RefPlus engineering department for recommendations. Long lines and/or high operating temperature differences (discharge, hot gas and suction lines with hot gas defrost) require some expansion loop to avoid line break. More details can by found online at www.copper.org.

All piping must be properly supported for proper operation. Follow ASHRAE, RSES, specifying engineer or the industry standard rules. Normally, any straight run must be supported in at least two locations near each end of the run. As a guide, 3/8'' to 7/8'' diameter pipes should be supported every 5', 1-1/8'' and 1-3/8'' every 7' and 1-5/8'' and larger every 9' to 10'. When changing directions in a run of tubing, **no corner should be left unsupported**. Support should be placed at a maximum of 2' in each direction from the corner.

Piping attached to vibrating parts (compressor, condensing unit base and high-pressure gas piping) must be supported in such a way that it will not limit the movement of the vibrating parts. Rigid mounting will fatigue the copper tubing.

Thoroughly inspect all piping after the equipment is in operation and add support whenever line vibrations are significantly greater than most of the other piping. Extra support is relatively inexpensive as compared to refrigerant loss. See Figure 15 and Figure 16.

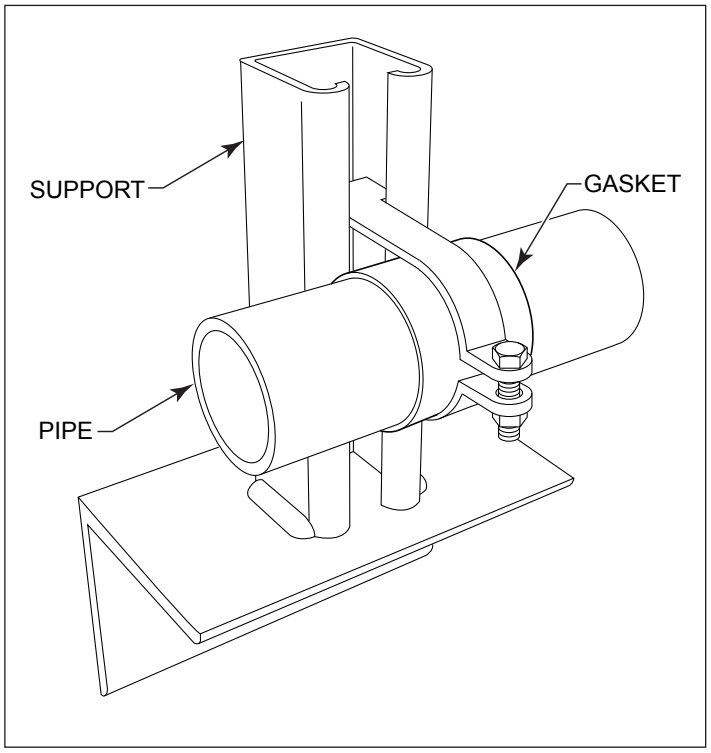

Figure 15 Typical pipe support

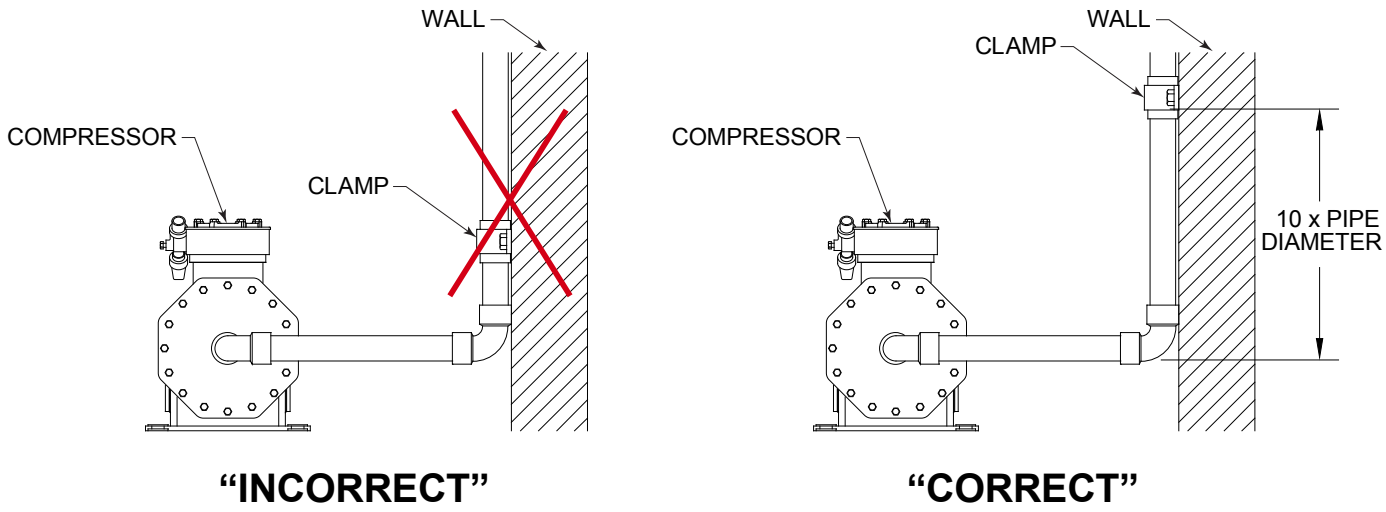

Figure 16 Typical piping support from a compressor to a wall. Note: suction vibration absorber not shown.

LINE SIZING AND BASIC PIPING RULES

For proper line sizing, use an industry accepted program from a refrigerant or refrigeration valve manufacturer.

SPORLAN

Refrigeration valves and line sizing, individual line sizing are user friendly.

www.sporlanonline.com
Literature
Sporlan miscellaneous information
Selection program and download.

HONEYWELL, GENETRON

Line sizing only - full system on one page. It is a highly-engineered selection program.

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CHEMOURS

Line sizing, individual line sizing and a highly-engineered selection program.

www.chemours.com
Download the Chemours Refrigerant Expert Tool.
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BASIC PIPING RULES

1. Ensure proper liquid refrigerant feed to evaporators.
2. Provide practical refrigerant line sizes without excessive pressure drop.
3. Prevent excessive amount of lubricating oil from being trapped in any part of the system.
4. Protect the compressor from lubricating oil loss at all times.
5. Prevent liquid refrigerant or oil from entering the compressors during operation and idle time.
6. Maintain a clean and dry system.

RECOMMENDED VELOCITY FOR GOOD OIL RETURN OF POE WITH HFC - FPM (M/S)

FPM	Minimum Horizontal	Minimum Vertical	Design	Maximum
Condensate	NA	NA	≤ 100 (0.5)	150 (0.8)
Liquid	NA	NA	≤ 300 (1.5)	300 (1.5)
Suction	500 (2.5)	900 (4.6)	1000 (5.1) - 3000 (15.2)	4000 (20.3)
Discharge	500 (2.5)	900 (4.6)	2000 (10.2) - 3000 (15.2)	3500 (17.8)
HG Defrost	500 (2.5)	900 (4.6)	1000 (5.1) - 2000 (10.2)	3000 (15.2)

IMPORTANT: A calibrated pressure gauge and regulator must always be used with nitrogen cylinders.

The suction line must be sized to maintain proper line velocities with a practical line pressure drop. It is usually equal to 2°F (1.1°C). To ensure proper oil return, all horizontal lines must be sloped down toward the compressor with a minimum pitch of 1/4" (6.4 mm) per 10 ft (3 m).

An access fitting must be installed (when not part of the evaporator) on the evaporator suction line to read an accurate suction pressure for superheat adjustment.

In situations where it is necessary for the suction line to rise, an oil trap must be installed at the bottom of the riser as shown in Figure 17. To ensure oil return through a riser in the suction line, a velocity of no less than 1000 FPM (5.1 m/s) is required. When a system has capacity variation or unloaders, a double riser when at less than 50% capacity may be necessary to keep the velocity at a minimum of 900 FPM (4.6 m/s). You can drop one size for suction riser to lift the oil. A trap should be provided for each additional 20 ft (6 m) of riser. See Figure 18.

Avoid oil and refrigerant migration between active and inactive evaporators in a common suction system. When multiple evaporators are connected to a common suction line, it must enter from the top. The first evaporator suction connection should have an inverted trap as shown in Figure 19 and Figure 20.

Suction lines should not be exposed to heat or the sun. The line must be properly insulated if it is necessary to run suction line outside of the building or through heated areas. The suction line must be insulated in any situation where the pipe may sweat or freeze.

If isolation valves are installed on the suction lines, full port ball valves should be used.

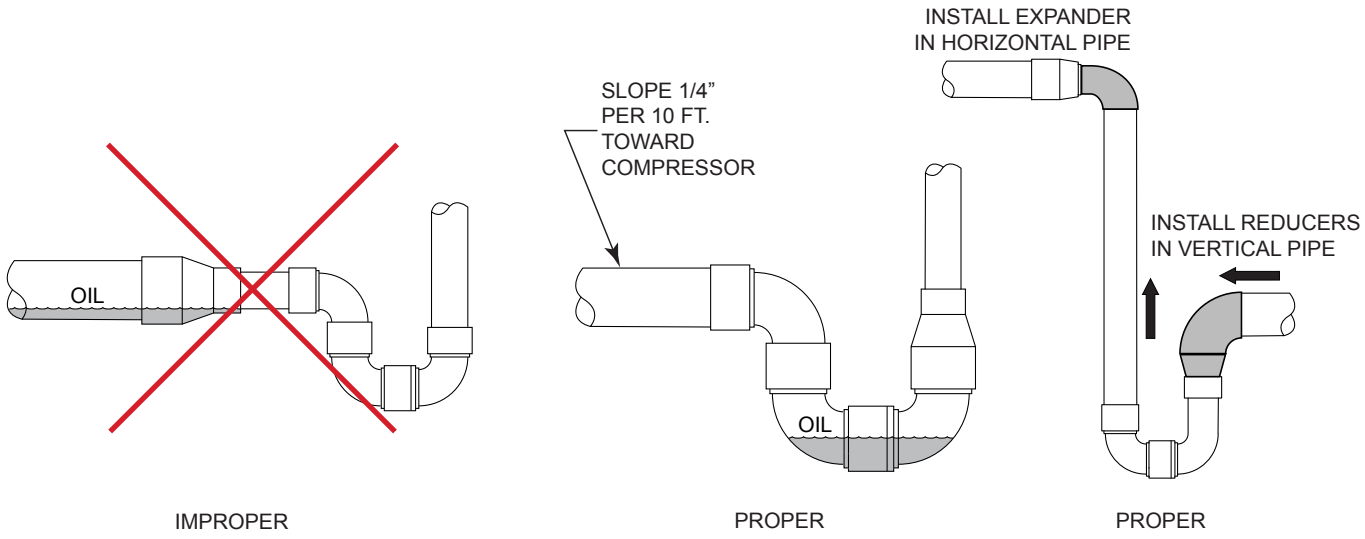

Figure 17 Suction oil trap construction

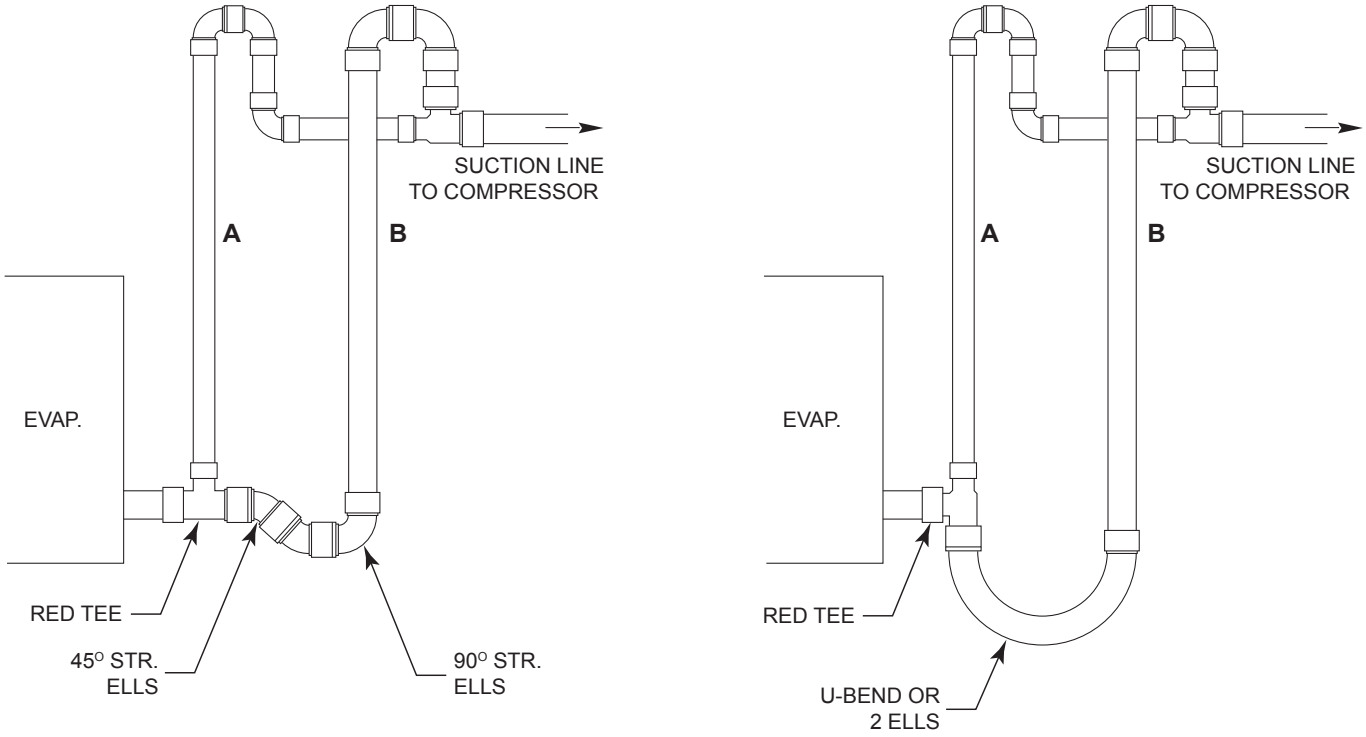

Figure 18 Double suction riser

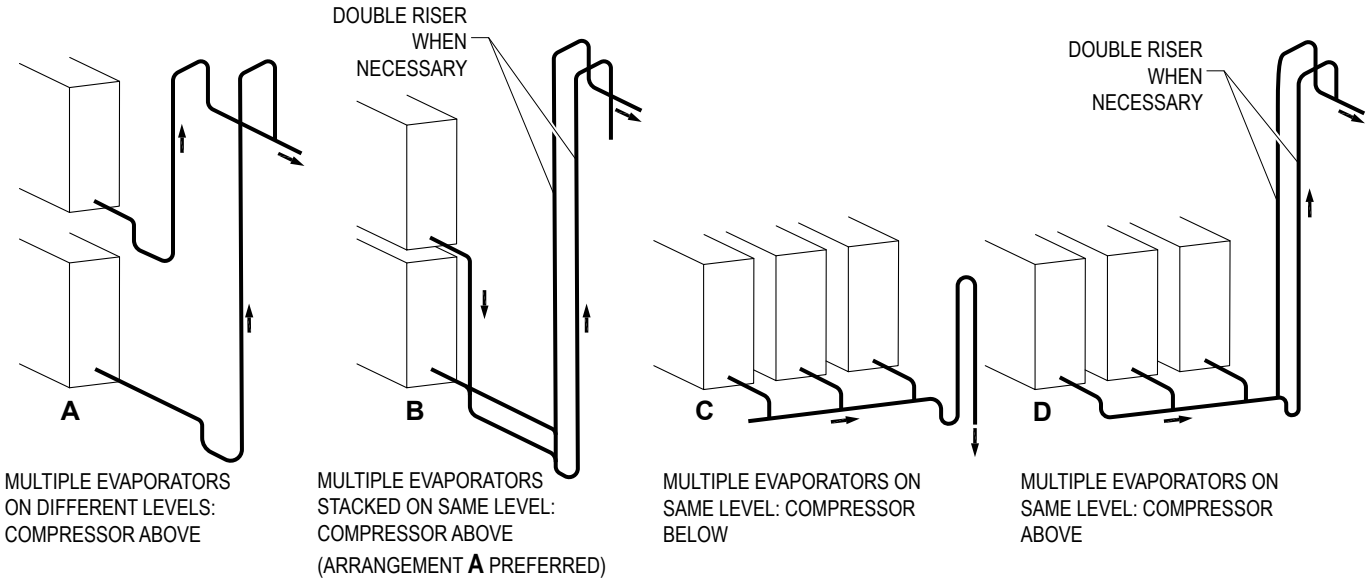

Figure 19 Multiple evaporator suction line construction

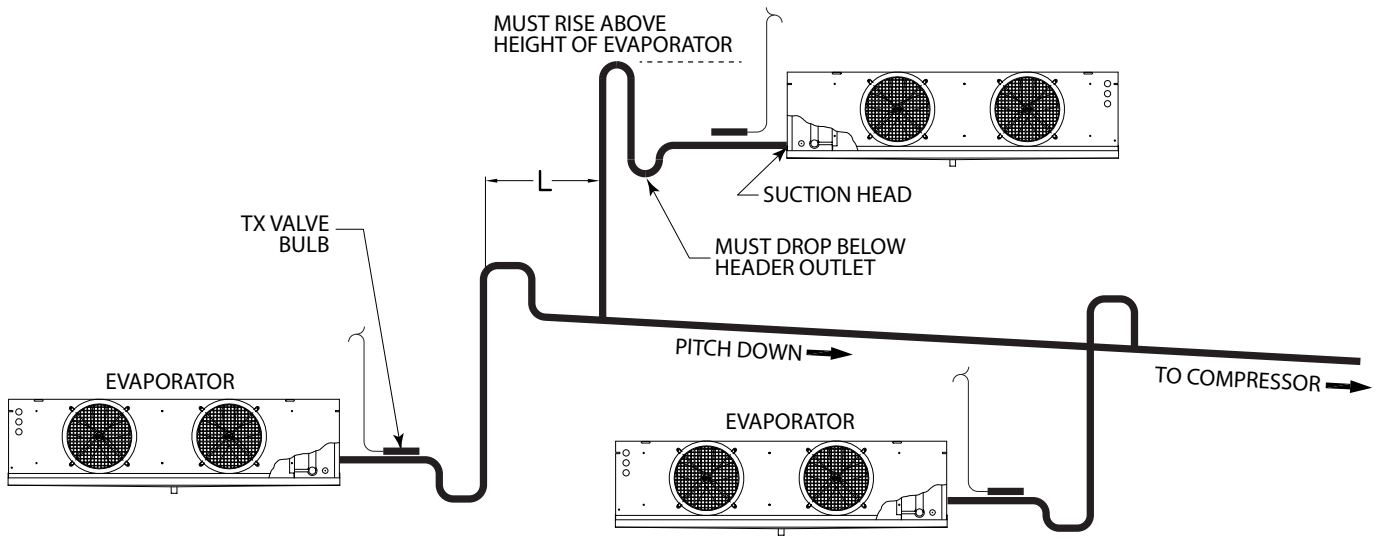

Figure 20 Multiple evaporator suction line construction

LIQUID LINE

The liquid line should always drop from the receiver. Liquid sub-cooling is required when a liquid line rises higher than the receiver. Make sure you have from 0.25°F (0.14°C) to 0.5°F (0.27° C) of sub-cooling for each foot (305 mm) of liquid riser. Liquid lines with more than 30' (9 m) of vertical lift need special attention. All RefPlus air-cooled condensing units have an independent condenser sub-cooling circuit. For water or remote air-cooled condenser application, a suction to liquid heat exchanger can be used or a separate sub-cooling circuit in the remote air-cooled condenser may be necessary. Be sure that the superheat, when using a liquid to suction heat exchanger, does not exceed the maximum recommended by the compressor manufacturer. Contact to RefPlus engineering department for more details.

The liquid connection must be taken from the bottom of the liquid line piping when multiple evaporators are on the same liquid line.

Do not exceed a maximum of 300 FPM (1.5 m/s) for the liquid line velocity from the receiver to the evaporator.

Excessive pressure drop in the liquid line must be avoided to keep a solid column of liquid at the thermostatic or electronic expansion valve (TXV or EEV). The liquid line solenoid valve (when supplied) should be installed in the liquid line just ahead of the TXV. Sweating of the liquid line may occur in warm and humid conditions due to the sub-cooled condition of the liquid. Liquid line insulation may be required.

Before installing the expansion valve, make sure the distributor is a Venturi Flow (standard Alco) or the nozzle is installed for the orifice type (special Sporlan). When an auxiliary distributor adaptor is supplied with the orifice type, the orifice must be installed in the auxiliary connector. This is to ensure that the hot gas bypasses the orifice. For optimum performance, the expansion valve outlet should be connected directly to the distributor. If reducing couplings or adaptors are required, keep them close coupled. **Do not** install elbows between the expansion valves and the distributor. The expansion valves must be selected to match the system capacity. Follow the expansion valve manufacturer rating when selecting the valve. Be sure to use the correct multiplier for the sub-cooled liquid. Use balanced port TXV or EEV with RefPlus condensing units. They are all supplied with a sub-cooling circuit with variable sub-cooled liquid temperature.

DISCHARGE AND HOT GAS LINE FOR REMOTE CONDENSER APPLICATION

The discharge and hot gas line must be sized to maintain proper line velocities with a practical line pressure drop, which is usually equal to 2°F (1.1°C). To ensure proper oil return, all horizontal lines must be sloped down toward the condenser with a minimum pitch of 1/4 in. (6 mm) per 10 ft. (30.5 m).

In situations where it is necessary for the discharge or hot gas line to rise, an oil trap or a check valve must be installed at the bottom of the riser to avoid oil draining back to the compressor head.

To ensure oil return through a riser in the discharge or hot gas line, a velocity of no less than 1000 FPM (5.1 m/s) is required. When a system has unloaders, a double riser may be necessary to keep the velocity at a minimum of 900 FPM (4.6 m/s) when unloaded. A trap should be provided for each additional 20 ft (6 m) of riser. You can drop one size for a discharge riser to lift the oil. Avoid any discharge line pulsation that can cause line vibration. Pulsation can cause damage to the discharge piping and the brazed joints.

CONDENSATE DRAIN LINE

Properly protected from freezing, **copper or steel pipes should be used**. Food approved plastic can also be used for medium temperature coolers above 35°F (2°C). The drain line must have a minimum of 4'' per foot pitch for proper drainage. The unit must be perfectly level in two directions. The drain line should be at least as large as the evaporator drain connection. **All plumbing connections should be made in accordance with local plumbing codes**. All condensate drain lines must be trapped and run to an open drain. They must **never** be connected directly to the sewer system. Traps in the drain lines must be in a warm ambiance. We recommend a trap on each evaporator. Traps located outside the building must be insulated and wrapped with a drain line heater. The heater must be permanently energized. A heat input of at least 20 W per linear foot of drain line for a 0°F (-18°C) room and 30 W per linear foot of drain line for a -20°F (-29°C) room should be satisfactory.

Always trap drain lines individually to prevent vapour migration.

Power must be disconnected before cleaning the drain pan. Drain pans also serve as cover for hazardous moving parts. **Operation without the drain pan constitutes a hazard**.

Inspect drain pans periodically to ensure free drainage of condensate and ice formation. If the drain pan contains standing water, check for proper installation and level.

Drain pans should be cleaned regularly with warm soapy water.

LEAK TESTING AND EVACUATION

Leak testing and evacuation must be done in accordance with local and national codes.

Once all refrigerant connections are made, leak test all joints before charging the system with refrigerant. After leak testing, all moisture and non-condensable gas must be evacuated from the system. Attach a deep vacuum pump and electric gauge on both the high and low-pressure sides of the system. Pull a 500-micron vacuum and hold for 24 hours. If the vacuum is not holding, check for leaks and make sure that gauge hoses and caps are not leaking.

Make sure all valves such as the compressor, hot gas, receiver, and liquid solenoid are open. Make sure no section is isolated from the system. Break the vacuum in the system with the refrigerant to be used. Always charge the refrigerant into the system through a 16 in^3 (262 cm^3) drier (field-supplied) in the charging manifold.

REFRIGERATION VALVES AND CONTROLS

OUTDOOR AIR-COOLED SYSTEM

Many types of head-pressure controls are available:

- Single mechanical preset, standard on our outdoor air-cooled units. It is preset to 150 PSIG for maximum efficiency. 180 PSIG is available when heat recovery is needed. Refer to Sporlan bulletin 90-30, 90-30-1 and 90-31 for details.
- Adjustable dual flooding valves are optional on all outdoor air-cooled units. They must be adjusted in the field to 150 PSIG or 180 PSIG if heat recovery is needed. Refer to Sporlan bulletin 90-30, 90-30-1 and 90-31 for details.
- Adjustable electronic with stepper type valves are also optional. The controller must be programmed in the field according to the job requirement. Refer to Sporlan bulletin 100-50-5.5 for details.

Pressure actuated fan cycling is standard on outdoor air-cooled units with multiple fans. A two-speed (50%, 100%) control is optional on ECM condenser fan motors. Pressure actuated variable speed is optional on single fan units, on the first motor or on all motors on multiple fan units. Those options reduce the amount of refrigerant required to flood the condenser and stabilize the operating pressure during winter operation. For remote air-cooled condenser applications, refer to the selected units for optional fans and refrigerant pressure controls. To meet the published AWEF rating, the minimum condensing pressure must be set to 150 PSIG or approximately 70ºF (21ºC). Make sure the compressor is designed for the lower condensing pressure/temperature. The Sporlan hot gas bypass check valve should be selected for 20 PSI (139 kPa) differential. If the pressure drop from the condenser inlet connection to the receiver is more than 14 PSI (97 kPa) , use a higher differential pressure valve like the 35 PSI (241 kPa).

If the system has an adjustable hot gas bypass valve (ex. Parker), the pressure must be set higher than the pressure drop from the inlet of the condenser to the receiver.

During summer operating conditions (condensing pressure higher than preset pressure), the hot gas bypass should be closed. Cold to warm bypass line is normal. If the valve opens (hot bypass line) and you get sub-cooled liquid out of the condenser, this is a sign that the pressure drop is higher than 15 PSI or that a bypass valve is stuck open.

WATER-COOLED SYSTEM

Field installed, optional, water regulating valves are complete with a capillary tube or flexible hose with a 1/4" flare connection, containing a depressor pin. The depressor pin ensures easy installation and replacement without losing the refrigerant charge. Water regulating valves must be field adjusted. The flow will automatically adjust to the required cooling demand. When using chilled or cold water/glycol, an optional energy saving floating head pressure system with a minimum of 70°F (21°C) saturated condensing can be used. Those conditions increase the system capacity and reduce the power demand. The size of the system (compressor/condenser) can be reduced to match the required capacity.

SYSTEM WITH MECHANICAL CONTROLS

All controls must be field adjusted. The pressure switch differential must be set such that the compressor will not short cycle. **A compressor, for a safe and reliable operation, should not start/stop more than 8 times per hour**. With mechanical controls, an optional, time delay relay is an efficient way to avoid short cycling.

The high-pressure safety switch must not be adjusted at more than 90% of the relief valve setting, according to CSA B52 and ASHRAE 15.

OPTIONAL FAN SPEED CONTROL

Model IE and OE with optional ECM motors

RefPlus offers an optional variable speed single phase ECM motor. An electronic, fixed pressure, electronic speed control sends a 0/10 VDC signal to an ECM motor that varies the speed from 600 to 1500 RPM (OE(X)-002 to 010) and from 200 to 1200 RPM (OE(X)-011 to 220). (Some pressure adjustments can be done).

The 10 VDC signal is from a 24 VAC to an adjustable 6 to 24 VDC output. This control is factory set to 9.5 VDC. Use a voltmeter set at VDC to check the output voltage. A potentiometer is mounted on the board for fine tuning, if necessary. If the output voltage exceeds 10 VDC, the motor will not react normally, and it will run at a very low speed.

Model OM, ON, ECM Motors

RefPlus offers a variable speed, 3-phase, ECM motor. An electronic, fixed pressure, electronic speed control, sends a 0/10 VDC signal to the motor, this varies the speed from 200 to 1550 RPM on OM units and from 200 to 970 RPM on ON units (some pressure adjustments can be done).

The 10 VDC signal comes from the ECM motor.

Model OM with optional variable speed PSC motors

RefPlus offers a variable speed, single phase, PSC motor and an electronic, adjustable pressure, variable speed control for the motor speed. The speed varies from approximately 250 to 1100 RPM (wave chopper type). This combination is not as efficient as the ECM option. The motor may generate some electrical noise at certain speeds.

LOW SUCTION, LIQUID INJECTION REQUIREMENTS (L6)

Units with suffix L6, R407A/F, R448A and R449A may require some liquid injection due to high discharge/oil temperature. Suction to liquid heat exchanger should be avoided as this would increase the suction superheat and discharge/oil temperature. This could cause more liquid injection reducing system efficiency.

These refrigerants do not have as high a discharge temperature as the R22 but are higher than the R404A/R507. Therefore, liquid injection and/or ventilation, when required, is supplied with RefPlus units (low temperature).

Copeland, small, semi-hermetic air-cooled compressors (direct suction) do not require any liquid injection.

Copeland, low-temperature Scrolls are supplied with a mechanical liquid injection. This is a head temperature hydraulic sensor. This system injects a calibrated amount of liquid refrigerant in the compressor injection port. This bypasses the compressor motors and reduces the suction superheat and the discharge/oil temperature.

Copeland Discus compressors are supplied with a Demand Cooling System. A Demand Cooling System is an electronic head/discharge temperature sensor, electronically controlling the liquid injection in the compressor body bypassing the compressor motor.

Bitzer compressors require ventilation. Liquid injection is only required when suction temperature is below -40°F/°C.

The condenser fan supplies the cooling air. For remote and water-cooled units, a compressor head cooling fan is supplied.

Liquid injection only occurs during high-condensing and suction superheat conditions. Possible causes are abnormally high summer ambient temperatures, dirty condenser coils, defective condenser fans, high-suction superheat, defective TXV/EEV, low refrigerant charge or badly designed piping.

RefPlus units are all factory piped and controlled for maximum efficiency and dependable operation.

REFRIGERATION OILS

CAUTION

- ***Units are designed for HFC or HFC/HFO refrigerant blends and are supplied with polyolester (POE) oil.***
- ***This oil is very hygroscopic and care should be taken when using POE.***
- ***All oil must be used at once. Any remaining oil must be properly disposed of.***
- ***System corrosion and ultimate failure can occur if moisture level reaches than 100 ppm.***
- ***POE must be handled carefully and proper personal protective equipment (gloves, eye protection etc.) must be used when handling POE lubricant. POE must not come into contact with surface or material that might be harmed by POE, including without limitation, certain polymers (e.g. PVC/CPVC and polycarbonate).***

OIL COLOUR

New POE lubricant will be clear and straw colour. After use, it may acquire a darker colour. This does not indicate a problem as the darker colour merely reflects the activity of the lubricant's protective additive.

OIL LEVEL

POE oil lubricant exhibits a greater tendency to introduce oil into the cylinder during flooded start conditions. **If allowed to continue, this condition will cause mechanical failure of the compressor**.

A crankcase heater is required with condensing units and it must be turned on 24 hours before start-up.

Oil level must be maintained between 1/8 to maximum 1/4 of the sight glass when the system is stabilized.

Verify the required amount of oil for Hermetic and Scroll compressors. Some additional oil may be required when excessive refrigerant charge is required for a normal operation. Contact RefPlus technical sales department for more details.

POE oil must be used with HFC and HFC/HFO blends. This oil is also compatible with HCFC refrigerants.

REFRIGERANT GLIDE

To meet international mandated lower Global Warming Potential (GWP) levels, the commercial refrigeration industry has moved to refrigerant blends.

R407A, R407C, R407F, R448A and R449A are a mixture of different molecules that retain their individual evaporating and condensing points.

With R404A and R507, the refrigerant glide is less than 1°F (0.55°C) and can be ignored.

With R407A, R 407C, R407F, R448A and R449A, the glide is in the range of 6°F (3.3°C) to 10°F (5.5°C).

The condensing pressures are also higher than that of R404A at the same operating conditions.

The glide will change the frost characteristic of a low-temperature evaporator and the end defrost thermostat may need to be relocated.

STANDARD SEQUENCE OF OPERATION

STANDARD UNITS ARE WIRED FOR A CONTINUOUS PUMP DOWN CYCLE.

When the cold room temperature rises above the room thermostat setting, the thermostat contacts close, energizing the liquid line solenoid.

The suction pressure rises above the low-pressure setting and the low-pressure switch contact closes. This energizes the compressor/condenser fan contactor and starts the refrigeration cycle if the compressor is not stopped by other safety controls when supplied. Example: oil failure switch, discharge temperature, phase monitor, etc.

On multiple condenser fan units, the fan will cycle according to the condensing pressure.

When variable speed condenser fans are supplied, the speed will change according to the condensing pressure.

When the room temperature drops below the room thermostat setting, the room thermostat contacts open and de-energize the liquid line solenoid.

The compressor pumps the refrigerant from the evaporator and from the piping.

Suction pressure drops below the low pressure setting. Low pressure contacts open.

This will de-energize the compressor/condenser fan contactors and terminate the refrigeration cycle.

In the standard operation cycle, the evaporator fans run constantly.

A low-pressure bypass timer is optional to force the start-up in very cold conditions.

A single pump down cycle sequence (non-recycle pump-down) is optional for a system with an extremely long off cycle. This is to avoid a repeated pump down cycle that can damage the compressor.

AIR DEFROST TIMER OPTION

There are two ways of controlling frost formation on systems above 34°F (1.1°C).

Equipment selected for a maximum of 16 hours per day in a stable room load and room temperature above 40°F (4.4°C) may operate without an air defrost timer.

For unstable room load and/or colder temperature, **RefPlus recommends the use of an optional air defrost timer.**

The operating sequence is the same as standard pump down cycle, plus the following:

- The optional air defrost timer contact is in series with the room thermostat.
- The timer will have the same function as the room thermostat.
- The evaporator fans are in constant operation mode, drawing warmer air through the coil, melting the ice.
- For systems close to 34°F (1.1°C), use longer off cycle.
- Typical timing is 3 to 4 times a day for a period of 30 to 60 minutes.
- A temporary rise in room temperature will occur during the defrost cycle.

STANDARD ELECTRIC DEFROST MECHANICAL TIMER OPTION

The recycling pump down cycle remains in function with the additional sequence for the defrost cycle.

The Electric Defrost timer contains two switches (one for the heaters and one for the evaporator fans) as well as a time-safe switch and a release solenoid. This solenoid is controlled by the end-of-defrost and fan-delay thermostat.

The time safe switch on the clock **is not** for the defrost termination. If the evaporator does not send the end-defrost signal (from the defrost termination thermostat), there will not be a fan delay cycle. This will cause the humid and wet air to freeze on fans, fan guards and the ceiling in front of the unit cooler. Also, continuous partial defrost cycle, with coil bottom constant frosting will eventually damage the evaporator tubes and may cause refrigerant leaks.

The time safe should be adjusted the following way:

After the room has reached its operating condition and the latent load is what it should be, verify a few defrost cycles and add approximately from 30 % to 40% more time, without ever exceeding 45 minutes. i.e. If the defrost cycle timing with a proper defrost load was 26 minutes, then set the time safe to 35 minutes. In conclusion, the time safe is not the end defrost. The evaporator controls must terminate the defrost cycle. The time safe is to ensure that the evaporator will not overheat in case of a control defect.

DEFROST SEQUENCE

When the defrost clock calls for a defrost cycle:

A: Switch number 2 (contact between 2 and 4) opens:

- This initiates a pump down cycle by closing the solenoid valve.
- Once the cycle is finished, the compressor contactor is de-energized and the NC auxiliary switch closes.
- The evaporator fans are also stopped during the defrost cycle.

B: Switch number 1 (contact between 1 and 3) closes:

- This sends a signal to energize the defrost heaters. It will be delayed by the compressor contactor NC auxiliary switch until the compressor finishes the pump down cycle.
- If the system does more than one pump down cycle, the heaters will be de-energized.
- This function ensures that the heaters and the compressor will not be energized at the same time. This will limit the power supply to a system.
- After the pump down cycle, the heaters are energized, and the coil starts defrosting.
- The ice on the evaporator melts. When all the ice is gone, the coil temperature will rise.
- When the coil temperature reaches the end-defrost temperature setting, the thermostat sends a signal to contact ‘X’ on the time clock, this is the release solenoid.
- When ‘X’ is energized, switch number 1 (contact 1 and 3) opens.
- This de-energizes the defrost heaters.
- Switch number 2 closes (contact between 2 and 4) opens the solenoid if there is a cooling demand, the evaporator fans will be delayed by the end defrost/fan delay thermostat.
- Once the evaporator coil temperature drops below freezing or the set temperature, the fan-delay thermostat contacts energize the fan contactor.
- Cooling cycle is on if there is a cooling demand.
- High-efficiency electronic demand defrost systems are also available. Refer to the operator's manual of the electronic controller.

Refer to electrical diagrams in Figure 21 to Figure 24.

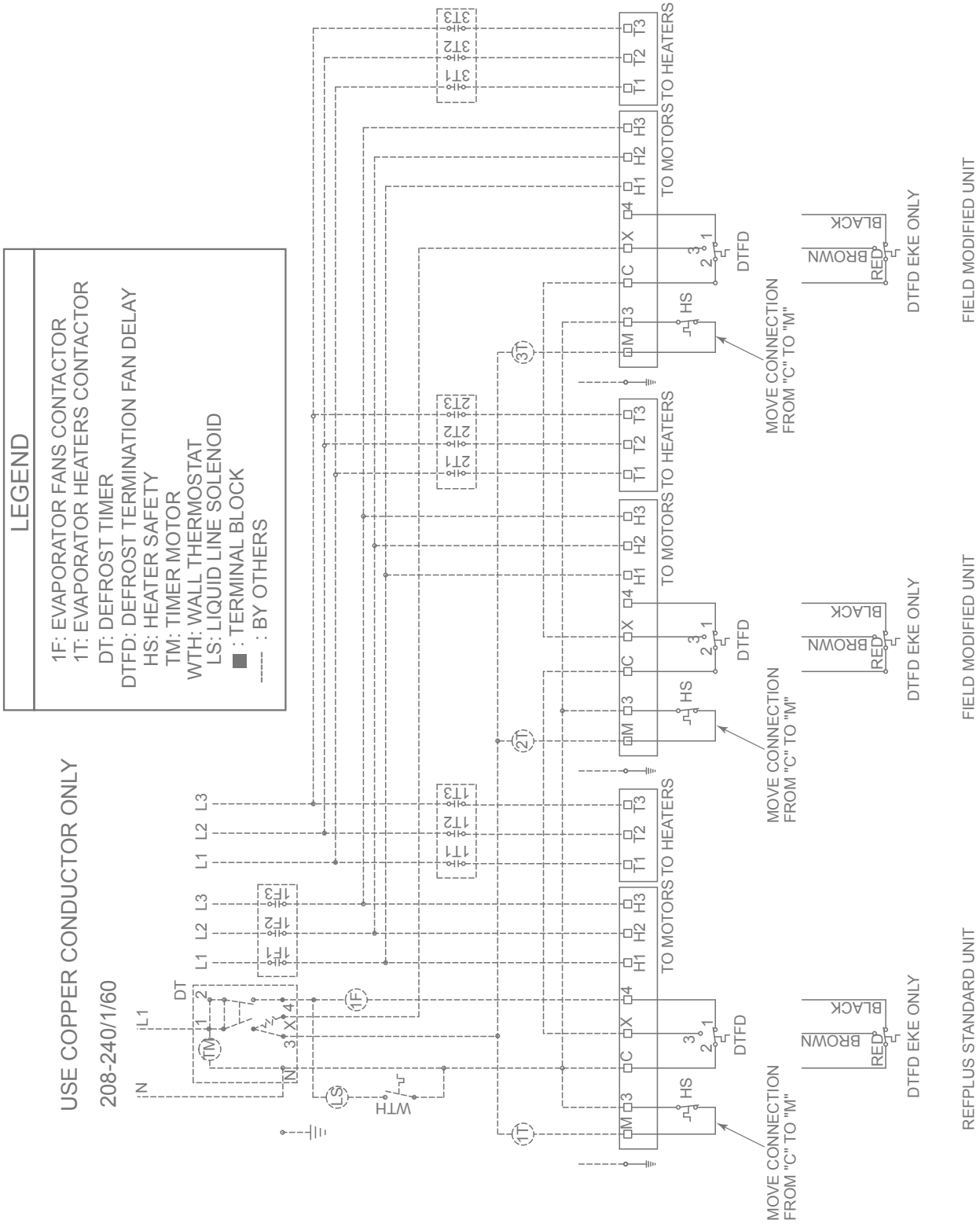

Figure 21 Typical wiring diagram (multiple electric defrost unit)

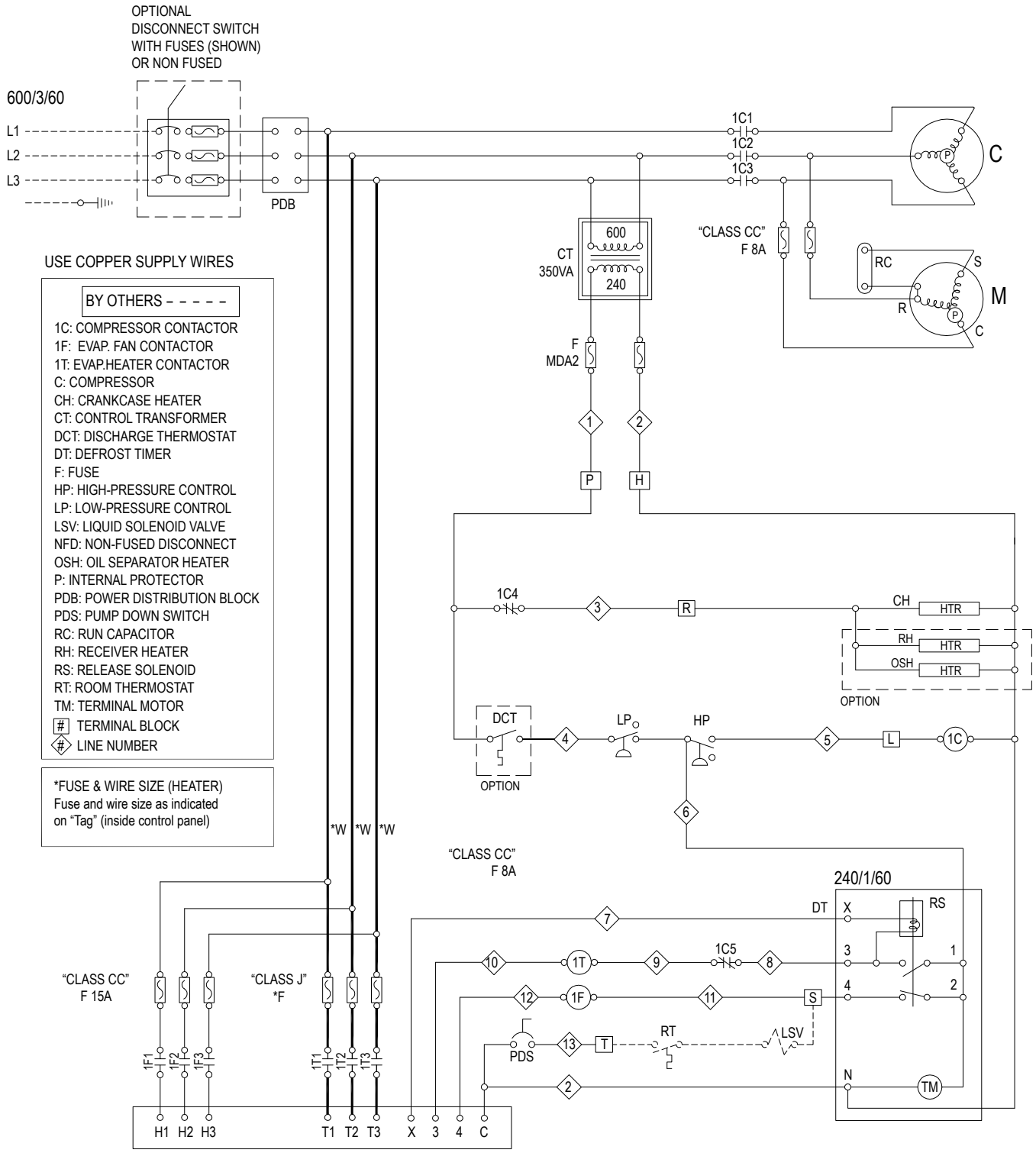

Figure 22 Typical wiring diagram (electric defrost kit - one evaporator)

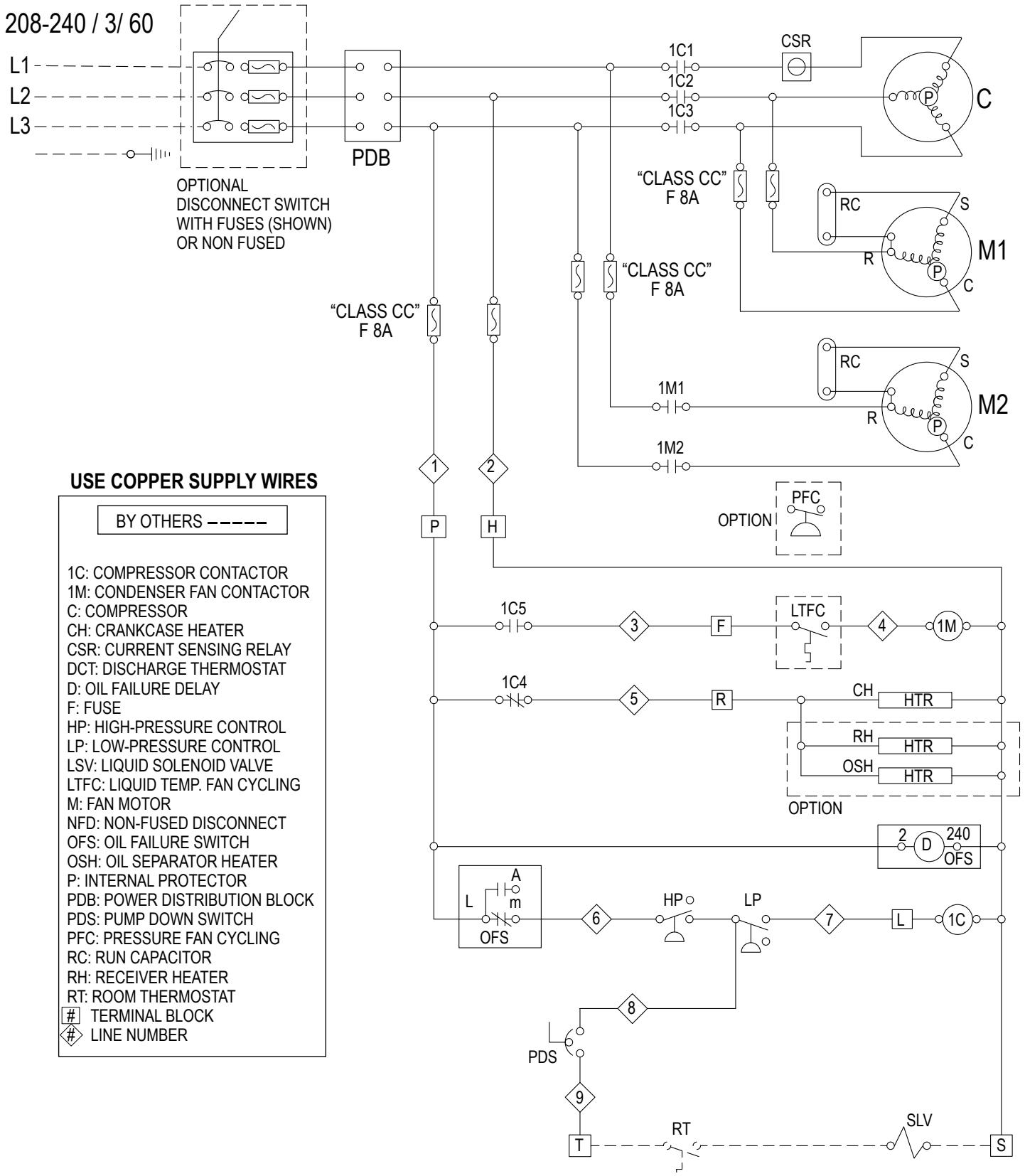

Figure 23 Typical wiring diagram (two fans - coresense)

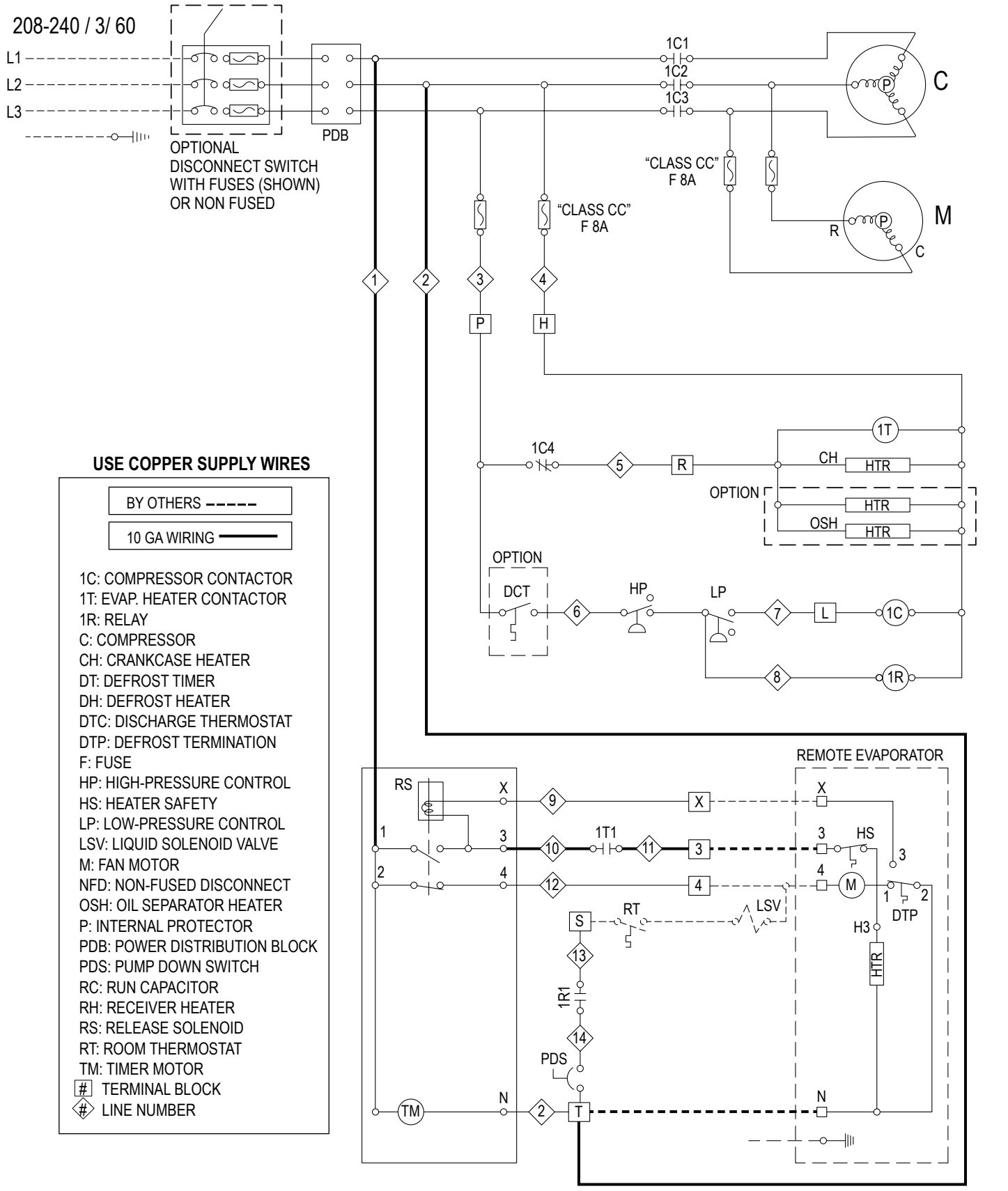

Figure 24 Typical wiring diagram (electric timer)

START-UP

PREPARE THE SYSTEM

1. Check oil level in the oil separator (if supplied).
2. Add oil to system (if necessary).
3. Open all refrigeration valves.
4. Connect the high-side gauge to the refrigerant receiver outlet valve and the suction fitting on the compressor.
5. Units with a scroll compressor must be checked for proper direction of rotation.
6. Unlock semi-hermetic compressor spring mount (shipping blocks).

REFRIGERANT

Be sure leak testing and evacuation was successfully done before adding refrigerant.

Add liquid refrigerant to the high side until the system pressure equals the refrigerant cylinder pressure.

For blends (series 4 and 5 refrigerants), start the compressor and add liquid refrigerant through a calibrated restrictor in the suction connection of the compressor until the sight glass is clear and proper sub-cooling is obtained from the condenser.

For R-134a, start the compressor and add refrigerant vapour through the suction connection of the compressor until the sight glass is clear and proper sub-cooling is obtained from the condenser.

If the system is designed for winter operation (flooding valve type), check the condenser summer/winter refrigerant charge.

Charge the system in summer operating condition with cycle fans off and block some of the condenser surface to simulate summer operating conditions (pressure and/or temperature) without condenser flooding. Recommended pressures and temperature are over 100ºF (38ºC) for 180 psig flooding valve or over 80ºF (26.7ºC) for 150 psig flooding valve.

Once stabilized, add the difference of the winter/summer charge specified on the following refrigerant (R-448A) charge list, to the system.

This should be sufficient to maintain the operating pressure during winter conditions (-30ºF (-35ºC)).

The system should be verified at the beginning of the winter on a cold day to ensure proper winter charge.

Additional refrigerant charge for winter operation (R-448A):

OE

Model	LBS	KG
002-006	1.1	0.50
007-010	2.2	1
011-019	3.2	1.45
020-025	4.8	2.18
030-035	4.4	2
040-045	6.6	3
050-060	12.5	5.67
061-076	7.5	3.40
080-099	14.9	6.76
100-119	11	4.99
120-150	16.4	7.44
200-220	21.9	9.93

OM (SINGLE)

Model	LBS	KG
061-090	9.8	4.45
099-100	14.7	6.67
119-140	19.6	8.89
150	14.4	6.53
200	21.6	9.80
220	28.8	13.06

OM (DUAL)

Model	LBS	KG
92-102	20.7	9.39
122-182	19.6	8.89
202	29.3	13.29
232-282	39.1	17.74
302	28.8	13.06
402	43.2	19.60
442	57.6	26.13

ON (SINGLE)

Model	LBS	KG
200-250	17.6	7.98
300	26.5	12.02
340	35.3	16.01
350-370	26	11.79
400	39	17.69
500	52.1	23.63

ON (DUAL)

Model	LBS	KG
502	35.3	16.01
602	52.8	23.95
682	70.4	31.93
702-742	52.1	23.63
802	78.1	35.38

Notes:
Tables on page 24 are based on R-448A. Multiply by the following factors to get other refrigerant charge:

R134A: 1.11
R404A: 0.95
R407A: 1.04
R407C: 1.04
R407F: 1.02
R410A: 0.96
R449A: 1.00

Tables represent total additional charge of the unit. If unit is a two-circuit, divide the total by 2 to get an individual circuit charge.

SERVICE

System operating temperature, oil level, and system pressure should be checked and recorded periodically to ensure stable system operation. For any help, tips, and questions pertaining to the condensing unit, refer to the troubleshooting chart on page 26.

IMPORTANT: Disconnect all power before servicing.

INSPECTION

After one day of operation, check for any abnormal vibration in the unit.

IMPORTANT: Compressor hold-down bolts should be checked periodically and re-tightened if necessary.

CLEANING

It is recommended that all condensers and evaporators of a refrigeration system be checked periodically for dirt accumulation. Grease and dust must be removed from fans, fan guards and drain pans.

Occasional cleaning of finned surfaces can be done by first dusting off the fins, then cleaning with a mild detergent and a warm water spray.

The inner face of the condenser coil may be cleaned through the access panel on the side of the units or by removing the fan guards (OM and ON).

IMPORTANT: Do not use alkaline or acid solution as it will damage the coils. The detergent must be completely rinsed before stopping the cleaning operation.

FAN MOTORS

Fan motors are permanently lubricated and thermally protected for service-free operation. An automatic internal thermal protection could be triggered if the coil is blocked. If the motors are inoperative, check the supply voltage at the motor leads before attempting any maintenance and service. **The motors can start on the automatic thermal protector at any time.**

ADDING OIL

If oil is needed, allow the system to pump down.

1. Turn off all power to the unit.
2. Close the suction and discharge valves at the compressor.
3. Partially unscrew the filler hole pipe plug. Allow pressure to bleed before totally removing the plug. (The filler hole is located just above and to the left of the crankcase sight glass on most compressors.)
4. Add compressor manufacturer-approved oil through the filler hole. **Be sure oil has not been** exposed to air or other contaminants.
5. Replace and tighten filler hole pipe plug.
6. Re-open the compressor suction and discharge valves.
7. Restart the unit.

SEMI-HERMETIC COMPRESSOR

Oil level must be maintained at 1/2 or 3/4 full (Bitzer compressor) or 1/8 to 1/2 full (Copeland compressor) as indicated on the sight glass. If oil level is low, add manufacturer approved oil to the compressor. Do not over fill. Check oil level 2 hours and 2 days after the addition of oil.

Excessive oil quantity in a system may lead to liquid slugging and compressor damage.

A well-balanced unit should not require any additional oil after a week of operation.

If the level does not stabilize, there is an oil logging problem. Check all piping for proper installation. Correct any defect that would prevent the oil from coming back. Remove excess oil if the level goes over 3/4 full sight glass.

RECOMMENDED POE OIL FOR ALL HFC REFRIGERANTS

Copeland Compressor: Copeland Ultra 22CC, Copeland 3MA, Mobil EAL ARTIC 22CC, ICI (Virginia KMP) EMKERATE RL 32CF.

Bitzer Compressor: ICI (Virginia KMP) EMKERATE RL32S, Mobil EAL ARTIC32, Castrol Icematic SW32.

Carlyle Compressor: Castrol E68, ICI (Virginia KMP) EMKERATE RL68H, CPI CP-2916S, CPI Solest 68, BP Marine Enersyn MP-S68.

TROUBLESHOOTING CHART

PROBLEM	POSSIBLE CAUSES	POSSIBLE CORRECTIVE STEPS
Compressor will not run	1. Main switch open. 2. Fuse blown. 3. Thermal overloads tripped. 4. Defective contactor or coil. 5. System shut down by safety devices. 6. No cooling required. 7. Liquid line solenoid will not open. 8. Motor electrical trouble. 9. Loose wiring.	1. Close switch 2. Check electrical circuits and motor winding for shots or grounds. Investigate for possible overloading. Replace fuses after fault is corrected. 3. Overloads are automatically reset. Check unit closely when unit comes back on line. 4. Repair or replace defective parts. 5. Determine type and cause of shutdown and correct it before resetting safety switch. 6. None. Wait until unit calls for cooling. 7. Repair or replace coil. 8. Check electrical circuits and motor for open windings. Also check for a short circuit or motor burn out. 9. Check all wire junctions. Tighten all terminal screws.
Compressor is noisy or vibrating	1. Flooding of refrigerant into crankcase. 2. Improper piping support on suction, discharge or liquid line. 3. Worn compressor. 4. Scroll compressor rotation reversed.	1. Check setting of expansion valves. 2. Relocate, add or remove hangers. 3. Replace. 4. Rewire for phase change.
High-discharge pressure	1. Non-condensables in system. 2. System overcharges with refrigerant. 3. Discharge shutoff valve partially closed. 4. Fan not running. 5. Head pressure control setting. 6. Dirty condenser coil.	1. Remove the non-condensable. 2. Remove excess refrigerant. 3. Open valve. 4. Check electrical circuit. 5. Adjust control setting. 6. Clean condenser coil.
Low-discharge pressure	1. Faulty condenser temperature regulation. 2. Suction shut-off valve partially closed. 3. Insufficient refrigerant in system. 4. Low suction pressure. 5. Variable head pressure valve.	1. Check condenser control operation. 2. Open valve. 3. Check for leaks. Repair and add charge. 4. See corrective steps for low suction pressure. 5. Check valve setting.
High-suction pressure	1. Excessive load. 2. Expansion valve (TXV & EEV) overfeeding.	1. Reduce load or add additional equipment. 2. Regulate superheat. Check remote bulb (temp. and pressure).
Low-suction pressure	1. Lack of refrigerant. 2. Evaporator dirty or iced. 3. Clogged suction line or compressor suction gas strainers. 4. Clogged liquid line filter dryer. 5. Expansion valve (TXV & EEV) under-feeding. 6. Condensing temperature too low.	1. Check for leaks. Repair leak and add charge. 2. Clean evaporator. 3. Replace cartridge(s). 4. Replace liquid line filter dryer cartridge or filter dryer. 5. Regulate superheat. Check remote bulb (temp. and pressure). 6. Check means for regulating condensing temperature.

PROBLEM	POSSIBLE CAUSES	POSSIBLE CORRECTIVE STEPS
Low or no oil pressure	1. Clogged suction oil strainer. 2. Excessive liquid in crankcase. 3. Low oil pressure safety switch defective. 4. Worn oil pump. 5. Low oil level. 6. Crankcase oil filter is dirty or clogged. Oil pressure sensor is dirty. 7. Loose fitting on oil lines. 8. Pump housing gasket leaks.	1. Clean. 2. Check crankcase heater. Reset expansion valve for higher superheat. Check liquid line solenoid valve operation. 3. Replace oil pressure safety switch. 4. Replace oil pump. 5. Add oil. 6. Clean crankcase oil filter or sensor. 7. Check and tighten system. 8. Replace gasket.
Compressor loses oil	1. Lack of refrigerant. 2. Excessive compression ring blow-by. 3. Refrigerant flood-back. 4. Improper piping or traps.	1. Check for leaks and repair. Add refrigerant. 2. Replace valve plate. 3. Maintain proper superheat at compressor. 4. Correct piping.
Compressor thermal protector switch open	1. Operating beyond design conditions. 2. Discharge valve partially shut. 3. Blown valve plate gasket. 4. Dirty condenser coil. 5. Overcharged system.	1. Add facilities so that conditions are within allowable limits. 2. Open valve. 3. Replace gasket. 4. Clean coil. 5. Reduce charge.

REPLACEMENT PARTS

Download the parts manual
at http://refplus.com/en/parts-services/

WARRANTY

RefPlus warrants the labeled (serial no.) new Refplus equipment and all parts thereof, to be free from defects in workmanship and material at the time of purchase. Apply to original purchaser only (not transferable).

Under this warranty, RefPlus shall be limited to repairing or exchanging any parts, without charge FOB factory or nearest authorized parts wholesalers, which may prove defective to the satisfaction of RefPlus within one year from date of start-up, not to exceed eighteen (18) months from date of shipment from the factory.

The warranties to repair or replace above recited, are the only warranties, express, implied, or statutory, made by RefPlus. No express or implied warranties as to merchantability or fitness for a particular purpose or use. RefPlus neither assumes, nor authorizes any person to assume for it, any other obligation or liability in connection with the sale of said equipment or any part thereof.

EXCLUSIONS

THIS WARRANTY SHALL NOT APPLY TO LOSS OF FOOD OR REFRIGERANT DUE TO FAILURE FOR ANY REASON. REFPLUS SHALL NOT BE LIABLE:

1. For any repairs or replacement by buyer without the written consent of RefPlus, or when the equipment is installed or operated in a manner contrary to the instructions covering installation and service which accompanied such equipment.
2. For any damages, delays, or losses, direct or consequential, caused by defects, nor for damages caused by short or reduced supply of materials, fire, flood, strikes, acts of God, or circumstances beyond its control.
3. When the failure or defect of any part or parts is incidental to ordinary wear, accident, abuse or misuse; or when the serial number of the equipment has been removed, defaced, altered, or tampered with.
4. When this equipment is operated on low or improper voltages.
5. When this equipment is moved to different location other than the original installation.
6. For payment of any removal or installation charges of parts or units.

Specifications subject to change without notice.

CONDENSING UNIT STARTUP REPORT FORM

IMPORTANT: This startup report form must be filled out, signed and sent to RefPlus for the warranty to be honoured.

1. GENERAL INFORMATION

JOB LOCATION: _____

JOB No: _____

CONDENSING UNIT MODEL No.: _____ SERIAL No.: _____

COMPRESSOR MODEL No.: _____ SERIAL No.: _____

2. PRE-START-UP (Check each item when completed)

☐ CHECK ALL ELECTRICAL CONNECTIONS AND TERMINALS FOR TIGHTNESS

☐ CHECK ALL FAN MOTORS AND MOTOR MOUNTS FOR TIGHTNESS

☐ VERIFY REFRIGERANT CHARGE USING CHARGING CHART LABEL ON CONDENSING UNIT

☐ CHECK REFRIGERANT AND OIL LEVEL IN SYSTEM

☐ CHECK CRANKCASE HEATER / RECEIVER HEATER FOR PROPER OPERATION

3. START-UP

REFRIGERANT

REFRIGERANT CHARGE _____ LBS

REFRIGERANT TYPE _____ (I.E. R448A)

ELECTRICAL

COMPRESSOR VOLTAGE	L1 - L2		L2 -L3		L3 - L1	
COMPRESSOR AMPS	L1		L2		L3	
COMPRESSOR	VOLTS		PHASE		HERTZ	

TEMPERATURE	START-UP	AFTER 24 HOURS OF OPERATION
AMBIENT TEMPERATURE	_____ ºF	_____ ºF
SUPERHEAT AT COMPRESSOR	_____ ºF	_____ ºF
DISCHARGE TEMPERATURE	_____ ºF	_____ ºF
SUB-COOLING	_____ ºF	_____ ºF
LIQUID TEMPERATURE	_____ ºF	_____ ºF

PRESSURES (in cooling mode)

REFRIGERANT SUCTION _____ PSIG TEMP AT COMPRESSOR _____

REFRIGERANT DISCHARGE _____ PSIG TEMP AT COMPRESSOR _____

EVACUATION: NUMBER TIMES _____ FINAL MICRON _____

4. FIELD INSTALLED EXPANSION VALVE

MANUFACTURER _____

MODEL _____

DATE: _____ **TECHNICIAN**: _____

SIGNATURE: _____

FILL OUT FORM MANUALLY, TAKE A PHOTO AND SEND TO:
service@refplus.com

OR

FILL OUT FORM ONLINE **SEND**

Guardian+

PRECISION CONTROLLERS FOR A TROUBLE-FREE COLD ROOM OR FREEZER

RefPlus as a solution for making your cold room or freezer management easier, more precise and more efficient:

The **Guardian+ Controller Family.**

Guardian+ LEAD LAG & DEFROST CONTROL RC-L

Cold Room Lead-Lag Control System

The Guardian+ Lead Lag Controller monitors room temperature in real time and uses predictive smart algorithms to optimize Lead Lag operation. It can manage up to 8 systems and can be programmed to rotate the lead system to equalize run hours.

Guardian+ SMART EVAPORATOR CONTROL RC-S

Smart Evaporator Control System

Guardian+ Smart Evaporator Controller controls both temperature and defrost, providing precision temperature measurements and assuring setpoints are followed . It eliminates unnecessary defrosts typically associated with time-based alternatives thus reducing energy consumption & preserving product integrity.

Guardian+ FLUID COOLER & PUMP PACKAGE CONTROL RC-F

Fluid Cooler & Pump Package Control System

The Fluid Cooler and Pump Package Controller manages the fan cycling and fan speed (when variable speed fans are installed) to control the outlet fluid temperature. Also, it offers the possibility to manage the operation of up to two pumps.

RefPlus®

The RefPlus EcoEfficient+ program aims to improve your environmental footprint by reducing refrigerant leakage, noise and power consumption with uncompromising performance.

ecoefficient+

cityquiet zeroleak smartpower

CERTIFIED **ISO-9001**

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