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**Copeland™ Refrigeration Condensing Units M and F-Line User Manual**

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## IMPORTANT SAFETY INFORMATION

Those involved in the design, manufacture, and installation of a system, system purchasers, and service personnel may need to be aware of hazards and precautions discussed in this section and throughout this document. OEMs (Original Equipment Manufacturers) integrating a condensing unit into a system should ensure that their own employees follow this bulletin and provide any necessary safety information to those involved in manufacturing, installing, purchasing, and servicing the system.

### Responsibilities, Qualifications and Training

OEMs are responsible for system design, selection of appropriate components, integration of this component into the system, and testing the system. OEMs must ensure that staff involved in these activities are competent and qualified.

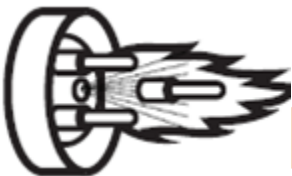
OEMs are also responsible for ensuring that all product, service, and cautionary labels remain visible or are appropriately added in a conspicuous location on the system to ensure they are clear to any personnel involved in the installation, commissioning, troubleshooting or maintenance of this equipment.

Only qualified and authorized HVAC or refrigeration personnel are permitted to install, commission, troubleshoot and maintain this equipment. Electrical connections must be made by qualified electrical personnel.

Observe all applicable standards and codes for installing, servicing, and maintaining electrical and refrigeration equipment.

### Terminal Venting and Other Pressurized System Hazards

If a compressor's electrical terminal pin loses its seal, pressurized oil, refrigerant, and debris may spray out. This is called "terminal venting".



The ejected debris, oil, and refrigerant can injure people or damage property. The oil and refrigerant spray can be ignited by electrical arcing at the terminal or any nearby ignition source, producing flames that may project a significant distance from the compressor. The distance depends on the pressure and the amount of refrigerant and oil mixture in the system. The flames can cause serious or fatal burns and ignite nearby materials.

Each compressor has a terminal cover or molded plug that covers electrical connections. The cover or plug helps to protect against electric shock and the risks of terminal venting. If terminal venting occurs, the cover or plug helps contain the spray of refrigerant and oil and reduces the risk of ignition. If ignition occurs, the plug or cover helps contain the flames. However, neither the terminal cover nor the molded plug can completely eliminate the risk of venting, ignition, or electric shock.

See <http://www.Climate.Emerson.com/terminal> for more details about terminal venting.

Additionally, a compressor's refrigerant lines keep refrigerant and oil under pressure. When removing or recharging refrigerant from this component during service, this can pose a pressurized fluid hazard.

**POE Oil Hazards** This equipment contains polyolester (POE) oils. Certain polymers (e.g., PVC/CPVC and polycarbonate) can be harmed if they come into contact with POE oils. If POE oil contacts bare skin, it may cause an allergic skin reaction.

**Flammable Refrigerant Hazards**



If **flammable refrigerant** is released from a system, an explosive concentration can be present in the air near the system. If there is an ignition source nearby, a release of flammable refrigerant can result in a fire or explosion. While systems using flammable refrigerant are designed to mitigate the risk of ignition if the refrigerant is released, fire and explosion can still occur. See <https://climate.emerson.com/en-us/training-support/safety-resource-center/flammable-refrigerants> for more information on flammable refrigerant safety.

**Electrical Hazards**



Until a system is de-energized, and capacitors have been discharged, the system presents a risk of electric shock.

**Hot Surface and Fire Hazards**



While the system is energized, and for some time after it is deenergized, the compressor may be hot. Touching the compressor before it has cooled can result in severe burns. When brazing system components during service, the flames can cause severe burns and ignite nearby combustible materials.

**Lifting Hazards**



Certain system components may be very heavy. Improperly lifting system components or the compressor can result in serious personal injury. Use proper lifting techniques when moving.

**SAFETY ICON/WORD EXPLANATION**

The signal word explained below are used throughout the document to indicate safety messages.



**DANGER** indicates a hazardous situation which, if not avoided, will result in death or serious injury.



**WARNING** indicates a hazardous situation which, if not avoided, could result in death or serious injury.



**CAUTION**, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

**PRECAUTIONS****⚠ WARNING**

Do not use means to accelerate the defrosting process or to clean, other than those recommended by the manufacturer.

The appliance shall be stored in a room without continuously operating ignition sources (for example: open flames, an operating gas appliance or an operating electric heater).

Do not pierce or burn.

Be aware that refrigerants may not contain an odor.

**MISE EN GARDE**

Ne pas utiliser de moyens autres que ceux recommandés par le fabricant pour accélérer le processus de dégivrage ou pour nettoyer l'appareil.

L'appareil doit être entreposé dans un local ne contenant pas de sources d'inflammation permanentes (flammes nues, appareil à gaz ou dispositif de chauffage électrique en fonctionnement, par exemple).

Ne pas percer ou brûler.

Attention, les fluides frigorigènes peuvent ne pas dégager d'odeur.

**⚠ WARNING**

Do not damage the refrigerating circuit

**NOTICE:** Servicing shall be performed only as recommended by the manufacturer.

1. Always wear personal protective equipment (gloves, eye protection, etc.).
2. Keep clear of the compressor when power is applied.
3. **IMMEDIATELY GET AWAY** if you hear unusual sounds in the compressor. They can indicate that terminal pin ejection may be imminent. This may sound like electrical arcing (sizzling, sputtering or popping). However, terminal venting may still occur even if you do not hear any unusual sounds.
4. Never reset a breaker or replace a blown fuse without performing appropriate electrical testing
5. A tripped breaker or blown fuse may indicate an electrical fault in the compressor. Energizing a compressor with an electrical fault can cause terminal venting. Perform checks to rule out an electrical fault.
6. Disconnect power and use lock-out/tag-out procedures before servicing.
  - a. Before removing the terminal cover or molded plug, check that **ALL** electrical power is disconnected from the unit. Make sure that all power legs are open. (Note: The system may have more than one power supply.)
  - b. Discharge capacitors for a minimum of two minutes
  - c. Always use control of hazardous energy (lock-out/tag-out) procedures to ensure that power is not reconnected while the unit is being serviced.
7. Allow time for the compressor to cool before servicing.

- a. Ensure that materials and wiring do not touch high temperature areas of the compressor.
  
8. Keep all non-essential personnel away from the compressor during service and use.
  - a. This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.
  - b. Children should be supervised to ensure that they do not play with the appliance.
  
9. Remove refrigerant from both the high and low side of the compressor. Use a recovery machine and cylinder designed for appropriate refrigerants only. **For Flammable refrigerant**, do not use standard recovery machines because they contain sources of ignition. Only vent R290 refrigerant into the atmosphere if the system is in a well-ventilated area, if allowed per EPA guidelines.
  
10. Never use a torch to remove the compressor. Only tubing cutters should be used.
  
11. Use an appropriate lifting device to install or remove the compressor.
  
12. Never install a system and leave it unattended when it has no charge, a holding charge, or with the service valves closed without electrically locking out the system.
  
13. Always wear appropriate safety glasses and gloves when brazing or unbrazing system components.
  
14. Charge the system with only approved refrigerants and refrigeration oils.
  
15. This equipment contains polyolester ("POE") oils. Keep POE oils away from certain polymers (e.g., PVC/CPVC and polycarbonate) and any other surface or material that might be harmed by POE oils. Proper protective equipment (gloves, eye protection, etc.) must be used when handling POE lubricant. Handle POE oil with care. Refer to the Safety Data Sheet (SDS) for further details. If POE oil contacts bare skin, it may cause an allergic skin reaction. Contact your local poison control center if POE oil contacts skin or eyes.
  
16. Before energizing the system:
  - a. Securely fasten the protective terminal cover or molded plug to the compressor, and
  - b. Check that the compressor is properly grounded per the applicable system and compressor requirements.
  
17. For appliances that use a **flammable refrigerant**, component parts shall be replaced with like components so as to minimize the risk of possible ignition due to incorrect parts.
  
18. This appliance is not intended for use at altitudes exceeding 2000m (6562 ft). Consult OEM for design considerations to be made for high altitude conditions and use.

## INSPECTION

Inspect unit for shipping damage. Immediately report any damage to the carrier. Check the unit nameplate to verify that the model number is correct for the application. Read all compressor and condensing unit warning labels.

Any accessories received unmounted, such as contactors, controls, or water valves should immediately be tied to the units.

## INSTALLATION, SERVICING AND REPAIR

Condensing units shall only be connected to an appliance suitable for the same refrigerant and shall be of the same voltage. Reference Condensing Unit's nameplate and wiring diagram for field wiring connections to be certain.

The installation of the appliance and the refrigerant unit must only be made by the manufacturer's service personnel or suitably qualified person.



In order to reduce flammability hazards the installation of this appliance must only be carried out by a suitably qualified person.

**Condensing Units Installed Outdoors:**

1. This product shall not be installed within 20 ft (6.1m) of any building opening.
2. If this product is enclosed within a penthouse, lean-to, or other open structure, natural or mechanical ventilation shall be provided.
3. Any pressure relief devices and fusible plugs shall discharge to the atmosphere at a location not less than 15 ft (4.57m) above adjoining ground level and not less than 6.1m (20ft) from any window, ventilation opening, or exit in any building.
4. Refrigerant circuit access ports located outdoors shall be secured to prevent unauthorized access.
5. The appliance is to be installed in accordance with the requirements in the Safety Standard for Refrigeration Systems, ANSI/ASHRAE 15.

**Condensing Units Installed Indoors**

**Factory pre-charged units with flammable refrigerants** must take into account the minimum room area, “A<sub>min</sub>”, for which they are to be installed. To determine A<sub>min</sub>, please refer to the unit’s nameplate for the amount factory charged refrigerant and type of refrigerant.

Pre-charged Refrigerant Amount per Nameplate (mc)		A <sub>min</sub>					
		R454A		R454C		R455A	
lb	kg	ft <sup>2</sup>	m <sup>2</sup>	ft <sup>2</sup>	m <sup>2</sup>	ft <sup>2</sup>	m <sup>2</sup>
0.25	0.11	7.98	0.74	7.63	0.71	7.00	0.65
0.5	0.23	15.96	1.48	15.25	1.42	14.00	1.30
0.75	0.34	23.95	2.22	22.88	2.13	21.00	1.95
<b>1</b>	<b>0.45</b>	<b>31.93</b>	<b>2.97</b>	30.50	2.83	28.00	2.60
1.25	0.57	39.91	3.71	38.13	3.54	35.00	3.25
1.5	0.68	47.89	4.45	45.75	4.25	42.00	3.90
1.75	0.79	55.87	5.19	53.38	4.96	49.00	4.55
2	0.91	63.85	5.93	61.00	5.67	56.00	5.20
2.25	1.02	71.84	6.67	68.63	6.38	63.00	5.85
2.5	1.13	79.82	7.42	76.25	7.08	70.00	6.50
2.75	1.25	87.80	8.16	83.88	7.79	77.00	7.15

**Example:** If the nameplate of unit states that it is charged with 1 lb (0.45 kg) of refrigerant R454A, then, A<sub>min</sub> = 31.93 ft<sup>2</sup> (or 2.97m<sup>2</sup>)

**Notes:**

A<sub>min</sub> calculation is based on room Height of 7.217826 ft (2.2m)

LFL is based on Table 102DV worst case formulation

**Checks to the area**

Prior to beginning work on systems containing **flammable refrigerants**, safety checks are necessary to ensure that the risk on ignition is minimized. For repair to the refrigeration system, the Work Procedure shall be followed and ensure that there are no ignition sources.

## Work procedure

Work shall be undertaken under a controlled procedure to minimize the risk of a flammable gas or vapor being present while the work is being performed

## General Work Area

All maintenance staff and others working in the local areas shall be instructed on the nature of the work being carried out.

## Checking for presence of refrigerant

The area shall be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants

## Presence of Fire Extinguisher

If any hot work is to be conducted on the refrigerating equipment or any associated parts, appropriate fire extinguishing equipment shall be available on hand. A dry chemical or CO2 fire extinguisher should be adjacent to the charging area.

## No Ignition Sources

No person carrying out work in relation to a REFRIGERATING SYSTEM which involves exposing any pipe work shall use any sources of ignition in such a manner that it may lead to the risk of fire or explosion. All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, repairing, removing and disposal, during which refrigerant can possibly be released to the surrounding space. Prior to work taking place, the area around the equipment shall be surveyed to make sure that there are no flammable hazards or ignition risks. "No Smoking" signs shall be displayed.

## Ventilated area

Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.

## Checks to the Refrigeration Equipment

Where electrical components are being changed, they shall be fit for the purpose and to the correct specification. At all times, the manufacturer's maintenance and service guidelines shall be followed. If in doubt, consult the manufacturer's technical department for assistance.

### The following checks shall be applied to installations using FLAMMABLE REFRIGERANTS:

1. The actual REFRIGERANT CHARGE is in accordance with the room size within which the refrigerant containing parts are installed;
2. The ventilation machinery and outlets are operating adequately and are not obstructed;
3. If an indirect refrigerating circuit is being used, the secondary circuit shall be checked for the presence of refrigerant;
4. Marking to the equipment continues to be visible and legible. Markings and signs that are illegible shall be corrected;

5. Refrigerating pipe or components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or suitably protected against being so corroded.

### Checks to electrical device

Repair and maintenance to electrical components shall include initial safety checks and component inspection procedures. If a fault exists that could compromise safety, then no electrical supply shall be connected to the circuit until it is satisfactorily dealt with. If the fault cannot be corrected immediately but it is necessary to continue operation, an adequate temporary solution shall be used. This shall be reported to the owner of the equipment, so all parties are advised.

1. Initial safety checks shall include:
  - a. That capacitors are discharged; this shall be done in a safe manner to avoid possibility of sparking;
  - b. That no live electrical components and wiring are exposed while charging, recovering, or purging the system
  - c. That there is continuity of earth bonding.
2. Repairs to sealed components
  - d. During repairs to sealed components, all electrical supplies shall be disconnected from the equipment being worked upon prior to any removal of sealed covers, etc. If it is absolutely necessary to have an electrical supply to equipment during servicing, then a permanently operating form of leak detection shall be located at the most critical point to warn of a potentially hazardous situation.
  - e. During repairs to sealed components, all electrical supplies shall be disconnected from the equipment being worked upon prior to any removal of sealed covers, etc. If it is absolutely necessary to have an electrical supply to equipment during servicing, then a permanently operating form of leak detection shall be located at the most critical point to warn of a potentially hazardous situation.
  - f. Ensure that the apparatus is mounted securely.
  - g. Ensure that seals or sealing materials have not degraded to the point that they no longer serve the purpose of preventing the ingress of flammable atmospheres. Replacement parts shall be in accordance with the manufacturer's specifications.
3. Repair to intrinsically safe components
  - h. Do not apply any permanent inductive or capacitance loads to the circuit without ensuring that this will not exceed the permissible voltage and current permitted for the equipment in use.
  - i. Intrinsically safe components are the only types that can be worked on while live in the presence of a flammable atmosphere. The test apparatus shall be at the correct rating.
  - j. Replace components only with parts specified by the manufacturer. Other parts can result in the ignition of refrigerant in the atmosphere from a leak.

NOTE: The use of silicon sealant can inhibit the effectiveness of some types of leak detection equipment. Intrinsically safe components do not have to be isolated prior to working on them.

### 4. Cabling

Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges, or any other adverse environmental effects. The check shall also take into account the effects of aging or continual vibration from sources such as compressors or fans



#### 5. Detection of flammable refrigerants

Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used. The following leak detection methods are deemed acceptable for all refrigerant systems:

- k. Electronic leak detectors may be used to detect refrigerant leaks but, in the case of **flammable refrigerants**, the sensitivity might not be adequate, or might need re-calibration. (Detection equipment shall be calibrated in a refrigerant-free area.) Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. Leak detection equipment shall be set at a percentage of the LFL of the refrigerant and shall be calibrated to the refrigerant employed, and the appropriate percentage of gas (25 % maximum) is confirmed.
- l. Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine can react with the refrigerant and corrode the copper pipe-work.

**NOTE** Examples of leak detection fluids are: Bubble method, Fluorescent method agents.

If a leak is suspected, all naked flames shall be removed/extinguished.

If a leakage of refrigerant is found which requires brazing, all of the refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak. Removal of refrigerant shall be according to "Removal and evacuation"

### Removal and evacuation

When breaking into the refrigerant circuit to make repairs - or for any other purpose - conventional procedures shall be used. However, for **flammable refrigerants** it is important that best practice be followed, since flammability is a consideration.

The following procedure shall be adhered to:

1. safely remove refrigerant following local and national regulations;
2. purge the circuit with inert gas;
3. evacuate (optional for A2L);
4. purge with inert gas (optional for A2L);
5. open the circuit by cutting or brazing

The refrigerant charge shall be recovered into the correct recovery cylinders if venting is not allowed by local and national codes. For appliances containing **flammable refrigerants**, the system shall be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process might need to be repeated several times. Compressed air or oxygen shall not be used for purging refrigerant systems.

For appliances containing **flammable refrigerants**, refrigerants purging shall be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum (optional for A2L). This process shall be repeated until no refrigerant is within the system (optional for A2L). When the final oxygen-free nitrogen charge is used, the system shall be vented down to atmospheric pressure to enable work to take place.

Ensure that the outlet for the vacuum pump is not close to any potential ignition sources and that ventilation is available.

## Charging procedures

In addition to conventional charging procedures, the following requirements shall be followed:

1. Ensure that contamination of different refrigerants does not occur when using charging equipment. Hoses or lines shall be as short as possible to minimize the amount of refrigerant contained in them.
2. Cylinders shall be kept in an appropriate position according to the instructions.
3. Ensure that the refrigeration system is earthed prior to charging the system.
4. Label the system when charging is complete (if not already).
5. Extreme care shall be taken not to overfill the Refrigeration system.
6. Prior to recharging the system, it shall be pressure-tested with the appropriate purging gas.
7. The system shall be leak-tested on completion of charging but prior to commissioning.
8. A follow up leak test shall be carried out prior to leaving the site.

See section **Leak Check and Refrigerant Charging** for further details

## Decommissioning

Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment and all its detail. It is recommended good practice that all refrigerants are recovered safely. Prior to the task being carried out, an oil and refrigerant sample shall be taken in case analysis is required prior to re-use of recovered refrigerant. It is essential that electrical power is available before the task is commenced.

1. Become familiar with the equipment and its operation.
2. Isolate the system electrically.
3. Before attempting the procedure, ensure that:
  - a. mechanical handling equipment is available, if required, for handling refrigerant cylinders;
  - b. all personal protective equipment is available and being used correctly;
  - c. the recovery process is supervised at all times by a competent person;
  - d. recovery equipment and cylinders conform to the appropriate standards.
4. Pump down refrigerant system, if possible.
5. If a vacuum is not possible, make a manifold so that the refrigerant can be removed from various parts of the system.
6. Make sure that cylinder is situated on the scales before recovery takes place.
7. Start the recovery machine and operate in accordance with instructions.
8. Do not overfill cylinders (no more than 80% volume liquid charge)
9. Do not exceed the maximum working pressure of the cylinder, even temporarily.
10. When the cylinders have been filled correctly and the process completed, make sure that the cylinders and equipment are removed from site promptly and all isolation valves on the equipment are closed off.
11. Recovered refrigerant shall not be charged into another refrigerating system unless it has been cleaned and checked,
12. Equipment shall be labeled stating that it has been de-commissioned and emptied of refrigerant. The label shall be dated and signed. For Appliances containing **flammable refrigerants**, ensure that there are labels on the equipment stating the equipment contains flammable refrigerant.

## Recovery

When removing refrigerant from a system, either for servicing or decommissioning, it is recommended good proactive that all refrigerants are removed safely.

When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge is available. All cylinders to be used are designated for the recovered refrigerant and labelled for that refrigerant (i.e., special cylinders for the recovery of refrigerant). Cylinders shall be complete with pressure-relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.

The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of all appropriate refrigerants including, when applicable, flammable refrigerants. In addition, a set of calibrated weighing scales shall be available and in good working order. Hoses shall be complete with leak-free disconnect couplings and in good condition. Before using the recovery machine, check that it is in satisfactory working order, has been properly maintained and that any associated electrical components are sealed to prevent ignition in the event of a refrigerant release. Consult manufacturer if in doubt.

The recovered refrigerant shall be returned to the refrigerant supplier in the correct recovery cylinder, and the relevant waste transfer note arranged. Do not mix refrigerants in recovery units and especially not in cylinders.

If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The evacuation process shall be carried out prior to returning the compressor to the suppliers. Only electric heating to the compressor body shall be employed to accelerate this process. When oil is drained from a system, it shall be carried out safely.

## Mounting Location



**Keep any required ventilation openings clear of obstructions.**

It is recommended to have a clearance of at least 1.5 ft (500mm) between the condenser face and adjacent wall or unit.

Where multiple units are to be installed in the same location, the contractor needs to consider each individual case carefully. Air recirculation and local heat build-up should be avoided at all times.

The unit should never be installed adjacent to a dust source (Such as a dirty road or extractor fan). External contamination of the condenser fins lead to high condensing temperatures and will reduce the life of the unit.

The condensing unit should be located in a clean, dry, level and well-ventilated area.

Check the selected location for the unit to ensure that racks, braces, flooring, foundations, etc., are adequate to support the weight of the unit.

Check the unit nameplate to see that the electrical rating of the condensing unit corresponds with the power ratings of the building/application installation location (i.e. display case).

Place the unit on a level surface and mount with bolt\* or studs using two (2) or more provided mounting holes within the unit's base plate/chassis to secure unit. NOTE: bolts/studs are not factory provided.

Refer to OEM installation instructions for additional mounting and installation instructions.

### **Air Cooled Models**

An Adequate supply of air must be provided for cooling as well as a means for exhausting the air to avoid recirculation. Ensure that discharge air from one unit does not circulate to another unit.

Normally this can be accomplished by locating the unit so that there is no restriction of inlet air to the condenser, and by providing sufficient free area around the unit so that short cycling of the air does not occur. units operating with dirty condensers and/or restricted air flow will be susceptible to overheating.

### **Water Cooled Models**

If the condensing unit is water-cooled, it must be installed in a location not subject to freezing temperatures in cold weather.

Water must be supplied at all times during operation, with the maximum outlet temperature of 120°F (48.9°C)

Water pressure must be adequate to provide an amount of water for proper cooling. Where cooling towers are used, the cooling tower connections of the condenser can be used to reduce the pressure drop through the condenser.

When cooling tower are used, bleed to the drain must be provided (approximately 2 gallons (7.57 liters) per hour per horsepower) to avoid concentration of impurities.

All water lines should be well flushed before being connected to the condensing unit.

If water pressure is excessive, a pressure reducing valve must be used since the condenser should not be exposed to operating pressure in excess of 150 PSIG (1034.21 KPA).

**For Water Cooled Models using Flammable Refrigerants**, any fluid circuits connected to the appliance shall safely release abnormal pressure. It shall not allow the release of flammable refrigerant into areas served by other circuits if these do not comply with the minimum room area limit.

### **Piping**

Piping material, pipe routing, and installation shall include protection from physical damage in operation and service and be in compliance with national and local codes and standards, such as ANSI/ASH RAE 15, IAPMO Uniform Mechanical Code, ICC International Mechanical Code, or CSA 852.

All field joints shall be accessible for inspection prior to being covered or enclosed; the installation of pipework shall be kept to a minimum;

**Pipe-work in the case of flammable refrigerants** shall not be installed in an unventilated space, if that space is smaller than “Amin” Minimum Area per UL 60335-2-89 Annex 101.DVU, except for A2L refrigerants where the installed pipes comply with UL 60335-2-89 Clause 22.115DV.

Mechanical connections made in accordance with UL 60335-2-89 Clause 22.115DV shall be accessible for maintenance purposes;

Provision shall be made for expansion and contraction of long runs of piping.

Protection devices, piping, and fittings shall be protected as far as possible against adverse environmental effects, for example, the danger of water collecting and freezing in relief pipes or the accumulation of dirt and debris;

Piping in the refrigeration system shall be so designed and installed to minimize the likelihood of hydraulic shock damaging the system steel pipes and components shall be protected against corrosion with a rustproof coating before applying any insulation;

Flexible pipe elements shall be protected against mechanical damage, excessive stress by torsion, or other forces, and they should be checked for mechanical damage annually; precautions shall be taken to avoid excessive vibration or pulsation;

After completion of field piping for split systems, the field pipework shall be pressure tested with an inert gas and then vacuum tested prior to refrigerant charging, according to the following requirements:

1. The minimum test pressure for the low side of the system shall be the low side design pressure and the minimum test pressure for the high side of the system shall be the high side design pressure, unless the high side of the system cannot be isolated from the low side of the system in which case the entire system shall be pressure tested to the low side design pressure.
2. The test pressure after removal of pressure source shall be maintained for at least 1 hour with no decrease of pressure indicated by the test gauge, with the test gauge resolution not exceeding 5% of the test pressure.
3. During the evacuation test, after achieving a vacuum level specified in the manual or less, the refrigeration system shall be isolated from the vacuum pump and the pressure shall not rise above 1500 microns within 10 minutes.
4. The vacuum pressure level shall be specified in the manual and shall be the lessor of 500 microns or the value required for compliance with national and local codes and standards, which may vary between residential, commercial and industrial buildings.

Field made refrigerant joints indoors shall be tightness tested according to the following requirements:

1. The test method shall have a sensitivity of 5 grams per year of refrigerant or better under a pressure of at least 0.25 times the maximum allowable pressure. No leak shall be detected.
2. All site made joints in HERMETICALLY SEALED SYSTEMS shall be tested for leaks at a pressure of at least 0.25 x maximum allowable pressure using detection equipment with a sensitivity of at least 3 g/year of refrigerant.

## **ELECTRICAL CONNECTIONS**

Field power connections are labeled L1, L2, L3 (on three phase only), and G (ground).

Wire sizes must be suitable for the Minimum Circuit Ampacity (MCA) of the unit. See Unit's Nameplate for MCA values required.

Wiring shall meet all local and national building codes.

**If the SUPPLY CORD is damaged, it must be replaced by the manufacturer, its service agent or similarly, qualified persons in order to avoid a hazard.**

## LEAK CHECK AND REFRIGERANT CHARGING

Units are either shipped with a dry air holding charge or are pre-charged with refrigerant from the factory. Refer to the unit's nameplate to verify if unit is pre-charged or not, and to note which refrigerants are approved for use.



Never apply a refrigerant to a condensing unit it is not approved for, especially in the case of flammable refrigerants in a condensing unit that is not approved for the use of flammable refrigerants.

### Pre-charged Requirements

Pre-charged units will be marked with the factory charged refrigerant and amount on the unit's nameplate.

Factory pre-charged units are typically supplied with quick connection fittings and do not require evacuation of the condensing unit. Reference the original equipment manufacturer's installation guidelines for the refrigeration system to complete quick connect fitting assembly, along with the system's electrical connection requirements.

### Dry Air Charged Requirements

The unit's nameplate will list only the appropriate refrigerants allowed for use. The charge amount on the condensing unit's nameplate from the factory will be left blank (unless pre-charged from the factory or OEM), allowing installer to add the charge amount next to the appropriate refrigerant applied in the field during installation.

In many cases, more than one refrigerant is approved and appears on the condensing unit's nameplate.

Mark out the refrigerants that does not apply to the refrigerant being used in the system with a permanent marker or ballpoint pen. For example: If R404A, R448A and R449A are shown on the nameplate, but the unit is charged with R448A, mark out R404A and R449A.



All components charged with dry air must be evacuated before charging with a refrigerant.

Purge the dry air charge from the unit by opening the liquid line shut off valve or removing the liquid line outlet fitting or plug, whichever is applicable. Connect the suction and liquid lines to the unit. When sweat connections are made in connecting lines, be sure that the inside of the tubing is clean before installing.

Use a dry nitrogen bleed during brazing. Charging ports may be provided on the liquid and suction service valves. Service valves should not be open to atmosphere longer than 15 minutes. Compressors with POE (polyolester) oil will quickly become contaminated when opened to atmosphere.

On any installation, the use of a suction line filter, liquid line filter dryer and moisture indicator is recommended, if not already equipped on the condensing unit itself.

Pressurize the system to 185 PSIG (1275.53 kPa) with an approved pressure source to leak check. Use a leak detection solution or electronic leak detector following the manufacturer's directions.

Pressurize and leak test the entire system including the condensing unit, evaporator, and all connecting tubing, fittings, and brazed joints using the **intended operating refrigerant for leak testing**. DO NOT USE OXYGEN OR COMBUSTIBLE GASES for Leak Testing. A pressure equal to the low side test pressure marked on the unit nameplate is recommended for leak testing. Repair any leaks found.

Connect **an approve** vacuum pump to both the low and high side evacuation valves (if provided) with copper tube or high vacuum tube 3/8" inch (9.525 mm) I.D. and draw a deep vacuum of 1500 microns. Do not use the

compressor to pull a vacuum and do not operate the compressor in a vacuum. Break the vacuum with nitrogen.

**Evacuate system, then charge with the desired refrigerant. Evacuate the system to hold at 500 microns and break the vacuum with refrigerant. Remove the vacuum pump.** The system is now ready for charging. Charge the system with the correct amount of refrigerant and mark the amount with a permanent marker or ball point pen, in the space provided on the nameplate.

When charging through the suction service valve the refrigerant should always be charged in vapor form, NEVER IN LIQUID FORM. It should always be charged through a dryer. Charging in liquid form may damage the valve plate assembly as well as scrub the oil out of the compressor bearings.

Non-Azeotropes must be charged in the liquid phase only. To avoid compressor damage, liquid must always be charged into the high side or into an accumulator.

Be sure there is not an overcharge of refrigerant. An overcharge might permit liquid refrigerant to enter the compressor and damage the valves, rods, pistons, etc.

When shipped from the factory; compressors are charged with the proper oil level for most applications. Proper oil level is the center of the oil sight glass (if equipped). To check the oil, stop the compressor and read the oil level. This reading should be taken 10 seconds after the compressor is stopped. Any other oil reading can be misleading. When used on a remote installation, it is sometimes necessary to add oil.

Check the oil at the start-up and again every two hours thereafter until the level stabilizes. **It is also recommended that after two weeks of operation a sample of the oil should be removed from the compressor.** A new dryer should be installed. If it is necessary to add oil to the system, use only the proper Emerson approved refrigeration oil referenced in [Form 93-11](#) located our online product information at [Emerson.com/OPI](http://Emerson.com/OPI).

### Superheat Requirements

In order to assure that liquid refrigerant does not return to the compressor during the running cycle, attention must be given to maintaining proper superheat at the compressor suction inlet. A minimum of 20°F (11°C) superheat is recommended.

Instructions on how to determine the refrigerant charge can be found by referencing the appropriate compressor application guide for the compressor used within the system, located on our online product information at [Emerson.com/OPI](http://Emerson.com/OPI).

[AE-4-1426 Application Guidelines for ZB\\*\\*KAE and YB\\*\\*KAE Copeland Scroll™ Refrigeration Compressors](#)

[AE4-1425 Application Guidelines for Low Temperature ZF\\*\\*KAE and YF\\*\\*KAE 1-2.5HP Copeland Scroll™ Refrigeration Compressors](#)

[AE-1431 Application Guidelines for ZB\\*KAU Copeland R-290 Scroll™ Compressors](#)

[AE-1344 Application Guidelines for Copeland™ RFT, RRT, RST Compressors](#)

[AE-1305 Application Guidelines for Copeland™ AF, AR & AS Refrigeration Hermetic Compressors](#)

[AE-1380 Guide for the Use of R-290 Refrigerant in Copeland™ Refrigeration Compressors](#)

[AE-1387 Application Guidelines for ZS\\*\\*KAE and YS\\*\\*KAE Refrigeration Copeland Scroll™ Compressors](#)

## INITIAL STARTUP

Copeland refrigeration units do not have a time delay or bump start unless the unit is equipped with an “EUC” (Electronic Unit Controller) programmed with these features. Consult the EUC label on the electrical box. Note: Not all condensing units come with an EUC. Some have mechanical pressure controls.

### Default EUC Settings (if equipped)

Factory-installed Electronic Unit Controller (“EUC”) are pre-programmed with the proper settings, resulting in little to no setup time. The unit comes with an attached label showing how to adjust the low pressure cut-in and cut-out.

There is a label on the inside of the enclosure which lists all of the factory default settings for the controller (including those not adjustable), a basic controller wiring schematic, basic button descriptions, the controller part number, the pre-loaded program part number, and contact information. This information can be used if a service replacement controller is needed.

The built-in EUC control settings can be referenced in [AE8-1376 Electronic Unit Controller](#), located on our online product information at [Emerson.com/OPI](https://emerson.com/OPI).

## ADDITIONAL INFORMATION:

### Performance data, wiring diagrams, parts lists

All condensing units have performance data, wiring diagrams, replacement parts list, etc. which can be found on our online product information (OPI) site: [Emerson.com/OPI](https://emerson.com/OPI)

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