Guide for the Use of R-290 Refrigerant in Copeland™ Refrigeration Compressors

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Safety Instructions

Copeland™ compressors are manufactured according to the latest U.S. and European Safety Standards. Particular emphasis has been placed on the user's safety. Safety icons are explained below and safety instructions applicable to the products in this bulletin are grouped on page 3. These instructions should be retained throughout the lifetime of the compressor. You are strongly advised to follow these safety instructions.

Safety Icon Explanation

- **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.
- **SAFETY INSTRUCTIONS**: is used to indicate general instructions relative to safe work practices.
- **CAUTION**: without the safety alert symbol, is used to address practices not related to personal injury.
- **FLAMMABILITY**

 DISCLAIMER

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The handling of flammable refrigerants and its associated systems and equipment is to be done by qualified and trained technicians only.

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## Instructions Pertaining to Risk of Electrical Shock, Fire, or Injury to Persons

### ELECTRICAL SHOCK HAZARD
- Failure to follow these warnings could result in serious personal injury.
- Disconnect and lock out power before servicing.
- Discharge all capacitors before servicing.
- Use compressor with grounded system only.
- Molded electrical plug must be used when required.
- Refer to original equipment wiring diagrams.
- Electrical connections must be made by qualified electrical personnel.

### PRESSURIZED SYSTEM HAZARD
- Failure to follow these warnings could result in serious personal injury.
- System contains refrigerant and oil under pressure.
- Remove refrigerant from both the high and low compressor side before removing compressor.
- Use appropriate back up wrenches on rotalock fittings when servicing.
- 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.
- Use only approved refrigerants and refrigeration oils.
- Personal safety equipment must be used.

### BURN HAZARD
- Failure to follow these warnings could result in serious personal injury or property damage.
- Do not touch the compressor until it has cooled down.
- Ensure that materials and wiring do not touch high temperature areas of the compressor.
- Use caution when brazing system components.
- Personal safety equipment must be used.

### COMPRESSOR HANDLING
- Failure to follow these warnings could result in personal injury or property damage.
- Use the appropriate lifting devices to move compressors.
- Personal safety equipment must be used.

### FLAMMABILITY

### Safety Statements
- Refrigerant compressors must be employed only for their intended use.
- Only qualified and authorized RHVAC refrigeration personnel are permitted to install, commission and maintain this equipment.
- Electrical connections must be made by qualified electrical personnel.
- All valid standards and codes for installing, servicing, and maintaining electrical and refrigeration equipment must be observed.
- Guidelines for the safe use of hydrocarbon refrigerants (A handbook for engineers, technicians, trainers and policy makers) can be downloaded from www.gtz.de/proklima
1. General Information

**DANGER**

*R-290 is flammable and should be handled by qualified personnel in accordance with appropriate care for safe use.*

R-290 (Propane) refrigerant can be used as a Hydrocarbon refrigerant alternative for traditional HCFC/HFC low or medium temperature applications. R-290 CANNOT be used as a retrofit refrigerant, it is only to be used in new systems specifically designed for R-290.

Before supplying compressors for use with R-290, it is first necessary to perform an evaluation of the risks involved with the use of this refrigerant. The customer should perform a risk assessment to ensure proper knowledge about the handling and use of the R-290 in the refrigerant system (for further information please contact the Emerson Climate Technologies Application Engineering Department). It is recommended that manufacturers of refrigeration systems using flammable refrigerants such as R-290, develop accurate charging, leak testing and system testing methods to guarantee that all necessary safety procedures have been met.

Safety standards have been developed for the use of hydrocarbons, including leakage simulation tests and specifications for several electrical components which may come into contact with leaking refrigerants. The following set of UL and international standards, from the International Electrotechnical Commission, on electrical safety contains rules for the design and testing of appliances operating with flammable refrigerants:

- **UL-471**
- **IEC 60335-2-24**: Household refrigerators and freezers
- **IEC 60335-2-34**: Motor compressors
- **IEC 60335-2-89**: Commercial refrigerators and freezers
- **IEC 60335-2-40**: Heat pumps, air conditioners and dehumidifiers

2. Compressor Nomenclature

**CAUTION**

*Standard refrigeration compressors cannot be used in R-290 applications under any circumstances!*

There are only a limited number of R-290 compressors available at this time; the compressor's nomenclature will be designated with a "U" in the eighth character for R-290 application. Example: ASE18C4U-IAA

3. System Component Compatibility

All of the components in the refrigeration system that may contain contaminants should conform to the requirements outlined in form **DIN 8964**(1). (AHRI is developing standards specific to Hydrocarbon-only refrigerants such as R-290 and the new specs will be out soon.)

The presence of the contaminants paraffin and silicon is not permitted.

4. Expansion Device

For a new application the first component to be designed should be the capillary tube.

Generally, when designing an R-290 system based on an existing R-22 system, the same capillary tube can be used although the length should be decreased by approximately 5%. It is not recommended to use a capillary tube with an internal diameter less than .024" (0.6 mm).

For each system the optimal dimensioning of the capillary tube should be performed in an appropriate test laboratory, in order to obtain the best working conditions.

For accurate sizing of TXV type expansion devices please contact the TXV manufacturer.

5. Evaporator and Condenser

Evaporator and condenser system options are available to reduce the required system charge. Examples would be smaller tubing dimensions and micro-channel style coils.

6. Filter Drier

Refrigerant R-290 requires the use of a normal filter drier. The Emerson EK Filter Driers are suitable for use with R-290 refrigerant (Propane). These filter driers use an XH-6 molecular sieve and this MS provides the best water adsorption capacity of any of the MS’s on the market today.

Always consult the manufacturer for the proper selection of the filter drier.

7. Evacuation and Charging Equipment

Good refrigeration practice suggests system evacuation from both low side and high side, achieving a minimum

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(1) The soluble residual contents and solid residues must be less than 100mg/m² of system internal surface area. Of this a maximum of 40 mg/m² can be soluble and the maximum of 60mg/m² can be insoluble.
level of 0.14 mbar (100 μHg) with a non-condensable value of less than 0.3% by volume.

Use charging equipment suitable for use of the refrigerant R-290, and if possible, dedicate this equipment for use only with this refrigerant.

Service and repair of R-290 systems should be completed only by trained service technicians, taking into account all local laws and regulations. R-290 requires special handling and care due to its flammability. Good ventilation is required during service of the refrigeration system; vacuum pump vents need to be directed to open air. An electronic scale is also recommended to maintain the required charging accuracy.

8. Refrigerant Charge

For each system, the optimal refrigerant charge should be determined in an appropriate test laboratory in order to obtain the best working conditions. In addition, the system charge must not exceed the established SNAP guidelines.

The US Significant New Alternatives Policy (SNAP)
The SNAP ruling for hydrocarbon is divided into two components:

Refrigerators and freezers: the charge limitations are 57g (2.0 ounces) in any refrigerator, freezer, or combination refrigerator and freezer.

Retail food refrigerator and freezers: the charge limitation for propane R-290 is 150g (5.29 ounces).

(For more information, visit http://www.epa.gov/ozone/snap.)

9. Moisture

In order to avoid problems that can shorten the life of the refrigeration system, use components that are supplied internally dried and properly sealed to prevent the entrance of moisture. These components should remain sealed until they are used.

The moisture content in a system should conform to form DIN 8964. The level of moisture present in the refrigeration circuit should be below 40ppm and after the system has been operating, the filter dryer should remove moisture from the system from a level below 20ppm.

10. Leak Control

It is recommended that special attention be given to the correct brazing, or other forms of union of the system components, to avoid the possibility of leaks. It is also recommended that a Nitrogen purge be implemented while brazing on any refrigeration system.

To maximize efficiency in controlling leaks, it is recommended to use a leak detector designed for use with refrigerant R-290, or as an alternative, a detector designed for use with Helium. Consult the manufacturer for their recommendations on the use of their equipment.

11. High Pressure Limit Control

To protect the system, it may be necessary to install a high pressure limit switch to control the maximum discharge pressure. The settings on this limit switch should be in accordance with the limits established by the system manufacturer. High pressure switches must comply with the ignition test requirements in section SB5.2 of UL 471.

12. Oil Type and Specification

Compressors are charged with a specific quantity of Lubrizol RL22HB POE oil.

13. Application Instructions

Contact System OEM for specific application instructions. For general compressor guidelines, please reference AE4-1305 (Application Guidelines for AF, AR & AS Refrigeration Hermetic Compressors) and AE4-1344 (Application Guidelines for RFT, RRT, RST Compressors).
ADDENDUM

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⚠️ CAUTION

POE must be handled carefully and the proper protective equipment (gloves, eye protection, etc.) must be used when handling POE lubricant. POE must not come into contact with any surface or material that might be harmed by POE, including without limitation, certain polymers (e.g. PVC/CPVC and polycarbonate).