Application Engineering

Guidelines and Recommendations for selecting Start Components for Copeland Brand Compressors

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COPELAND

Safety

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 integrating the compressor 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

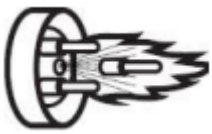
• OEMs are responsible for system design, selection of appropriate components, integration of this component into the system, and testing the system. OEMs must ensure that staff involved in these activities are competent and qualified.

• 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 copeland.com/terminal-venting 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.

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 copeland.com/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.

POE Oil Hazards

This equipment contains polyol ester (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.

Precautions

• Always wear personal protective equipment (gloves, eye protection, etc.).

• Keep a fire extinguisher at the jobsite at all times.

• Keep clear of the compressor when power is applied.

- 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.**

• Never reset a breaker or replace a blown fuse without performing appropriate electrical testing

- **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.**

• Disconnect power and use lock-out/tag-out procedures before servicing.

- 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.)

- Discharge capacitors for a minimum of two minutes

- Always use control of hazardous energy (lock-out/tag-out) procedures to ensure that power is not reconnected while the unit is being serviced.

• Allow time for the compressor to cool before servicing.

- Ensure that materials and wiring do not touch high temperature areas of the compressor.

• Keep all non-essential personnel away from the compressor during service.

• For A3 refrigerants (R290) remove refrigerant from both the high and low sides of the compressor. Use a recovery machine and cylinder designed for flammable refrigerants. Do not use standard recovery machines because they contain sources of ignition such as switches, high- and low-pressure controls and relays. Only vent the R290 refrigerant into the atmosphere if the system is in a well-ventilated area.

• Never use a torch to remove the compressor. Only tubing cutters should be used for both A2L and A3 refrigerants.

• Use an appropriate lifting device to install or remove the compressor.

• 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.

• Always wear appropriate safety glasses and gloves when brazing or unbrazing system components.

• Charge the system with only approved refrigerants and refrigeration 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.

• Before energizing the system:

1. Securely fasten the protective terminal cover or molded plug to the compressor, and

2. Check that the compressor is properly grounded per the applicable system and compressor requirements.

Signal Word Definitions

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.

Copeland Supplied capacitors

Run Capacitors

Run capacitors are used on compressors to improve efficiency, raise the motor's power factor, and lower noise. Run capacitors are continuously in the operating circuit. Copeland supplied run capacitors have received compliance from Underwriters' Laboratories, Inc. and Canadian Standards Association. All Copeland supplied run capacitors meet the requirements of the current revision of EIA Standard 456 or IEC 60252-1. The phasing out of PCB materials in run capacitors triggered a wave of development and redesign in the capacitor industry. Metallized film and "soggy foil" designs have been developed to replace the old foilpaper capacitors. The basic result is a new generation of round run capacitors, smaller in size, lighter in weight, and more economical. The great majority of Copeland capacitor and relay assemblies have been redesigned to use these new run capacitors. All current usage capacitors incorporate a pressure interrupter which breaks the circuit in the event of overheating and swelling of the capacitor. However, a unique characteristic of the new designs is that due to the very thin material used, any short or ground in the capacitor will tend to burn itself free and become self healing. Not only does this eliminate many early capacitor failures, it also obsoletes the need for an identified terminal on the run capacitor identifying the terminal most likely to short to ground. Run capacitors now have an AFC rating, identifying the available fault current, which is the short circuit interrupting capability of the pressure sensitive interrupter in amperes. Most capacitors are rated at 10,000 amps, but 5000 amps is adequate for motor application. See the Copeland Electrical Handbook (Form No. 6400) for run capacitor listings.

Start Capacitors

Start capacitors are used on compressors where system designs require high starting torque. Start capacitors are designed for intermittent service only and have a high microfarad (MFD) rating. Copeland supplied start capacitors have received compliance from Underwriters' Laboratories, Inc. and Canadian Standards Association. All Copeland supplied start capacitors meet the requirements of the current revision of EIA Standard 463B for heavy duty (Type 1) start capacitors. Their construction is of the electrolytic type in order to obtain high capacitance. All standard Copeland start capacitors are supplied with bleed-resistors securely attached and soldered to their terminals. The use of capacitors without these resistors will result in sticking relay contacts and/or erratic relay operation especially where short cycling is likely to occur. This is due to the start capacitor discharging through the relay contacts as they close, following a very short running cycle. The resistor permits the capacitor charge to bleed down at a much faster rate, preventing arcing and overheating of the relay contacts. The use of capacitors supplied by Copeland is recommended. If a start capacitor needs to be installed that does not have a bleed resistor, a 15,000-18,000 ohm, 2 watt resistor should be soldered across the terminals of each start capacitor. Care should be taken to prevent their shorting to the case or other nearby metallic objects. If sticking contacts are encountered on any start relay, the first item to check is the start capacitor resistor. If damaged, or not provided, install a new resistor, and clean the relay contacts or replace the relay. Suitable resistors can be obtained from any electronic parts wholesaler or retailer.

The PTC Start Assist

The PTC (Positive Temperature Coefficient) resistor is used for applications where high starting torque is not required. A Copeland approved PTC resistor may be connected in parallel with the run capacitor, placing it in series with the start winding. The PTC has a low resistance when it is cold. When the motor starts, the low resistance causes a large current to flow through the resistor. The current drawn by the resistor is out of phase with the current drawn by the motor windings, and this provides the torque to start. As soon as the resistor draws current, it begins to heat, and the positive temperature effect of the resistor causes it to rapidly increase its resistance. By the time the motor reaches full speed, very little current is drawn by the resistor. Although it remains connected to the motor circuit, it has no significance in the operation of the compressor.

Revision Tracking R3

The document format has been updated to the new Copeland format

All occurrences of "Emerson" have been removed

A note regarding A3 and R290 venting has been updated