

Application Engineering

Cooling Requirements for Copelametic and Copeland Discus Compressors

BULLETIN NO: AE4-1135 R26

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Safety

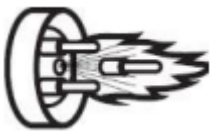
Important Safety Information

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](https://www.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.

Introduction

In response to customer inquiries, both domestic and international, Copeland has reviewed our application requirements for oil bypass loop with demand cooling module and head fans applied on Copeland Discus compressors in the R-404A/R-507 low temperature applications. Product engineering has done extensive testing of various parameters, including unloading as well as fully loaded. The results were the basis for the application envelope shown in Figure 1.

Note: Oil Cooler is obsolete, see Oil bypass loop and phased out oil-cooler section for more details. At the end of this bulletin, you'll find Table 4 detailing models that are available with an oil bypass loop that formally used an oil cooler.

The latest testing has shown that if the suction return gas is maintained below 65°F, Discus compressors can be operated down to -25°F evaporating on R- 404A/R-507 without the requirement of a head fan. Additionally, head fans can be eliminated at even lower evaporating temperatures if return gas temperatures can be maintained at the lower values. Copeland application engineering will approve these applications upon receipt of acceptable test data.

The cooling requirements for all other Copelametic motor-compressors and refrigerants are clearly defined below.



Any deviation from these recommendations can result in failure of the compressor.

Approved Oils

For a complete list of approved POE lubricants, refer to Form 93-11, Copeland Accepted Refrigerants and Lubricants.

applications, and connected in series for nominal 460 volt, 60 cycle and 380 volt, 50 cycle power supplies. The nine terminals are provided so the necessary wiring connections can be made by means of jumper bars, which must be positioned correctly to insure proper compressor operation.

POE may cause an allergic skin reaction and 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). Refer to the Safety Data Sheet (SDS) for further.

Air-Cooled Compressor

As the name implies, air-cooled compressors are totally dependent on heat transfer to the air to maintain proper temperatures.

Air-cooled compressors require constant airflow across the compressor for proper cooling. Merely drawing air through a compartment over the compressor is not adequate - direct impingement on the compressor from the fan discharge is necessary.

If the compressor is mounted in the fan discharge stream on a condensing unit, adequate cooling will be provided. When applied with a remote condenser, an auxiliary fan is required.

If compressor cooling is provided by the condenser fan, fan cycling for head pressure control is not acceptable unless auxiliary cooling is provided.

Water-Cooled Compressor

Some smaller Copelametic compressors are wrapped with water coils for application on water-cooled condensing units. If water is circulated through the coil wrapped around the compressor, adequate cooling will be provide

Refrigerant-Cooled Compressors (Non-Discus)

Refrigerant suction cooled compressors (non-Discus) are adequately cooled by the refrigerant at evaporating temperatures above 0°F. If operated at evaporating temperatures below 0°F, auxiliary cooling is required.

At evaporating temperatures below 0°F, the compressor can be cooled adequately by the condenser fan discharge. Fan cycling for head pressure control is not acceptable unless auxiliary cooling is provided. Fan cycling for head pressure control for medium and high temperature applications is acceptable.

Details

Vertical cooling fans are recommended for compressors 3 H.P. in size and larger when auxiliary cooling is required. A standard fan assembly developing 1000 CFM airflow is available, with interchangeable brackets to fit different model compressors.

Two Stage Compressors

Compressors that formally used an oil cooler (6RL, 6RT, 4RL) must be applied with an oil bypass loop and vertical cooling fan.

All two stage compressors are provided with an interstage expansion valve and adequate cooling is provided by the refrigerant. No auxiliary fan is required.

Discus Head Fan Requirements with Low Temperature R-407A, R-407C and R-407H

Copeland Discus compressors are also approved for use with R-407A/C/H in low temperature applications. Latest testing by Copeland engineering has shown that as long as the compressor is equipped with Copeland Demand Cooling, a Copeland Discus compressor using R-407A/C/H in low temperature applications does not require a head fan.

Table 4 lists the low temperature compressor model numbers which Copeland has released without the oil bypass loop and demand cooling module attached.

Oil Bypass Loop and Phased Out Oil Cooler

Some Discus II compressors originally came with an oil cooler which now is obsolete (See Table 4 for reference). If the Discus II compressor is equipped for an oil cooler, but your application doesn't require it or it got damage, an oil bypass loop must be used to maintain proper oil flow to:

- 1. Bearings
- 2. Crank
- 3. Piston-rod assemblies within the compressor

See Figure 2 for Reference.

Failure to use an oil bypass loop as shown in Figure 3 will result in damaged mechanical components, effectively voiding the compressor's warranty. Discus III models are not offered with oil coolers, so if a Discus II service replacement compressor is required and equipped with an oil bypass loop, the instructions above must be implemented.

Oil bypass loop kit 928-1506-01 is available for Discus Compressor that originally came with obsolete oil cooler kit. The main components of this kit are oil bypass loop and T-fitting assembly.

Figure 4 shows oil bypass loop details, part# 528- 1378-00.

Figure 5 shows T-fitting assembly details, part# 036-0415-01.

Nomenclature Discus II and Discus III

The nomenclature examples below show the 4th character changing for the Discus III models. This applies for 4D and 6D compressor only.

	Discus II	Discus III
Standard	4DH3R22ME-TSK-C00	4DHNR22ME-TSK-C00
Digital	4DHDR22ME-TSK-C00	4DHXR22ME-TSK-C00

General Guidelines and More Information

For general Copeland Discus compressor please log in to Online Product Information at Copeland.com/OPI, refer to

the Application Engineering bulletins listed below, or contact your Application Engineer.

AE4-1287	Copeland Discus Compressors with Demand Cooling System
AE21-1355	Digital Capacity Control for Copeland Discus Refrigeration Compressors

Figures & tables

Table 1 : Vertical Fan Assemblies (To be mounted on top of compressors)

Part Number	For Compressor Model	Description
998-0550-00	All	Fan assembly including 230-1-60/50 shaded pole motor, fan blade, guard.
998-0550-06 ¹	All	Fan assembly including 230-1-60/50 ECM motor, fan blade, guard.
998-0550-01	All	Fan assembly including 440/380-1-60/50 motor, fan blade, guard.
998-0550-02	All	Fan assembly including 115-1-60/50 motor, fan blade, guard.
998-0574-00	L	Mounting kit including bracket, studs, spacers, connectors, conduit.
998-0574-01	M	Mounting kit including bracket, studs, spacers, connectors, conduit.
998-0574-02	N	Mounting kit including bracket, studs, spacers, connectors, conduit.
998-0574-03	4D-4R	Mounting kit including bracket, studs, spacers, connectors, conduit.
998-0574-16	4D*N ² (Short Head Models)	Mounting kit including bracket, studs, spacers, connectors, conduit.
998-0574-17	4D*X,4D*N ² (Tall Head Models)	Mounting kit including bracket, studs, spacers, connectors, conduit.
998-0574-04	6D-6R	Mounting kit including bracket, studs, spacers, connectors, conduit.
998-0574-18	6D*N ² (Short Head Models)	Mounting kit including bracket, studs, spacers, connectors, conduit.
998-0574-19	6D*X,6D*N ² (Tall Head Models)	Mounting kit including bracket, studs, spacers, connectors, conduit.
998-0574-05	6DL/T-6RL/T	Mounting kit including bracket, studs, spacers, connectors, conduit.
998-0574-06	9R old style head	Mounting kit including bracket, studs, spacers, connectors, conduit.
998-0574-08	9D-9R new style head* 3D	Mounting kit including bracket, studs, spacers, connectors, conduit.
998-0574-11	2D	Mounting kit including bracket, studs, spacers, connectors, conduit.
998-0574-10	*3D Moduload/ Discus digital	Mounting kit including bracket, studs, spacers, connectors, conduit.
928-1506-01	4DL/N/P/S/T-4RL / 6DC/D/E/F/L/T-6RL/T	Oil bypass loop & t-fitting kit.
936-0415-01	4DL/N/P/S/T-4RL / 6DC/D/E/F/L/T-6RL/T	T-fitting kit for demand cooling and oil bypass tube.
528-1378-00	4DL/N/P/S/T-4RL / 6DC/D/E/F/L/T-6RL/T	Oil bypass loop ONLY.

¹ Drop-in replacement for shaded pole motor 998-0550-00.

Table 2 Vertical Cooling Fan Space Requirement

Compressor Model	Add to Compressor Height, Inches
L	8
N	8
M	8.5
9	8.5
4	9.5
4D*X,4D*N ²	7.3
6	10.25
6D*X,6D*N ²	9.5

² Overall height is measured from the mounting point to the top of the fan guard

Table 3 Horizontal Fan Assemblies

(To blow on compressor side)

Compressor HP	Minimum Air Flow (cfm)	Fan and Motor Assembly		Fan Space Requirement	
		Part Number	Electrical	Additional Height to Compressor (in.)	Additional Width to Compressor (in.)
1	650	998-0050-00	230V-1Ø-60/50 Hz	1.25	5.50
1 1/2	650	998-0050-00	230V-1Ø-60/50 Hz	1.25	5.50
2	650	998-0050-02	230V-1Ø-60/50 Hz	None	5.50
		998-0050-03	460V-1Ø-60/50 Hz	None	5.50

Table 4 Nomenclature Scheme to Identify Copeland Discus II Compressor Models without Requirement of Oil Bypass Loop & T-Fitting

Discus II Models w/ Oil Bypass Loop & T- Fitting	Discus II Models (Standard) without Oil Bypass Loop & T- Fitting	Discus II Models 1-Bank Unloader without Oil Bypass Loop & T- Fitting	Discus II Models 2-Bank Unloader without Oil Bypass Loop & T- Fitting
4DN3F47Kx-TSK/TSE	---	4DE <u>3</u> F47Kx-TSK/TSE	---
4DL3F63Kx-TSK/TSE	4DH <u>3</u> F63Kx-TSK/FSD/TSE	---	---
4DP3F63Kx-TSK/TSE	---	4DK <u>3</u> F63Kx-TSK/FSD/TSE	---
4DT3F76Kx-TSK/FSD/TSE	4DJ3F76Kx-TSK/FSD/TSE		---
4DS3F76Kx-TSK/TSE	---	4DR <u>3</u> F76Kx-TSK/FSD/TSE	---
4RL1-150x-TSK/TSE	---	---	---
4RL2-150x-TSK/TSE	---	---	---
6DL3F93Kx-TSK/TSE	6DH <u>3</u> F93Kx-TSK/FSD/TSE		---
6DC3F93Kx-TSK/TSE	---	6DK <u>3</u> F93Kx-TSK/FSD/TSE	---
6DD3F93Kx-TSK/	---	---	6DP <u>3</u> F93Kx-TSK/FSD/TSE
6DT3F11Mx-TSK/FSD/TSE	6DJ3F11Mx- TSK/FSD/TSE/ESX	---	---
6DE3F11Mx-TSK	---	6DR <u>3</u> F11Mx-TSK/FSD/TSE	---
6DF3F11Mx-TSK/ TSE	---	---	6DS <u>3</u> F11Mx-TSK/FSD/TSE
6RL1-250x-FSM/TSE/TSK	---	---	---
6RT1-300x-FSD/TSE/TSK	---	---	---

Note 1: All these models are being superseded to Discus III.

Note 2: Discus III models are not offered with oil bypass loop and t-fitting.

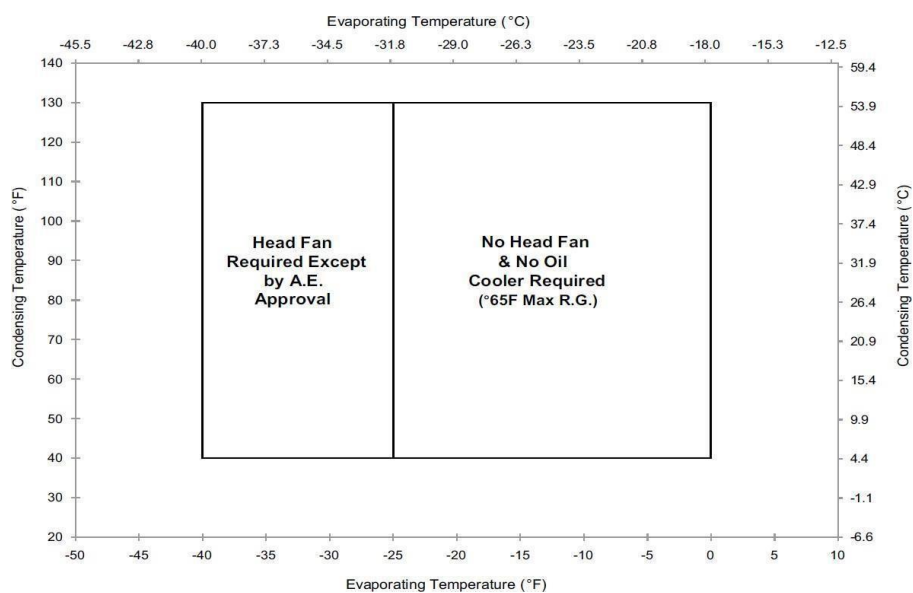


Figure 1 Discuss Head Fan Requirements R-404A, R-507

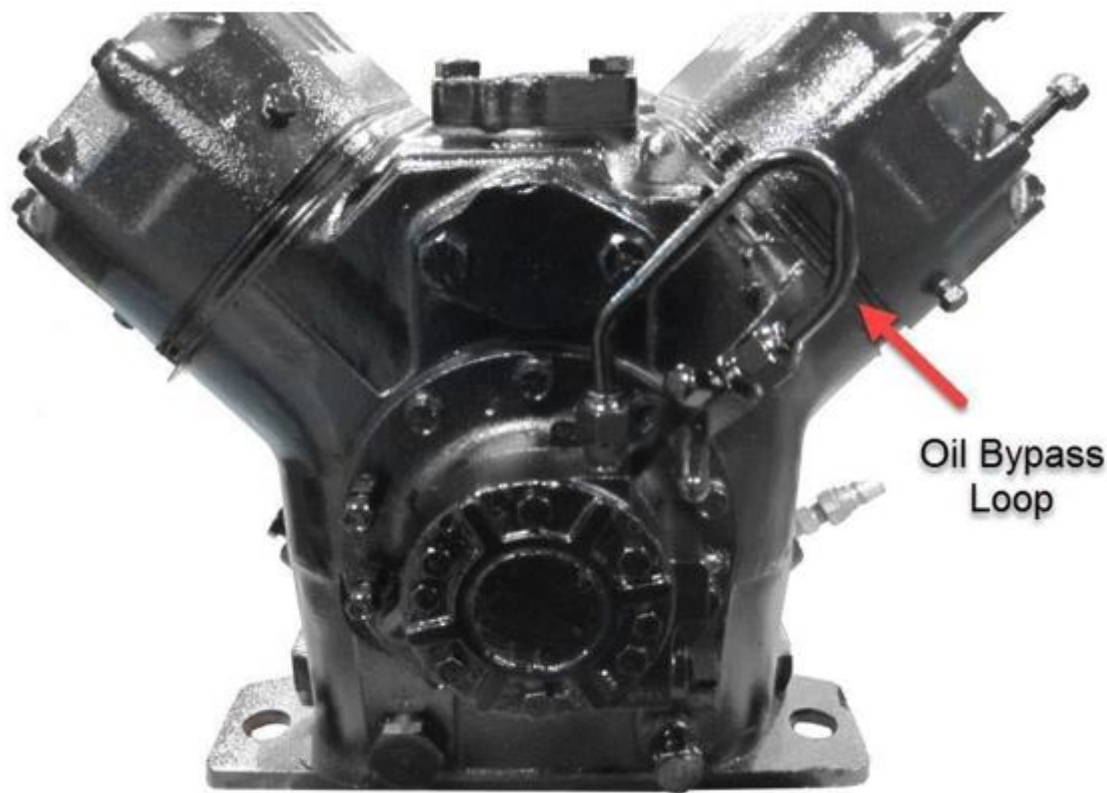


Figure 2 Oil Bypass Loop Position



Figure 3 Failure to Use a Bypass Loop



Figure 4 Oil Bypass Loop Part# 528-1378-00

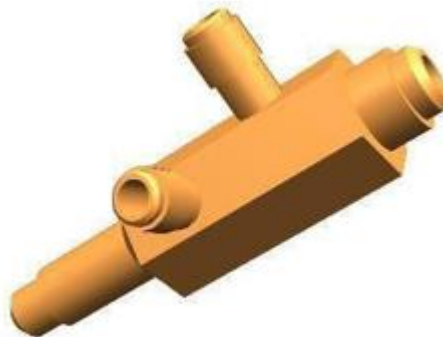


Figure 5 T-Fitting Assembly Part# 036-0415-01

Revision Tracking R26

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.

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