Cooling Requirements for Copelametic™ and Copeland Discus™ Compressors

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Revision Tracking R23
Pg. 6 – Added kit part number for 4D and 6D tall head models, revised description for short head kits.

Revision Tracking R22
Pg. 6 – Part kit # 998-0550-06 added for ECM Fan motor

Revision Tracking R21
Pg. 4 – Script about POE oil was updated to Warning.

Revision Tracking R20
Pg. 2-3- Safety Instructions added.
Pg. 4 Separate Oil Warning section added.

Pg. 4 - Note related to Oil Cooler deleted.
Pg. 4-5- Oil cooler mention changed to “Oil Bypass Loop and Demand Cooling module” where it applies.
Pg. 5 - Oil Bypass Loop section added.
Pg. 5 - General Guidelines and More Information Section added.
Pg. 6 - Changes made on Table 4.
Pg. 6 – Part kit # 928-1506-01 table added.
Pg. 7 - Table 4 updated.
Pg. 8-9 - Figures related to Oil Bypass loop position added.
Pg. 9 - Figures of Oil Bypass loop and T-Fitting added.
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.

⚠️ NOTICE is used to address practices not related to personal injury.

⚠️ CAUTION, without the safety alert symbol, is used to address practices not related to personal injury.

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

**ELECTRICAL SHOCK HAZARD**
- 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.
- Failure to follow these warnings could result in serious personal injury.

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

**BURN HAZARD**
- 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.
- Failure to follow these warnings could result in serious personal injury or property damage.

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

Safety Statements
- Refrigerant compressors must be employed only for their intended use.
- Only qualified and authorized HVAC or 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.
Introduction

In response to customer inquiries, both domestic and international, Emerson 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 as long as 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. Emerson 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.

CAUTION

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, Emerson Accepted Refrigerants and Lubricants.

WARNING

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 details.

Air-Cooled Compressors

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 Compressors

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 provided.

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.
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.

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

Two Stage Compressors
All two stage compressors are provided with an inter-stage expansion valve and adequate cooling is provided by the refrigerant. No auxiliary fan is required.

Discus Head Fan Requirements With Low Temperature R-407A and R-407C
Copeland Discus compressors are also approved for use with R-407A and R-407C in low temperature applications. Latest testing by Emerson engineering has shown that as long as the compressor is equipped with Copeland Demand Cooling™, a Copeland Discus compressor using R-407A or R-407C in low temperature applications does not require a head fan. Table 4 lists the low temperature compressor model numbers which Emerson has released without the oil bypass loop and demand cooling module attached.

Oil Bypass Loop and Phased Out Oil Cooler
CAUTION
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.

<table>
<thead>
<tr>
<th>Discus II</th>
<th>Discus III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard 4DH3R22ME-TSK-00</td>
<td>4DHNR22ME-TSK-C00</td>
</tr>
<tr>
<td>Digital 4DHDR22ME-TSK-00</td>
<td>4DHXR22ME-TSK-C00</td>
</tr>
</tbody>
</table>

General Guidelines and More Information
For general Copeland Discus compressor please log in to Online Product Information at Emerson.com/OPI, refer to the Application Engineering bulletins listed below, or contact your Application Engineer.
Table 1 Vertical Fan Assemblies  
(To be mounted on top of compressors)

<table>
<thead>
<tr>
<th>Part Number</th>
<th>For Compressor Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>998-0550-00</td>
<td>All</td>
<td>Fan assembly including 230-1-60/50 shaded pole motor, fan blade, guard.</td>
</tr>
<tr>
<td>998-0550-06</td>
<td>All</td>
<td>Fan assembly including 230-1-60/50 ECM motor, fan blade, guard.</td>
</tr>
<tr>
<td>998-0550-01</td>
<td>All</td>
<td>Fan assembly including 440/380-1-60/50 motor, fan blade, guard.</td>
</tr>
<tr>
<td>998-0550-02</td>
<td>All</td>
<td>Fan assembly including 115-1-60/50 motor, fan blade, guard.</td>
</tr>
<tr>
<td>998-0574-00</td>
<td>L</td>
<td>Mounting kit including bracket, studs, spacers, connectors, conduit.</td>
</tr>
<tr>
<td>998-0574-01</td>
<td>M</td>
<td>Mounting kit including bracket, studs, spacers, connectors, conduit.</td>
</tr>
<tr>
<td>998-0574-02</td>
<td>N</td>
<td>Mounting kit including bracket, studs, spacers, connectors, conduit.</td>
</tr>
<tr>
<td>998-0574-03</td>
<td>4D-4R</td>
<td>Mounting kit including bracket, studs, spacers, connectors, conduit.</td>
</tr>
<tr>
<td>998-0574-16</td>
<td>4D*N² (Short Head Models)</td>
<td>Mounting kit including bracket, studs, spacers, connectors, conduit.</td>
</tr>
<tr>
<td>998-0574-17</td>
<td>4D<em>X,4D</em>N² (Tall Head Models)</td>
<td>Mounting kit including bracket, studs, spacers, connectors, conduit.</td>
</tr>
<tr>
<td>998-0574-04</td>
<td>6D-6R</td>
<td>Mounting kit including bracket, studs, spacers, connectors, conduit.</td>
</tr>
<tr>
<td>998-0574-18</td>
<td>6D*N² (Short Head Models)</td>
<td>Mounting kit including bracket, studs, spacers, connectors, conduit.</td>
</tr>
<tr>
<td>998-0574-19</td>
<td>6D<em>X,6D</em>N² (Tall Head Models)</td>
<td>Mounting kit including bracket, studs, spacers, connectors, conduit.</td>
</tr>
<tr>
<td>998-0574-05</td>
<td>6DL/T-6RL/T</td>
<td>Mounting kit including bracket, studs, spacers, connectors, conduit.</td>
</tr>
<tr>
<td>998-0574-06</td>
<td>9R old style head</td>
<td>Mounting kit including bracket, studs, spacers, connectors, conduit.</td>
</tr>
<tr>
<td>998-0574-08</td>
<td>9D-9R new style head* 3D</td>
<td>Mounting kit including bracket, studs, spacers, connectors, conduit.</td>
</tr>
<tr>
<td>998-0574-11</td>
<td>2D</td>
<td>Mounting kit including bracket, studs, spacers, connectors, conduit.</td>
</tr>
<tr>
<td>998-0574-10</td>
<td>*3D Moduload/ Discus digital</td>
<td>Mounting kit including bracket, studs, spacers, connectors, conduit.</td>
</tr>
<tr>
<td>928-1506-01</td>
<td>4DL/N/P/S/T-4RL 6DC/D/E/F/L/T-6RL/T</td>
<td>Oil bypass loop &amp; t-fitting kit.</td>
</tr>
<tr>
<td>936-0415-01</td>
<td>4DL/N/P/S/T-4RL 6DC/D/E/F/L/T-6RL/T</td>
<td>T-fitting kit for demand cooling and oil bypass tube.</td>
</tr>
<tr>
<td>528-1378-00</td>
<td>4DL/N/P/S/T-4RL 6DC/D/E/F/L/T-6RL/T</td>
<td>Oil bypass loop ONLY.</td>
</tr>
</tbody>
</table>


Indicates 4D/6D Discus III models
### Table 2 Vertical Cooling Fan Space Requirement

<table>
<thead>
<tr>
<th>Compressor Model</th>
<th>Add to Compressor Height, Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>8</td>
</tr>
<tr>
<td>N</td>
<td>8</td>
</tr>
<tr>
<td>M</td>
<td>8.5</td>
</tr>
<tr>
<td>9</td>
<td>8.5</td>
</tr>
<tr>
<td>4</td>
<td>9.5</td>
</tr>
<tr>
<td>4D<em>X,4D</em>N²</td>
<td>7.3</td>
</tr>
<tr>
<td>6</td>
<td>10.25</td>
</tr>
<tr>
<td>6D<em>X,6D</em>N²</td>
<td>9.5</td>
</tr>
</tbody>
</table>

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)

<table>
<thead>
<tr>
<th>Compressor HP</th>
<th>Minimum Air Flow (cfm)</th>
<th>Fan and Motor Assembly</th>
<th>Fan Space Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Part Number</td>
<td>Electrical</td>
</tr>
<tr>
<td>1</td>
<td>650</td>
<td>998-0050-00</td>
<td>230V-1Ø-60/50 Hz</td>
</tr>
<tr>
<td>1 1/2</td>
<td>650</td>
<td>998-0050-00</td>
<td>230V-1Ø-60/50 Hz</td>
</tr>
<tr>
<td>2</td>
<td>650</td>
<td>998-0050-02</td>
<td>230V-1Ø-60/50 Hz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>998-0050-03</td>
<td>460V-1Ø-60/50 Hz</td>
</tr>
</tbody>
</table>
Table 4 Nomenclature Scheme to Identify Copeland Discus II Compressor Models without Requirement of Oil Bypass Loop & T-Fitting

<table>
<thead>
<tr>
<th>Discus II Models w/ Oil Bypass Loop &amp; T-Fitting</th>
<th>Discus II Models (Standard) without Oil Bypass Loop &amp; T-Fitting</th>
<th>Discus II Models 1-Bank Unloader without Oil Bypass Loop &amp; T-Fitting</th>
<th>Discus II Models 2-Bank Unloader without Oil Bypass Loop &amp; T-Fitting</th>
</tr>
</thead>
<tbody>
<tr>
<td>4DN3F47Kx-TSK/TSE</td>
<td>---</td>
<td>4DE3F47Kx-TSK/TSE</td>
<td>---</td>
</tr>
<tr>
<td>4DL3F63Kx-TSK/TSE</td>
<td>4DH3F63Kx-TSK/FSD/TSE</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>4DP3F63Kx-TSK/TSE</td>
<td>---</td>
<td>4DK3F63Kx-TSK/FSD/TSE</td>
<td>---</td>
</tr>
<tr>
<td>4DT3F76Kx-TSK/FSD/TSE</td>
<td>4DJ3F76Kx-TSK/FSD/TSE</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>4DS3F76Kx-TSK/TSE</td>
<td>---</td>
<td>4DR3F76Kx-TSK/FSD/TSE</td>
<td>---</td>
</tr>
<tr>
<td>4RL1-150x-TSK/TSE</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>4RL2-150x-TSK/TSE</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>6DL3F93Kx-TSK/TSE</td>
<td>6DH3F93Kx-TSK/FSD/TSE</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>6DC3F93Kx-TSK/TSE</td>
<td>---</td>
<td>6DK3F93Kx-TSK/FSD/TSE</td>
<td>---</td>
</tr>
<tr>
<td>6DD3F93Kx-TSK/</td>
<td>---</td>
<td>---</td>
<td>6DP3F93Kx-TSK/FSD/TSE</td>
</tr>
<tr>
<td>6DT3F11Mx-TSK/FSD/TSE</td>
<td>6DJ3F11Mx-TSK/FSD/TSE/ESX</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>6DE3F11Mx-TSK</td>
<td>---</td>
<td>6DR3F11Mx-TSK/FSD/TSE</td>
<td>---</td>
</tr>
<tr>
<td>6DF3F11Mx-TSK/</td>
<td>---</td>
<td>---</td>
<td>6DS3F11Mx-TSK/FSD/TSE</td>
</tr>
<tr>
<td>6RL1-250x-FSM/TSE</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>6RT1-300x-FSD/TSE</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

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 Discus Head Fan Requirements R-404A, R-507
Figure 2 Oil Bypass Loop Position

Figure 3 - Failure to Use a Bypass Loop

Oil bypass must be used to ensure proper oil flow. Eliminating the bypass will cause compressor failure and will void all Emerson warranties.
Figure 4 - Oil Bypass Loop Part# 528-1378-00

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

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