

Copeland Scroll® Compressor Module

Installation, Operation & Maintenance Manual

Model Family
SZO22
SZV22



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COMPRESSOR MODULE NOMENCLATURE

Model	Max Delivery Pressure (PSIG)	Max Flow (MCFD)	Drive HP	High Press Switch Setting (PSIG)	Low Press Switch Setting	High Temp Setting °F (°C)	Oil Thermal Bypass Valve Setpoint °F (°C)	Gas Bypass Valve	Module Weight (Lbs.)
<i>Single Scroll Units</i>									
SZO22C3A-EDE-234	125	100	10	215	2" W.C. (5 mbarg)	240 (116)	200	YES	350
SZV22C1A-EDE-140	190	100	15	215	2" W.C. (5 mbarg)	280 (138)	250	NO	356

NOTE:

SZO modules are intended for use with clean, dry gas in applications with moderate ambient temperatures. Oil thermal bypass valve setpoint is 200°F. Most SZO module applications use PAO oil.

SZV modules keep discharge gas temperatures elevated to help with dewpoint control. SZV modules insulate the separators and use a 250°F oil thermal bypass valve. In cold ambient, and SZV module should be used with an enclosure. Most SZV module applications use PAG oil.

Refer to Copeland Scroll Gas Compression Module Performance Program for all details.

IMPORTANT SAFETY INFORMATION

This manual contains important instructions for installation, operation and maintenance of your Copeland Scroll® Compressor Module.



WARNING

The Compressor Module must be installed **ONLY** in systems that have been designed by qualified engineering personnel. The system must conform to all applicable local and national regulations and safety standards.

These instructions are intended to assist in the installation and operation of the Compressor Module and **MUST** be kept with the Compressor.

Service and maintenance of the Compressor Module must be performed by qualified technicians only. Service and maintenance must conform to all applicable local and national regulations and safety standards.

Thoroughly review this manual, all instructions and hazard warnings before performing any work on the Compressor Module.

Maintain all Compressor Module operation and hazard warning labels.



WARNING

Flammable gas can form explosive mixtures with air. Explosive gases can cause property damage, serious personal injury or death.



WARNING

Failure to disconnect and lockout electrical power from the Compressor Module before attempting maintenance can cause shock, burns, severe personal injury or death.



WARNING

Loosening or removing pressure-containing components from the Compressor Module when it is in operation can cause major property damage, serious personal injury or death.

Failure to relieve system pressure prior to performing service or maintenance on the Compressor Module can cause property damage or serious personal injury.



CAUTION

Extreme heat can cause personal injury or property damage.



CAUTION

Always use a lifting device capable of supporting the full weight of the Compressor Module or component being lifted.

Handling or lifting heavy assemblies can cause personal injury or property damage.

SAFETY SYMBOLS USED IN THIS MANUAL



SAFETY ALERT SYMBOL

When you see this symbol on the Compressor Module or in this manual, look for one of the following words and be aware of the potential for personal injury or property damage.



WARNING

A Warning describes hazards that CAN or WILL cause serious personal injury, death or major property damage.



CAUTION

A Caution describes hazards that CAN cause personal injury or property damage.



NOTE

A Note indicates special instructions that are very important and must be followed.

1.0 INTRODUCTION

The Copeland Scroll® SZO22 Compressor Module comes equipped with one Copeland Scroll® Compressor designed for Class I, Division II applications. The Compressor Module is designed for assembly into a Compressor Package ready for service in the field; the completed housing is done by equipment Packagers. This section provides an overview of these components.

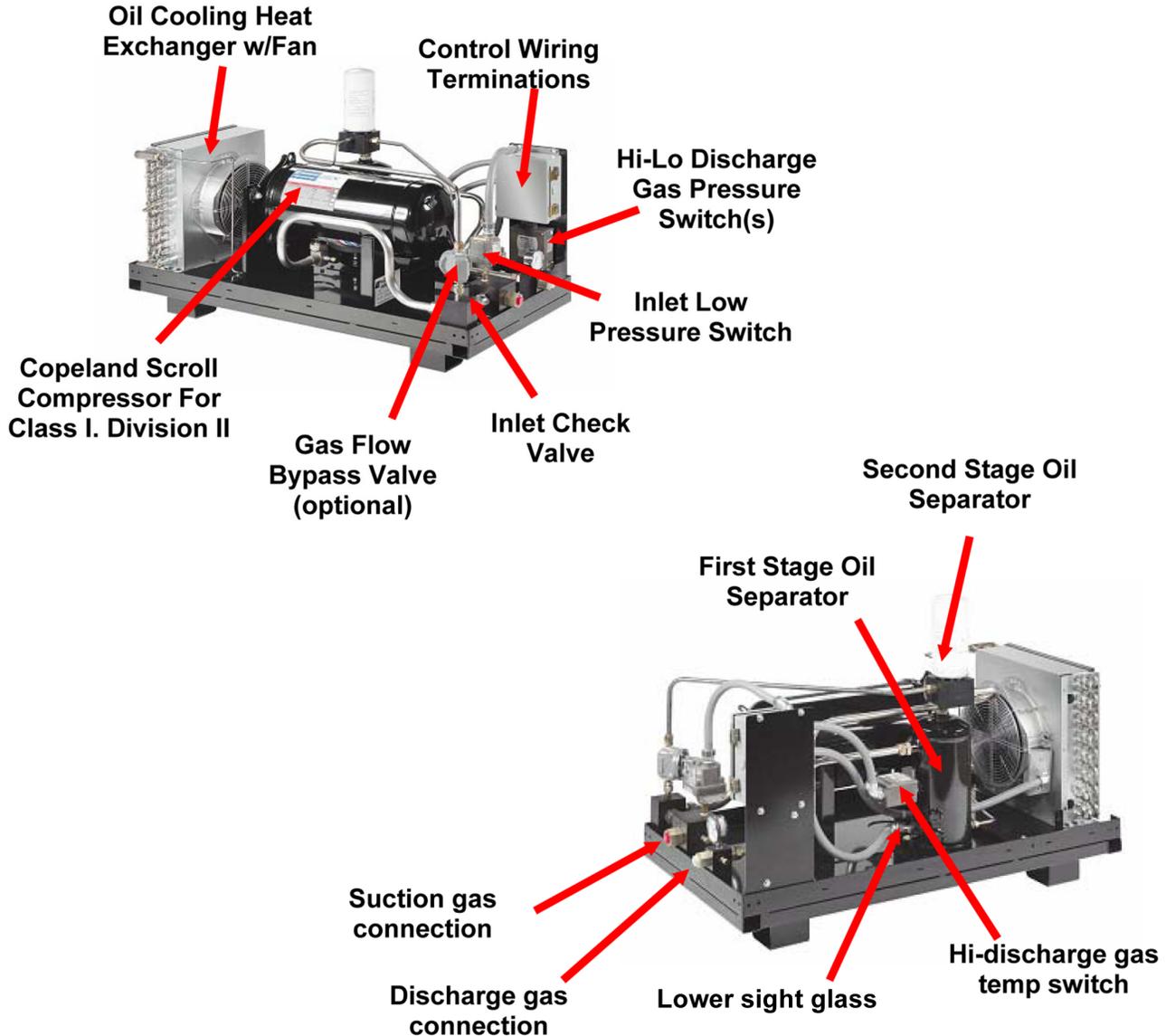
These terms are used throughout this manual:

- **Compressor Module** - the SZO22 Compressor Module shown in **Section 1.1**
- **Compressor** - a Copeland Scroll® Compressor
- **Compressor Package** - the entire assembly, including the Compressor Module, ready for service in the field
- **Packagers** - the company that prepares the Compressor Module for service
- **VFD** - Variable Frequency Drive used to power a variable speed Compressor Module

1.1 The Compressor Module

The **Compressor Module** consists of one Compressor and the other components shown in **Figure 1**.

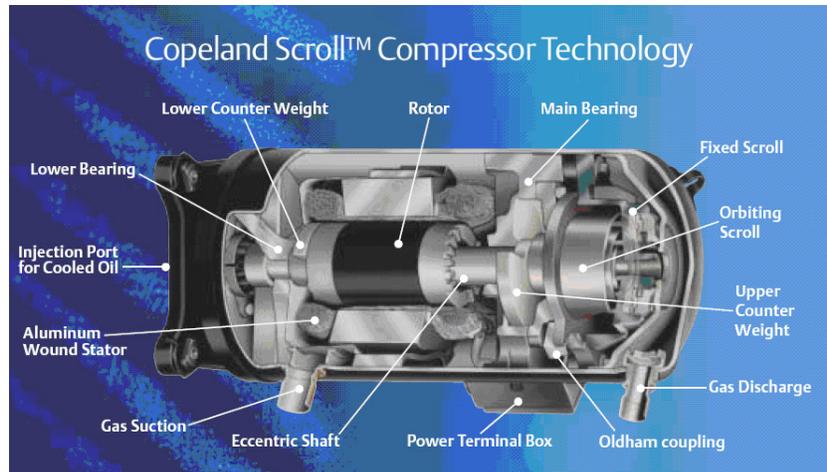
Figure 1 Compressor Module Components



1.2 The Compressor

The **Compressor** refers to the Copeland Scroll® Compressor. **Figure 2** shows a cross-section of a Compressor and its key components.

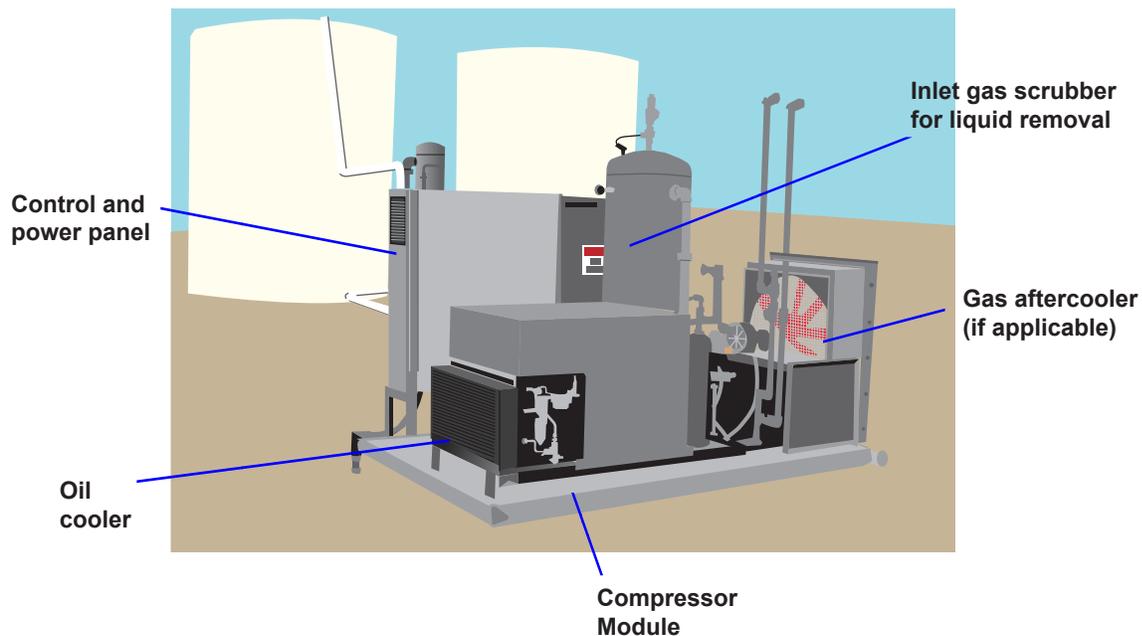
Figure 2 Copeland Scroll® Compressor Cross Section (not shown: Encapsulated Stator)



1.3 The Compressor Package

The **Compressor Package** consists of the Compressor Module housed in an assembly ready for service in the field. Equipment **Packagers** customize the assembly and complete the fabrication for Compressor Modules for each application. **Figure 3** shows a simplified example of a Compressor Package.

Figure 3 Typical Compressor Package



2.0 INSTALLATION

2.1 Installation Guidelines

2.1.1 Required Component—Inlet Gas Scrubber

An appropriate inlet gas scrubber is **REQUIRED** to remove liquids from the gas prior to compression. If there is potential for liquid slugging, a suitable trap must be installed to prevent liquid from flooding and damaging the Compressor.



NOTE

Failing to use an appropriate inlet gas scrubber to remove liquids from the gas prior to compression can cause flooding and damage the Compressor.

2.1.2 General Installation Guidelines

Follow these general guidelines for installation:

- The Compressor Module must be installed and operated in compliance with all applicable codes and regulations.
- The system must be installed on a level surface.
- Install pipe unions or flanges to connect the system to the inlet and discharge piping for ease of service.
- Install isolation valves on the inlet and discharge piping.
- A common ground must be connected between the Compressor Module and the Compressor Package chassis. This ground must comply with the National Electric Code (NEC) and any other applicable codes.
- Solid debris also must be removed from the gas prior to compression. When required, use a 5 to 10-micron inlet filter to remove debris from the gas stream. The degree of filtration required depends on the specific application.

2.2 Inlet and Discharge Pressures

Refer to **Table 1** for acceptable inlet and discharge pressure levels.

Table 1 Inlet and discharge pressure limits

Type	Level	Operating Guidelines
Minimum Inlet Pressure	0.75 psig / 2" water column (model specific)	Consult factory for operations below 0.0 psig.
Maximum Inlet Pressure	10 / 25 psig (model specific)	Operation at pressures above 25 psig will result in: <ul style="list-style-type: none"> • Excessive oil carryover • Loss of oil from the Compressor Module
Discharge Pressure Range	70 psig to 190 psig (depends on model)	When the discharge pressure of the Compressor Module reaches the maximum, which ranges from 70 to 190 psig, depending on the model (see Compressor Module Nomenclature on page iv): <ul style="list-style-type: none"> • The Compressor Module goes into high discharge pressure recycle if equipped. • The Compressor Module's bypass regulator diverts gas from the high-pressure side to the low-pressure side of the module. All Compressor Modules must be equipped with pressure-limiting or relief devices.
Minimum Differential Pressure	70 psi	A minimum pressure differential of 70 psi between inlet and discharge pressure is required for proper operation.

NOTE: Required Component – High Pressure Discharge Gas Bypass Valve

To eliminate redundancy, the high pressure discharge gas bypass (recycle) valve was removed from some of the scroll modules. Packagers will need to install pressure relief downstream of our module. See table on page iv.

2.3 Ambient Temperature Range

The Compressor Module operating ambient temperature is 20°F to +122°F (-29° to +50°C). For details on ambient temperatures for VFD startup and Compressor Module operation, see **Table 10** on page **24**.

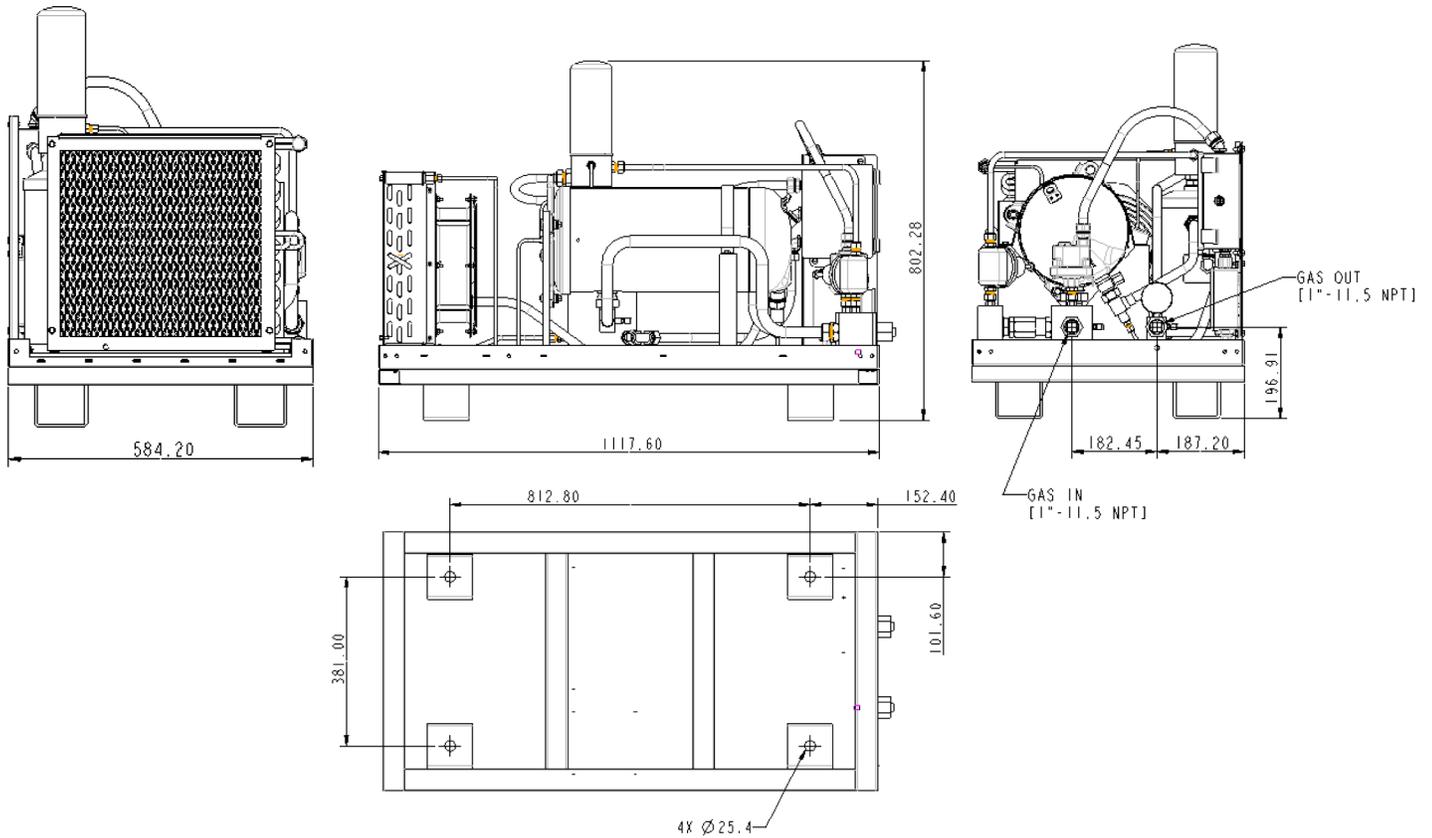
2.4 Installation Clearance and Dimensions

Allow sufficient clearance on all sides for service access, especially for gas and electrical connections at the rear of the Compressor Module. Check applicable national and local electrical codes.

Cooling air flow is back to front—from the gas connection end to the oil cooler end. Do not block or restrict the cooler fans or oil cooler.

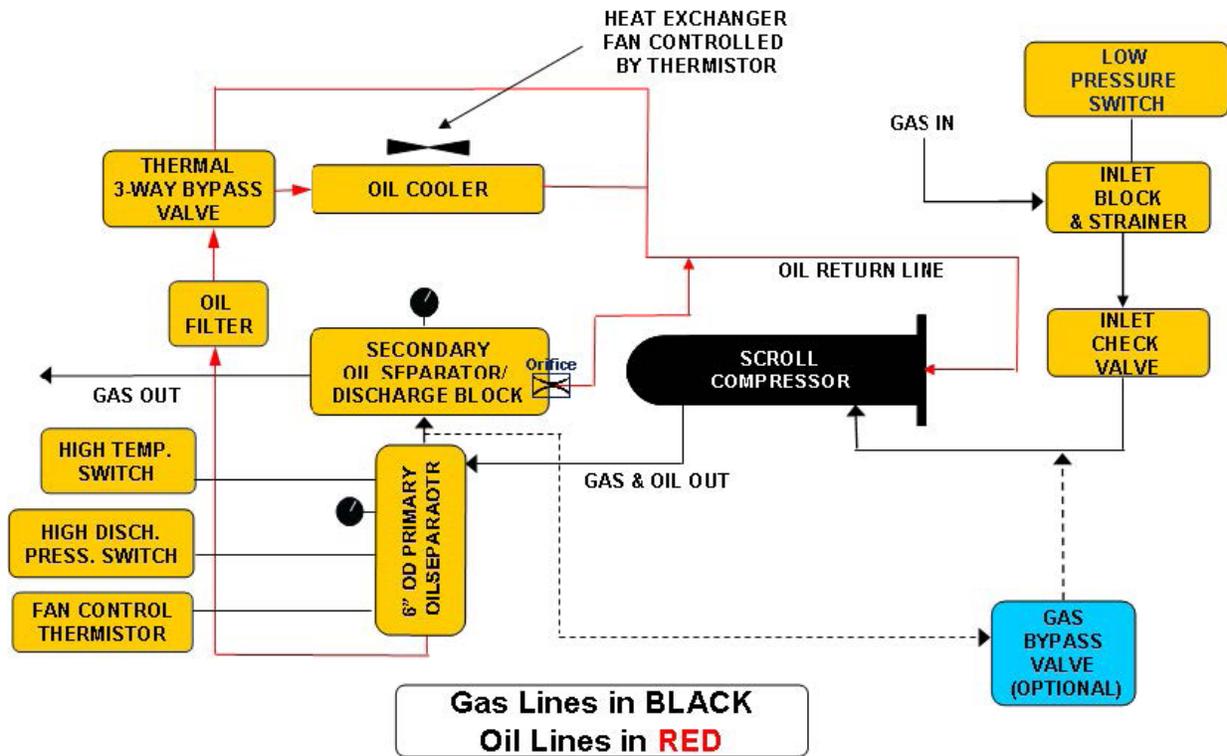
Refer to **Figure 4** for the dimensions of the Compressor Module.

Figure 4 Compressor Module Dimensions, in. (mm)



2.5 Process and Instrumentation Diagrams (P&IDs)

Figure 5 Compressor Module Gas and Oil Flow Diagram and Safety Shutdowns



Single Compressor Module Gas & Oil Flow Diagram & Safety Shutdowns
 (Gas bypass valve shown is optional)

2.6 Electrical Controls

2.6.1 General Considerations

All shutdown devices are dry contact switches rated Class I, Division II that are wired to a terminal box for connection to the packager supplied control circuit. The common wires on all switches are connected together. All switches are closed unless a fault condition is detected.

All safety and protective devices must be installed and used in accordance with applicable codes and regulations.

Switches

All switch connections are wired to terminal strips in a junction box on the Compressor Module.

Switch	Status
• Low Inlet Gas Pressure	Normally Open, closes on pressure rise
• High Discharge Gas Pressure	Normally Closed, opens on pressure rise
• High Temperature	Normally Closed, opens on temperature rise

Electrical Considerations - Variable Speed Compressor Module

- Compressor power for a variable speed Compressor Module is the **Variable Frequency Drive (VFD)**.
- Compressor speed control can be either a 4-20 mA or 0-10V signal (transducer supplied by customer) applied to the VFD. Speed can also be manually controlled with a potentiometer or the VFD can be set for a fixed speed.
- The Compressor is protected by the VFD.
- The customer control circuit must supply an **Enable** signal to the VFD before the drive will accept a **Run Fwd** signal.
- The VFD will start when the **Enable** signal is on and a **Run Fwd** signal is applied.
- The VFD will stop if the **Run Fwd** signal is off or the **Enable** signal is removed.

NOTE



*The drive provides 24V for the **Enable** and **Run Fwd** signals.*

*The installer must connect the **Enable** and **Run Forward** terminals to the drive's 24V terminal.*

2.6.2 Oil Cooler Fan Control

The Compressor Module temperature is controlled by managing module oil flow and temperature. The module's precise temperature control is critical to system performance and equipment life. Maintaining proper temperature control also reduces the possibility of gas condensing into liquids during operation.

- Cooling fans require 24VDC, 4.5A (105 Watts) for the Compressor Module. Fan speed is controlled by a 0-10VDC control signal that is applied to the yellow lead on the fan terminal strip. Standard Compressor Modules use a nonlinear PTC thermistor to monitor oil temperature and provide a speed signal.
- High temperature Compressor Modules use a linear NTC thermistor to monitor oil temperature. This signal is available to support a customer-provided fan speed control circuit.
- All power connections are wired to terminal strips in a junction box on the Compressor Module.

Figure 6 Brushless DC Fan

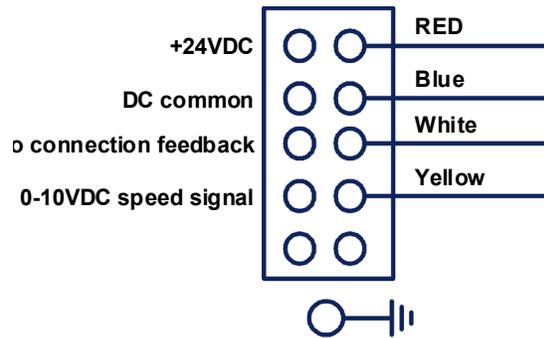
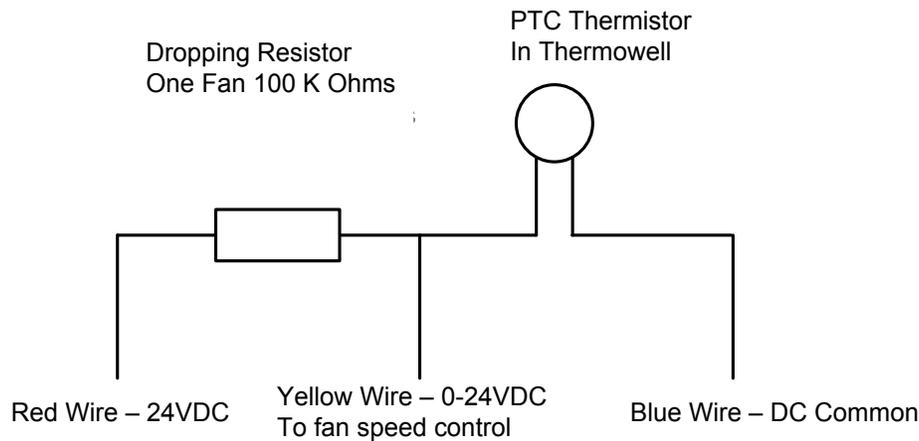
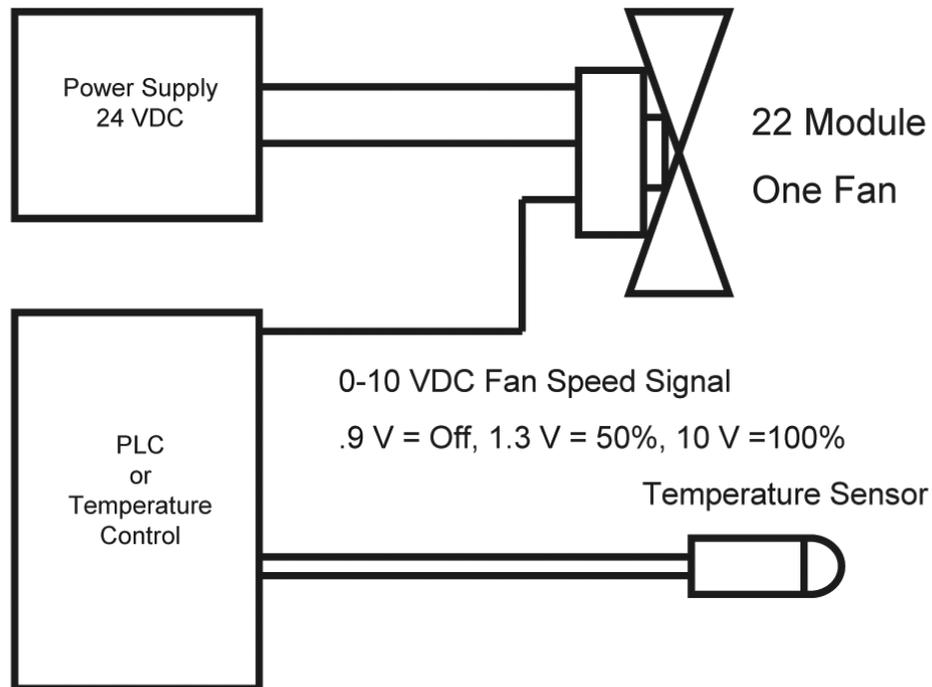


Figure 7 Basic Fan Control System



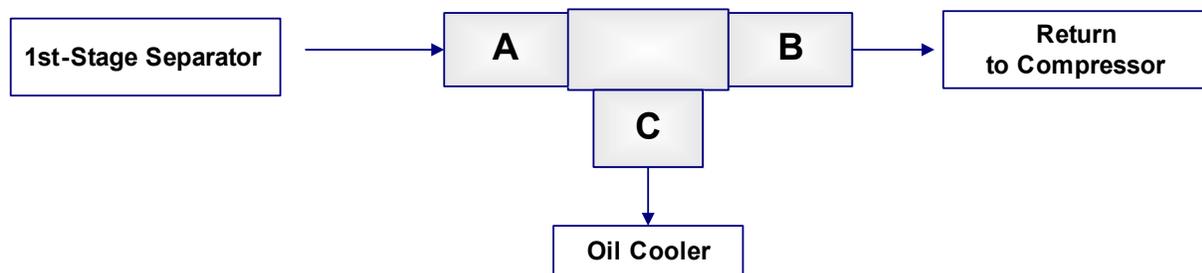
The PTC Thermistor is nonlinear and switches to high resistance in the 170-190°F (77-88°C) range.

Figure 8 Optional Customer-Installed High Temperature Fan Control System



- Compressor requirements: 0.8 to 2 GPM (3.0-755 LPM) flow rate
- Thermal oil bypass valve, standard setting: 200°F (93°C) / 250°F model specific
- Thermal bypass valve operation (valve's purpose is to provide discharge temperature control)
- Oil flow on valve is A to B when the unit is cold and A to C when the heat rises (see **Figure 9**).

Figure 9 Oil Cooling and Thermal Valve

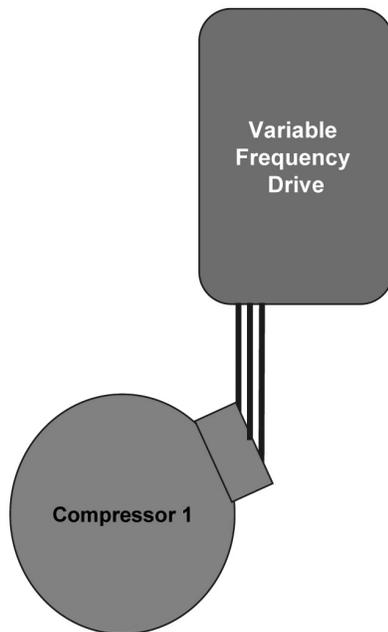


2.6.3 Compressor Module Motor Protection

Variable Speed Compressor Module Protection

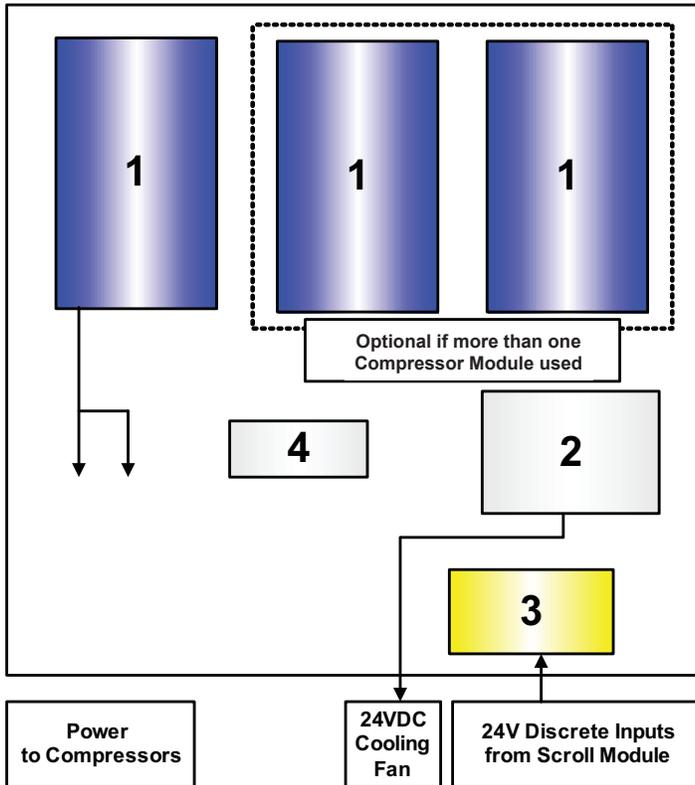
- The VFD provides overload protection for the compressor.
- Module capacity can be changed by varying the typical Compressor speed, ranging from 2400 to 4800 rpm.

Figure 10 Motor Control



2.6.4 Electrical Requirements

Figure 11 Typical Compressor Module Electrical Requirements



Code	Description
1	Control Techniques VFD,* 10 or 15 HP model specific
2	24VDC power supply **
3	PLC or other control for inputs from Compressor Module
4	480V 3-phase input ***

Notes

- * VFD on Variable Speed Drive models.
- ** All other components supplied by Packagers.
- *** Contact factory for information about single-phase and other voltage applications.

Table 2 Typical Compressor Module power supply requirements

Compressor Power (data based on 480VAC)	Variable Speed
Module horsepower	10 or 15 HP
VFD voltage supply range	342-528VAC
Phase	3-phase*
Frequency	50/60 Hz
Low Voltage DC Specifications - Oil Cooler Fan Voltage and Power	
Fan motor voltage	24VDC
Total fan motor current	4.5A

Additional power may be required to support customer logic and control circuits.

* Contact factory for information about single-phase applications.

** Reduced capacity at 50 Hz.

2.6.5 Wiring

Figure 12 Control Circuit Terminations



Control Wiring Terminations

Blue (LIP)	1	1	
	2	2	
Red (HDP)	3	3	
Red (HT)	4	4	
Red (To Fan+ 24 VDC)	5	5	
Yellow (To Fan Run)	6	6	Yellow (Fan Thermistor)
Blue (Fan Thermistor)	7	7	Jumper
Blue (Fan DC Common)	8	8	
Brown (HT)	9	9	
Brown (LIP)	10	10	Jumper
Brown (HDP)	11	11	
	12	12	
Green/Yellow (HT)	13	13	
Green/Yellow (HDP)	14	14	Green/Yellow (LIP)
Green/Yellow (Fan Ground)	15	15	

2.6.6 Variable Frequency Drive (VFD) Terminations

Refer to Product Bulletin on Variable Frequency Drive Applications for details on VFD terminations and typical VFD parameters.

3.0 OPERATION

3.1 Initial Startup - Compressor Module

The following inspections should be made on initial startup—typically, by the Packager—and after long periods of storage.

- Verify acceptable pre-startup conditions using the checklist in **3.1.1 - Pre-Startup Checklist**.
- Start the Compressor Module, then perform the checks in **3.1.2 - Post-Startup Checklist**.

3.1.1 Pre-Startup Checklist

Perform these checks BEFORE starting the Compressor Module:

MAIN POWER

Check for the following conditions:

- 1. Motor type is correct for the application, either Variable Speed C3A or C2A motor.
- 2. Power phasing to the terminal strip and Compressors is correct.
- 3. Supply voltage to the Variable Frequency Drive (VFD) or Fixed Speed Compressor motors is correct.
- 4. All chassis, earth grounds are connected.
- 5. A load reactor or other approved filter is installed for systems with power lead lengths in excess of 200 ft. (61m) between the VFD and Compressor Module terminal box.

LOW VOLTAGE DEVICES

Verify these conditions for low voltage devices:

- 1. DC polarity is correct.
- 2. Temperature control device—if other than standard thermistor control—is working properly.

SAFETY AND CONTROL DEVICES

Make sure that all safety and control switches and devices are configured to inhibit Compressor operation if a fault condition is detected, including:

- 1. Low inlet pressure switch
- 2. High discharge pressure switch
- 3. High temperature switch

- 4. Variable Frequency Drive (VFD) fault
- 5. Motor overload trip
- 6. Other safety and control switches and devices

MECHANICAL SYSTEMS

Inspect for these conditions:

- 1. **(Required)** Compressor inlet is protected from water slugging.
- 2. **(Recommended)** Gas filtration and treatment is appropriate for the application.
- 3. Packager configuration applies back pressure to the Compressors.
- 4. Inlet and discharge valves allow the module to be isolated.
- 5. All guards and protective covers are installed.
- 6. Protection from freezing is provided if needed for the application and location.
- 7. A suitable enclosure providing protection from the elements is appropriate for the application and location.

3.1.2 Post-Startup Checklist

Perform these checks AFTER starting the Compressor Module:

DURING INITIAL OPERATION, PERFORM THESE CHECKS:

- 1. Compressor Module builds pressure on initial startup; no unusual mechanical noise.
- 2. Oil level is correct at minimum and maximum speeds.
- 3. No gas leaks are present.
- 4. No oil leaks are present.
- 5. Oil cooler fan turn on and run at the appropriate temperature.
- 6. Oil cooler fan speed varies with temperature.
- 7. Compressor motor speed varies appropriately for the Packager configuration.
- 8. Compressor continues to operate in bypass when the Compressor Module discharge is blocked.
- 9. Compressor Module is leak tight (maintains approximately 30 psig or more when the Compressors are initially turned off).

3.2 Initial Startup - Compressor Package

Refer to your Packager's user manual for information on procedures to start up the Compressor Package, which includes equipment added to the Compressor Module by the Packager.

3.3 Normal Operation Checklist

Observe the following conditions after startup—when power is applied to the VFD and the VFD receives the signal from the Compressor Package control system to run:

CHECK FOR THESE CONDITIONS UNDER NORMAL OPERATION:

- 1. Compressor speed should range from 2400 to 4800 rpm during normal operation.
- 2. Suction pressure range is model specific.
- 3. Discharge pressure should range from 70 psig to 190 psig, depending on the model (see **Compressor Module Nomenclature** on page **iv**).
- 4. Pressure differential between suction and discharge is at least 70 psi.
- 5. First-stage separator temperature should be between 170°F and 220°F (77-104°C) model specific.
- 6. Oil cooler fans should either run continuously or cycle periodically under normal conditions.

If any of these conditions are not met during normal operation, shut down the unit and refer to **5.0 - Troubleshooting** on page **22**.

4.0 MAINTENANCE

4.1 Routine Maintenance

Perform the maintenance procedures in **Table 5** at least once per year or more often if needed.

Oil consumption varies by application and during initial operation. Monitor the oil level routinely to determine a consistent pattern of actual consumption.

Table 3 Maintenance summary

Components	Maintenance	Reason	For details, see:
Lubrication & Cooling System	<ul style="list-style-type: none"> Monitor and check the oil level. 	A low oil level or loss of oil in the system will result in overheating or mechanical failure.	4.3 - Oil Service (page 19)
	<ul style="list-style-type: none"> Add oil as needed. 		4.3 - Oil Service (page 19)
	<ul style="list-style-type: none"> Change oil annually. Note: Some applications may require more frequent service. 	A high oil level may result in excessive oil carryover and oil discharge from the Compressor Module when the Compressors are turned off.	4.3 - Oil Service (page 19)
	<ul style="list-style-type: none"> Check the condition of the lubricant periodically. Normal color is clear or light gray. 		—
	<ul style="list-style-type: none"> Change the oil filter (if equipped) annually or as required. 		—
Gas Inlet System	<ul style="list-style-type: none"> Inspect and clean the inlet screen annually or more often as needed. 	A restricted inlet screen will result in reduced flow.	4.6 - Cleaning the Inlet Screen (page 21)
Second-Stage Separator System	<ul style="list-style-type: none"> Inspect and clean the scavenge line orifice annually or more often as needed. 	A restricted scavenge line orifice will result in excessive oil carryover.	4.7 - Servicing the Scavenge Line Orifice (page 21)
	<ul style="list-style-type: none"> Change the second-stage oil separator element annually or more often if contaminated. Note: Some applications may require more frequent service. 	A dirty or plugged separator element will result in excessive oil carryover.	4.8 - Changing the Second-Stage Separator Element (page 24)
Oil Heat Exchanger	<ul style="list-style-type: none"> Ensure heat exchanger cooling fins are clear of dust and debris. Verify that the fans run freely. 	—	—

See **5.0 - Troubleshooting** on page **22** for additional details.

4.2 Maintenance Tools

Figure 15 shows the tools needed for maintenance of the Compressor Module. Contact the Packager to obtain a maintenance tool kit. These are typical air conditioning and refrigeration service tools.

Figure 13 Maintenance Tools



Back-seating control valve



Oil pump, piston type, high pressure
Designed to operate up to 250 psig



Filter wrench
Alternate product: Strap filter wrench



Charging hose
60" (1524mm)



Extension hose with valve
6" (152mm)



CAUTION

When pressure is applied to the oil pump, the handle may extend rapidly.

Verify the Compressor Module pressure is 0 psig before removing the second-stage oil separator.



NOTE

One full stroke oil pump of the handle dispenses 1.6 oz. (47ml) of oil. Move the pump handle slowly using long, slow, full strokes.



NOTE

The hose fittings contain a core depressor that opens the Schrader valve when the fittings are attached. A backseating control valve can be used to open the Schrader valves on the Compressor Module.

When the knob is turned fully counterclockwise, the core depressor is retracted and the backseating control valve can be installed on a Schrader valve without loss of oil.

When the knob is turned clockwise, the core retractor is extended, opening the Schrader valve.

4.3 Oil Service

The oil level indicated on the first-stage oil separator site glasses varies with inlet and discharge pressures and operating speed.

- New oil is clear, it may be necessary to use a flashlight to verify the correct oil level.
 - The oil level should never reach the top of the upper site glass on the primary oil separator under any operating conditions.
 - If possible block the compressor discharge to force the system into full bypass.
1. Compressor operating at minimum speed 1,800 RPM,
 - Lower site glass 50%: No action required.
 - Lower site glass less than 50%: Add approved oil to this level.
 - Lower site glass more than 100%: Remove excess oil.
 2. Compressor is operating at full speed 4,800 RPM the lower site glass will be 100% full and the upper site glass will also show some level of oil
 - Upper site glass 50%: No action required.
 - Upper site glass 100% or more: Remove excess oil.

High Oil Carryover

1. System is overfilled with oil: The oil level should never reach the top of the primary oil separator top site glass under any operating condition.
2. No back pressure on the discharge when the compressor is turned off resulting in oil foaming and carrying over to the secondary oil separator: Check upper site glass when the compressor is first turned off.
3. Contaminated or oil saturated secondary oil separator: Replace the secondary oil separator every 8,000 operating hours, more frequently if the gas is dirty.
4. Clogged or restricted scavenge line orifice: Remove inspect and clean.
5. Clogged or restricted oil scavenge tube: Remove inspect and clean.
6. Incorrect oil: Use only approved oil.
7. Inlet pressure too high: Verify that the inlet pressure is less than 10 PSIG.

Symptoms

- Low oil level, High temperature fault, Oil in gas.

Possible Cause

- Secondary oil separator is saturated with oil or at the end of its service life. Replace.
- Oil level above top site glass under any operating condition. System overfilled with oil. Remove excess oil, replace secondary oil separator.
- Failed "O" ring in the oil separator block assembly. Repair or replace assembly.

- Scavenge line orifice or screen is restricted. Clean or replace.
- Insufficient back pressure. Confirm 50-60 psig or higher backpressure when the compressor is running.
- No specific cause found. Replace oil separator block assembly, scavenge line and secondary oil separator element.

4.4 Cleaning the Inlet Screen

The 30-mesh screen in the inlet block must remain unobstructed for optimal flow rate. If the flow rate is lower than expected even when the Compressor is running properly, this screen may be obstructed.

Figure 14 Gas Inlet Block and Screen



To inspect and clean the inlet screen:

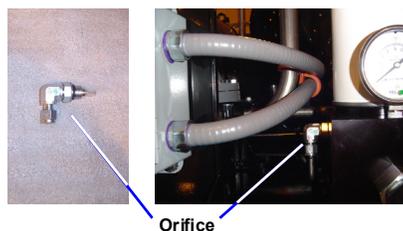
1. Turn off and isolate the Compressor from all power sources.
2. Turn off the gas supply.
3. Vent the system to 0 psig.
4. Remove the SAE plug on the side of the inlet block.
5. Remove the screen.
6. Inspect the screen and inside of the block. Clean or replace if necessary.
7. Replace SAE nut.
8. Return the Compressor Package to service.
9. Check for leaks at all fittings that have been disturbed.

4.5 Servicing the Scavenge Line Orifice

The scavenge line orifice in the oil separator block must remain clear of obstruction. If this orifice is restricted, the secondstage oil separator can become saturated, increasing oil consumption.

Note: image shown is 90 degree orifice. Procedure is the same for straight orifice.

Figure 15 Scavenge Line Orifice



To inspect and clean the orifice:

1. Turn off and isolate the Compressor from all power sources.
2. Turn off the gas supply.
3. Vent the system to 0 psig.
4. Disconnect the tube and remove the fitting.
5. Inspect the screen. Clean or replace the fitting assembly if necessary.
6. Replace the fitting and reconnect the tube. Tighten the swage nut hand tight plus 1/4 turn.
7. Return the Compressor Package to service.
8. Check for leaks at all fittings that have been disturbed.

4.6 Changing the Second-Stage Separator Element

To replace the second-stage separator element:

1. Turn off and isolate the Compressor from all power sources.
2. Turn off the gas supply.
3. Vent the system to 0 psig. Follow applicable safety procedures and codes.
4. Loosen the separator element by turning it counterclockwise with a strap wrench.
5. Remove the separator element. Verify the gasket is removed with the separator.
6. Inspect the separator block for contaminants and remove any debris.
7. Apply a small amount of oil to the gasket and internal "O" ring on the new separator element.
8. Install the element on the separator block; turn clockwise to tighten.
9. Return the Compressor Package to service.
10. Check for leaks at all fittings that have been disturbed

5.0 TROUBLESHOOTING

This section offers tips for troubleshooting.

5.1 Troubleshooting Guide

Refer to **Table 6** for recommended solutions to typical problems.

Table 4 Troubleshooting

Problem	Recommended Actions
Low Inlet Gas Pressure Fault	<ul style="list-style-type: none"> • Closed gas inlet valve. • Restricted or insufficient gas supply. • Blocked inlet filter/screen (located internally on the Compressor Module inlet block).
High Oil Temperature Fault	<ul style="list-style-type: none"> • Blocked air flow across oil cooler. • Ensure cooling fans are operating when the unit is running and up to temperature; at approximately 180°F (82°C), fans should start to run at minimum speed. • Ensure adequate oil level in first-stage separator (see 4.3 - Oil Service on page 19).
High Discharge Pressure Fault	<ul style="list-style-type: none"> • Restricted discharge and bypass valve fault.
VFD Fault	<ul style="list-style-type: none"> • The drive LED will display the specific fault (see Table 7).

Table 5 VFD fault codes and descriptions

Code	Description
UU	Insufficient voltage
OU	Excessive voltage
OI.AC	Excessive motor current (instantaneous condition)
It.AC	Excessive motor current (overload condition)
Oh1, Oh2	Excessive heat sink temperature
Ph	Loss of AC supply phase

5.2 Platform Symptoms Diagnosis

Use the following guidelines to troubleshoot operating problems.

Table 6 Platform troubleshooting guidelines

Problem	Recommended Actions
Low Gas Flow	<ul style="list-style-type: none"> • Low inlet pressure • Insufficient gas supply • High temperature • Bypass valve open • Low Compressor speed • Restricted inlet screen
High Oil Carryover	<ul style="list-style-type: none"> • Saturated or dirty secondstage oil separator • High oil level • Restricted scavenge orifice • Insufficient back pressure • Oil dilution
Compressors Won't Run	<ul style="list-style-type: none"> • Determine drive status. • Is inhibit circuit closed? • Is run signal present? • Does the VFD indicate a fault code?
Incorrect Compressor Speed	<ul style="list-style-type: none"> • Low inlet pressure • High discharge pressure • High temperature, fan, low oil, oil cooler • Problem with speed control sensor and related components
High Temperature	<ul style="list-style-type: none"> • Low oil level • Restricted oil filter • Blocked oil cooler air flow • Oil cooler fan not operating • Operation conditions outside of Compressor Module specifications

6.0 SPECIFICATIONS

Table 7 Compressor Module Specifications

General Information	
Inlet pressure range	Model specific - refer to application envelope
Outlet pressure range	70 to 275 psig (depends on model—see page iv)
Mechanical Description	
Module weight	Approximately 350 lb. (160kg)
Suction connection	1.0" NPT
Discharge connection	0.75" NPT
Sound level	Approximately 72 dBA @ 1 m, 58 dBA @ 10 m
Vibration	3 mil at 60 Hz
Minimum cold start ambient temperature ^{1,4}	Compressor -20°F (-29°C) VFD power 14°F (-10°C)
Ambient operating temperature range ^{1,4}	0 to 122°F (-18 to 50°C)
Module dimensions	See Figure 4 on page 7
Materials of Construction	
Compressor - general	Cold rolled steel, aluminum, cast iron as required
Compressor bearings	Self-lubricated, sleeve type, steel backed
Oil heat exchanger	Aluminum
Oil/gas separator tank	Cold rolled steel
Tubes/fittings/skid structure	Stainless/carbon steel
Lubrication	
Oil type	Synthetic, 15 or 32 weight, PAO (special factory-supplied blend)
System oil capacity, oz. (ml)	170 fluid ounces (5.0 liters)
Projected oil consumption ²	Approximately 40 oz. (0.9 l) / 8,000 hours at 0.25 psig suction (<5 ppm)
System Electrical (Standard)	
Minimum VFD ambient startup temperature ^{3,4}	+14°F (-10°C)
Power supply to inverter • Voltage range • Input frequency range	380 to 480VAC (50/60 Hz)
Overpressure detection (outlet)	215 psig open
Underpressure detection (inlet)	0.75 psig open (low pressure system) / 2" water column
Oil overtemperature detection	240°F (110°C) open (280°F for SZV) model specific
Fault output to customer	Packager to establish
Run input from customer	Dry contact
Gas Medium	
Natural gas	
H ₂ S maximum content ⁵	25 ppm
Moisture content ⁵	100% saturated, no free liquids
Inlet temperature ⁵	-20 to 115°F (-28 to 46°C); protection from freezing if water is present

1. If the Compressors are started at temperatures above the listed minimums and continue to run, the minimum operating temperature is 20°F (-29°C).
2. Based on sweet gas wellhead gas. Results may vary due to gas quality and site conditions.
3. Do not apply power to the VFD if ambient temperature is below this level.
4. If power is continuously supplied to the VFD when the Compressor is off, the minimum starting temperature is -4°F (-20°C).
5. Consult factory for more details and applications guidelines.

APPENDIX A - MATERIAL DATA SAFETY SHEET

The information in this material safety data sheet should be provided to all who use, handle, store, transport or are otherwise exposed to this product. CPI believes the information in this document to be reliable and up to date as of the date of publication, but makes no guarantee that it is.



CAUTION

This oil is intended for use only in the Copeland Scroll® Compressor used in natural gas applications.

Use of any other oil may result in failure and is not covered by warranty.

DISPOSE OF WASTE OIL PROPERLY:

- If the oil has not been contaminated, it can be disposed the same as a synthetic motor oil.
- If the oil is contaminated, the end user must comply with all applicable regulations for disposal of hazardous materials.

A.1 SUPPLIER

CPI Engineering Services Inc.
2300 James Savage Rd.
Midland, MI 48642
Emergency Number: (989) 496-3780

A.2 PRODUCT NAME AND INFORMATION

Product (Trade name and synonyms)	CP-6006 Series
Chemical Name	Poly-Alpha-Olefin (PAO)
Chemical Family	Synthetic Hydrocarbon
Formula	$C_{10n}H_{20n}+2$
CAS#	Proprietary

A.3 COMPONENTS AND HAZARD STATEMENT

This product is non-hazardous. The product contains no known carcinogens. No special warning labels are required under OSHA 29 CFR 1910.1200.

FDA Statement. This product complies with FDA 21 CFR 178.3570 regarding lubricants for incidental food contact.

A.4 SAFE HANDLING AND STORAGE

Handling. Do not take internally. Avoid contact with skin, eyes, and clothing. Upon contact with skin, wash with soap and water. Flush eyes with water for 15 minutes and consult physician. Wash contaminated clothing before reuse.

Storage. Keep container tightly sealed when not in use.

A.5 PHYSICAL DATA

Appearance	Clear, water-white liquid
Boiling Point	>300°F (149°C)
Vapor Pressure	<0.01mm Hg @ 20°C (0.00039 in.Hg @ 68°F)
Specific Gravity (water=1)	0.79-0.85
Volatiles, Percent by Volume	0%
Odor	None
Solubility in Water	Insoluble
Evaporation Rate (butyl acetate=1)	Nil

A.6 FIRE AND EXPLOSION HAZARDS

Flash Point (by Cleveland Open Cup)	320-530°F (160-276°C)	
Flammable Limits	Not established	
Auto-Ignition Temperature	No data	
HMIS Ratings	Health	0
	Flammability	1
	Reactivity	0
NFPA Ratings	Not established	
Extinguishing Media	Dry chemical; CO ₂ foam; water spray (fog)	
Unusual Fire and Explosion Hazards	None	
Special Fire Fighting Techniques	Burning fluid may evolve irritating/noxious fumes. Firefighters should use NIOSH/MNSA-approved self-contained breathing apparatus. Use water to cool fire-exposed containers. Use water carefully near exposed liquid to avoid frothing and splashing of hot liquid.	

A.7 REACTIVITY DATA

Stability	Stable
Hazardous Polymerization	Will not occur
Incompatible Materials	Strong oxidizers
Conditions to Avoid	Excessive heat
Hazardous Decomposition Products	Analogous compounds evolve carbon monoxide, carbon dioxide, and other unidentified fragments when burned. See A.6 - Fire and Explosion Hazards .

A.8 HEALTH HAZARD DATA

Threshold Limit Value	5mg/m ³ ACGIH	
Situations to Avoid	Avoid breathing oil mists.	
First Aid Procedures	Ingestion	Consult physician at once. DO NOT INDUCE VOMITING. May cause nausea and diarrhea.
	Inhalation	Product is not toxic by inhalation. If oil mist is inhaled, remove to fresh air and consult physician.

To the best of our knowledge the toxicity of this product has not been fully investigated. Analogous compounds are considered to be essentially non-toxic.

A.9 PERSONAL PROTECTION INFORMATION

Respiratory Protection	Use in well ventilated area.
Ventilation	Local exhaust
Protective Gloves	Not required, but recommended, especially for prolonged exposure
Eye/Face Protection	Goggles

A.10 SPILL OR LEAK PROCEDURES

In case of spill:

- Wear suitable protective equipment, especially goggles.
- Stop source of spill.
- Dike spill area.
- Use absorbent materials to soak up fluid (e.g., sand, sawdust, commercially available materials).
- Wash spill area with large amounts of water.
- Properly dispose of all materials.

A.11 WASTE DISPOSAL METHODS

Incinerate this product and all associated wastes in a licensed facility in accordance with federal, state, and local regulations.

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