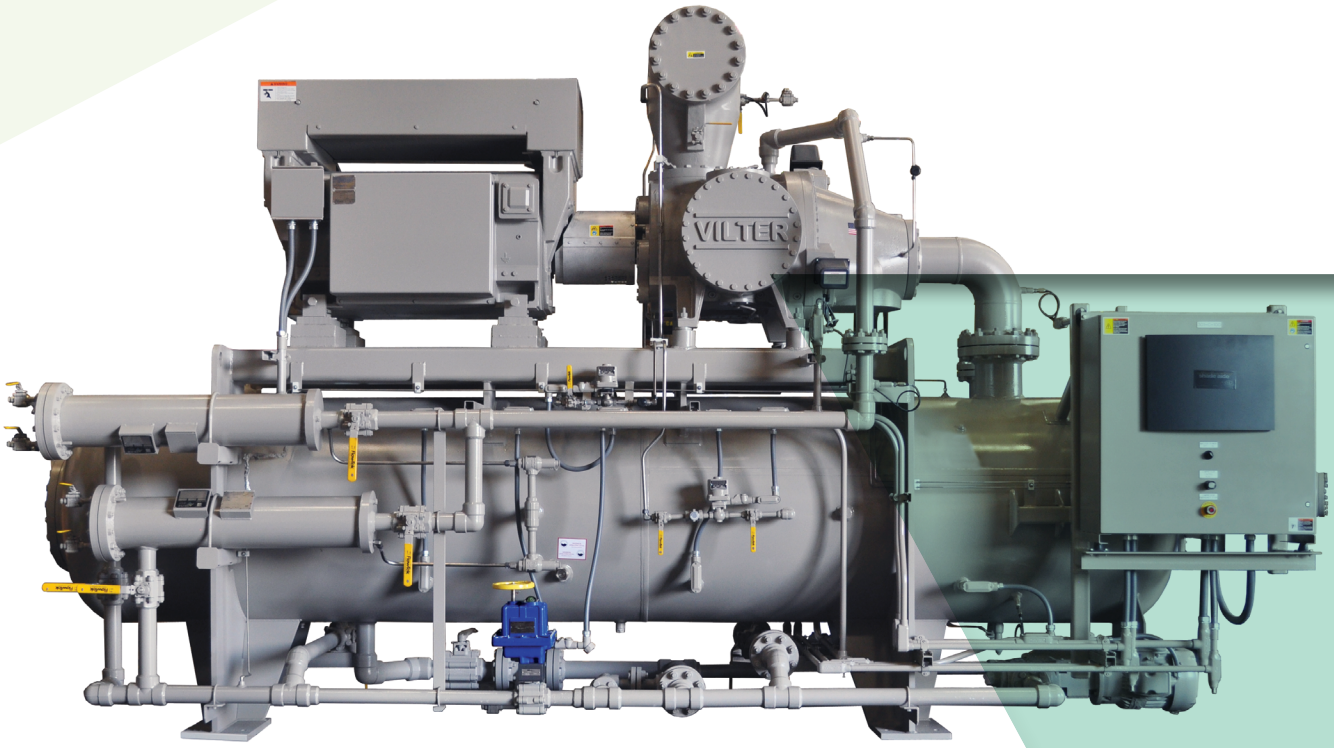
VSG/VSGC/VSSG/VSSGC Single Screw Compressor Unit

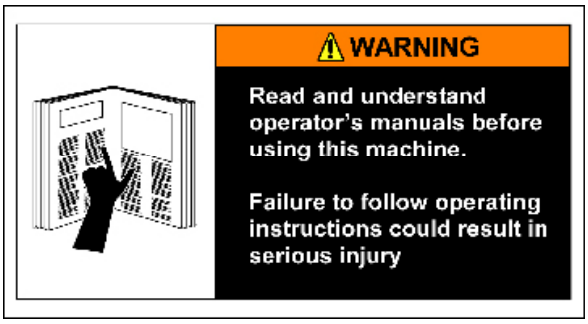
Installation, Operation & Maintenance Manual

FOR UNITS BUILT AFTER JULY 1, 2013



VILTER by COPELAND

Important Message



READ CAREFULLY BEFORE INSTALLING AND STARTING YOUR COMPRESSOR.

The following instructions have been prepared to assist in installation, operation and removal of Vilter Single Screw Compressors. Following these instructions will result in a long life of the compressor with satisfactory operation.

The entire manual should be reviewed before attempting to install, operate, service or repair the compressor.

Only qualified personnel shall operate, install and maintain the equipment.

Qualified personnel shall be accredited by a local regulatory agency, which requires that they are continually scrutinized by an organization whose sole mission is to establish, maintain and assure that the highest industry standards are set and met in a continuous and ongoing basis. The credentials shall address topics ranging from plant safety, operating concepts and principles and operations through the basics of refrigeration compliance and PSM (Process Safety Management) requirements.

Follow local workplace occupational safety and health regulations.

A compressor is a positive displacement machine. It is designed to compress gas. The compressor must not be subjected to liquid carry over. Care must be exercised in properly designing and maintaining the system to prevent conditions that could lead to liquid carry over. Vilter Manufacturing is not responsible for the system or the controls needed to prevent liquid carry over and as such Vilter Manufacturing cannot warrant equipment damaged by improperly protected or operating systems.

Vilter screw compressor components are thoroughly inspected at the factory. However, damage can occur in shipment. For this reason, the equipment should be thoroughly inspected upon arrival. Any damage noted should be reported immediately to the Transportation Company. This way, an authorized agent can examine the unit, determine the extent of damage and take necessary steps to rectify the claim with no serious or costly delays. At the same time, the local Vilter representative or the home office should be notified of any claim made.

All inquires should include the Vilter sales order number, compressor serial and model number. These can be found on the compressor name plate on the compressor.

All requests for information, services or parts should be directed to:

Copeland Industrial LP (Vilter)
Customer Service Department
5555 South Packard Ave
Cudahy, WI 53110-8904 USA
Telephone: 1-414-373-7615, Fax:1-414-744-3483
E-mail: info.vilter@copeland.com, Website: Copeland.com/Vilter

Equipment Identification Numbers:

Vilter Order Number: _____Compressor Serial Number: _____
Vilter Order Number: _____Compressor Serial Number: _____

Standard VILTER™ Warranty Statement

It is now on the web site. You can access it here:
Go to www.Copeland.com/Vilter ,then scroll down to find Lifecycle Services -> Warranty Information
Or click directly:
Warranty Information | Copeland US

The EC Declaration of Incorporation

It is now on the web site. You can access it here:
Go to www.Copeland.com/Vilter ,then scroll down to find Lifecycle Services -> Compliance -> Legal & Compliance
Or click below directly:
EC Declaration of Incorporation - Single Screw Compressor

Table of Contents

Section Title **Page Number**

Table of Contents

Section Title **Page Number**

Section 4 • Operation

Table of Contents

Section Title **Page Number**

Section 5 • Maintenance/Service

Table of Contents

Section Title **Page Number**

Section 6 • Troubleshooting

Table of Contents

Section Title **Page Number**

Section 7 • Warranty and Parts

Section 8 • Spare Parts List

Table of Contents

Section Title **Page Number**

Appendices

List of Tables and Figures

Tables

Table of Contents

Section Title **Page Number**

Figures

Table of Contents

Section Title **Page Number**

Table of Contents

Section Title **Page Number**

How To Use This Manual

This manual contains instructions for gas compressor units. It has been divided into eight sections and Appendices:

Section 1: General Information

Section 2: Theory of Operation

Section 3: Installation

Section 4: Operation

Section 5: Maintenance & Service

Section 6: Troubleshooting

Section 7: Warranty and Parts

Section 8: Spare Parts List

Appendices

Appendix A: Torque Specifications

Appendix B: Vilter Oil

Appendix C: Recommended Remote Air Cooled Oil Cooler Piping

Appendix D: Vibracon® Installation Procedure

It is highly recommended that the manual be reviewed prior to servicing system parts.

Figures and tables are included to illustrate key concepts.

NOTE:

The symbol ‹ at the bottom of every page:

Click the symbol ‹ . It will take you back to your previous page.

Safety precautions are shown throughout the manual. They are defined as the following:

NOTICE - Notice statements are shown when there is important information that shall be followed. Not following such notices may result in void of warranty, serious fines, serious injury and/or death.

WARNING - Warning statements are shown when there are hazardous situations, if not avoided, it may result in serious injury and/or death.

CAUTION - Caution statements are shown when there are potentially hazardous situations, if not avoided, will result in damage to equipment.

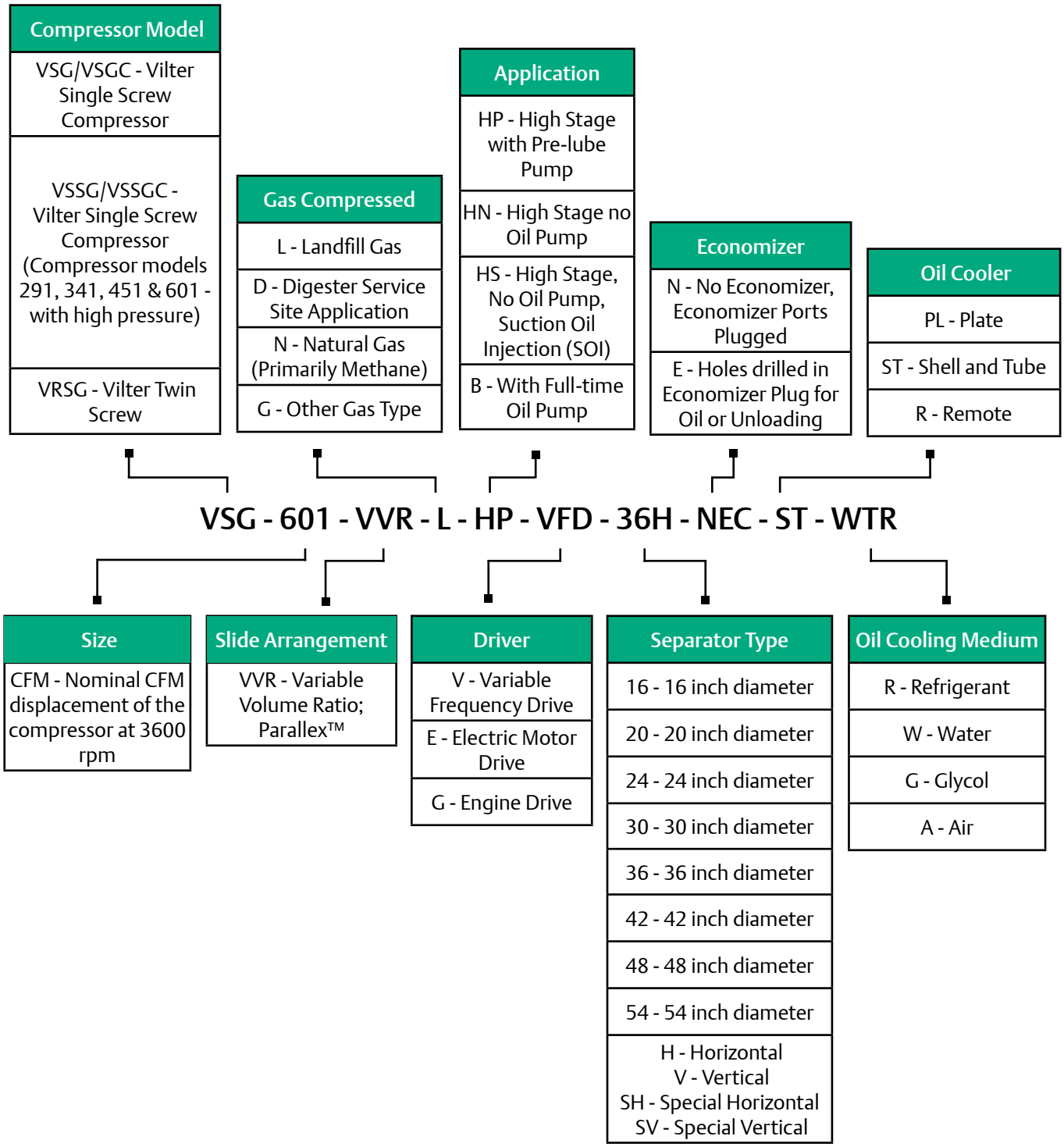
NOTE - Notes are shown when there is additional information pertaining to the instructions explained.

Additional Important Notes

- Installation, operation and maintenance instructions can be found in the associated software manual and bare shaft compressor manual.
- Due to continuing changes and unit updates, always refer to the Vilter.com or Copeland.com/Vilter website to make sure you have the latest manual.
- Any suggestions of manual improvements can be made to Vilter Manufacturing at the contact information on page iii.

Gas Compressor Unit Model Designations

The compressor unit model designation can be found on the nameplate. For nameplate location, see Compressor Unit Component Identification on page 1-4.



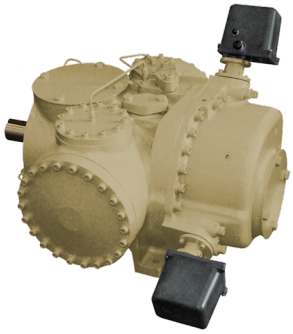
System Unit Identification

To keep definitions of units simple and consistent, Vilter has defined the following three:

- Bare Shaft Compressor
- Compressor Unit
- Package Unit

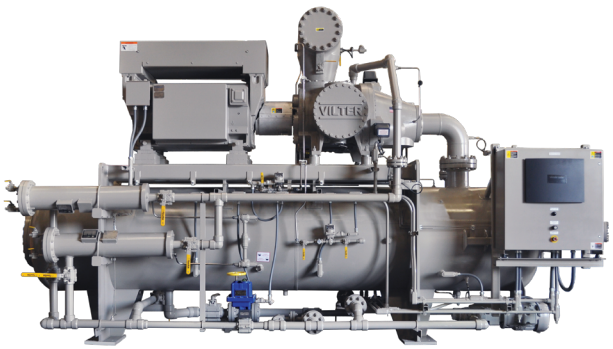
Bare Shaft Compressor

A bare shaft compressor is just the compressor with no coupling and motor nor foundation.



Compressor Unit

A compressor unit consists of the bare shaft compressor with the coupling, motor, oil separator, frame, micro-controller system and oil system. A compressor unit typically a single screw compressor unit, is not mounted on a structural steel base.



Package Unit

A package unit is a complete system mounted on a structural steel base with interconnecting piping.

Compressor Unit Component Identification

Each gas compressor unit may differ, but below are typical components that can be found on each unit.

1 - Motor
2 - Coupling and Guard
3 - Suction Check Valve
4 - Suction Strainer
5 - Suction Stop Butterfly Valve
(Typically Shipped Loose)
6 - Compressor
7 - Discharge Pipe
8 - PLC Panel
9 - The Hole in Housing for Grounding Wire
10 - Oil Pump
11 - Oil Heater
12 - Oil Separator
13 - Oil Temperature Control Valve (Oil Mixing Valve)
14 - Oil Pump Strainer
15 - Oil Sight Glass
16 - Oil Filter
(Optional Dual Oil Filters Shown)
17 - Discharge Connection
18 - Oil Separator Inspection Port
19 - Thermal/Acoustic Oil Separator Blanket
(Optional Per Application)
20 - Nameplate
21 - Heat Trace Insulation
(Optional Per Application)
22 - Frame
23 - Oil Cooler (Shell and Tube Heat Exchanger)

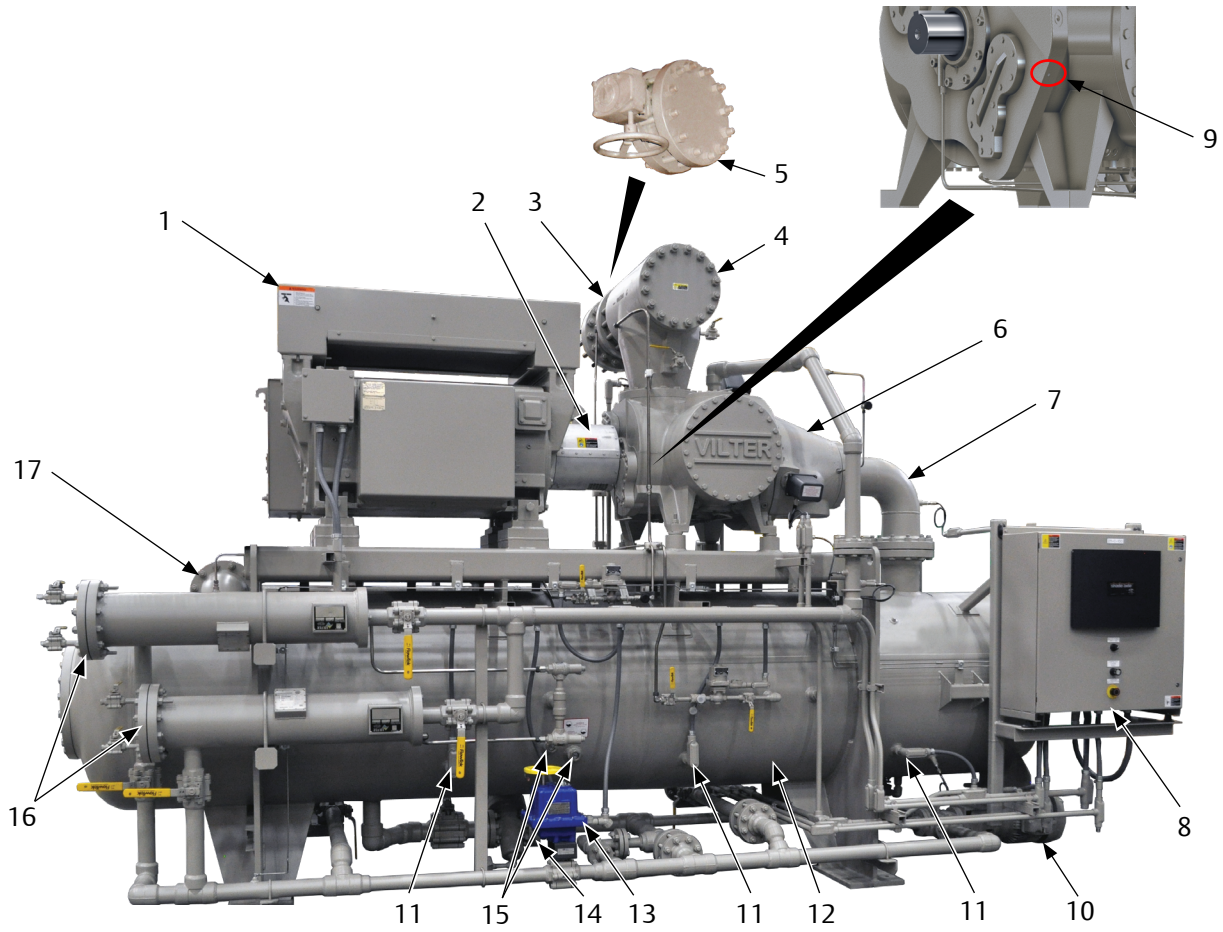


Figure 1-1. Gas Compressor Unit Components (1 of 3)

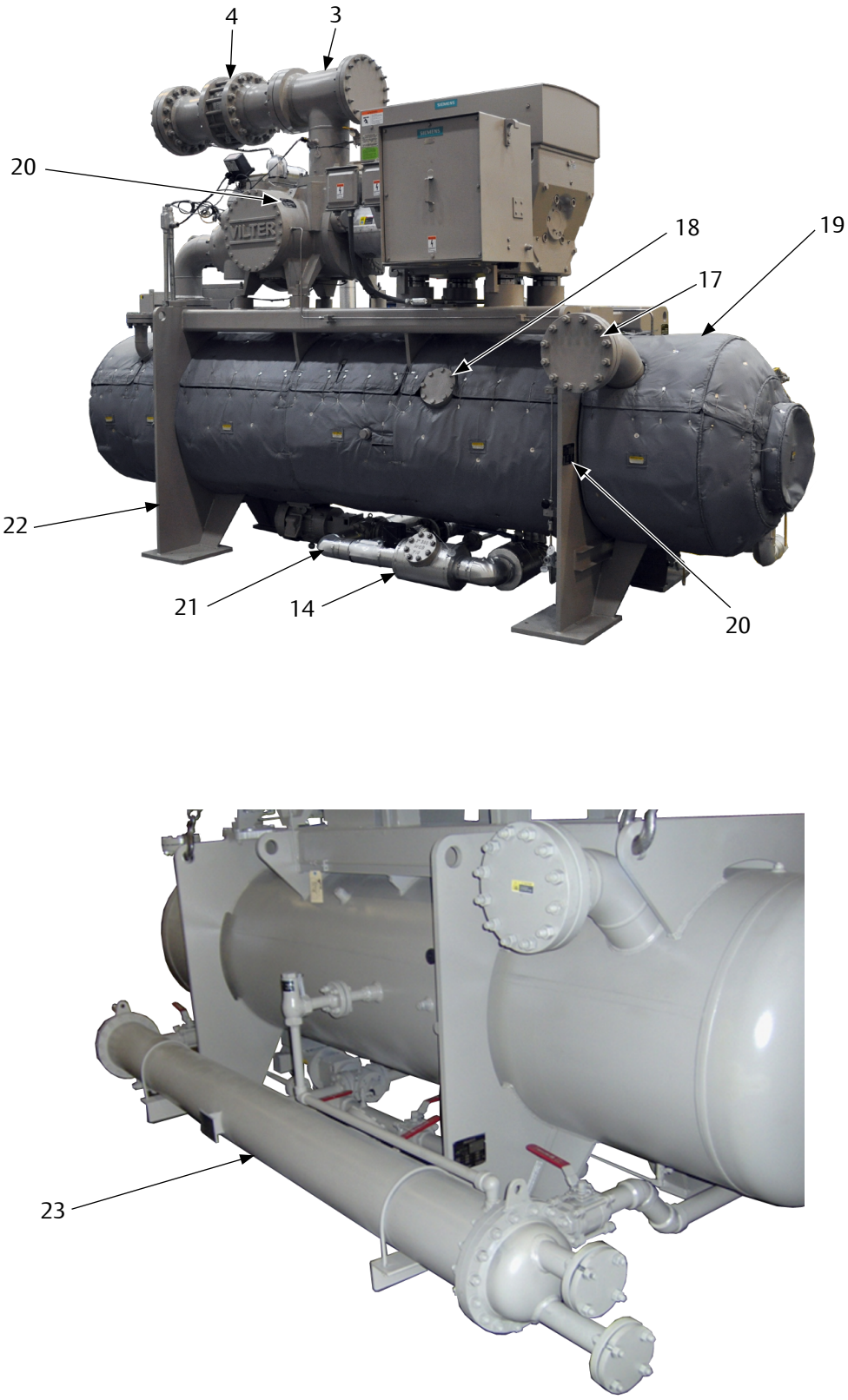


Figure 1-1. Gas Compressor Unit Components (2 of 3)

Compressor Unit Component Identification (Continued)

24 - RTD/TT Transmitter (Oil Filter Outlet)

25 - Suction Oil Charging Valve

26 - Pressure Transmitters (Oil Injection Temperature)

27 - RTD/TT (Suction)

28 - Volume Slide Valve Actuator

29 - RTD/TT (Discharge)

30 - Capacity Slide Valve Actuator

31 - Pressure Transmitters (Filter Inlet, Oil Pressure, Discharge 1 and 2)

32 - Block & Bleed Assembly

33 - Remote Oil Cooler (Finned Fan Heat Exchanger)

34 - Oil Separator Drain

35 - RTD/TT (Oil Separator)

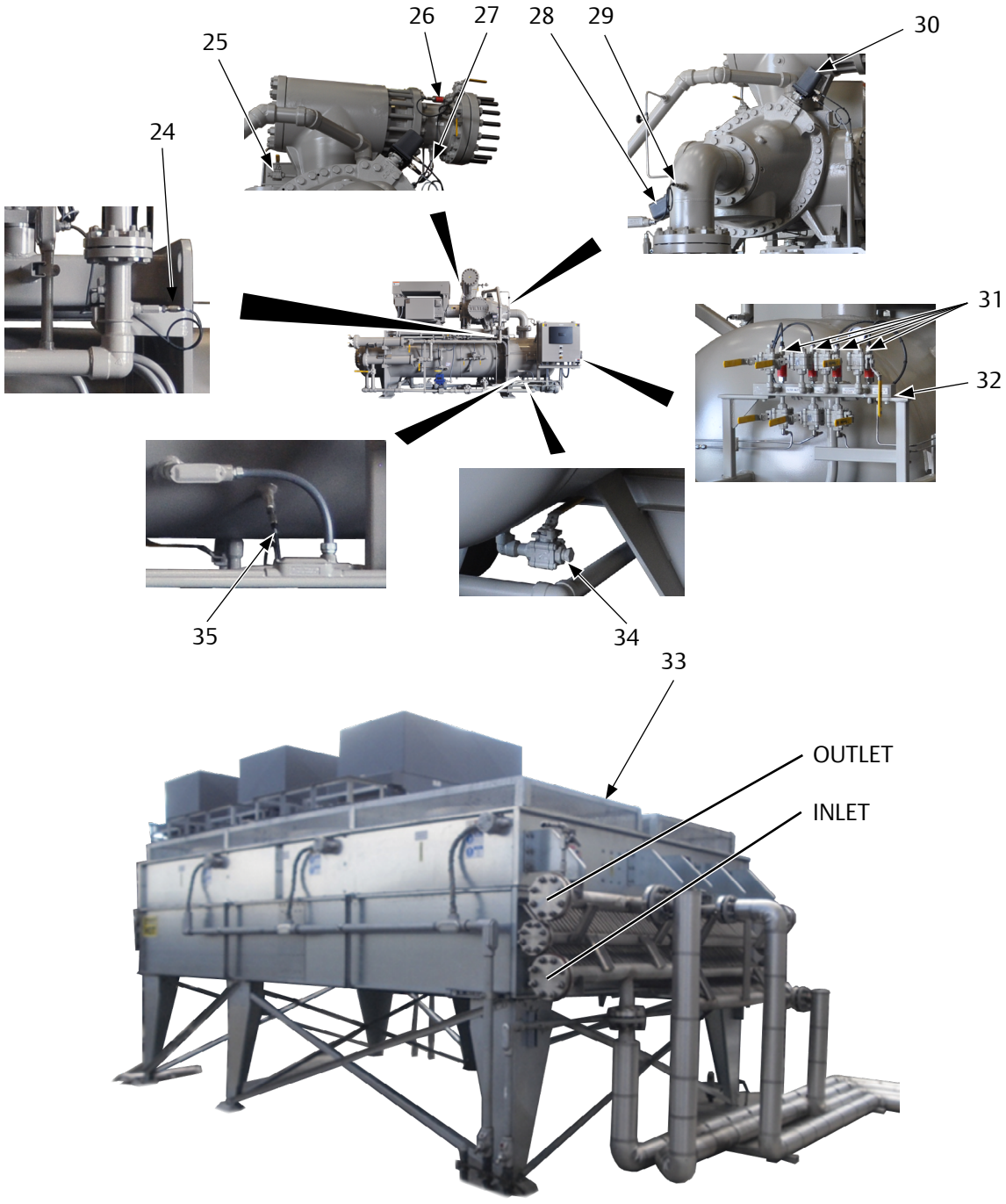
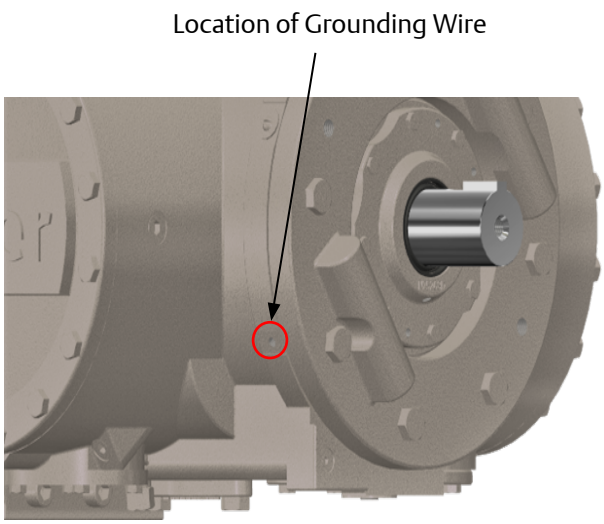
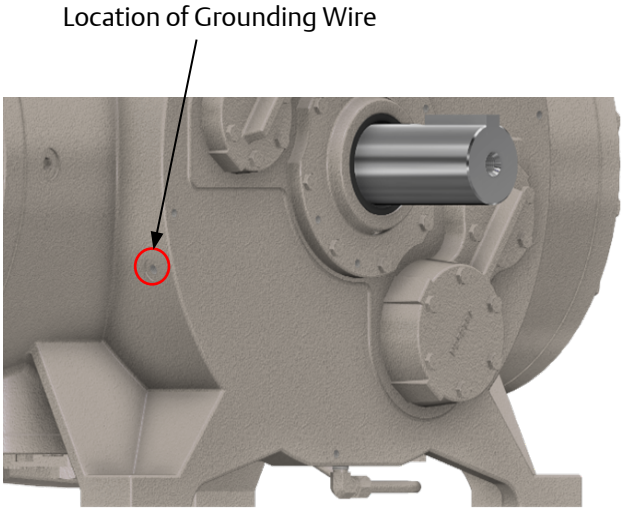


Figure 1-1. Gas Compressor Unit Components (3 of 3)

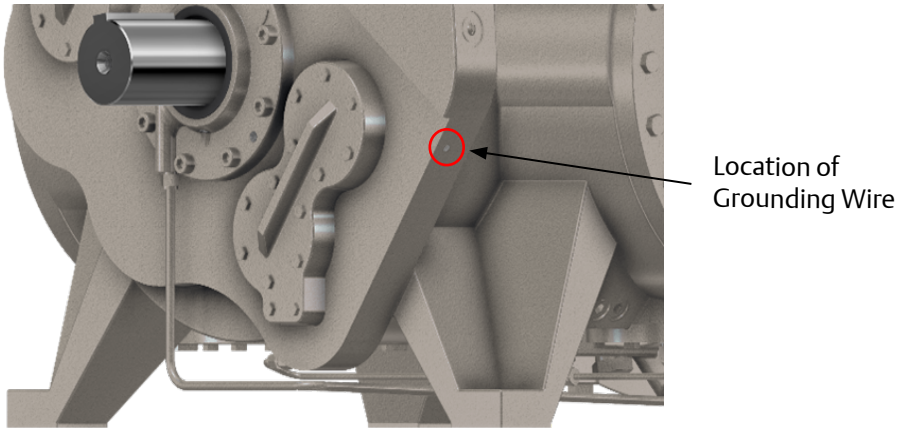
Grounding Wire Location



(a) VSG 501, 601, 701 (240mm) &
VSG 301, 361, 401 (205mm)



(b) VSG 751 & 901 (280mm)
VSSG 291, 341, 451, 601 (240mm)
VSG 791, 891, 1051, 1201, 1301 (310mm)
VSG 2401, 2601, 2801, 3001 (401mm)



(c) VSG 1551, 1851, & 2101 (350mm)

Figure 1-2. The Grounding-Wire Hole Location on Housing for Various Screw Compressor Models

Instrument Identification Letters

Use this list to identify components shown in the Piping & Identification Diagram.

A	Analysis
AAH	Concentration High
AAHH	Concentration/Detection High High
AI	Analysis/Moisture Indicator
AIT	Analysis/Detection Indicating Transmitter
AT	Analysis/Detection (Blind)
AU	Analysis/Detection Monitor
BFV	Butterfly Valve
CV	Check Valve
E	Voltage
EAH	Voltage High
EAHH	Voltage High High (Shutdown)
EI	Voltage Indication
F	Flow
FAH	Flow High
FAHH	Flow High High (Shutdown)
FAL	Flow Low
FALL	Flow Low Low
FC	Flow Controller/Fail Close
FG	Flow Gauge
FI	Flow Indication (Soft)/ Flow Sight Indicator (Glass)
FIC	Flow Indicating Controller
FIT	Flow Indicating Transmitter
FOP	Orifice Plate
FT	Flow Transmitter (Blind)
FV	Flow Control Valve
FY	Flow/Relay/Convertor
G	Gas
GIT	Gas Detecting Indicating Transmitter
GAH	Gas Detected Concentration Level High
GAHH	Gas Detected Concentration Level High High (Shutdown)
H	Hand
HH	Hand Hole
HO	Held Open (Solenoid Valve Only)
HV	Hand Valve
I	Current
IAH	Amperage High
IAHH	Amperage High High (Shutdown)
II	Current Indication
IT	Current Transmitter (Blind)
J	Power
JB	Junction Box (Wire Termination)
JI	Power Indication
JIT	Power Indicating Transmitter
JT	Power Transmitter (Blind)
K	Time Schedule
KC	Time Controller (Blind)
KI	Time Indication
KIC	Time Indication Controller
KR	Time Recorder
KY	Time/Relay/Convertor
L	Level
LAH	Liquid Level High
LAHH	Liquid Level High High (Shutdown)
LAL	Liquid Level Low
LALL	Liquid Level Low Low (Shutdown)
LC	Level Controller
LE	Level Probe (Element)
LG	Level Gauge
LI	Indication (Soft)/Level Sight Indicator (Glass)
LIT	Level Indicating Transmitter
LO	Lock Open
LSH	Level Switch High
LSHH	Level Switch High High (Shutdown)
LSL	Level Switch Low
LSLL	Level Switch Low Low (Shutdown)
LT	Level Transmitter (Blind)
LV	Level Control Valve
LY	Level/Relay/Convertor
MCC	Motor Control Center
MGV	Manifold Gauge Valve
NC	Normally Closed
NO	Normally Open
NV	Needle Valve
P	Pressure
PAH	Pressure High
PAHH	Pressure High High (Shutdown)
PAL	Pressure Low
PALL	Pressure Low Low
PC	Pressure Control
PDAH	Pressure Differential High
PDAHH	Pressure Differential High High (Shutdown)
PDAL	Pressure Differential Low
PDALL	Pressure Differential Low Low (Shutdown)
PDC	Pressure Differential Control
PDI	Differential Pressure Indication
PDIC	Pressure Differential Indicating Controller

PDIT	Pressure Differential Indicating Transmitter
PDSH	Pressure Differential Switch High
PDSHH	Pressure Differential Switch High High (Shutdown)
PDSL	Pressure Differential Switch Low
PDSLL	Pressure Differential Switch Low Low (Shutdown)
PDT	Differential Pressure Transmitter (Blind)
PDV	Pressure Differential Control Valve (Pneumatic Actuator)
PFY	Pressure Ratio Convertor/ Relay
PFC	Pressure Ratio Controller
PG	Pressure Gauge
PI	Pressure Indication (Soft)
PIC	Pressure Indicating Controller
PIT	Pressure Indicating Transmitter
PSE	Pressure Rupture Disk
PSH	Pressure Switch High
PSHH	Pressure Switch High High (Shutdown)
PSL	Pressure Switch Low
PSLL	Pressure Switch Low Low (Shutdown)
PSV	Pressure Safety Relief Valve
PT	Pressure Transmitter (Blind)
PV	Pressure Control Valve
Q	Quantity and Heat
QE	Heater Element, Immersion, Tracing
R	Radiation
S	Speed, Frequency
SC	Speed Control
SD	Shutdown
SIC	Speed Indicating Controller
T	Temperature
TC	Temperature Controller
TAH	Temperature High
TAHH	Temperature High High (Shutdown)
TAL	Temperature Low
TALL	Temperature Low Low (Shutdown)
TE	Temperature Element (RTD, Thermocouple, etc.)
TG	Temperature Gauge
TI	Temperature Indication (Soft)
TIC	Temperature Indicating Controller
TIT	Temperature Indicating Transmitter
TRV	Transfer Valve 3-Way
TSH	Temperature Switch High
TSHH	Temperature Switch High High (Shutdown)
TTSL	Temperature Switch Low
TSLL	Temperature Switch Low Low (Shutdown)
TT	Temperature Transmitter (Blind)
TV	Temperature Control Valve
TW	Temperature Thermo-well
TY	Temperature/Relay/ Convertor
U	Multi Variable
V	Vibration, Mechanical Analysis
VE	Vibration Probe
VFD	Variable Frequency Drive
VG	Block/Bleed, Gauge Valve
VSH	Vibration Switch High
VSHH	Vibration Switch High High (Shutdown)
VT	Vibration Transmitter (Blind)
VU	Vibration Monitoring System
W	Weight
XA	Status (Stopping/Not Running) Alarm/Common Alarm
XC	State Controller
XI	Running Indication
XV	Solenoid Valve
XY	State Relay/Convertor
Y	Event, State, Presence
YAH	Fire Alarm
YE	Fire Detecting Sensor
YIT	Fire Indicate and Transmit
YK	Fire Control Station
Z	Position, Dimension
ZC	Position Controller
ZE	Position Element
ZI	Position Indicator
ZIT	Position Indicating Transmitter
ZT	Position Transmitter (Blind)
ZY	Position Transmitter (Blind)
ZZ	Position Actuator (Capacity or Volume)

Symbol Identification

Use this list to identify symbols shown in the Piping & Identification Diagram.


3-Way Valve


3-Way Solenoid Valve


Angle Valve


Ball Valve


Basket Strainer


Block/Bleed Gauge Valve


Butterfly Valve


Check Valve


Diaphragm Actuator

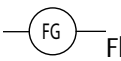

Diaphragm
Spring-Opposed


Diaphragm
Pressure-Balanced


Differential Pressure
Regulating Valve


Drive Coupling


Flange Set



Flow/Sight Glass


Gate Valve

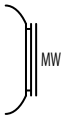

Globe Valve


Hand Expansion Valve

Heater


Heat Trace


Insulation



Man-Way Cover


Manifold Gauge Valve

Motorized Ball Valve


Needle Valve


Orifice Plate

Pilot Light


Pipe Plug


Pipe Reducer


Pneumatic Actuator
Control Valve


Relief Valve


Regulating Valve Inlet
Pressure


Regulating Valve Outlet
Pressure


Rotary Valve


Rupture Disc


Schroder Valve


Solenoid Valve


Spring-Closing Drain
Valve


Stop/Check Valve


Strainer

Thermostatic Valve 3-Way

Thermowell (SW or NPT)

Thermowell (SW or NPT)

Venturi Injector Nozzle

Vibration Absorber

Scope of Supply

Major Component Identification

Use this list to identify major components shown in the Piping & Identification Diagram.

Air Drive

Compressor

Damper or
Louver

Engine Drive

Filter

Finned Tube
Heat Exchanger

Heat Exchanger

Motor

Shell and Tube
Heat Exchanger

Fan

Tank/Drum
Vessel

Positive
Displacement
Pump

Major Component Identification (Continued)


Centrifugal Pump


Rotary Pump

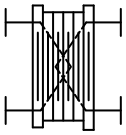
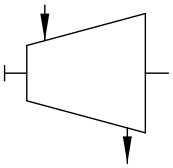


Plate & Frame Heat Exchanger


Turbine

Control and Instrument Identification


Discrete Instrument, Field Mounted


Discrete Instrument, Remote, Mount, Normally Accessible to Operator


Discrete Instrument, Local Rack Mounted, Normally Accessible to Operator


Shared Display/Control, Field Mounted


Shared Display/Control, DCS or Remote Control Panel Normally Accessible to Operator


Shared Display/Control, Local Control Panel Normally Accessible to Operator


Programmable Logic Control, Field Mounted


Safety Instrumented System, Field Mounted


Programmable Logic Control, DCS or Remote Control Panel, Normally Accessible to Operator


Safety Instrumented System Main Control Panel or DCS


Programmable Logic Control, Auxiliary (Local) Control Panel, Normally Accessible to Operator


Safety Instrumented System Auxiliary (Local) Control Panel


Computer Function, Field Mounted

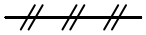

Computer Function, DCS or Remote Control Panel, Normally Accessible to Operator

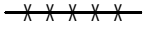

Computer Function, Local Operator Panel, Normally Accessible to Operator

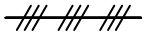

Interlock


Permissive

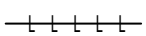
Line Type Designations


Pneumatic Signal

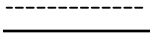

Capillary Tube


Electrical Signal

Internal System Link (Software or Data Link)


Mechanical Link

Hydraulic Signal


Customer Field Piping


Insulation

Valve and Instrument Tagging

a-bc-yz - ABC-DEFGH-IJKL

a = ABC, b = DE, c = FGH, y = IJK, z = L

A - Process cell or stage of compressor

B - Unit number in process cell or stage of compression

C - Service in process cell or stage of compression

- 1 - Gas lines
- 2 - Coolant lines
- 3 - Oil lube lines
- 4 - Refrigerant lines
- 5 - Condensate lines
- 6 - Air lines

D - Measured variable

E - Variable Modifiers

F - Readout or passive function

G - Output or active function

H - Function modifier

I - Loop number or sequential number

J - Loop number or sequential number

K - Loop number or sequential number

L - Suffix

Sample Tag

105-LSH-300-A

1 - First process cell or stage of compression

0 - First unit number in process cell or stage of compression

5 - Condensate service

L - Level

S - Switch

H - High

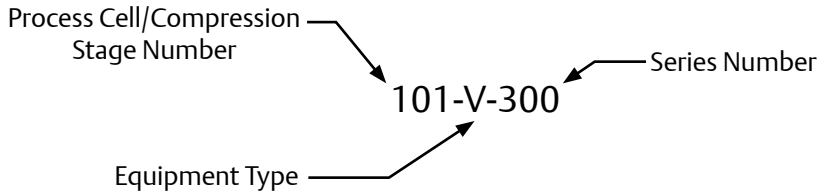
3 - Loop number or sequential number

0 - Loop number or sequential number

0 - Loop number or sequential number

A - Another exactly the same device in the same loop as 105-LSH-300

Equipment Number Identification



Equipment Type

A - Agitator, Mechanical Mixers, Aerators

B - Blowers

C - Compressors

D - Drivers

E - Heat Exchangers

F - Fans

P - Pumps

R - Reactors

U - Filters, Strainers

V - Vessels, Tanks, Separators, Scrubbers

Pipe Line Data Identification

AB - C - D - E - F
X - Y - Z

20-LFG-001-10-STD
PS-1-ET

A - Process cell or stage of compression
- 1 - Process cell first stage of compression
- 2 - Process cell first stage of compression
- 3 - Process cell first stage of compression
- 4 - Process cell first stage of compression
- 5 - Process cell low pressure refrigeration (booster)
- 6 - Process cell high pressure refrigeration (high stage)
- 7 - Open
- 8 - Open
- 9 - Open

B - Unit number in process cell or stage of compression

C - Service
- AR - Process Air
- BD - Blowdown
- BRR - Brine
- CHWS - Chilled Water Supply
- CHWR - Chilled Water Return
- CWR - Cooling Water Return
- CWS - Cooling Water Supply
- DR - Drain
- ER - Ethylene Refrigerant
- GLR - Glycol Return
- GLS - Glycol Supply
- H - Hydrogen
- HR - Hydrocarbon Refrigerant
- IAS - Instrument Air Supply
- LFG - Land Fill Gas
- LO - Lube Oil
- N - Nitrogen
- NG - Natural Gas
- NH - Ammonia
- PC - Process Condensate
- PG - Process Gas
- PR - Propylene Refrigerant/Propane
- SV - Safety Relief
- SO - Seal Oil
- VC - Vacuum Condensate

D - Numerical Sequence Number

E - Size
- #" - Nominal Pipe Size (Inches)

F - Standard/Other Standard
- STD - Vilter
- 0 - Other Standard (Not Vilter)

X - Insulation
- AC -Acoustic Control
- CC - Cold Service
- CP - Condensation Control
- N - Not Required
- PP - Personnel Protection
- PS - Process Stability
- TR - Traced (See Tracing Type)

Y - Insulation Thickness
- BO - By Others
- #" - Nominal Thickness (Inches)
- 0 - Insulation Not Required

Z - Heat Tracing
- ET - Electrical Heat Trace
- N - None

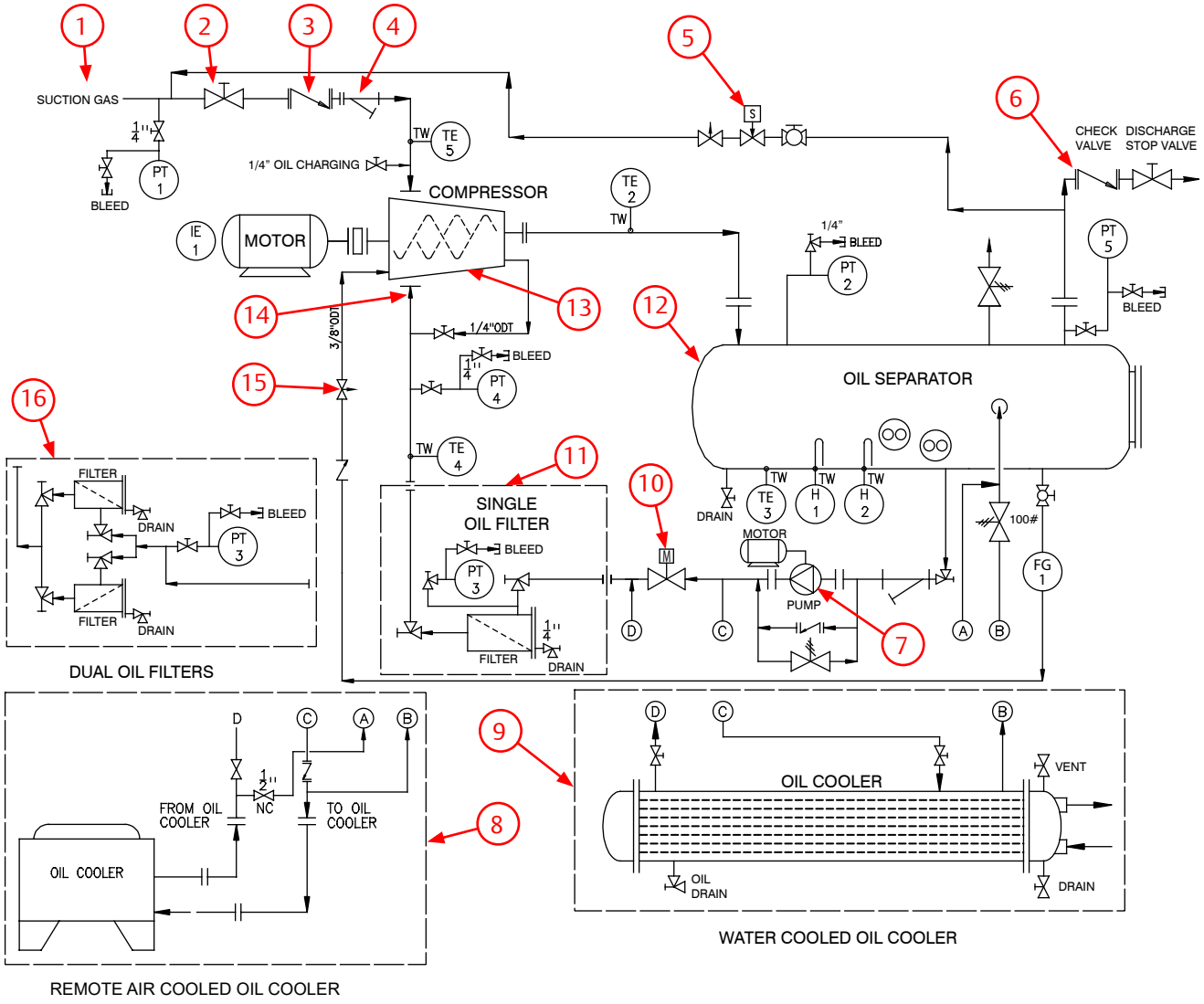


Figure 2-1. Gas Compression Unit P&ID

The gas and oil systems work in unison, but each one will be explained separately. Reference Figure 2-1 for gas and oil flow descriptions.

Gas Flow

The gas compression process begins as processed gas enters the suction inlet (1). The processed gas flows through a stop valve (2), check valve (3) then through a suction line strainer (4) to the compressor (13). The processed gas is then pressurized through the compressor and discharged as high pressure gas vapor into the oil separator (12). In the oil separator, the oil is then separated from the discharged gas vapor by impingement separation. The high pressure gas flows out to the aftercooler and scrubber for cooling while the oil is pumped or syphoned back to the compressor.

Check valves (3) and (6) are provided to stop the back flow of gas in the system when the compressor is shut down.

An equalizing line is also installed between the high pressure side (oil separator) and low pressure side (suction) to allow separator pressure to equalize to suction pressure at shutdown. This is controlled by the equalizing solenoid (5).

Oil Life and Oil Flow

The life of the oil is directly affected by the quality of the gas. Proper separation of any liquids must be accomplished before any liquids can get to the compressor suction. The discharge temperature of the compressor must be kept a minimum of 30°F (or 17°C) above the discharge gas dew point to prevent the condensing of liquids in the oil separator. The oil separator shell and legs must be insulated when the gas stream has a high probability of having condensables.

Oil in the gas compressor unit serves three primary purposes. They are compressor lubrication, sealing clearances between moving parts, and heat removal resulting from heat of compression and friction. Initially, oil flow is driven by a mechanical gear pump (7). Once the system reaches design conditions, the oil pump is shut off and oil flow is maintained by differential pressure in the system.

As the oil is separated from the gas in the oil separator (12), it is pumped or syphoned through an oil cooler (8 or 9), then filtered through a single (11) or dual oil filters (16) and back to the injection port (14) of the compressor (13). The oil cooler is a shell and tube water cooled heat exchanger (9) or a remote finned fan heat exchanger (8).

Furthermore, to collect oil from the coalescing side of the oil separator (12), a line is installed between the oil separator and the compressor. By opening the needle valve (15), this will allow oil dripping off the coalescing filters to be fed back to the compressor (13). In addition, the oil cooler (8 or 9) is piped in parallel to the oil temperature control valve (oil mixing valve) (10), which acts as a by-pass valve.

This is a continuous cycle.

Control System

The gas compressor unit is controlled by a Programmable Logic Controller (PLC) panel. This PLC panel's main function is to control the gas compression system from the data that it receives from the sensors around the unit. Refer to Compact Logix PLC manual (35391CL) for additional information.

Temperature Sensors and Pressure Transmitters

Resistance Thermometers (RTDs), temperature transmitters (TTs), and pressure transmitters are instruments used to measure temperatures and pressures at specific locations on the gas compressor unit, see Figure 2-1. Gas Compression Unit P&ID. RTDs or TTs are typically mounted on the suction pipe, discharge pipe, oil separator and oil filter outlet pipe. Pressure transmitters are typically mounted on the block and bleed assembly and directly on the suction pipe. The pressure transmitters measure suction pressure, inlet and outlet oil pressure, and oil separator pressure.

Delivery Inspection

All equipment supplied by Vilter are thoroughly inspected at the factory. However, damage can occur in shipment. For this reason, the units should be thoroughly inspected upon arrival, prior to off-loading. Any damage noted should be photographed and reported immediately to the transportation company. This way, an authorized agent can examine the unit, determine the extent of damage and take necessary steps to rectify the claim with no serious or costly delays. At the same time, the local Vilter representative or the home office should be notified of any claims made within ten (10) days after its discovery. Refer to Long Term Storage Log for additional recommendations.

Rigging and Lifting of Compressor Unit

WARNING

When rigging and lifting a compressor unit, use proper lifting device capable of lifting and maneuvering the weight and size of the compressor unit. Use only qualified personnel and additional personnel and lifting equipment (i.e. spreader bar) as required. Failure to comply may result in death, serious injury and/or damage to equipment.

Only qualified personnel shall operate rigging and lifting equipment. Ensure that the lifting device is capable of lifting the weight of the compressor unit, refer to the supplied Vilter General Assembly (GA) drawing.

To lift the compressor unit, use lifting points on compressor unit frame to attach the lifting device, see Figure 3-1. There are a few points to consider prior to moving the unit:

- Ensure that the weight is evenly distributed amongst the lifting device (i.e. lifting chains and spreader bar) prior to lifting.
- Ensure that the lifting device is not obstructed by any parts of the compressor unit to prevent damage to components.
- Use additional personnel as needed to spot and aid in maneuvering the compressor unit.
- Ensure there is plenty of space to maneuver the compressor unit and a clear path to its location.

Compressor Unit Inspections Prior to Installation and Storage

The compressor unit must be inspected prior to installation since components could have come loose and/or damaged during shipment or moving.

- Check for loose bolts, particularly the compressor and motor mounting nuts.
- Check for bent or damaged components. The compressor unit should have also been inspected prior to off-loading, see Delivery Inspection.

Use lifting chains/straps and spreader bar. Evenly distribute weight. Keep lifting chains and spreader bar clear of components to prevent damage.

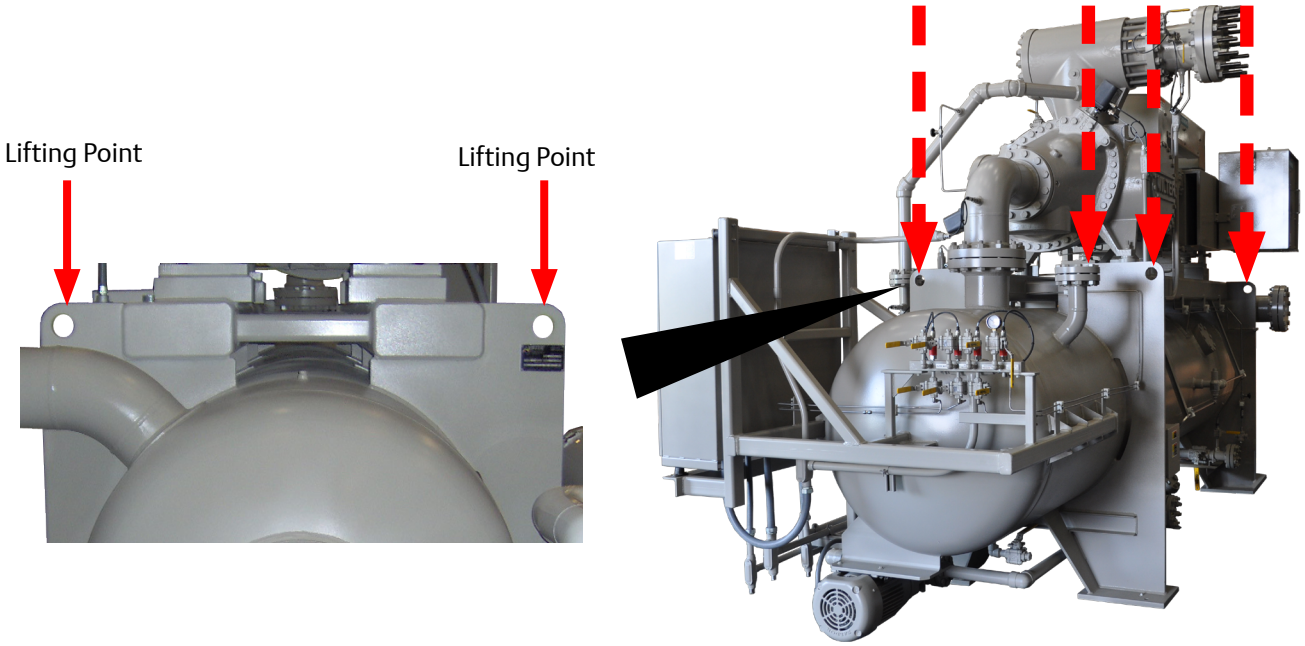


Figure 3-1. Rigging and Lifting Points

- Check that the nitrogen pressure is still holding pressure. The pressure gauge is located at the discharge bleed valve on the block and bleed assembly. Any leaks must be fixed and the system purged and recharged with dry nitrogen.

Recommended On-site Tools

The tools recommended to have on site are important for troubleshooting, inspections and compressor unit operation. Besides general mechanic tools, these tools are recommended:

- Dial Indicator (0.001" Graduation, 0"-1" Range) with 12" Adjustable Arm and Magnetic Base
- Feeler Gauge Set, 0.0015"-0.020" Range, 12" blade length
- Infrared Heat Gun
- Oil Pump (maximum of 2-3 GPM with motor approved for Division 1 or Division 2 and with ability to overcome suction pressure)
- Sockets and wrenches up to 2-1/2" (63.5 mm)
- Torque Wrenches (with ranges from 0 to 600 ft-lbs)
- Voltmeter

Long Term Storage Recommendations

The procedure described is a general recommendation for long term storage (over one month of no operation) of Vilter compressor units. It is the responsibility of the installation firm and end user to address any unusual conditions. Use the supplied Long Term Storage Log sheet to help with record keeping, see section Page 3-4.

Warranty of the system remains in effect as described at the beginning of this manual, section page i.

NOTE

The compressor must be inspected prior to long term storage since components could have come loose and/or damaged during shipment or moving. See previous section for inspection details.

Compressor Unit

The following are recommendations regarding long term storage:

- If the unit is designed for indoor duty, it must be stored in a heated building.
- If the unit is designed for outdoor duty and is to be stored outdoors, a canvas tarp is recommended for protection until installation. Adequate drainage should be provided. Place wood blocks under the base skid so that water does not collect inside the base perimeter or low spots in the tarp.
- All compressor stop valves must be closed to isolate the compressor from the remainder of the system. All other valves, except those venting to atmosphere, shall be open. The unit is shipped with dry nitrogen holding charge of 5 psig (5 psi above atmospheric pressure). It is essential to maintain the nitrogen holding charge.
- Cover all bare metal surfaces (coupling, flange faces, etc.) with rust inhibitor.
- Desiccant shall be placed in the control panel. If the panel is equipped with a space heater, it shall be energized. Use an approved electrical spray-on corrosion inhibitor for panel components (relays, switches, etc.)
- All pneumatic controllers and valves (Fisher, Taylor, etc.) are to be covered with plastic bags and sealed with desiccant bags inside.
- The holding charge of the nitrogen or clean dry gas in the system and compressor shall be monitored on a regular basis for leakage. If not already installed, it is required that a gauge shall be added to help monitor the nitrogen holding charge pressure. If a drop in pressure occurs, the source of leakage must be found and corrected. The system must be evacuated and recharged with dry nitrogen to maintain the package integrity.
- Manually rotate compressor shaft several revolutions (approximately 6) every 3 months. If the compressor unit is installed, wired and charged with oil, open all oil line valves and run the oil pump for 10 seconds prior to rotating the compressor shaft. Continue running the oil pump while the compressor shaft is being turned to help lubricate the surfaces of the shaft seal.
- Maintenance log to be kept with documenting dates to show all the procedures have been completed.
- Notify Vilter Service and Warranty Department when the compressor is started.

NOTE

The Long Term Storage Log (on Page 3-4) is an interactive form. You can fill it electronically and print the page as your record.

Compressor Motor

The following are general recommendations. Refer to specific motor manufacturer instructions for storage recommendations.

- Where possible, motors should be stored indoors in a clean, dry area. The preferred condition shall be uniform temperature between 40°F (4.5°C) and 140°F (60°C) throughout the room maintained at least 10°F (5.5°C) above the dew point. Relative humidity should be at 50% or less.
- Remove the condensation drain plugs from those units equipped with them and insert silica-gel into the openings. Insert one-half pound bags of silica-gel (or other desiccant material) into the air inlets and outlets of drip-proof type motors.

NOTE

Bags must remain visible and tagged, so they will be noticed and removed when the unit is prepared for service.

- If the motors are stored outside, they should be covered completely to exclude dirt, dust, moisture, and other foreign materials and animals. However, do not wrap the motor tightly. This will allow the captive air space to breathe, minimizing formation of condensation. The motor should also be protected from flooding or harmful chemical vapors.
- If the motor is movable, it is suggested that the entire motor be encased in a strong, transparent plastic bag. Before sealing the bag, attach a moisture indicator to the side of the motor and several bags of silica-gel desiccant shall be placed inside the bag around the motor. Replace the desiccants when the moisture indicator shows that the desiccant has lost its effectiveness.

NOTE

Make sure that none of the desiccants is in contact with the heater elements.

- Whenever the motor cannot be sealed, space heaters must be installed to keep the motor at least 10°F above the ambient temperature.
- Whether indoors or outdoors, the area of storage should be free from excessive ambient vibration which can cause bearing damage.
- Inspect the rust preventative coating on all external machined surfaces, including shaft extensions. Recoat the surfaces with a rust preventative material if needed.
- Rotate motor and compressor shafts several revolutions (approximately 6) per month to eliminate flat spots on the bearing surfaces. For motors utilizing anti-friction bearings, the shaft should be rotated once every 30 days by hand at 30 RPM for 15 seconds in each direction. Bearings should also be re-lubricated at 2-year intervals using the grease specified on the motor lubrication nameplate.
- For info regarding bearing lubricating and insulation testing, please refer to motor manufacturer's instructions.

NOTE

To claim a warranty, a full record of the above requirements will need to be submitted to Vilter. This will include Log Records and Supporting Pictures.

Air Cooled Oil Coolers

The following are general recommendations. Refer to specific air cooled oil cooler manufacturer instructions for storage recommendations.

- If the coolers are to be stored or not operated for an extended period of time, the fan motors may ingress moisture if they are not protected or operated regularly. In severe cases, the moisture will reduce the insulation level of the windings or cause rusting of the bearings necessitating removal for repairs at a motor repair facility. This is a common problem with large generating installations when the coolers are often ready but commissioning of the main turbine-generator is delayed for several months.
- The simplest remedy for installed coolers is to operate the fan motors for a few hours every week during the downtime period until regular operation resumes. The fan motors on stored coolers must be protected from the elements by covering them with waterproof tarps.

Long Term Storage Log

Company: _____

Serial Number: _____ Sales Order Number: _____

Name (Please Print): _____ Initial: _____

Date (M/D/Y): _____

	PSIG	Nitrogen Pressure - Current
	PSIG	Nitrogen Pressure - Recharged (If pressure is low, identify and fix leak prior to recharging, see Compressor Unit Leak Check procedure in Section 5 of the compressor manual)

Nitrogen Leak Location (Briefly explain nature of leak):

- ☐ Compressor Shaft (Rotate shafts at least 6 revolutions)
- ☐ Motor Shaft (Rotate shafts at least 6 revolutions)
- ☐ Motor Bearings Greased
- ☐ Air Cooled Oil Cooler Fan Rotated
- ☐ Bare Metal Surfaces (Check all bare metal surfaces for rust and ensure they are covered with rust inhibitor)
- ☐ Desiccants (Are desiccants still effective? If not, replace. Check control panel, motor, pneumatic controllers and valves)
- ☐ Cover Bags/Tarp (Ensure bags and tarps are not torn and are sealed over components correctly, replace if damaged)
- ☐ Valves (Stop valves are in closed position so the compressor unit is isolated. All other valves, except those venting and draining to atmosphere are to be open)
- ☐ Space Heater & Panel Components (Ensure space heater is energized and panel components are rust-free)

Name (Please Print): _____ Initial: _____

Date (M/D/Y): _____

	PSIG	Nitrogen Pressure - Current
	PSIG	Nitrogen Pressure - Recharged (If pressure is low, identify and fix leak prior to recharging, see Compressor Unit Leak Check procedure in Section 5 of the compressor manual)

Nitrogen Leak Location (Briefly explain nature of leak):

- ☐ Compressor Shaft (Rotate shafts at least 6 revolutions)
- ☐ Motor Shaft (Rotate shafts at least 6 revolutions)
- ☐ Motor Bearings Greased
- ☐ Air Cooled Oil Cooler Fan Rotated
- ☐ Bare Metal Surfaces (Check all bare metal surfaces for rust and ensure they are covered with rust inhibitor)
- ☐ Desiccants (Are desiccants still effective? If not, replace. Check control panel, motor, pneumatic controllers and valves)
- ☐ Cover Bags/Tarp (Ensure bags and tarps are not torn and are sealed over components correctly, replace if damaged)
- ☐ Valves (Stop valves are in closed position so the compressor unit is isolated. All other valves, except those venting and draining to atmosphere are to be open)
- ☐ Space Heater & Panel Components (Ensure space heater is energized and panel components are rust-free)

Clear Form

Foundation

Vilter Single Screw compressor units are low vibration machines. Under most conditions, no elaborate foundation is necessary. However a sound foundation maintains motor alignment and proper elevation, and is therefore required. Provided are recommendations for the foundation and anchoring of the compressor unit. The Vilter foundation supports the entire operating weight of the unit and is suitable for years of continuous duty. Included are specifications for concrete, rebar, aggregate, anchors and grout.

Considerations Prior To Starting

Consult professionals, such as building inspectors, structural engineers, geotechnical engineers and/or construction contractors prior to starting. Below are a few points to consider:

Site Characteristics:

- Soil information
- Site drainage
- Wind data
- Seismic zone
- Ingress and egress
- Power and power lines

Site Layout:

- Plant elevations, grading, drainage and erosion
- Accessibility to compressors for service
- Location of surrounding buildings
- Property lines and roadways
- Power
- Fire safety

Safety:

NOTE

Always check with a safety engineer before proceeding.

- Arrange equipment with adequate access space for safe operation and maintenance
- Wherever possible, arrange equipment to be served by crane. If not feasible, consider other handling methods
- Make all valves and devices safely accessible
- Use special bright primary color schemes to differentiate service lines
- Provide lightening protection for outdoor installations
- Relief valve venting

Foundation Materials

Materials needed to build the foundation are forms, concrete, sand, rebar, wire, grout, anchor bolts, expansion board and shims. A set of concrete forms will need to be acquired; generally, these can be rented or constructed from dimensional lumber. There should be enough 4,000 psi concrete with one inch aggregate to build the foundation. Also, there should be enough sand to provide a base of compacted sand four inches thick for the foundation to rest on, see Figure 3-2. Concrete Pad with Compressor Unit Dimensions - Side View. The rebar required is ASTM 615, grade 60, sizes #4 and #6. Wires will also be needed to tie the rebar together. The recommended grout is Masterflow 648CP high performance non-shirk grout to provide at least a 1" thick pad under each foot. The recommended anchors are 5/8" Diameter HILTI HAS SS threaded rod for outdoor installations or HAS-E rods for indoor installations. Anchor bolts shall have a five inch projection and 12-3/8" embedment. The required adhesive is HIT-ICE/HIT/HY 150 anchoring system. There should be enough one inch expansion boards to go around the perimeter of the foundation. Finally there should be enough shim stock and extra anchor bolt nuts to level the compressor unit.

Building The Foundation

Use the Vilter General Arrangement (GA) and foundation drawings to help secure a building permit and foundation construction. The Vilter GA drawing has the necessary dimensions required to determine the overall foundation size and where to locate the compressor unit on the foundation. It also shows the dimensions required to form up the housekeeping piers that the compressor unit rests on. The Vilter foundation drawing lists the necessary information to construct a suitable foundation. It includes the rebar requirements and locations. It also shows anchor bolt locations, grouting and the concrete specifications. Using the Vilter GA drawing, Vilter foundation drawing and the information from site characteristics, site layout and safety studies will provide enough data to allow building the foundation to proceed.

The foundation is to be cast and permanently exposed against the earth. Therefore, if constructing on an existing floor, typically indoors, the floor will need to be broken up to get to the earth. If starting from undisturbed soil, it must be also be prepared accordingly. In either

case, these are some check points to consider:

- Check the depth of your frost line to ensure the foundation extends below it
- Ensure the foundation rests entirely on natural rock or entirely on solid earth, but never on a combination of both
- Check the ability of the soil to carry the load
- Check wet season and dry season soil characteristics for static loading limits and elasticity
- Check local codes for Seismic Design requirements

For examples of foundation diagrams, see to Figure 3-2 and Figure 3-3.

NOTE

In Figure 3-3. Concrete Pad with Compressor Unit Dimensions - Front View and Figure 3-8. Concrete Pad Housekeeping Detail, the recommended housekeeping height of 6" is to allow maintenance/ service of the oil strainer and oil pump.

Once the site has been excavated and prepared, place four inches of sand down on the bed where the foundation will rest. The sand must be compacted before placing the forms and rebar. After the sand is compacted, use the Vilter GA drawing to construct the forms for the foundation. With forms in place, install expansion boards on the inside of the forms, for example, see Figure 3-4. Next, place your rebar in the forms as per the Vilter foundation drawing. When all rebars are in place the concrete can be poured. The concrete must then be trolled level and a surface texture etched in place. Leave the concrete to cure for at least 28 days.

Compressor Unit Installation

Once the foundation has cured, the compressor unit can be placed on the foundation, see Figure 3-5 and Figure 3-6. With the appropriate material handling equipment, lift the compressor unit by locations shown on the Vilter GA drawing and slowly place it on the foundation housekeeping piers. As per the Vilter GA drawing, ensure the compressor unit is correctly placed on the foundation. Once placed, use the spherical washers directly under the compressor as the surface to level the compressor unit, see Figure 3-7. Place shims under the feet of the compressor unit, as needed, until it is leveled, see Figure 3-8. Select the correct drill bit and drill thru the anchor bolt hole in the mounting feet of the compressor unit to the depth called for on the Vilter foundation drawing. Finally using the HILTI instructions, put your anchor bolts in place and wait for them to cure. Then place the nuts on the anchor bolts to finger tight and prepare to grout.

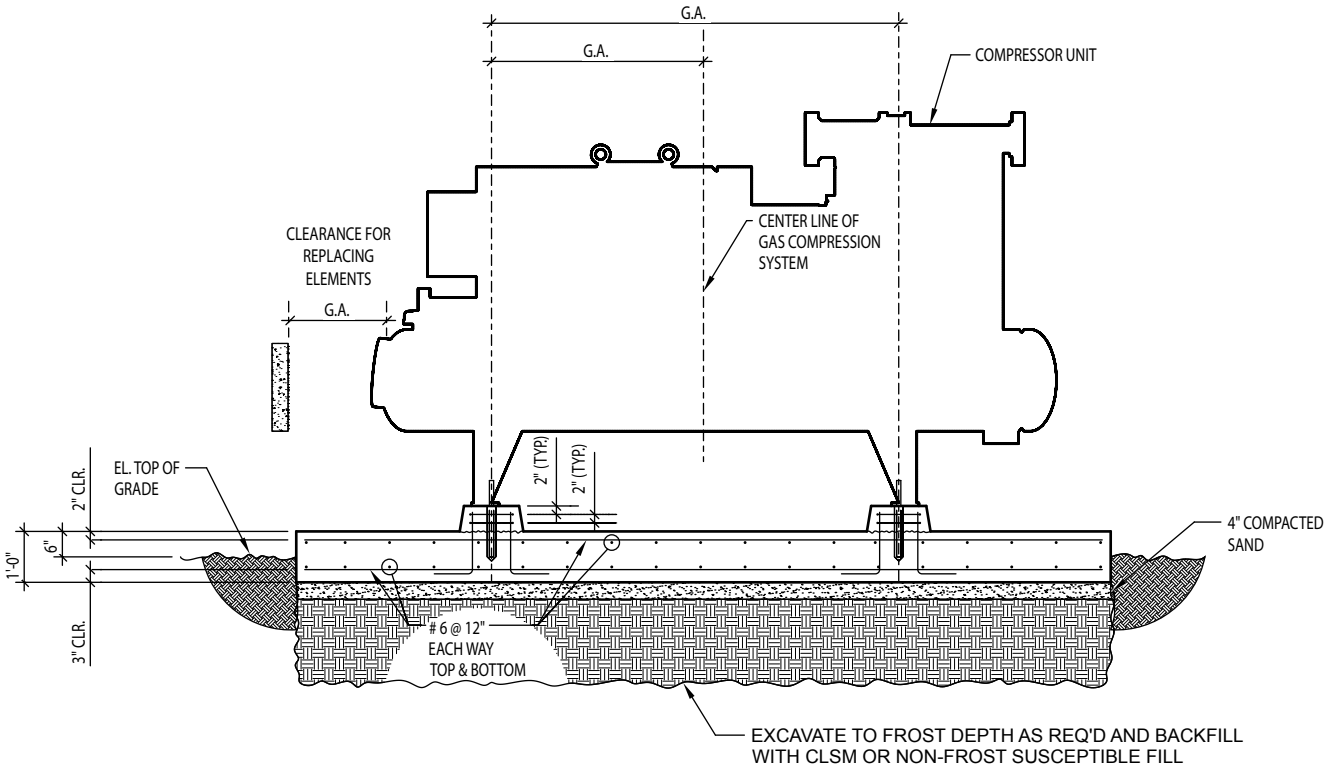


Figure 3-2. Concrete Pad with Compressor Unit Dimensions - Side View

Leveling and Grouting

The unit should be level in all directions. Wet the concrete pad according to the grout manufacturer's directions. Mix a sufficient amount of grout. The grout must be an expanding grout rather than shrinking to provide a tighter bond. Follow the manufacturer's recommendations for setting, precautions, mixing, and grout placement, finishing and curing. The grout must be worked under all areas of the feet with no bubbles or voids. If the grout is settled with a slight outside slope, oil and water can run off of the base. Once the grout has cured, torque the anchor bolts as per HILTI instructions.

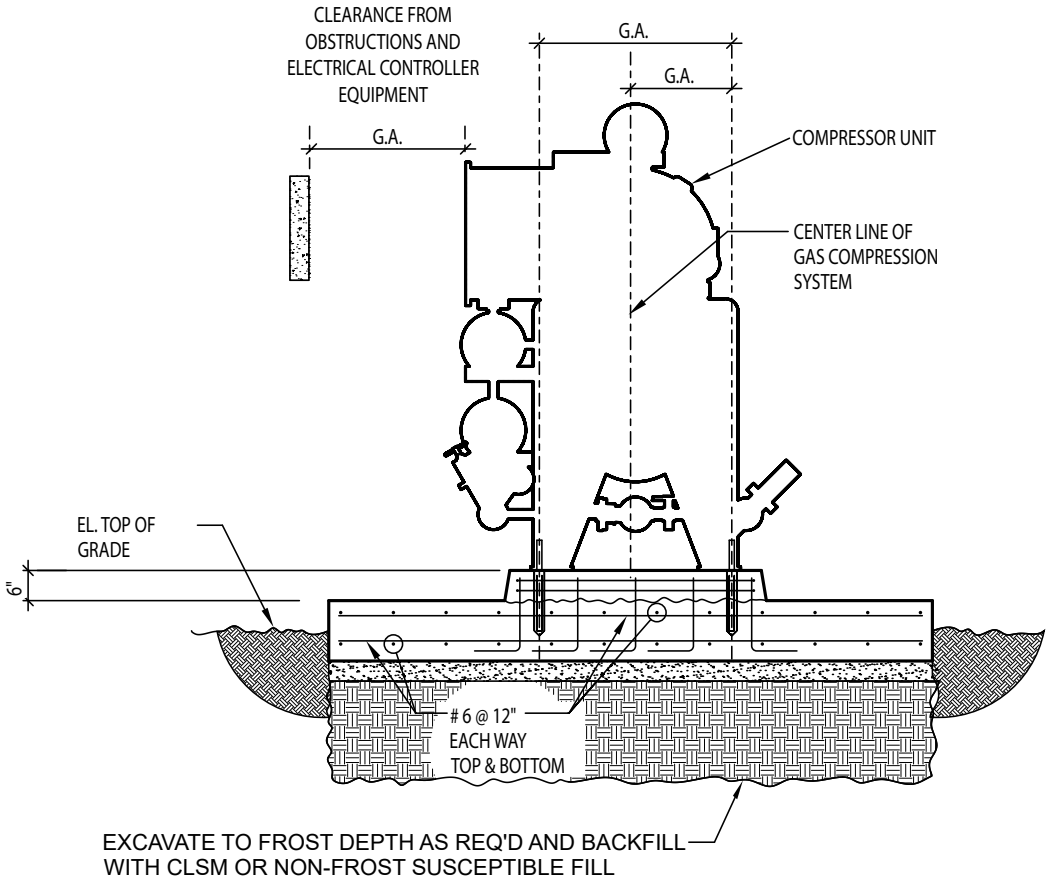


Figure 3-3. Concrete Pad with Compressor Unit Dimensions - Front View

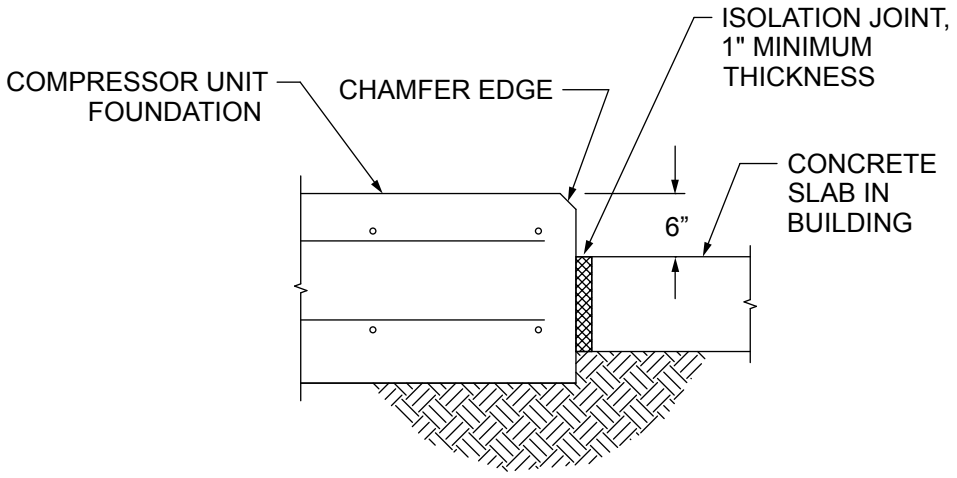


Figure 3-4. Interior Foundation Isolation

Additional Information

Codes and Standards

Vilter followed the following codes and standards when designing your foundation:

- ACI
- ASTM
- ASCE 7
- IBC

Operation and Performance

The foundation was designed for:

- Outside environment severe exposure
- Ambient temperature -10 degrees F to 105 degrees F
- Unit weight 20,000 lbs
- RPM 3600
- Soil bearing capacity 1,500 lbs/sq.ft.
- Wind speed 120 MPH
- Exposure factor D
- Wind importance factor 1.15
- Concrete poured on and permanently cast against the earth

General Design Requirements

The compressor foundation is designed to:

- Maintain the compressor in alignment and at proper elevation.
- Minimize vibration and prevent its transmission to other structures
- Provide a permanently rigid support
- Provide sufficient depth to dampen vibrations.

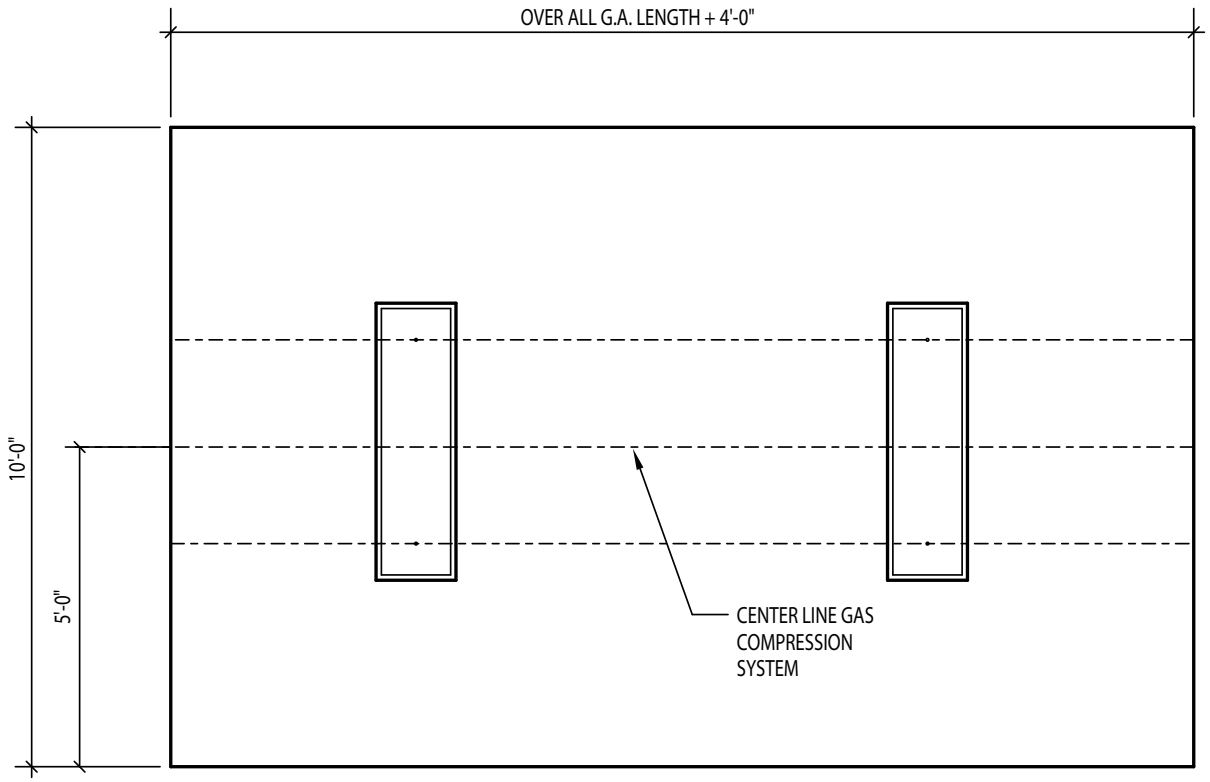


Figure 3-5. Foundation with Housekeeping Pads Dimensions - Top View

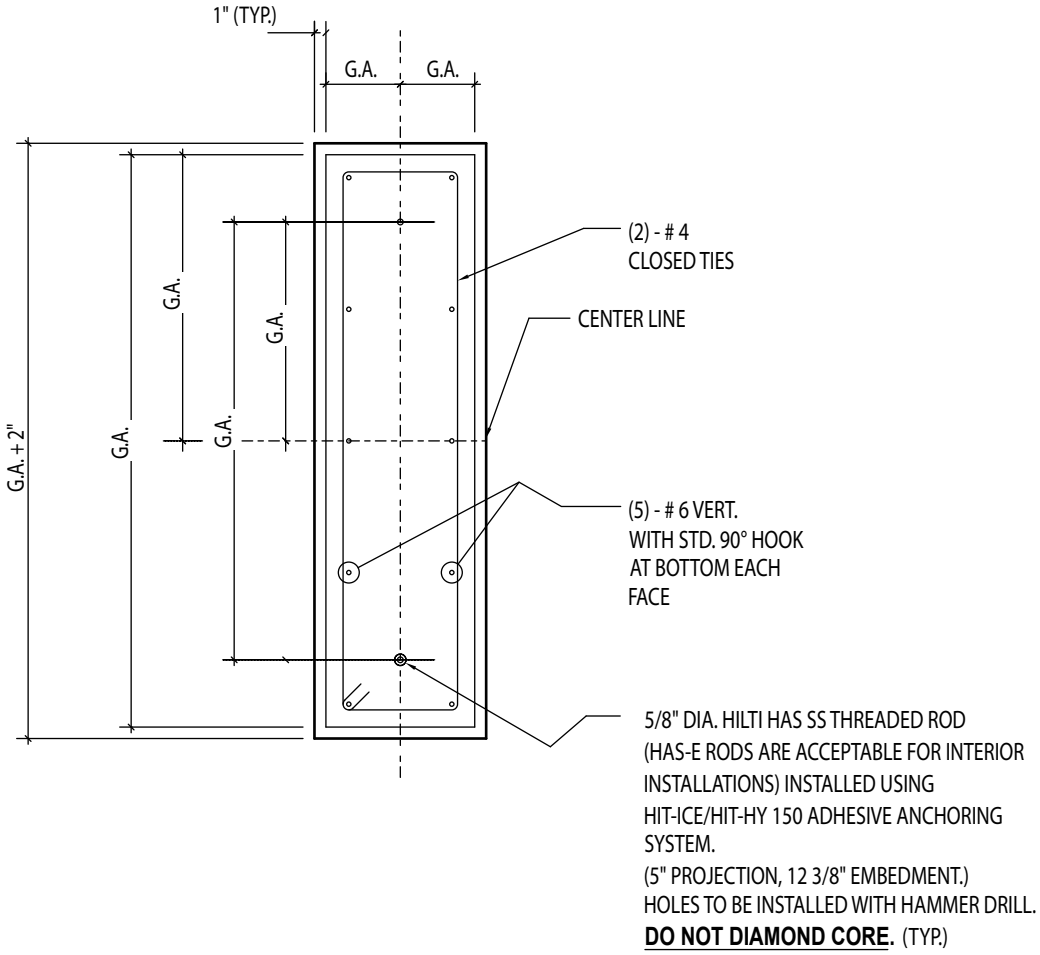


Figure 3-6. Housekeeping Pad Dimension Detail - Top View

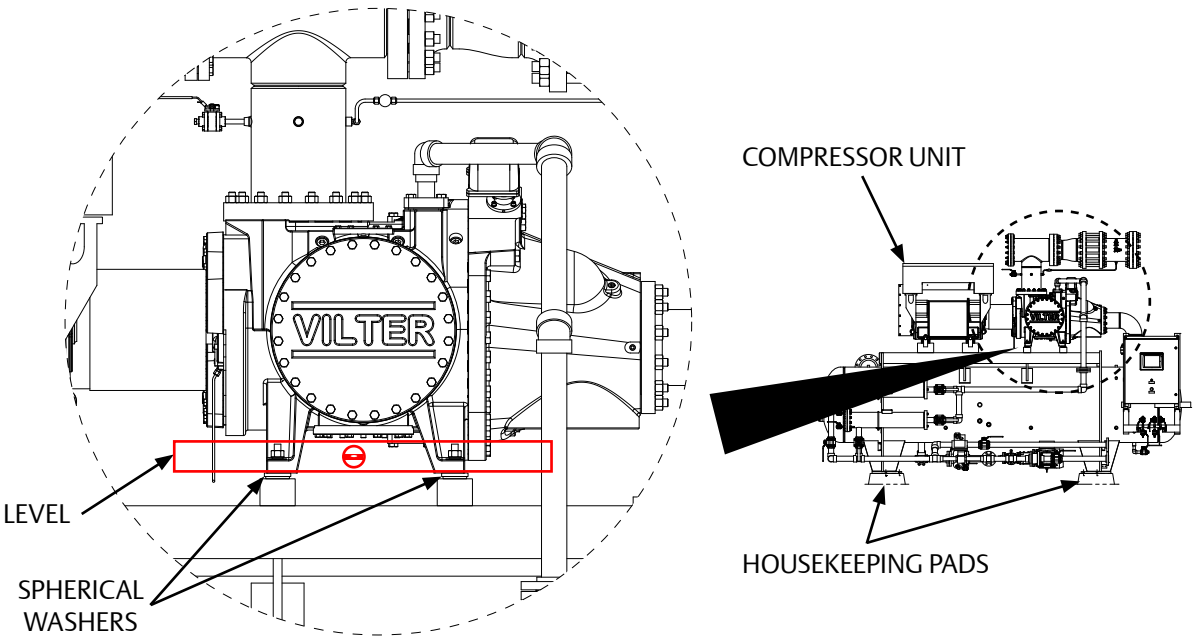


Figure 3-7. Level Compressor Unit Using Top Surface of Spherical Washers

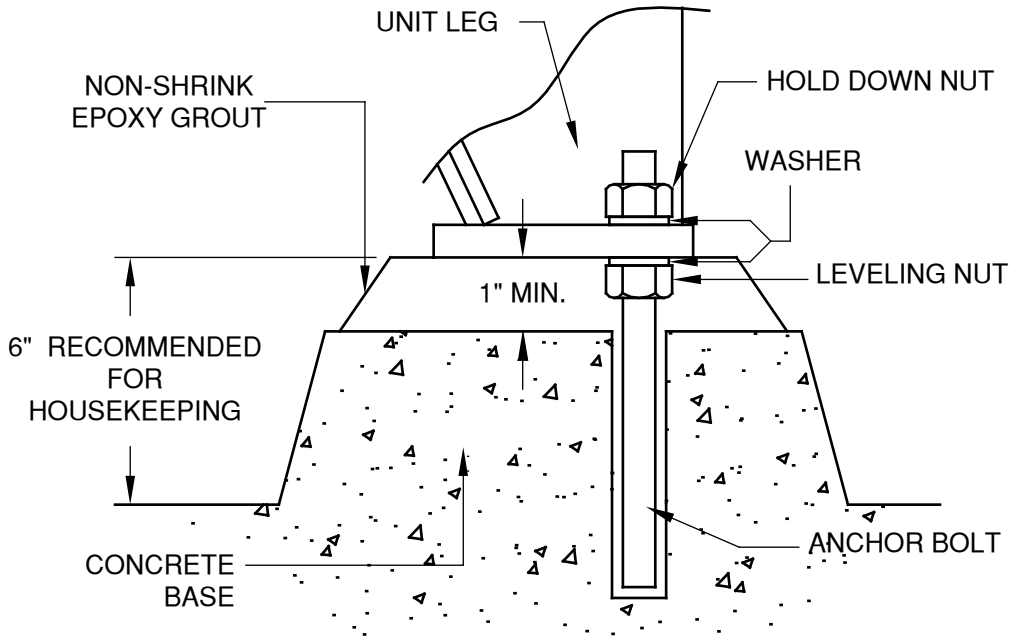


Figure 3-8. Concrete Pad Housekeeping Detail

Piping

The ideal load applied to flanges of the compressor unit is zero. However, it's not practical to expect that no loads will be applied to unit connections. Thermal, dead, live, wind & seismic loads must be considered and even tolerated. Well supported external piping connected to the compressor will still result in some loads applying forces and moments in three axes to unit flanges.

The most important issue is the motor-compressor misalignment caused by external forces (F in lbf) and moments (M in ft-lbf) imposed by plant piping. In Figure 3-9 and Table 3-1, are the maximum allowable forces and moments that can be applied to compressor flanges when the compressor is mounted on an oil separator.

It must be noted that it is necessary to check for compressor shaft movement when the job is complete. In no case shall the attached piping be allowed to cause more than 0.002" movement at the compressor shaft. If more than 0.002" movement is detected the piping must be adjusted to reduce the compressor shaft movement to less than 0.002". For example, the compressor shaft should not move more than 0.002" when piping is removed or connected to the compressor.

IMPORTANT – piping elements shall be supported per the requirements of ASME B31.3. See guidelines below, particularly with concern to minimizing loads on check valves.

Header Piping and Drains

Header drains should also be installed to allow drainage of liquids from the discharge and suction headers. See Appendix C • Recommended Remote Air Cooled Oil Cooler Piping for Recommended Header Piping.

CAUTION

Accumulated liquid in the suction header can damage the compressor if not drained. Always drain headers (suction and discharge headers) prior to start-ups. Failure to comply may result in damage to equipment.

Remote Air Cooled Oil Cooler Piping

If equipped with a remote air cooled oil cooler, it is important that the piping be installed correctly to and from the compressor unit and remote air cooled oil cooler. See Appendix C • Recommended Remote Air Cooled Oil Cooler Piping.

Flange Loads

Zero is the ideal load applied to the flanges of Vilter compressor Units. However, it's not practical to expect that no loads will be applied to Unit connections. Thermal, Dead, Live, Wind & Seismic loads must be considered & even tolerated. Well supported external piping connected to the compressor will still result in some loads applying forces and moments in three axes' to Unit flanges.

The most important issue is the motor/compressor misalignment caused by external forces and moments imposed by plant piping. Below is a table that lists the maximum allowable forces and moments that can be applied to Vilter compressor flanges when the compressor is mounted on an Oil Separator. Vilter defines this arrangement as a "Compressor Unit" as opposed to a "Bare Shaft Compressor" mounted to a foundation.

It must be noted that it is necessary to check for compressor shaft movement when the job is complete. In no case shall the attached piping be allowed to cause more than 0.002" movement at the compressor shaft. If more than 0.002" movement is detected the piping must be adjusted to reduce the compressor shaft movement to less than 0.002". E.g. compressor shaft should not move more than 0.002" when piping is removed or connected to the compressor. IMPORTANT – piping elements shall be supported per the requirements of ASME B31.3 as applicable. See guidelines below, particularly with concern to minimizing loads on check valves

Table 3-1. Maximum Allowable Flange Loads

Nozzle Dia. (in.)	Fz (lbf)	Fy (lbf)	Fx (ft-lbf)	Mzz (ft-lbf)	Myy (ft-lbf)	Mxx (ft-lbf)
4	400	400	400	300	300	300
6	600	600	600	500	500	500
8	900	900	900	1000	1000	1000
10	1200	1200	1200	1200	1200	1200
12	1500	1500	1500	1500	1500	1500
14	2000	2000	2000	2000	2000	2000

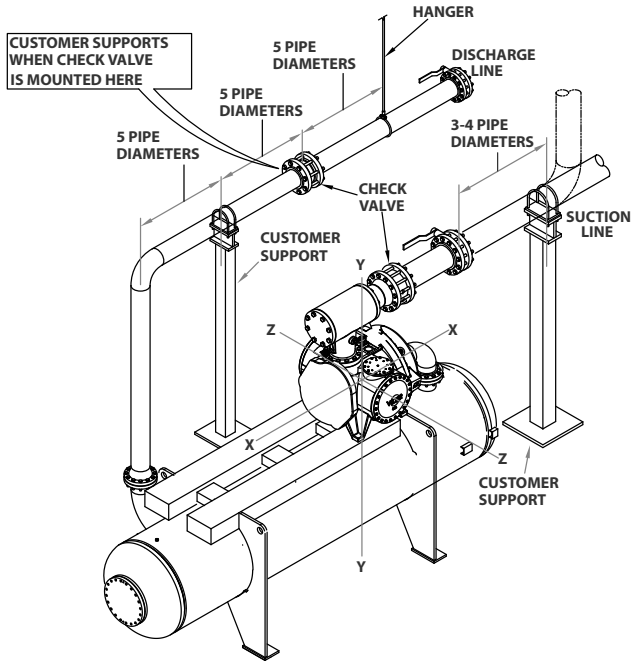


Figure 3-9. Maximum Allowable Flange Loads

General Installation Guideline for Multiple Air Coolers Installed in a Common Area

NOTE

This general installation guideline applies to all air coolers on site, whether they are supplied by or not supplied by Vilter.

The purpose of this guideline is providing design information when multiple air cooled heat exchangers are installed in a common area. There are two main focal points of this guideline. One area is free flow area which addresses how much free area is required to prevent air flow "starvation" of the units. The second item provides a guideline as to how multiple air cooled heat exchangers should be arranged to minimize the potential of hot air recirculation due to the environment.

Free Flow

There are two basic guidelines that we follow to address free flow area when multiple designs are being installed in a common area.

- Air coolers should be placed at least 1 fan diameter away from the nearest obstruction. This is based on the largest fan diameter in the bay of coolers.
- Intake area to the air cooler should have an intake velocity equal to or below 500FPM as the discharge velocity is above 500FPM.

We will look at each rule and provide pictorials and calculations for each guideline. Let's assume the following coolers are being installed in a common area:

- Cooler 1 - 7' wide x 10' long with a 6' fan moving 55,000CFM of air. Face velocity is 785FPM.
- Cooler 2- 8' wide x 12' long with a 7' fan moving 72,000CFM of air. Face velocity is 750FPM.
- Cooler 3- 10' wide x 16' long with a 9' fan moving 120,000CFM of air. Face velocity is 750FPM.

One Fan Diameter

In order to keep the leg height of the installation to a minimum we want to install the coolers at least 1 fan diameter from the nearest obstruction. Referring to Figure 3-10, the nearest obstruction is the building.

Based on the information above, the largest fan diameter in the installation is 9ft. Therefore, the coolers should be placed at least 9' away from the building.

Intake Velocity

Based on the information above, we are going to solve for the leg height that will provide an intake velocity of 500FPM. We know the following:

- The total airflow of the installation is 247,000CFM
- We have an intake perimeter of 82' for all 4 sides based on the cooler placement.
- Our intake velocity guideline is 500FPM

The equation used to calculate the leg height in Figure 3-11 is as follows:

Leg Height = (Total Airflow/Intake velocity)/Intake Perimeter

Leg Height = (247,000CFM/500FPM)/82ft

Leg Height = 6ft

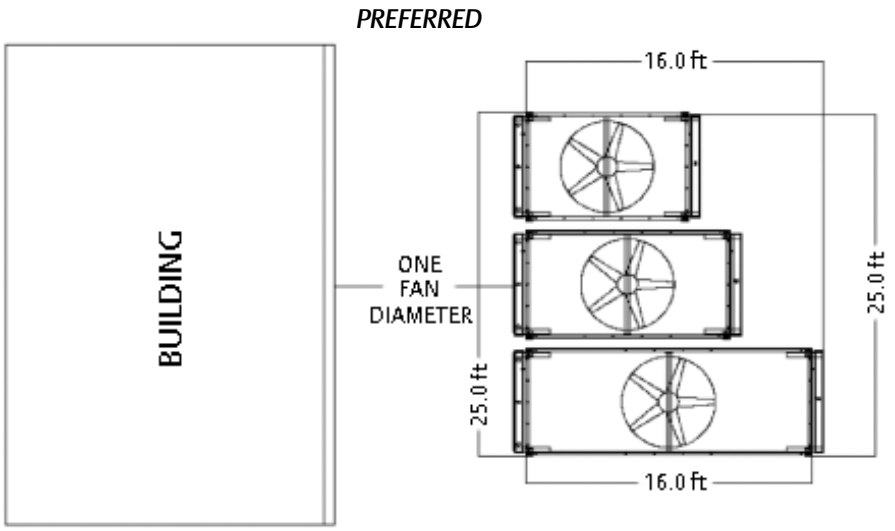


Figure 3-10. Installation of Coolers - One Fan Diameter Next to Building

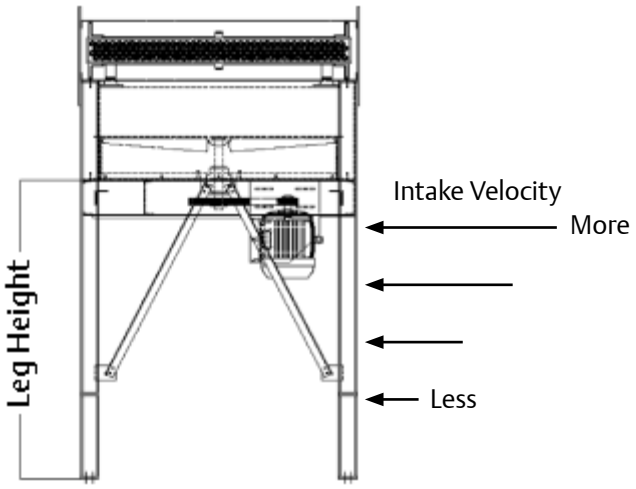


Figure 3-11. Leg Height

In this particular case the calculated minimum height is 6 feet to maintain an intake velocity of 500FPM or less based on having the coolers place 1 fan diameter away from the nearest obstruction. Let's look at an installation where the coolers need to be placed next to the building as in Figure 3-12.

Based on the information above, we are going to solve for the leg height that will provide an intake velocity of 500FPM. We know the following:

- The total airflow of the installation is 247,000CFM
- We have an intake perimeter of 3 sides 16ft, 16ft, and 25ft which totals 57'
- Our intake velocity guideline is 500FPM

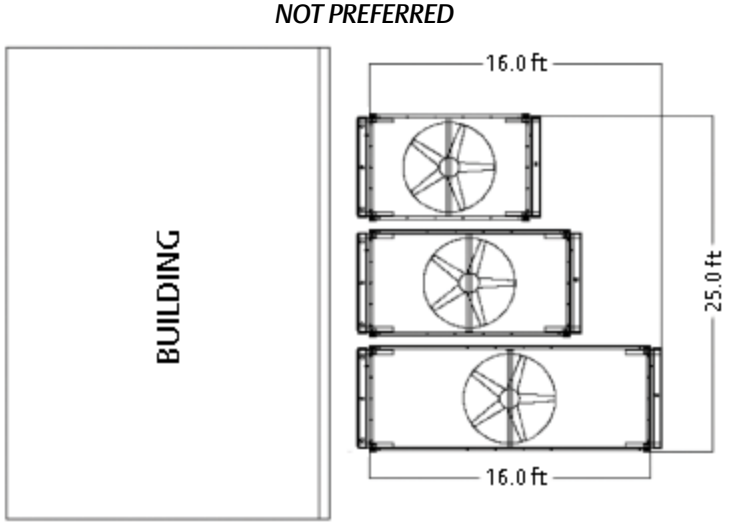
The equation used to calculate the leg height in Figure 3-11 is as follows:

Leg Height = (Total Airflow/Intake velocity)/Intake Perimeter

Leg Height = (247,000CFM/500FPM)/57ft

Leg Height = 8.667ft

We would round the leg height up to 9ft for this particular situation.



TOTAL INTAKE PERIMETER = 57 FEET

Figure 3-12. Installation of Coolers - Next to Building

Hot Air Recirculation

There are two situations where hot recirculation could occur.

- Intake velocity of the cooler is higher than the discharge velocity
- Environmental issues such as strong cross winds which is installation specific

We addressed how to minimize the opportunity for hot air recirculation involving the operation of the air coolers under the guidelines for the Free Flow section above. However, environmental hot air recirculation is something that is outside of the control of the cooler manufacturer. If the site has the potential for strong cross winds or tunneling then you may want to consider the following items to minimize the potential of hot air recirculation due to the environment.

- All air coolers should discharge at the same elevation.
- If feasible all of the air coolers in a common area should be placed as close to the next cooler as possible.

Unfortunately this comes with a cost. By reducing the intake perimeter available, the leg height increases, which is a cost. In addition there is no guarantee that hot air recirculation can be eliminated due to environmental issues.

Discharge Elevation

In order to minimize the potential for hot air recirculation, it is recommended to install the air coolers so that they all discharge at the same elevation. This is important because not all air coolers have the same plenum heights. You can satisfy the leg height requirements by the calculation above but not satisfy the requirements for discharge elevation. Based on the size of the coolers above, cooler 1 has a plenum height of 36", cooler 2 has a plenum height of 42", and cooler 3 has a plenum height of 54". Plenum heights are calculated from the standard of a 45 degree dispersion angle in API 661. If you would like more details on this calculation please contact engineering.

As you can see in Figure 3-13 in the not preferred configuration. The leg height requirement in the first calculation is satisfied. However, the coolers are not at the same discharge elevation. This could be an issue if there is a cross wind from left to right. Cooler 3 could block the discharge air flow from coolers 1 and 2 and recirculate it back down to the intake of the coolers. The best way to address this is to increase the leg heights on coolers 1 and 2 as shown in the preferred configuration.

This is especially critical if all of the air coolers are not place as close together as possible.

Cooler Placement and Spacing

The concern about cooler placement as far as proximity from one another has to do with the potential for hot air recirculation due to cross winds. Let's look at only having coolers 1 and 3 in the same area. The leg height requirement of cooler 1 is 3.23ft so we would use a 4ft leg height. The leg height requirement for cooler 3 is 4.61ft but we would put a 7 feet leg height on the cooler due to size and for serviceability. Figure 3-14 shows this installation.

In this case, if you get a strong cross wind from left to right there is the potential that the discharge coming from the top of cooler 1 could easily be pushed into the intake of cooler 3. Thus, in Figure 3-14, the not preferred configuration is more susceptible to the potential of hot air recirculation due to the environment and is not recommended. The preferred configuration is the recommended installation of the coolers with a space between them.

All of the information provided is a general guideline for installing multiple air coolers in a common area. If you minimally follow all of the Free Flow requirements and keep the air coolers discharging at the same elevation then you have a good basis for site layout.

Sometimes due to extenuating circumstances, the above guidelines cannot be followed. Please contact engineering to discuss remedies to accommodate different configurations.

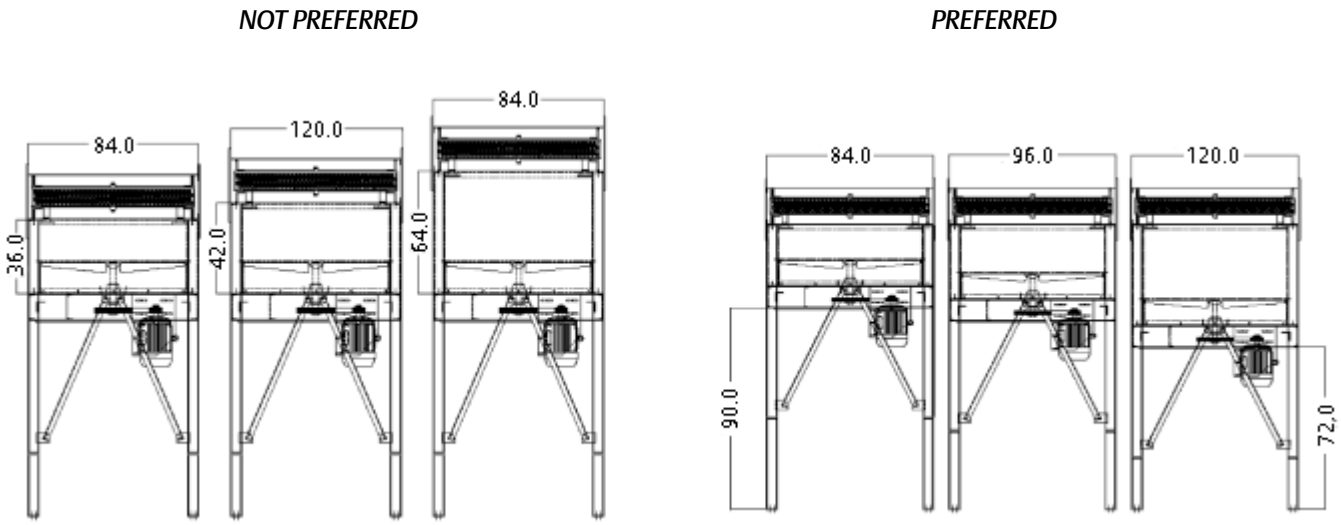


Figure 3-13. Discharge Elevation of Coolers

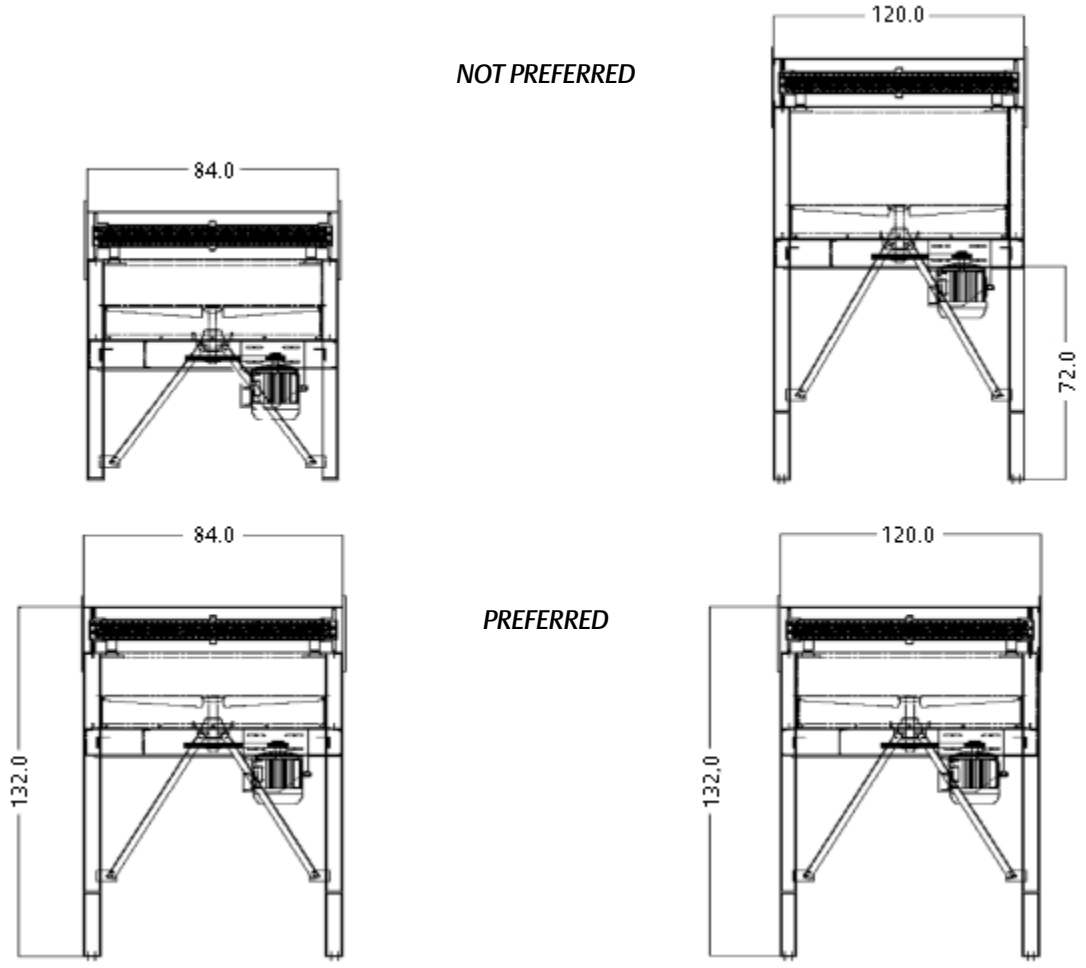


Figure 3-14. Cooler Placement and Spacing

Pressure Testing

CAUTION

Do not hydro test compressor unit. Failure to comply may result in damage to equipment.

CAUTION

The compressor unit along with other system units contain many components with various pressure ratings. Pressure relief protection provided considers the design pressure of a system components. Before replacing a pressure relief valve with a relief valve having a higher pressure setting, all system components must be evaluated for acceptability.

Pressure test in compliance with Chapter VI of the ASME B31.3 Process Piping Code.

Initial Oil Charging

Notice on Using Non-Vilter Oils

CAUTION

Do not mix oils. Failure to comply may result in damage to equipment.

NOTICE

Vilter does not approve non-Vilter oils for use with Vilter compressors. Use of oils not specified or supplied by Vilter will void the compressor warranty.

Due to the need for adequate lubrication, Vilter recommends only the use of Vilter lubricants, designed specifically for Vilter compressors. With extensive research that has been performed, we are able to offer gas compression lubricating oils. Use of oil not specified or supplied by Vilter will void the compressor warranty.

Please contact your local Vilter representative or the Home Office for further information.

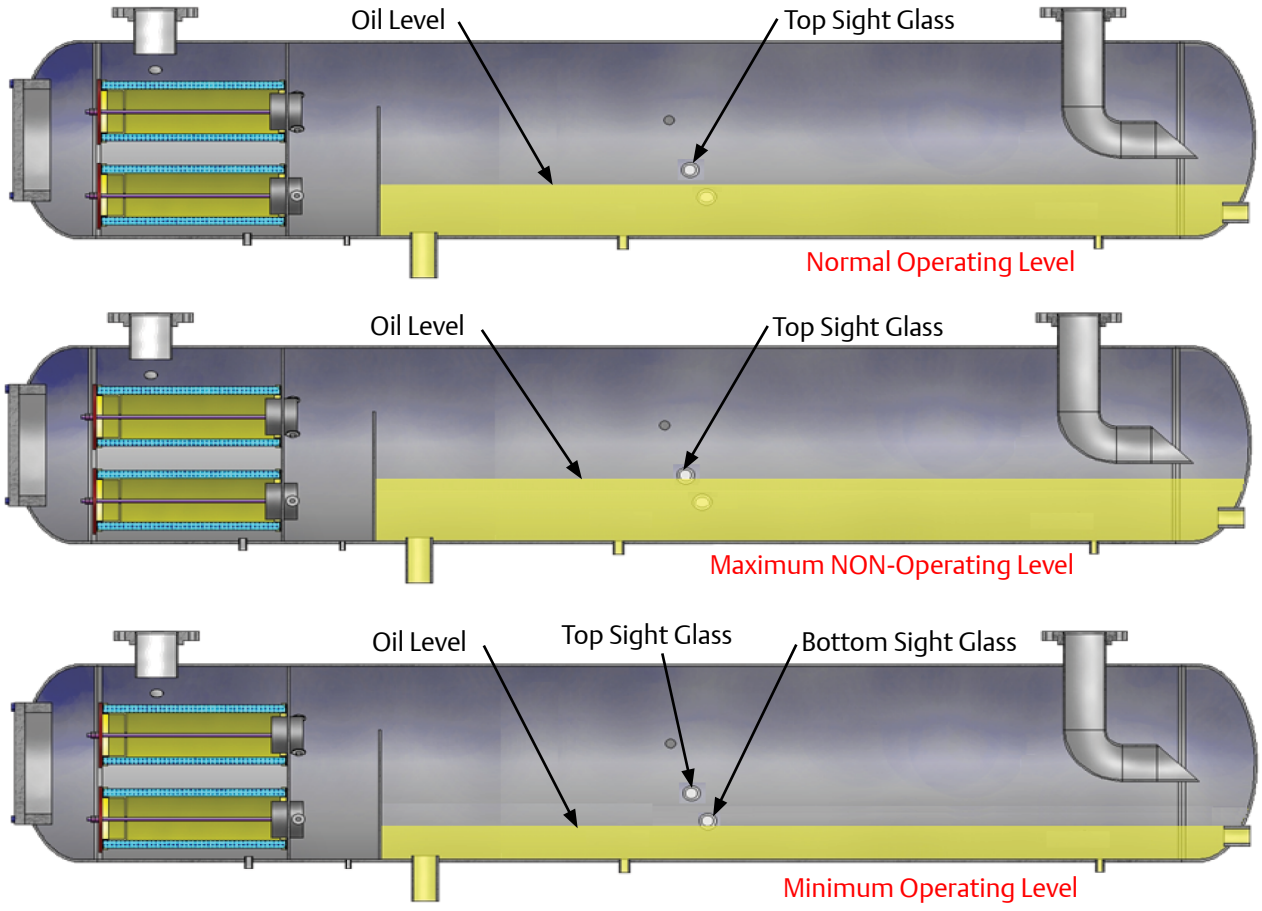


Figure 3-15. Oil Operating Levels

Unit Oil Charging and Priming

WARNING

Avoid skin contact with oil. Wear rubber gloves and a face shield when working with oil. Failure to comply may result in serious injury or death.

NOTICE

Failure to follow these instructions will result in bearing damage and compressor seizing and will void any and all warranties that may apply.

NOTICE

Always use an oil pump to charge the oil in the separator. While pulling the separator/compressor in a vacuum, never use the vacuum to pull the oil.

Typically, the compressor unit is shipped from Vilter with no oil charge. The normal operating level is between the two sight glasses on the oil separator, see Figure 3-15. Refer to supplied GA drawing for unit specific oil charge requirement.

For regular oil charging and draining procedures, see Section 5 Oil Charging.

Tool Required

- Oil Pump, Maximum 2-3 GPM with Motor approved for Division 1 or Division 2 and with ability to overcome suction pressure (VPN: A40849A).

(Reference Figure 3-17)

1. At initial start up, compressor unit must be off and depressurized prior to initial oil charging.
2. Using a properly selected oil pump, connect oil pump to oil separator drain valve (4) (for oil separator drain valve location, see Figure 3-16).
3. Open oil separator drain valve (4) and fill oil separator (3) to Maximum NON-Operating Level.
4. Once Maximum NON-Operating Level has been reached, shut off oil pump, close oil separator drain valve (4) and remove oil pump.
5. If equipped with remote oil cooler, refer to Priming Remote Oil Cooler and Piping procedure.

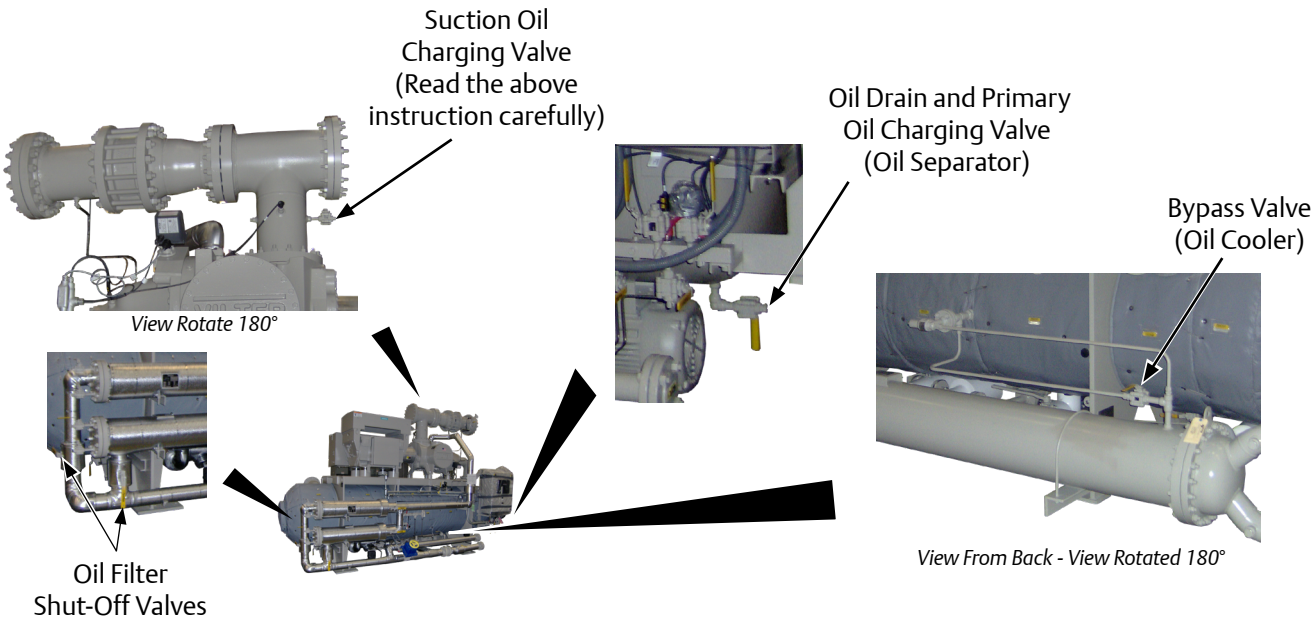


Figure 3-16. Suction Oil Charging Valve, Oil Cooler Drain Valve and Oil Filter Shut-Off Valves

Priming Oil Cooler (Shell and Tube) and Piping

If equipped with a shell and tube oil cooler, continue with the following steps:

6. Close shut-off valve (8) at oil filter inlet. Do the same for second oil filter, if equipped with dual oil filters. For shut-off valve location, see Figure 3-16.
7. Open oil bypass shut-off valve (5). For oil cooler bypass valve location, see Figure 3-16.
8. Energize compressor unit. The controller panel will energize the oil heaters.
9. Close oil mixing valve (oil temp. control valve) (7) via control panel. In Manual Mode, change "Manually Open (%)" value to "0".

NOTE

The oil cooler is considered primed when the oil level in the separator is constant.

10. Run the oil pump (6) twice for 1-2 minutes. Repeat this step until the oil level (9) is constant.

Priming Compressor and Oil Filters

NOTE

Running the compressor oil pump at this point will help lubricate the compressor bearings and shaft seal surfaces.

(Reference Figure 3-18)

11. Open shut-off valve(s) (8) at oil filter inlet(s).
12. Close oil bypass shut-off valve (5).
13. Open oil mixing valve (7) via control panel. In Manual Mode, change "Manually Open (%)" value to "100".
14. Run oil pump (6) for approximately 20 seconds only. Anytime you force the oil pump on the PLC will display the oil pressure.

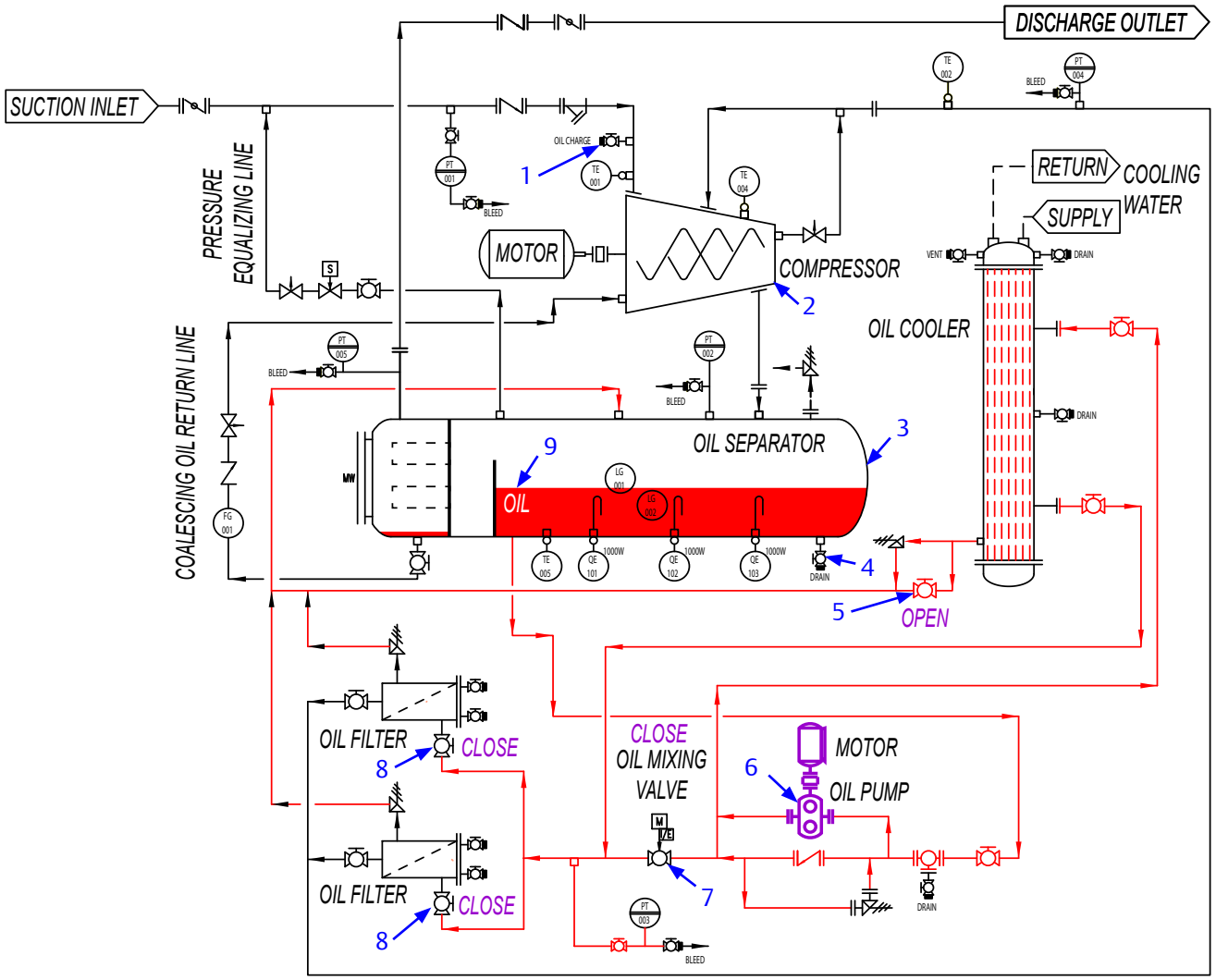


Figure 3-17. Priming Oil Cooler (Shell and Tube) and Piping

15. Stop oil pump (6) and wait for a minimum of 30 minutes. This will allow oil in the compressor (2) to drain and oil level (9) in oil separator (3) to settle.

NOTE

Oil mixing valve will remain in Manual Mode until it is changed to Auto Mode. For further details, see PLC Compact Logix manual.

16. Refer to Pre Start-Up Checklist and ensure all items are ready prior to starting the compressor.
17. When ready, run compressor unit and allow it to reach normal operating temperature.
18. If the unit needs additional oil, use a properly selected oil pump, connect oil pump to suction oil charging valve (1). For suction oil charging valve location, see Figure 3-16.
19. Open suction oil charging valve (1) and fill oil separator (3) to Normal Operating Level.
20. Once the Normal Operating Level has been reached, shut off the oil pump and close the suction oil charging valve (1). Disconnect and remove oil pump.

NOTE

Oil separator does not need to be filled again until oil level reaches Minimum Operating Level.

Every size of compressor will hold different amounts of oil, so amount of oil draining back into oil separator will vary.

21. More accurate fill levels can be accomplished by marking the level on the oil separator (3) after correct levels have been achieved during the unit operation and when the compressor unit has been down for 1 hour.

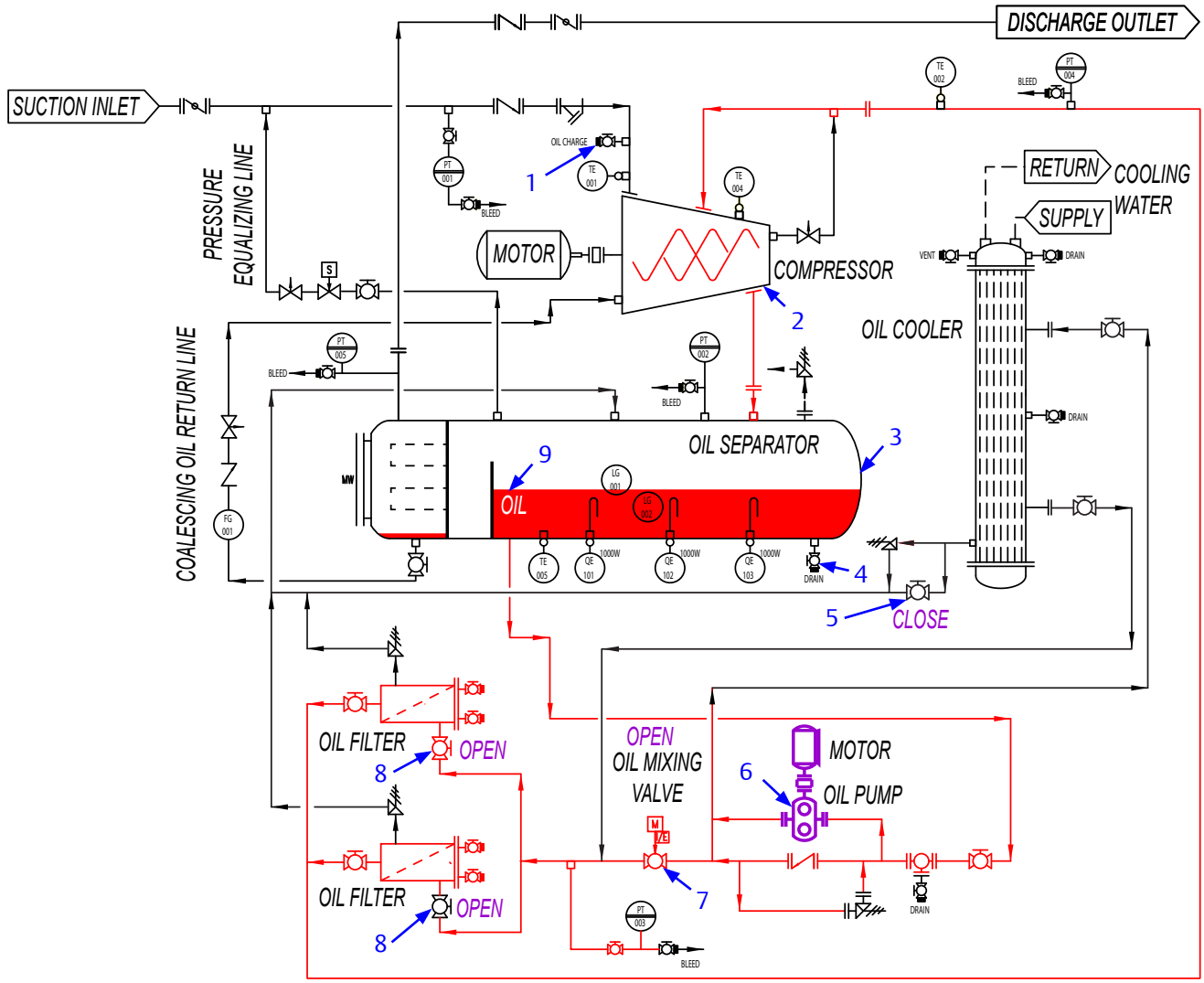


Figure 3-18. Priming Compressor (with Shell and Tube Oil Cooler) and Piping

Priming Remote Oil Cooler and Piping (Initial Oil Charging)

WARNING

Avoid skin contact with oil. Wear rubber gloves and a face shield when working with oil. Failure to comply may result in serious injury or death.

NOTICE

Failure to follow these instructions will result in bearing damage and compressor seizing and will void any and all warranties that may apply.

NOTE

This procedure is for remote oil coolers only.

Piping of oil must enter bottom connection of remote oil cooler and leave from top connection. For remote air cooled oil cooler piping, see Piping section.

(Reference Figure 3-19)

1. Verify oil level (8) is at Maximum Non-Operating Oil Level in separator (3). If oil level is not at Maximum Non-Operating Oil Level, add oil, see Initial Oil Charging - Unit Oil Charging procedure.
2. Close shut-off valve(s) (7) at oil filter inlet(s).
3. Open oil bypass shut-off valve (4).
4. Energize compressor unit.
5. Close oil mixing valve (oil temp. control valve) (6) via control panel. In Manual Mode, change "Manually Open (%)" value to "0".

NOTE

The oil cooler is considered primed when the oil level in the separator is constant.

6. Run oil pump (5) for a minimum of 5 minutes and as long as needed to purge all gas from oil cooler and piping.
7. When all gas is purged and/or the oil relief valves are actuated (will make noise), stop the oil pump.

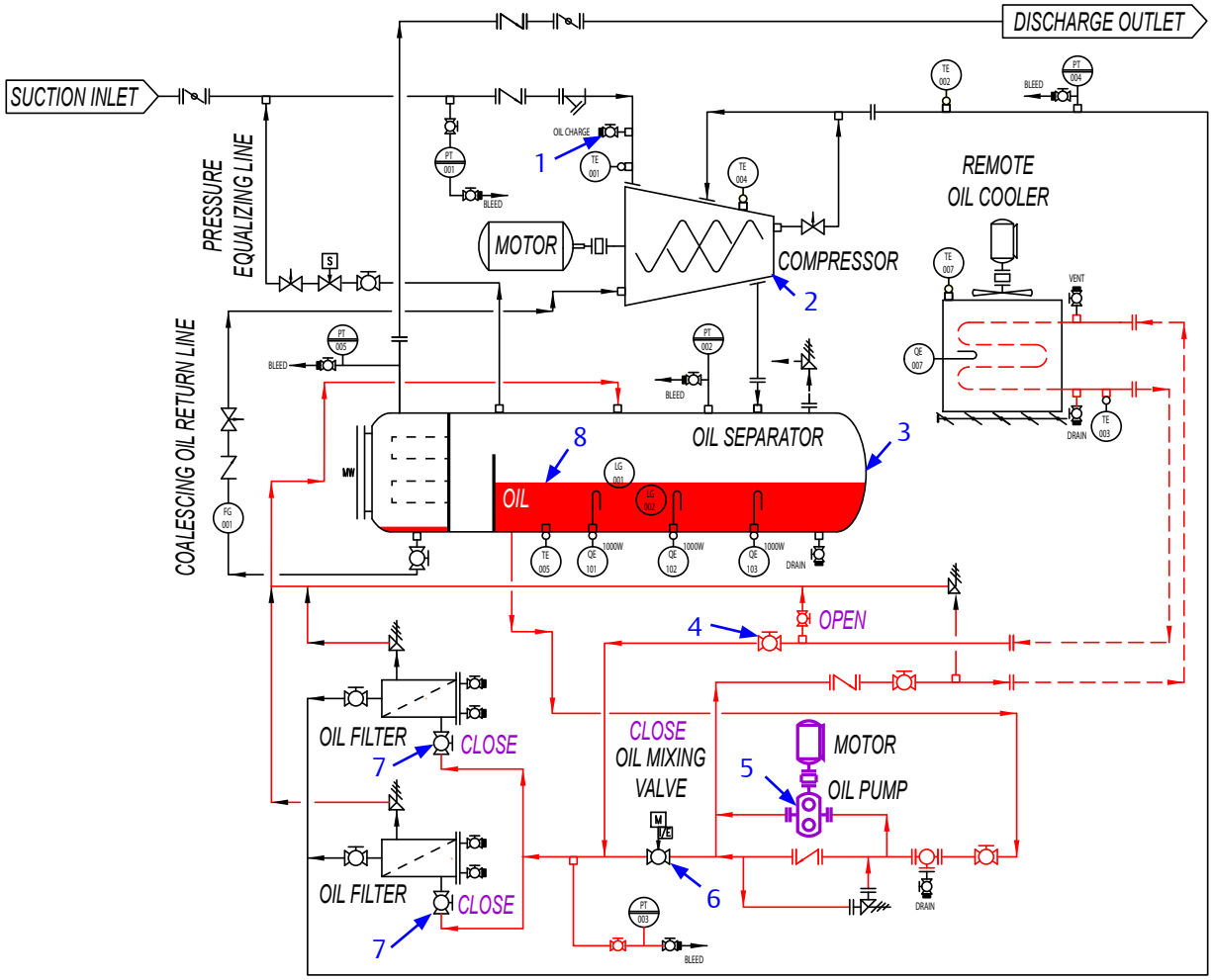


Figure 3-19. Priming Remote Oil Cooler and Piping

Priming Compressor and Oil Filters

NOTE

Running the compressor oil pump at this point will help lubricate the compressor bearings and shaft seal surfaces.

(Reference Figure 3-20)

8. Open shut-off valve(s) (7) at oil filter inlet(s).
9. Close oil bypass shut-off valve (4).
10. Open oil mixing valve (6) via control panel. In Manual Mode, change “Manually Open (%)” value to “100”.
11. Run oil pump (5) for approximately 20 seconds only.
12. Stop oil pump and wait for a minimum of 30 minutes. This will allow oil in the compressor (2) to drain and oil level (8) in separator (3) to settle.

NOTE

Oil mixing valve will remain in Manual Mode until it is changed to Auto Mode. For further details, see PLC Compact Logix manual.

13. Refer to Pre Start-Up Checklist and ensure all items are ready prior to starting the compressor.
14. When ready, run compressor unit and allow it to reach normal operating temperature.
15. If oil is needed use a properly selected oil pump, connect oil pump to suction oil charging valve (1). For suction oil charging valve location, see Figure 3-16.
16. Open suction oil charging valve (1) and fill oil separator (3) to Normal Operating Level.
17. Once the Normal Operating level has been reached, shut off the oil pump and close the suction oil charging valve (1). Disconnect and remove oil pump.

NOTE

Oil separator does not need to be filled again until oil level reaches Minimum Operating Level.

Every size of compressor will hold different amounts of oil, so amount of oil draining back into oil separator will vary.

18. More accurate fill levels can be accomplished by marking the level on the oil separator (2) after correct levels have been achieved during the unit operation and when the compressor unit has been down for 1 hour.

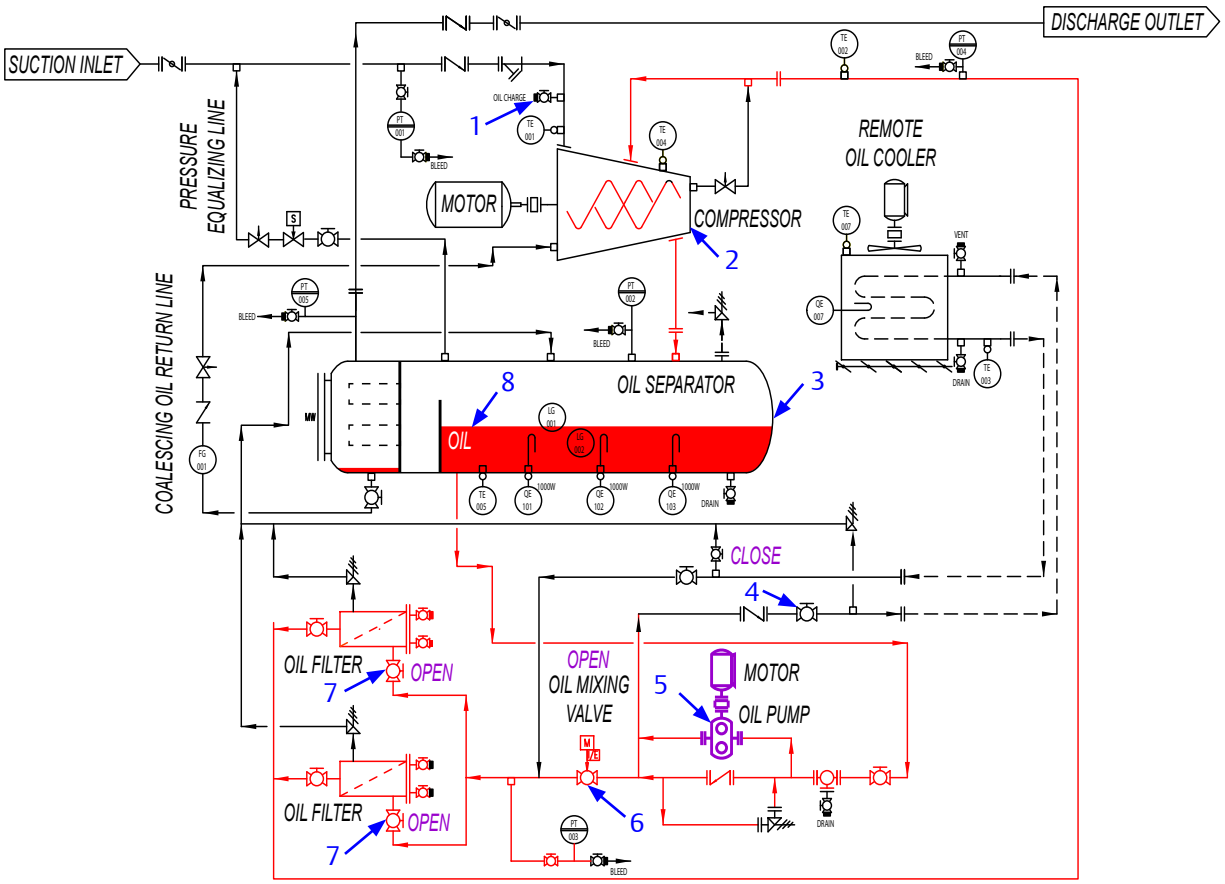


Figure 3-20. Priming Compressor and Oil Filters

Pre Start-Up

The following check list is to help prepare the equipment before the Vilter technician arrives at the jobsite. Vilter recommends that a trained technician go through the following tasks. The operating manuals provided by Vilter can be referenced for any type of questions or special instructions.

NOTICE

Each item below must be checked-off, signed and returned to Vilter Service Department. Failure to do so will "Null & Void" future warranty considerations.

Pre Start-Up Checklist

Name (Please Print): _____ Signature: _____

Company: _____ Vilter Sales Order Number: _____

Equipment Description: _____ Date (M/D/Y): _____

☐ 1. Confirm receipt of the digital IOM Manual, Submittal Drawings, and Spare Parts list.

☐ 2. Verify that all unit components & parts have been received per the packing slip & bill of lading. Check entire unit for visible damage – especially tubing, instrumentation, piping. Record any damage with pictures and inform Vilter within 10 days.

☐ 3. Verify that all units have Nitrogen charge. Add Nitrogen if charge is lost in transit, and report.

☐ 4. Ensure all rotating equipment is rotated according to manufacturer's specifications while in storage and during construction. Keep any long-term storage logs available for review by startup technician.

☐ 5. Verify unit is leveled, grouted, and secured to the mounting pad. Refer to the GA drawings for mounting specifications.

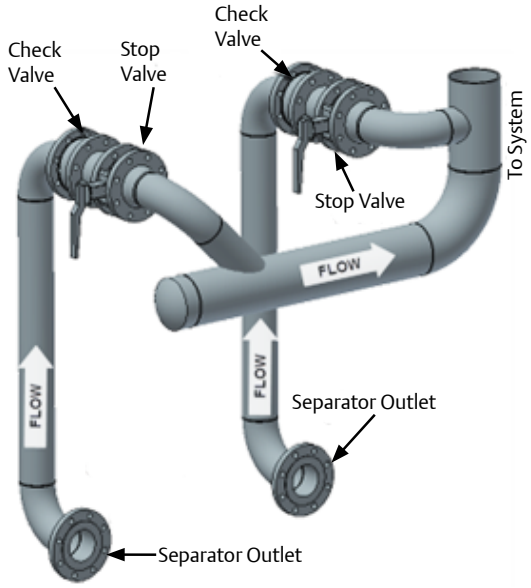
☐ 6. Proper electric supply and grounding need to be supplied to the unit. All power and control lines should be wired to unit per the supplied electrical drawings. Electric supply to be verified at each device requiring power.

☐ 7. Verify that all level switches are hardwired to the proper terminals in the controllers per the supplied electrical drawings.

☐ 8. The suction and discharge line must be piped and properly supported independent of the unit. Refer to the T-sheet for pipe load.

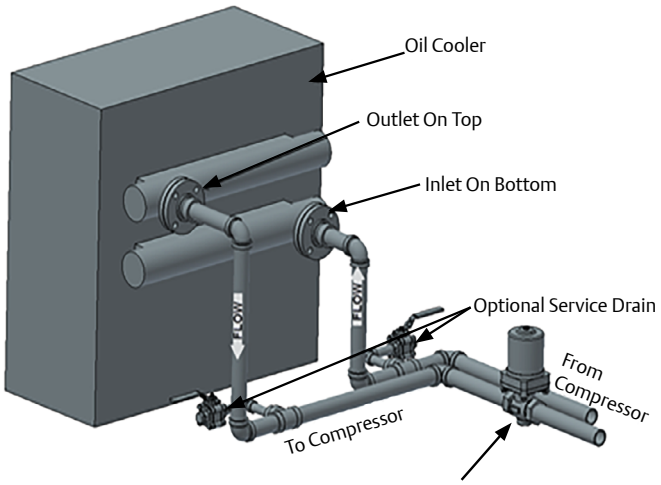
☐ 9. The discharge stop & check valve is shipped loose and must be installed. During off periods, liquid can condense in the line downstream of the discharge stop & check valve. It is recommended that the stop & check valve be located above the discharge header in a horizontal run to minimize the quantity of liquid that can accumulate downstream of the check (Illustration on next page. Refer to T-Sheet for air-cooled oil cooling).

(Continued on next page)



☐ 10. A dual safety relief valve is shipped loose for field installation. A connection is provided on the oil separator for the relief valve. Refer to ASME Code for proper sizing of relief valves and vent lines.

☐ 11. On air-cooled oil coolers, the oil lines from the compressor must be connected to the air-cooled oil cooler. Oil cooler fans will need to be wired and checked for proper rotation at startup. Refer to supplied GA drawing for connection points and piping sizes. (Illustration below, refer to T-Sheet for air-cooled oil cooling).



☐ 12. The oil separator should be charged with correct oil to the Maximum NON-Operating Level. Please note: additional oil will likely need to be added during startup when the oil circuit cycles.

☐ 13. Both the compressor and motor hubs should be checked for concentricity and perpendicularity.

☐ 14. The motor should be checked and shimmed for a soft foot prior to attempting alignment.

☐ 15. Verify motor has been lubricated per motor manufacturer recommendations. Proper re-lubrication amounts/types are found on the motor's lubrication plate or motor manual. These instructions must be closely followed to avoid premature failure of bearings and motor.

- [ ] 16. The center member of the compressor is shipped loose and should be left out to allow motor rotation check at the time of commissioning. However, the center member should be temporarily fitted to perform cold alignment ONLY, and then remove again.

- [ ] 17. Verify that all valves are in the open or designated position. Follow the P&ID drawings for guidelines.

- [ ] 18. If equipped, verify that the visual indicator on the Oil Temperature Control Valve (Oil Mixing Valve) position corresponds with "% OPEN" on the control panel. CLOSE position is 0% OPEN, OPEN position is 100% OPEN.

- [ ] 19. The unit should be pressure tested to check for leaks and purged with an acceptable dry gas. Do not pressurize from the suction end of the compressor, as this will drive the compressor in a forward motion without lubrication and may cause damage.

- [ ] 20. Arrange for a qualified electrician to be present on-site and available during Vilter startup visit.

- [ ] 21. Motor heaters need to be energized for a minimum of 48 hours before startup.

- [ ] 22. Recommended tools available per IOM manual (Refer to Installation Section 3).

- [ ] 23. Full operating load available for start-up activities.

Clear Form

Start-Up

The following check list is to help verify and check equipment prior to start-up. This is the responsibility of the Vilter Technician.

- ☐ 1. Review Pre Start-Up checklist.
- ☐ 2. Check oil pump rotation. This can be done by using the “Diagnostic Force Outputs” from Main Menu. Refer to Compact Logix PLC Software Manual.
- ☐ 3. Check compressor motor rotation (CCW or CW rotation facing compressor shaft). This can be done by using the “Diagnostic Force Outputs” from Main Menu. Refer to Compact Logix PLC Software Manual.
- ☐ 4. Cold and hot alignment. Verify with manufacturer’s limits.
- ☐ 5. Verify capacity slide calibration and correct command shaft rotation, even though it is factory calibrated.
- ☐ 6. Verify volume slide calibration and correct command shaft rotation, even though it is factory calibrated.
- ☐ 7. Check motorized oil mixing valve for proper setup.
- ☐ 8. Starter set up by vendor technician.
- ☐ 9. Blower set up by vendor technician.
- ☐ 10. Verify correct direction of flow for the oil line check valve.
- ☐ 11. Run oil pump to pre-lube the compressor (oil level in the oil separator should drop as lines are filled).
- ☐ 12. Calibrate transmitters to atmosphere.
- ☐ 13. Verify operation of all safeties.
- ☐ 14. Set scaling for main motor amps in PLC.
- ☐ 15. Record running data and final set points on data sheets.
- ☐ 16. Instruct Operators.

Clear Form

Notice on Using Non-Vilter Oils

CAUTION

Do not mix oils. Failure to comply may result in damage to equipment.

NOTICE

Vilter does not approve non-Vilter oils for use with Vilter compressors. Use of oils not specified or supplied by Vilter will void the compressor warranty.

Due to the need for adequate lubrication, Vilter recommends only the use of Vilter lubricants, designed specifically for Vilter compressors. With extensive research that has been performed, we are able to offer gas compression lubricating oils. Use of oil not specified or supplied by Vilter will void the compressor warranty.

Please contact your local Vilter representative or the Home Office for further information.

Operation

All operation (setpoint adjustments, calibrations, monitoring) of the compressor unit is done through the Compact Logix PLC. For additional procedural information, refer to Compact Logix PLC Software Manual (35391CM).

Oil Inspection

WARNING

When working with LFG, NG or other dangerous/ flammable gases, ensure there are adequate ventilation and vapor detectors. Refer to national fire and building codes. Failure to comply may result in serious injury or death.

WARNING

Avoid skin contact with any condensate or oil. Wear rubber gloves and a face shield when working with condensate or oil. Failure to comply may result in serious injury or death.

Inspect oil level through sight glasses on the oil separator, see Figure 4-1. Oil Operating Levels. Drain or fill oil as required. For Oil Draining and filling procedures, refer to Section 5 Oil Draining.

Dual Oil Filters

On compressor units equipped with dual oil filters, only one filter should be in operation at a time.

NOTE

During operation, both oil filter outlet shut-off valves should be open. This will help minimize the sudden loss of oil pressure when switching between oil filters for servicing.

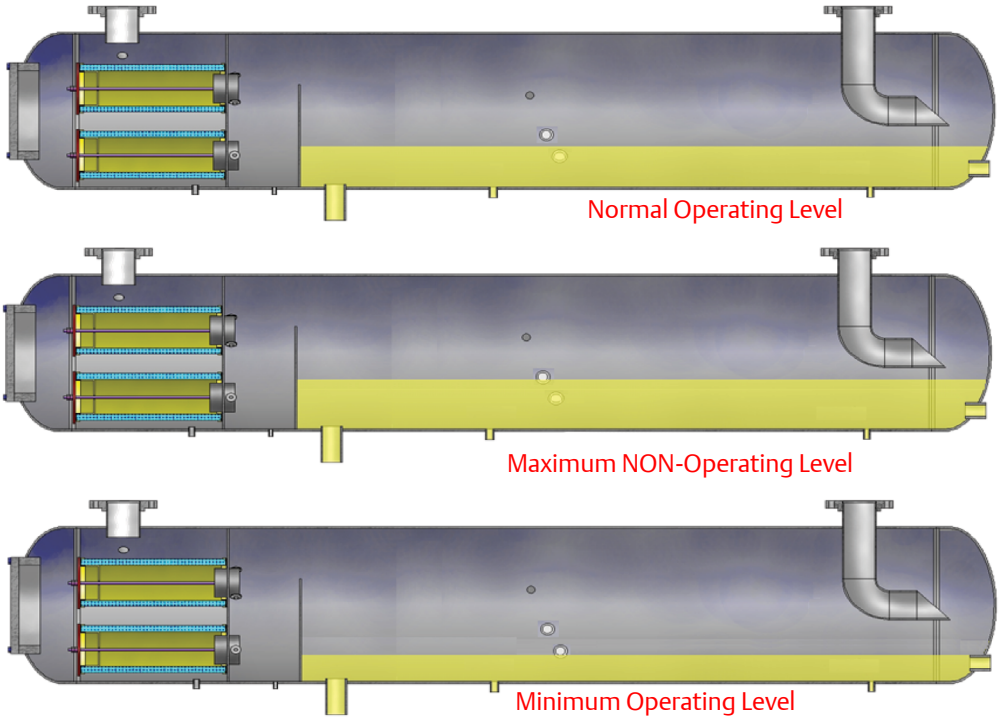


Figure 4-1. Oil Operating Levels

For further details, refer to Oil Filter Replacement in Section 5.

Control System

Calibration

Equipped for automatic operation, the screw compressor unit has safety controls to protect it from irregular operating conditions, an automatic starting and stopping sequence, capacity and volume ratio control systems.

Check all pressure controls to assure that all safety and operating control limits operate at the point indicated on the microprocessor.

The unit is equipped with block and bleed valves that are used to recalibrate the pressure transmitters. To use the block and bleed valves to recalibrate the pressure transmitters, the block valve is shut off at the unit and the pressure is allowed to bleed off by opening the bleed valve near the pressure transmitter enclosure. The transmitter can then be calibrated at atmospheric pressure (0 psig), or an external pressure source with an accurate gauge may be attached at the bleed valve.

The discharge pressure transmitter cannot be isolated from its pressure source. Hence, it is equipped with only a valve to allow an accurate pressure gauge to be attached and the pressure transmitter calibrated at unit pressure.

Recheck the transmitters periodically for any drift of calibration, refer to Table 5-1. Maintenance/Service Schedule in Section 5.

Starting, Stopping and Restarting The Compressor

Starting

Before the screw compressor unit can start, certain conditions must be met. All of the safety setpoints must be set appropriately, and differential pressure setpoint between suction and discharge should be accomplished. When “Unit Start” button in the start menu is pressed, the oil pump will start first. When sufficient oil pressure has built up and the compressor capacity control and volume ratio slide valves are at or below 5%, the compressor unit will start.

NOTE

The amount of oil pressure that needs to be achieved before compressor start is at least the minimum prelube pressure above setpoint set in the HMI. For additional information on Low Oil Pressure at Start, see Table 6-4. Compressor Troubleshooting Guide - General Problems & Solutions (1 of 3) in Section 6.

If the compressor is in the automatic mode, it will now load and unload in response to the system demands.

Stopping/Restarting

Stopping the compressor unit can be accomplished in a number of ways. Any of the safety setpoints will stop the compressor unit if an abnormal operating condition exists. The compressor unit stop button will turn the compressor unit off. If any condition turns the compressor unit off, the slide valve motors will drive the slide valves back to 5% or below. If the auto start option is selected (see Compact Logix PLC manual), the compressor unit will start up after a waiting period. With both options, the compressor slide valves must return below their respective 5% limits before the compressor unit can be restarted.

NOTE

An anti recycle timer will be activated for 20 minutes (to allow the compressor unit to equalize to suction pressure) between pre-lubing or pushing the start button.

Emergency Shutdown

Emergency shutdown is initiated by the following:

1. A shutdown or trip condition of a process variable while the system is in operation. If a process variable reaches a high-high or low-low shutdown setpoint, the compressor unit will automatically stop. A shutdown alarm is also generated on the control panel HMI screen annunciating the specific process variable trip condition.
2. The local emergency push button is located in front of the PLC control panel enclosure. When the local emergency shutdown push button is active, the compressor shutdown and energy to PLC outputs are taking it out. Also, the compressor capacity and volume slide valve will stay in their last position until the unit is powered up. Once recovery has been accomplished, the local emergency shutdown push button must be pulled and “compressor control power on” button in front of panel enclosure should be pushed.

Slide Valve Actuator Calibration (25972XP)

The slide calibration screen allows the user to calibrate slide valve actuators.

Slide Calibration Screen Overview

- To calibrate slides, log in as “MGR”.
- Press “Enter Slide Calibration” To Activate Slide Calibration Mode, see Figure 4-2 and Figure 4-3. (Machine MUST be stopped to enter slide calibration mode. Machine will not be allowed to start if slide calibration is active.)
- Up/down push-buttons move slide actuators.
- The screen indicates the correct rotation of the slide valve command shaft.

Both the capacity and volume slide actuators should be calibrated when one or more of these have occurred:

- Compressor unit starting up for the first time.
- A new actuator motor has been installed.
- There is an error code flashing on the actuator’s circuit board - an attempt to recalibrate should be made.
- The range of travel is not correct, and the command shaft travel is physically correct.
- The compressor is pulling high amperage, the calibration of the volume slide should be checked.
- An actuator does not unload below 5%, or an actuator that doesn’t move.

Calibrate Slide Valve Actuators (25972XP)

Slide valve actuators must be installed prior to calibration. Refer to Slide Valve Actuator Installation procedure. The following steps pertain to calibrating one slide valve actuator. Repeat procedure to calibrate the other slide valve actuator.

WARNING

After stopping the compressor, allow the compressor and surrounding components to cool down prior to servicing. Failure to comply may result in serious injury.

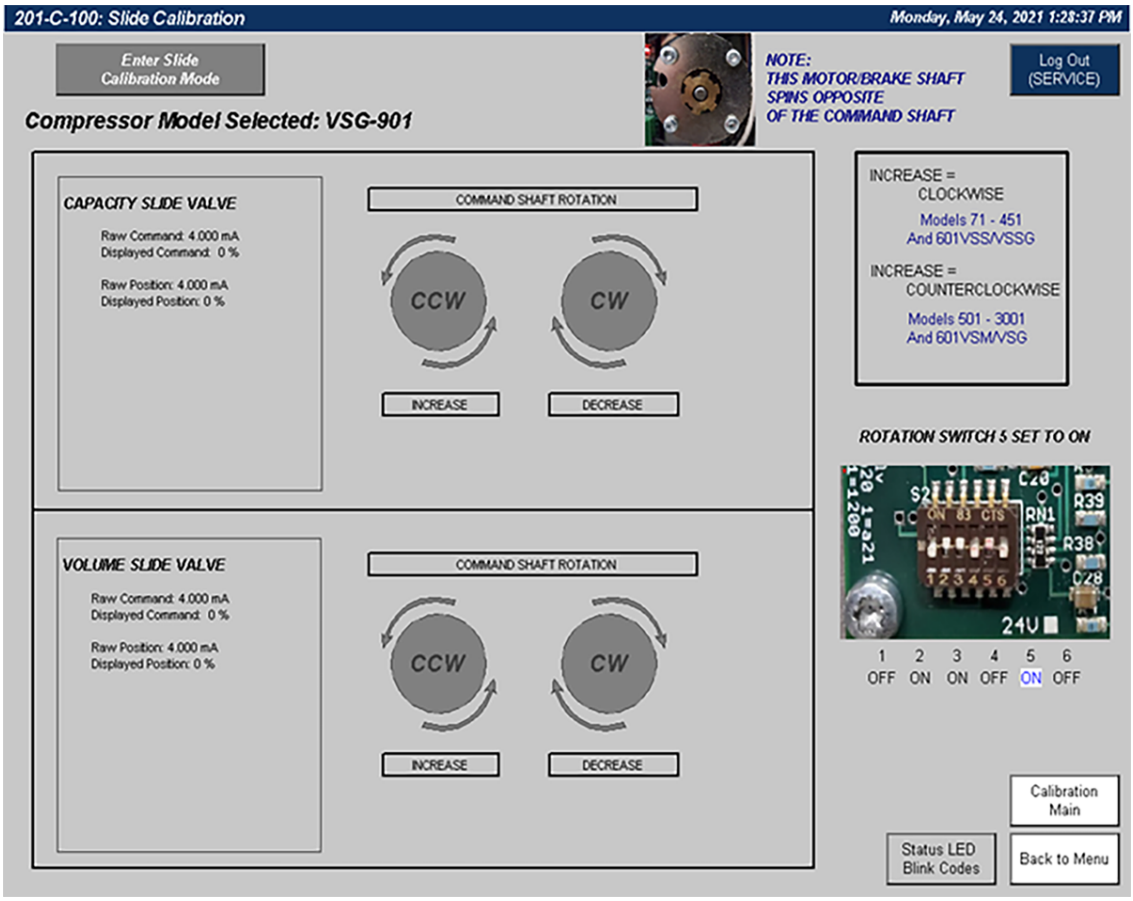


Figure 4-2. Slide Calibration Screen (Not in Calibration Mode)

To calibrate actuators, proceed with the following steps:

1. Stop compressor unit and allow to cool.
2. Remove screws securing actuator cover to actuator assembly. See Figure 4-4 for reference.
3. Carefully lift actuator cover from actuator assembly.
4. From main screen:
   - Press Main Menu > Instrument Calibration > Calibrate Slides
5. Check that dip switches are in the right position according to what is showed in the calibration screen.
6. Logging on with high-level access (MGR or SUPER) will prompt the Calibrate button to appear on Instrument Calibration Overview screen.
7. Enter Calibration mode in the screen by pressing the button “Enter Slide Calibration Mode”. See Figure 4-3.
8. In the calibration screen press the button labeled “Auto Calibrate Capacity” or “Auto Calibrate Volume”, depending on which slide valve you want to calibrate, this, places the actuator in calibration mode. The red LED will begin flashing. Calibration can also be done alternative by pressing the blue push button on the actuator for more than 2.5 seconds and then release it.

NOTE

Now the current “Capacity” or the current “Volume” value will be displayed on the Main screen and Slide Calibration screen.

NOTE

When automatic calibration is initiated, the actuator determines the span by moving CCW and then CW until the calibration torque thresholds are reached and then backing off from these limits by three degrees.

CAUTION

The actuator will not respond to set point input until it is calibrated. When the actuator is not calibrated the status LED displays the not calibrated blink code.

The actuator cannot be brought into automatic calibration mode if it has shut down on over-temperature. Once the actuator has cooled to where its temperature is below the threshold, then it can be calibrated.

9. Gently install the cover over the top of the actuator to where it contacts the base and O-ring seal.

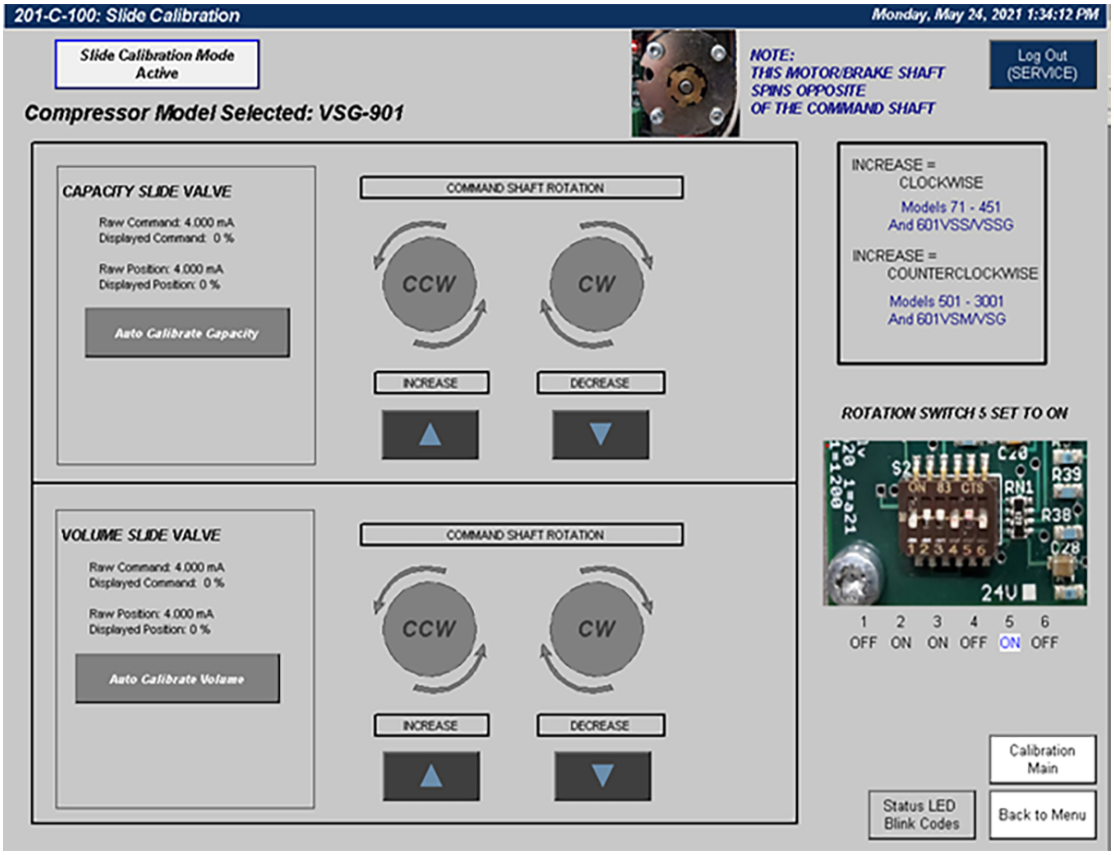


Figure 4-3. Slide Calibration Screen (In Calibration Mode)

CAUTION

Do not over tighten screws. Failure to comply may result in damage to equipment.

10. Check and make sure the cover is seated properly, then gently tighten the screws.
11. Repeat procedure to calibrate other slide valve actuator.
12. Once you finish calibration, press "Slide Calibration Mode Active" button to complete calibration and exit the slide calibration mode. Once you exit calibration mode, the screen should look as in figure 4-2.

The controller will automatically energize the actuator and drive it back to its minimum position (5% or below) for pre-start-up.

Figure 4-4. Actuator Inside

Figure 4-5. Rotation Check. Motor/Brake Shaft Spins Opposite of the Command Shaft

Slide Valve Actuators Calibration (For VPN 25972D Only)

Slide valve actuators must be installed prior to calibration. Refer to Slide Valve Actuator Installation procedure. The following steps pertain to calibrating one slide valve actuator. Repeat procedure to calibrate other slide valve actuator.

WARNING

After stopping the compressor, allow the compressor and surrounding components to cool down prior to servicing. Failure to comply may result in serious injury.

CAUTION

Do not calibrate in direct sunlight. Failure to comply may result in damage to equipment.

Both the capacity and volume slide actuators should be calibrated when one or more of these have occurred:

- Compressor unit starting up for the first time.
- A new actuator motor has been installed.
- There is an error code flashing on the actuator's circuit board - an attempt to recalibrate should be made.
- The range of travel is not correct and the command shaft travel is physically correct.
- The compressor is pulling high amperage, the calibration of the volume slide should be checked.
- An actuator does not unload below 5%, or an actuator that doesn't move.

To calibrate optical actuators, continue with the following steps:

CAUTION

If the compressor unit is starting up for the first time or a new actuator motor has been installed, leave the power cable and position transmitter cable disconnected until step 7.

1. Stop compressor unit and allow to cool.
2. Remove screws securing actuator cover to actuator assembly. See Figure 4-6 for reference.

CAUTION

Wires are attached to the connector on the actuator cover. Handle actuator cover with care to prevent damage to wires. Failure to comply may result in damage to equipment.

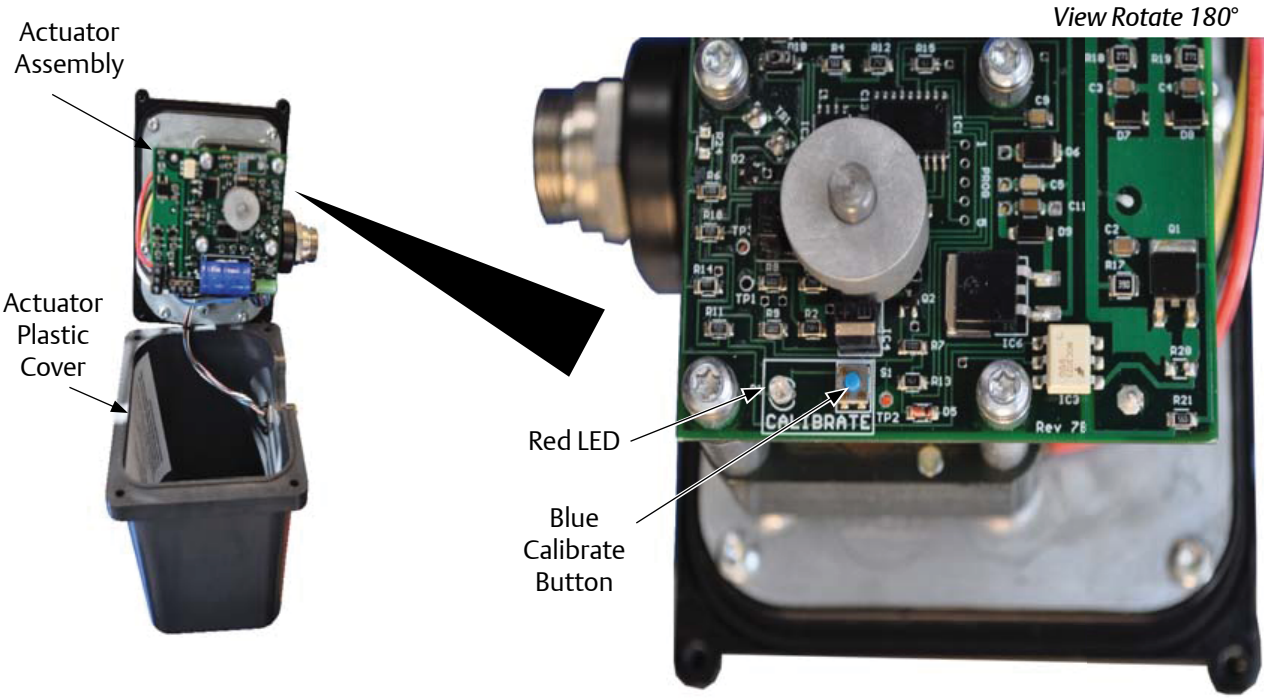


Figure 4-6. Actuator Assembly

3. Carefully lift actuator cover from actuator assembly and tilt towards Turck connectors. Raise cover high enough to be able to press the blue calibration button and be able to see the red LED on the top of assembly.
4. On the main screen of the PLC, press “Menu”, then “Instrument Calibration” button to enter the instrument calibration overview screen, then press “Calibrate Slides” button to enter the slide calibration screen, see Figure 4-7.
5. Logging on with high-level access will prompt the “Enter Slide Calibration Mode” button to appear.
6. Press “Enter Slide Calibration Mode” button to initiate calibration mode. The Slide Calibration button turns green and Set Max and Set Min buttons appear, see Figure 4-8.
7. If the compressor unit is starting for the first time or a new actuator was installed, connect connectors of power cable and position transmitter cable to new actuator.

NOTE

If the UP (increase) and DOWN (decrease) buttons do not correspond to increase (INC) or decrease (DEC) shaft rotation, swap the blue and brown wires of the “power cable” in the control panel. This will reverse the rotation of the actuator/command shaft.

8. Press UP or DOWN to move the slide valve and check for the correct rotation, see Table 4-1.

NOTE

When the actuator is in calibration mode, it outputs 0V when the actuator is running and 5V when it is still. Thus, as stated earlier, the actuator voltage will fluctuate during calibration. After the actuator has been calibrated, 0V output will correspond to the minimum position and 5V to the maximum position.

9. Quickly press and release the blue push button on the actuator one time. This places the actuator in calibration mode. The red LED will begin flashing rapidly.

CAUTION

DO NOT CONTINUE TO ENERGIZE THE ACTUATOR MOTOR AFTER THE SLIDE HAS REACHED THE MECHANICAL STOP. Doing so may cause mechanical damage to the motor or shear the motor shaft key. When the slide has reached the mechanical stop position, press down on the photo-chopper to release the brake, and thereby release the tension on the actuator motor.

NOTE

The “Slide calibration” screen on the Control Panel has a “Current” window, which displays twice the actuator output voltage. This value, (the % volume and the % capacity) displayed in the “Current Vol” and “Current Cap” Windows are meaningless until calibration has been completed.

10. Use the DOWN button on the control panel to drive the slide valve to its minimum “mechanical stop” position. Release the DOWN button when the slowing of the motor rotation and a winding sound from the actuator motor is noted.
11. Press down on the photo-chopper shaft to disengage the brake, releasing tension from the motor mount, see Figure 4-9. Hold the UP button for no more than 3 seconds to pulse the actuator to where the slide is just off of the mechanical stop and there is no tension on the motor shaft.
12. Quickly press and release the blue button on the actuator again. The red LED will now flash at a slower rate, indicating that the minimum slide valve position (zero position) has been set.

NOTE

Now the actuator is ready for calibrating to maximum position.

13. Use the UP button on the control panel to drive the slide to its maximum “mechanical stop” position. Release the UP button when the slowing of the motor rotation and a winding sound from the actuator motor is noted.
14. Press down on the photo-chopper shaft to disengage the brake, releasing tension from the motor mount. Hold the DOWN arrow button for no more than 3 seconds to pulse the actuator to where the slide is just off of its mechanical stop and there is no tension on the motor shaft.
15. Quickly press and release the blue button on the actuator one more time. The red LED will stop flashing. The actuator is now calibrated and knows the minimum and maximum positions of the slide valve it controls.
16. Gently lower the plastic cover over the top of the actuator to where it contacts the base and O-ring seal.

CAUTION

Do not over tighten screws. Failure to comply may result in damage to equipment.

17. Check and make sure the cover is seated properly, then gently tighten the four #10 screws.

18. Press the Slide Calibration button to complete calibration. The controller will automatically energize the actuator and drive it back to its minimum position (below 5%) for pre-start-up.

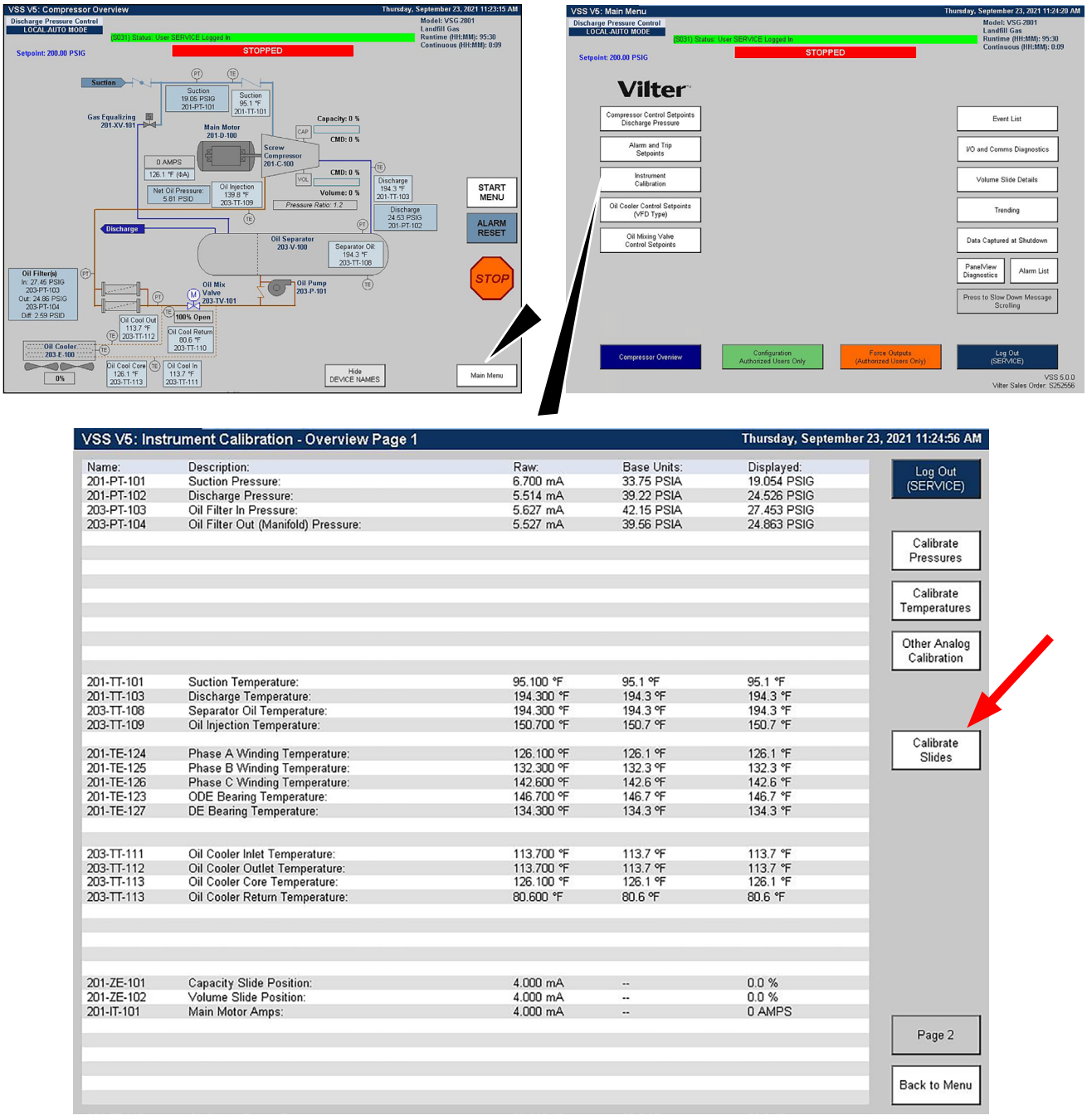
NOTE

Now the "Current Cap" or the "Current Vol" value will be displayed in the window on the "Main" screen and the "Slide Calibration" screen.

19. Repeat procedure to calibrate other slide valve actuator.

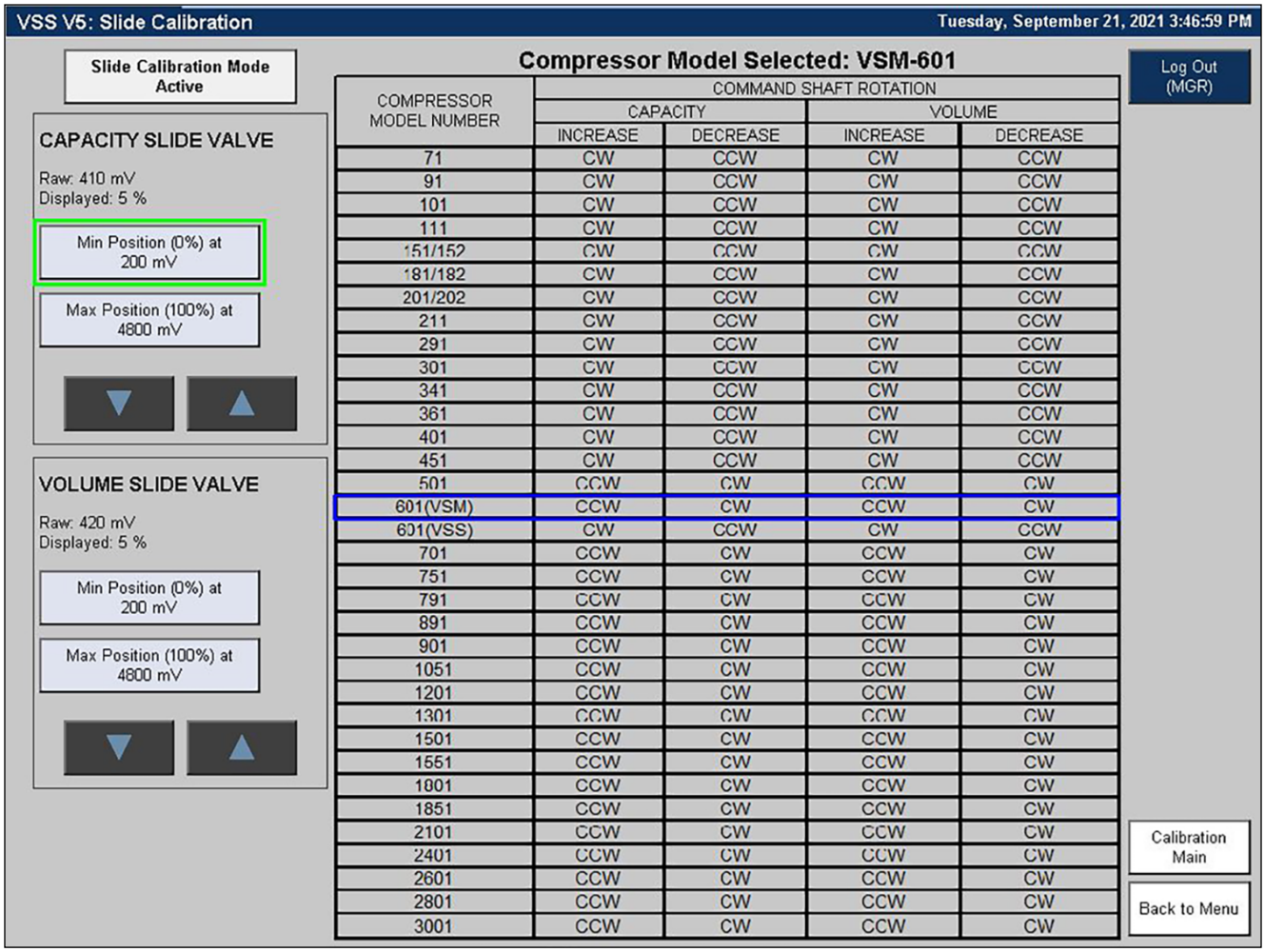
NOTE

The default settings for minimum millivolts is 200 mV and maximum is 4800 mV. See Figure 4-8.



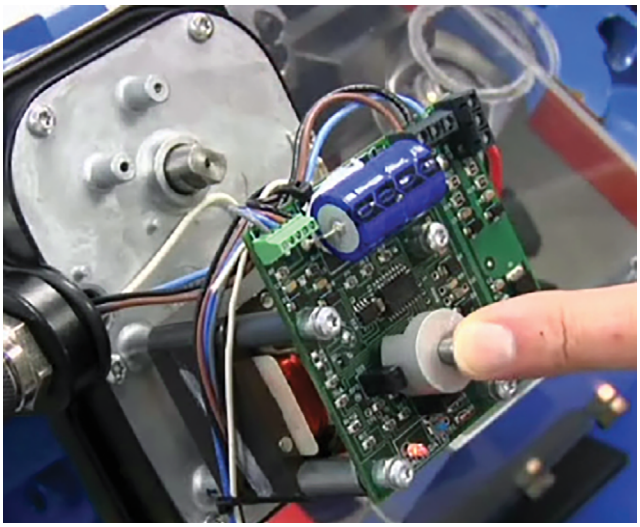
Name:	Description:	Raw:	Base Units:	Displayed:
201-PT-101	Suction Pressure:	6.700 mA	33.75 PSIA	19.054 PSIG
201-PT-102	Discharge Pressure:	5.514 mA	39.22 PSIA	24.526 PSIG
203-PT-103	Oil Filter In Pressure:	5.627 mA	42.15 PSIA	27.453 PSIG
203-PT-104	Oil Filter Out (Manifold) Pressure:	5.527 mA	39.56 PSIA	24.863 PSIG
201-TT-101	Suction Temperature:	95.100 °F	95.1 °F	95.1 °F
201-TT-103	Discharge Temperature:	194.300 °F	194.3 °F	194.3 °F
203-TT-108	Separator Oil Temperature:	194.300 °F	194.3 °F	194.3 °F
203-TT-109	Oil Injection Temperature:	150.700 °F	150.7 °F	150.7 °F
201-TE-124	Phase A Winding Temperature:	126.100 °F	126.1 °F	126.1 °F
201-TE-125	Phase B Winding Temperature:	132.300 °F	132.3 °F	132.3 °F
201-TE-126	Phase C Winding Temperature:	142.600 °F	142.6 °F	142.6 °F
201-TE-123	ODE Bearing Temperature:	146.700 °F	146.7 °F	146.7 °F
201-TE-127	DE Bearing Temperature:	134.300 °F	134.3 °F	134.3 °F
203-TT-111	Oil Cooler Inlet Temperature:	113.700 °F	113.7 °F	113.7 °F
203-TT-112	Oil Cooler Outlet Temperature:	113.700 °F	113.7 °F	113.7 °F
203-TT-113	Oil Cooler Core Temperature:	126.100 °F	126.1 °F	126.1 °F
203-TT-113	Oil Cooler Return Temperature:	80.600 °F	80.6 °F	80.6 °F
201-ZE-101	Capacity Slide Position:	4.000 mA	--	0.0 %
201-ZE-102	Volume Slide Position:	4.000 mA	--	0.0 %
201-IT-101	Main Motor Amps:	4.000 mA	--	0 AMPS

Figure 4-7. Overview, Main Menu and Instrument Calibration Screens (Compact Logix PLC)



Screen colors inverted for ease of reading.

Figure 4-8. Slide Calibration Screen (Compact Logix PLC)



Press down on Photo-chopper to release tension from motor shaft.

Figure 4-9. Photo-chopper

Table 4-1. Command Shaft Rotation Specifications*

Compressor Model	Command Shaft Rotation				No. of Turns/Rotation			Angle/Slide Travel		
	Capacity		Volume		Capacity			Volume		
	INC	DEC	INC	DEC	Turns	Degrees	Travel	Turns	Degrees	Travel
VSSG/VSSGC 291 VSSG/VSSGC 341 VSSG/VSSGC 451 VSSG/VSSGC 601	CW	CCW	CW	CCW	0.91	328	3.568”	0.52	187	2.045”
VSG/VSGC 301 VSG/VSGC361 VSG/VSGC 401	CW	CCW	CW	CCW	0.80	288	3.141”	0.45	162	1.767”
VSG/VSGC 501 VSG/VSGC 601 VSG/VSGC 701	CCW	CW	CCW	CW	0.91	328	3.568”	0.52	187	2.045”
VSG/VSGC 751 VSG/VSGC 901	CCW	CW	CCW	CW	1.09	392	4.283”	0.63	227	2.473”
VSG/VSGC 791 VSG/VSGC 891 VSG/VSGC 1051 VSG/VSGC 1201 VSG/VSGC 1301	CCW	CW	CCW	CW	1.22	439	4.777”	0.74	266	2.889”
VSG/VSGC 1551 VSG/VSGC 1851 VSG/VSGC 2101	CCW	CW	CCW	CW	1.48	533	5.823”	0.87	313	3.433”
VSG/VSGC 2401 VSG/VSGC 2601 VSG/VSGC 2801 VSG/VSGC 3001	CCW	CW	CCW	CW	1.80	648	7.072”	1.36	490	5.341”

*The large gear on the command shaft has 50 teeth. The teeth are counted when moving the command shaft from the minimum stop position to the maximum stop position.

The manual operating shaft on the gear motor should be turned the opposite direction of the desired command shaft rotation.

The capacity and volume control motors are equipped with a brake. If it is necessary to operate the control motors manually, the brake must be disengaged. The brake can be disengaged by pushing on the motor shaft on the cone end. The shaft should be centered in its travel. Do not use excessive force manually operating the motor or damage may result.

Oil Temperature Control Valve (Oil Mixing Valve) Operation

Initial Position

The temperature control valve is in the closed position when initially installed.

With the temperature control valve de-energized, the valve is set to its initial position. The temperature control valve will be in the closed position with the actuator indicator displaying CLOSED.

When the temperature control valve is energized, the valve will rotate to fully OPEN.

Operation

With the compressor not running, when electrically energized,the PLC will turn the temperature control valve to fully open (100%).

When the compressor starts, the valve remains fully open (100%) until the oil injection temperature rises above the control setpoint. When the oil injection temperature rises above the control setpoint, the oil temperature control valve will begin to close. The hot oil from the oil separator begins to divert to the oil cooler, mixing the hot and cooled oil flow streams together downstream of the oil temperature control valve. The valve can fully close (0%) diverting the entire oil flow stream to the oil cooler.

As the oil injection temperature drops below the setpoint, the oil temperature control valve begins to open so that the oil injection temperature does not become too cold.

When the compressor stops, the valve returns to fully open (100%).

Fail Position

- The temperature control valve remains in the last position when power is removed.

Screen Display

- The oil temperature control valve, identified as “OIL MIX” on the main PLC display screen, shows a numerical value with “%” as units. This is to be understood as “% OPEN.” It is a direct indication of the position of the ball valve.

100% Open

- Oil flow stream is entirely bypassing the oil cooler.

99% To 1% Open

- Oil flow stream is partially bypassing the oil cooler and partially diverted to the oil cooler.

0% Open

- Oil flow stream is entirely diverted to the oil cooler.

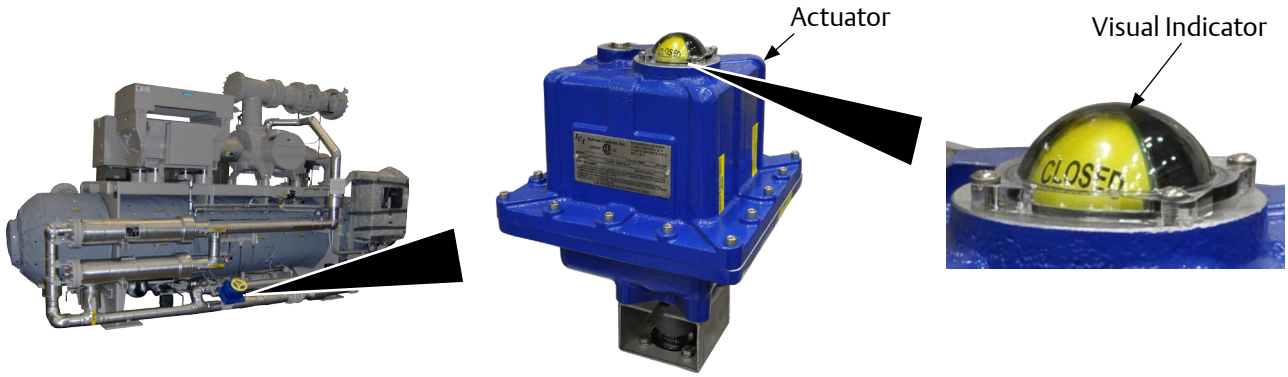


Figure 4-10. Oil Temperature Control Valve (Oil Mixing Valve)

Purging with Dry Nitrogen

Purging is recommended if the compressor will be inactive for 12 hours or more. For additional long term storage information, refer to Long Term Storage Recommendations in Section 3.

Preparation

WARNING

When working with LFG, NG or other dangerous/ flammable gases, ensure there are adequate ventilation and vapor detectors. Refer to national fire and building codes. Failure to comply may result in serious injury or death.

WARNING

When working with pressurized system, always wear safety glasses and/or face shield. Failure to comply may result in serious injury.

1. Press “Stop” button to stop compressor unit, see Figure 4-11.
2. Allow pressure in compressor unit to equalize to suction pressure, see Figure 4-12.
3. Close suction and discharge shut-off valves to isolate the compressor unit from house system. Lockout/tagout valves.
4. Close any other valves that may feed gas or oil to the compressor and oil separator.
5. Slowly open the discharge bleed off valve or the suction oil charging valve to depressurize compressor unit to atmosphere, see Figure 4-13. Keep valve in open position.

NOTE

Plugs are installed on bleed valves. Remove and install plugs prior to and after bleeding. Ensure to keep valves closed when removing and installing plugs.

6. Open discharge bleed valve to allow nitrogen to purge through compressor unit, see Figure 4-12.
7. Refer to PLC main screen for discharge pressure when purging.

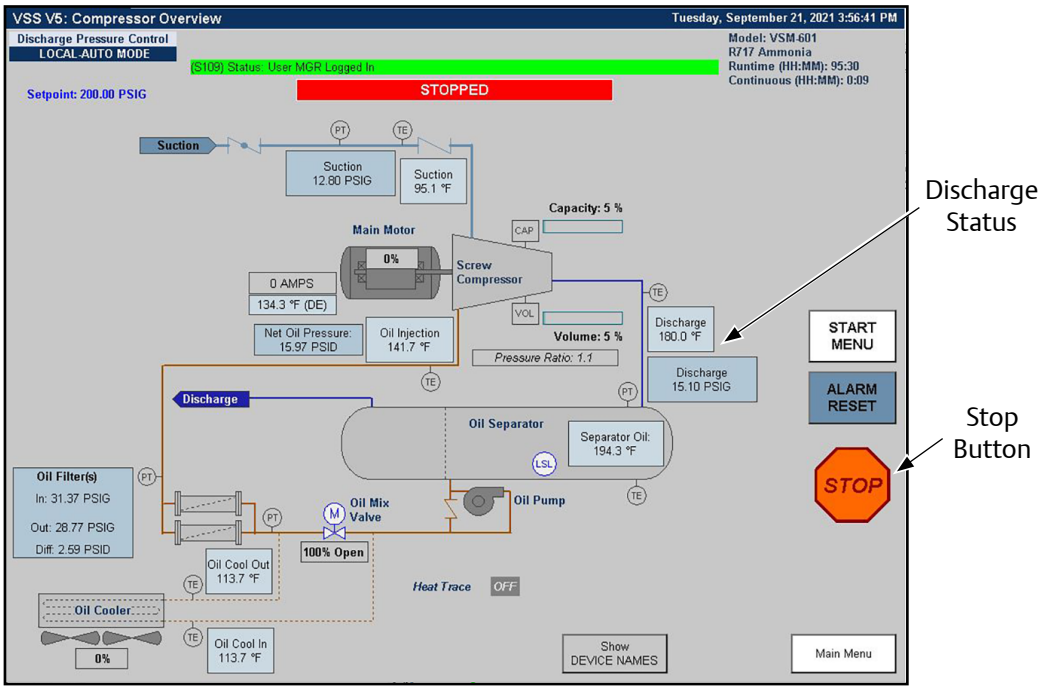


Figure 4-11. PLC Main Screen

Purge

CAUTION

Do not purge compressor unit with oxygen. Failure to comply may result in damage to equipment.

CAUTION

Do not allow compressor to spin while purging. Regulate purging pressure as needed. Failure to comply may result in damage to equipment.

8. Connect purging hose from nitrogen cylinder to suction oil charging valve.

NOTE

Purging is performed through the suction oil charging valve so that trapped gas can be pushed out of the compressor. This will help minimize metal surface oxidation of the compressor (due to the gas) while not in service.

9. Purge compressor unit for 10 minutes. Check discharge pressure on PLC main screen to make sure pressure is increasing.
10. Close discharge bleed valve while still purging.
11. Observe discharge pressure through the PLC main screen. Allow pressure to build to approximately 10 psig.
12. Once pressure is reached, stop purging and close suction oil charging valve. If pressure is greater than 10 psig, crack open discharge bleed valve, as needed, to slowly bleed the system to approximately 10 psig.
13. Wait 10 minutes to make sure there are no leaks and that the pressure is holding. If the unit does not hold pressure, check all isolation valves for correct operation; discharge, suction and oil return valves.
14. Remove purging hose from suction oil charging valve.

CAUTION

With a purged system, when getting the compressor unit ready for start-up, it is important to slowly open the suction valve to prevent a sudden rush of gas and oil. Failure to comply may result in damage to equipment.

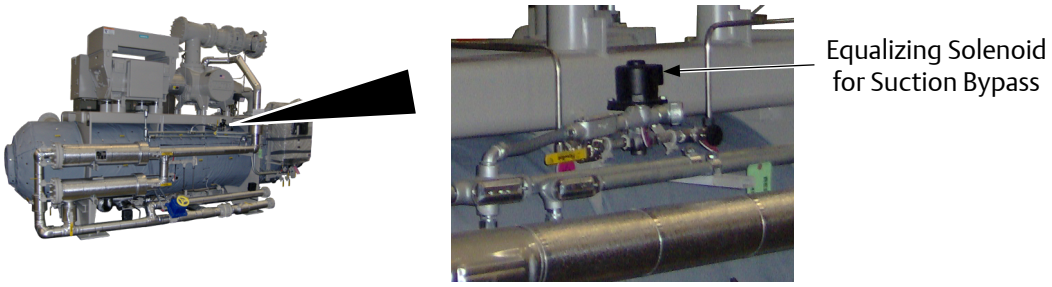


Figure 4-12. Equalizing Solenoid

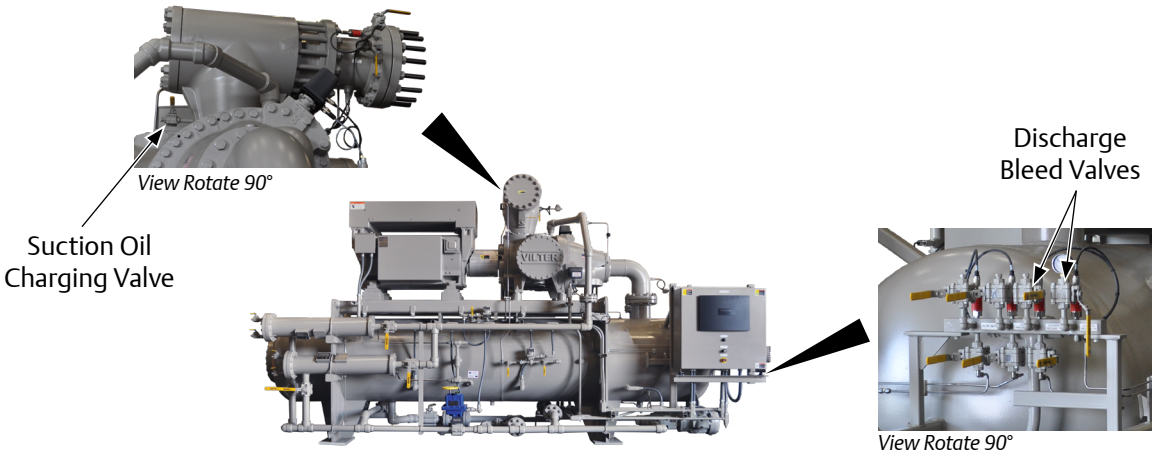


Figure 4-13. Suction Oil Charging Valve and Discharge Bleed Valve

Purging with Dry Gas

Purging is recommended if the compressor will be inactive for 12 hours or more. For additional long term storage information, refer to Long Term Storage Recommendations in Section 3.

Preparation

WARNING

When working with pressurized system, always wear safety glasses and/or face shield. Failure to comply may result in serious injury.

WARNING

When working with LFG, NG or other dangerous/ flammable gases, ensure there are adequate ventilation and vapor detectors. Refer to national fire and building codes. Failure to comply may result in serious injury or death.

NOTICE

To purge the compressor unit using a dry gas (i.e. methane), a purge line must be installed. If there is not enough purge pressure, connect purge line to a lower pressure line or to atmosphere. The purge line, associated valves and gauges are not provided from the factory and must be installed by the customer.

1. Refer to Figure 4-14 for recommended purge line design.
2. Press “Stop” button to stop compressor unit, see Figure 4-15.
3. Allow pressure in compressor unit to equalize to suction pressure, see Figure 4-16.
4. Close suction and discharge shut-off valves to isolate the compressor unit from house system. Lockout/tagout valves.
5. Close any other valves that may feed gas or oil to the compressor and oil separator.

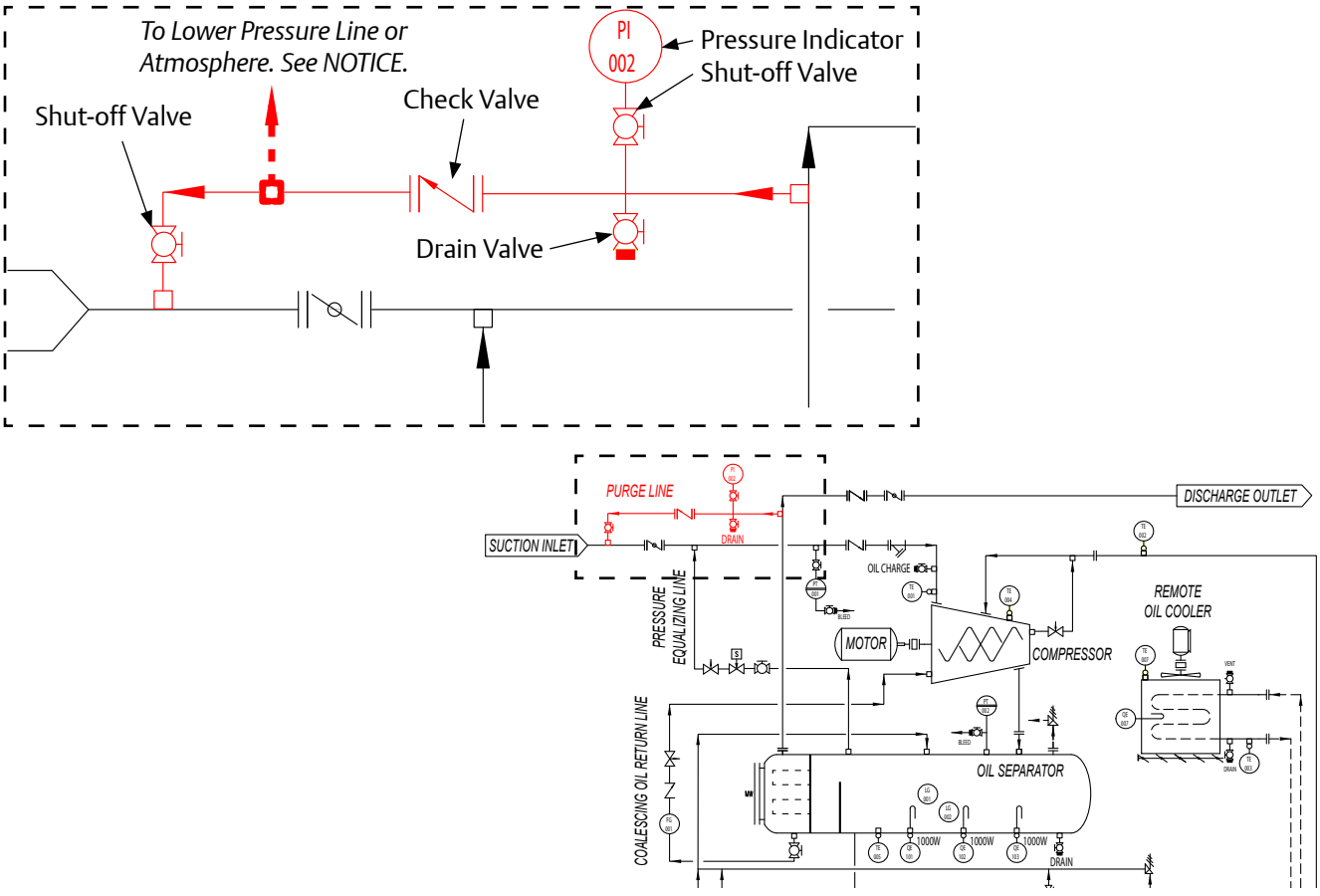


Figure 4-14. Customer Purge Line

NOTE

Plugs are installed on bleed valves. Remove and install plugs prior to and after bleeding. Ensure to keep valves closed when removing and installing plugs.

6. Slowly open the discharge bleed off valve or the suction oil charging valve and bleed remaining pressure in compressor unit to atmosphere, see Figure 4-17. Leave suction oil charging valve in open position.
7. If equipped with pressure indicator on purge line, open shut-off valve to pressure indicator.
8. If not equipped with pressure indicator, refer to PLC main screen for discharge pressure when purging.

Purge

CAUTION

Do not purge compressor unit with oxygen. Failure to comply may result in damage to equipment.

CAUTION

Do not allow compressor to spin while purging. Regulate purging pressure as needed. Failure to comply may result in damage to equipment.

9. Connect purging hose from gas cylinder to suction oil charging valve.

NOTE

Purging is performed through the suction oil charging valve so that trapped gas can be pushed out of the compressor. This will help minimize metal surface oxidation of the compressor (due to the gas) while not in service.

10. Purge compressor unit for 10 minutes. Check pressure indicator or discharge status on PLC main screen to make sure pressure is increasing.
11. Close shut-off valve on purge line while still purging.
12. Observe discharge pressure of compressor unit through the PLC main screen.
13. Allow pressure to build to approximately 10 psig in the compressor unit.
14. Once pressure is reached, stop purging and close suction oil charging valve.
15. Wait 10 minutes to make sure there are no leaks and that the pressure is holding. If the unit does not hold pressure, check all isolation valves for correct operation; discharge, suction and oil return valves.
16. Remove purging hose from suction oil charging valve.

CAUTION

With a purged system, when getting the compressor unit ready for start-up, it is important to slowly open the suction valve to prevent a sudden rush of gas and oil. Failure to comply may result in damage to equipment.

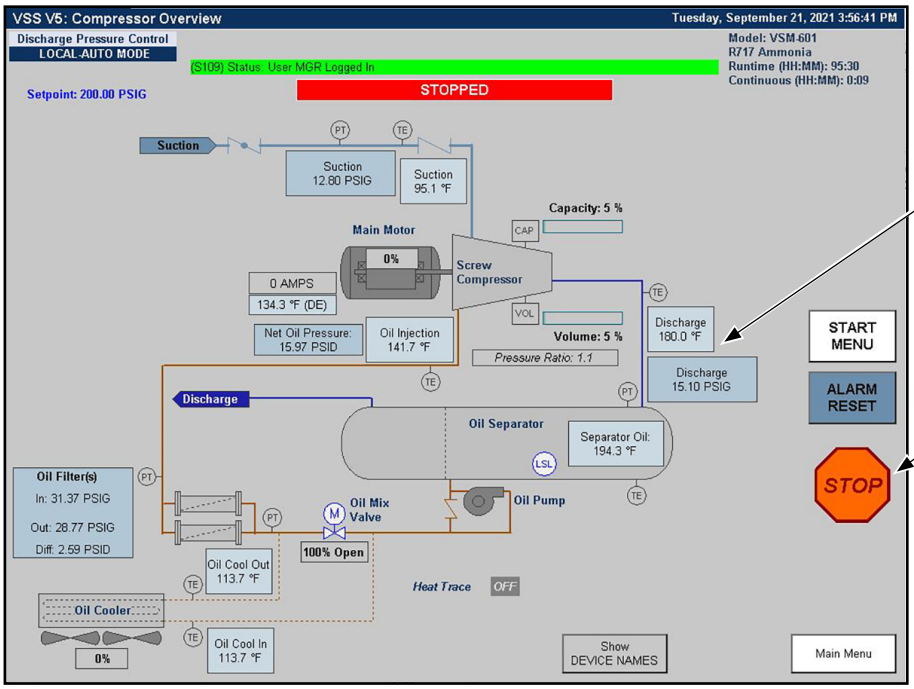


Figure 4-15. PLC Main Screen

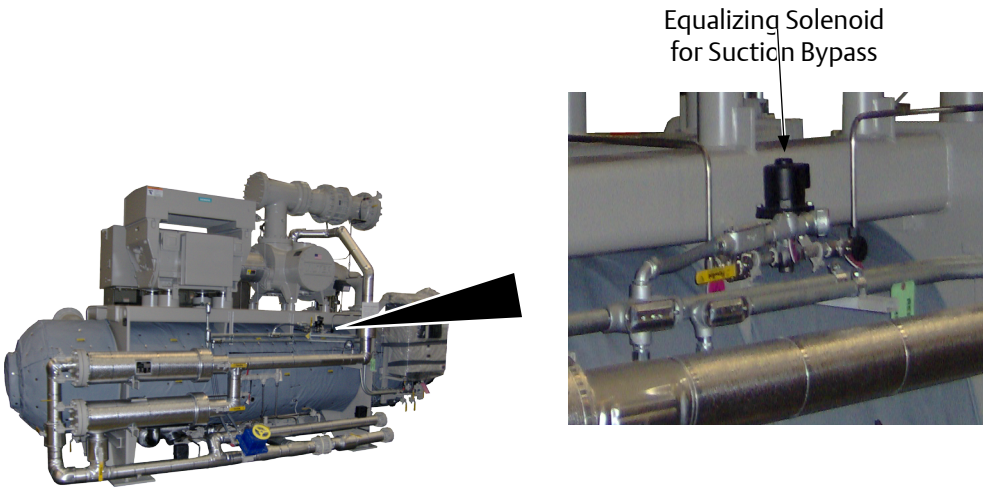


Figure 4-16. Equalizing Solenoid

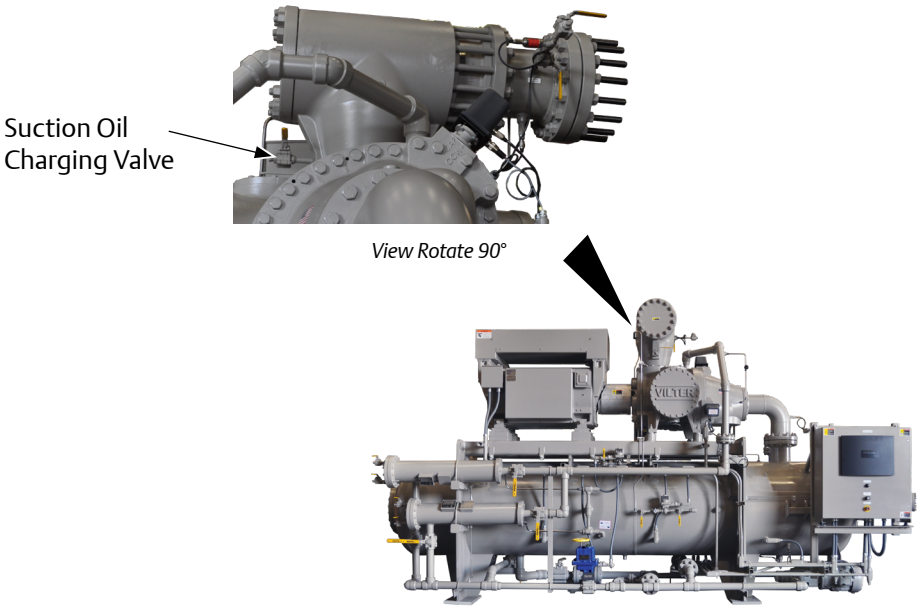


Figure 4-17. Suction Oil Charging Valve

Coalescing Oil Return Line Setup

Over time, oil will accumulate on the coalescing side of the oil separator. As a result, an oil return line with a shut-off valve, sight-glass, check valve and needle valve are installed between the coalescing side and compressor to return this oil back to the compressor.

To adjust the return flow, proceed with the following procedure:

NOTE

Do not fully open the needle valve unless directed by Vilter Customer Service. Leaving the needle valve fully open will reduce efficiency of the compressor unit.

1. Open shut-off valve on coalescing side of oil separator, see Figure 4-18.
2. While the unit is in operation, crack open needle valve and observe oil flow through sight-glass.
3. Slowly open needle valve more until a small amount of oil is seen in the sight-glass.

NOTE

The sight-glass should never be full with oil.

4. Periodically check the sight glass to insure that there is flow and some oil going through it.

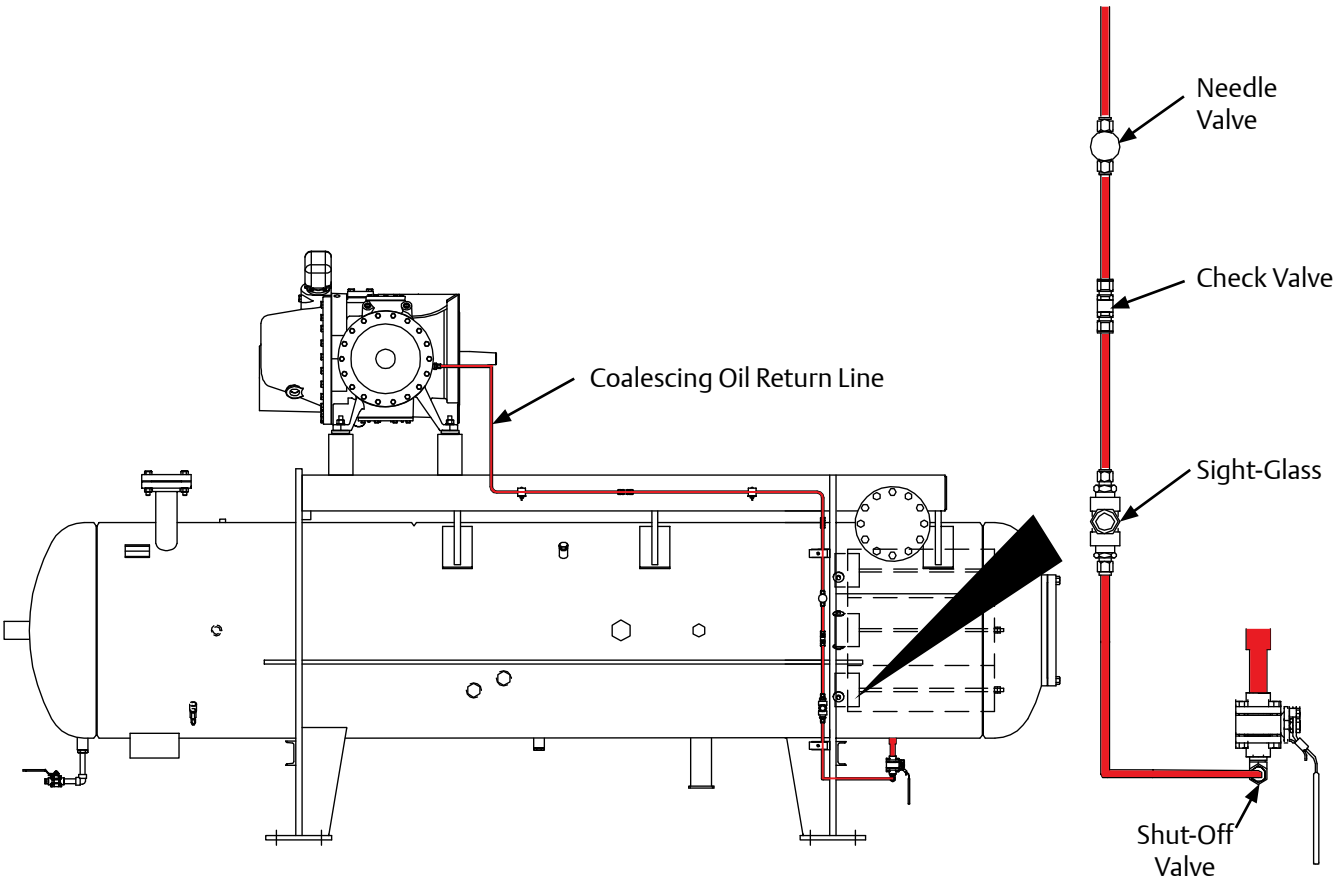


Figure 4-18. Coalescing Oil Return Line

Maintenance and Service Schedule for Gas Compression Applications

Follow this table for maintaining and servicing the compressor unit at hourly intervals.

Table 5-1. Maintenance/Service Schedule for Gas Compression Applications

Group	Inspection/ Maintenance	Service Interval (Hours) Based on WET SATURATED GAS										Service Interval (Hours) Based on DRY CLEAN GAS													
		200	5,000	10,000	15,000	20,000	25,000	30,000	35,000	40,000	To 120,000	200	5,000	10,000	20,000	30,000	40,000	50,000	60,000	70,000	80,000	90,000	100,000	110,000	120,000
Oil Circuit	Oil Change	Replace oil based on oil analysis report or visual contamination.										-	R	-	R	-	R	-	R	-	R	-	R	-	R
	Oil Analysis(1)	-	S	S	S	S	S	S	S	S	*	-	S	S	S	S	S	S	S	S	S	S	S	S	S
	Oil Filters	Prepare to replace when the pressure drop reaches the given limits.										R	R	R	R	R	R	R	R	R	R	R	R	R	R
	Oil Strainer	I	I	I	I	I	I	I	I	I	*	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Package	Coalescing Elements	-	I	R	-	I	-	R	-	I		-	-	-	-	R	-	-	R	-	-	R	-	-	R
	Coalescing Drain Line	I	I	I	I	I	I	I	I	I		I	I	I	I	I	I	I	I	I	I	I	I	I	I
	Suction Screen	I	I	I	I	I	I	I	I	I		I	I	I	I	I	I	I	I	I	I	I	I	I	I
	Liquid Line Strainers	I	I	I	I	I	I	I	I	I		I	I	I	I	I	I	I	I	I	I	I	I	I	I
	Hot Alignment after Initial Start Up	-	I	I	I	I	I	I	I	I		-	I	I	I	I	I	I	I	I	I	I	I	I	I
Control Calibration	Transmitters	I	I	I	I	I	I	I	I	I		I	I	I	I	I	I	I	I	I	I	I	I	I	I
	RTDs/ TTs	I	I	I	I	I	I	I	I	I		I	I	I	I	I	I	I	I	I	I	I	I	I	I
	Slide Valve Motors (3)	Slide valve calibration should be inspected monthly. Inspections can be performed through the control panel. If a Non-Movement Alarm appears, calibrate immediately.																							
Compressor (2)	Main Motors	See Motor Manual for proper lubrication procedures and service intervals.																							
	Inspect for Back Spin(4)	Inspect Every 5,000 Hours or As Needed 10,000 hours for the clean																							
	Inspect for Leaks	Check Monthly																							
	Shaft Seal Replacement	When oil leakage above 15 drops per hour																							
	Inspect Compressor**	-	I	I	-	I	-	I	-	I		-	I	I	I	I	I	I	I	I	I	I	I	I	I

I – Inspect /Calibrate S – Sampling R – Replace

Notes: *: Based on previous inspection findings extrapolate balance of service intervals or at least once a year.
**: Inspections include: gaterotor inspection (backlash measurement, shelf clearance and gaterotor float), end play measurement (main rotor & gaterotor), slide valve inspection (if applicable.

For Additional Notes, please see the next page.

Additional Notes

(1) Oil Analysis/Sampling is based on the gas stream. For the first year, sample the oil once a month to determine a base line of the longevity of the oil. It is the customer's discretion to increase the time period between oil sampling if oil contamination is unlikely or decrease the time period if there is a reason to believe the oil was contaminated during operation. In landfill applications (where gas mixtures change overtime) and/or corrosive or wet gas conditions exist, an oil sample must be taken every 2 to 3 months (quarterly) as a minimum.

Proper separation of any liquids must be accomplished to prevent droplets of liquid at the com pressor suction. The discharge temperature must be kept a minimum of 30° F above the discharge gas dew point to prevent the condensing of liquids in the oil separator. The oil shell and legs must be insulated when the gas stream has a high probability of having condensables. Replace the oil at the 6 month and 12-month intervals unless the oil sampling shows otherwise.

(2) The life of the compressor will be extended if the compressor unit is purged with nitrogen or sweet dry natural gas at shutdown. If there is more than one compressor at the site, the recommendations are to keep both operating unloaded (the compressors are efficient while unloaded) to prevent any H2S corrosion of the bearings due to any moisture condensing forming an acidic solution. If a compressor has to be shut down for more than 16 hours, flush the compressor out with fresh clean oil and drain the oil in addition to purging the compressor. Turn the compressor over by hand or use the drive motor to bump the compressor over monthly until operation is resumed.

(3) Slide Valve Calibration should be inspected monthly. This can be done via Control Panel - if a non movement alarm appears on the Control Panel, calibrate immediately (by pressing the call/stop button on explosion proof actuator 25972XP, or for older models, using the controller, or calibration tool 75002).

(4) When shutting off the compressor, normally there is a back spin of the compressor motor shaft in the opposite direction. 4 or 5 revolutions are normal to fill the suction cavity with high pressure gas from the Oil Separator. More than this will reflect a faulty Suction Check Valve or Open Bleed line around the Suction Check Valve, which should be closed during operation.

(5) Daily records should be kept on suction, discharge, oil pressures & temperatures, along with ensuring Temp Leaving Oil Separator is above Dew Point.

(6) Suction Header and drop leg should be checked and drained for moisture buildup.

Maintaining Proper Operation

To ensure proper operation, the following items should be checked

- Calibrate all transmitters and RTDs/TTs.
- Check capacity and volume actuator calibration
- Check fuses in the PLC panel
- Check for loose wiring connections in the PLC panel
- Check relay and contact operation for relays in the PLC panel
- Verify the operation of the suction and discharge check valves
- Check for correct rotation of all motors on the package (compressor, oil pump, and fan motors)
- Check that the piping to the oil cooler is correct.
- Check setup of soft starts and VFDs
- Verify set points in the PLC
- Check oil heater operation
- Check for loose bolts on the compressor unit. Tighten any loose bolts

Compressor Unit Isolation For Maintenance/Service

WARNING

When working with LFG, NG or other dangerous/ flammable gases, ensure there are adequate ventilation and vapor detectors. Refer to national fire and building codes. Failure to comply may result in serious injury or death.

WARNING

Avoid skin contact with any condensate or oil. Wear rubber gloves and a face shield when working with condensate or oil. Failure to comply may result in serious injury or death.

WARNING

At shutdown, open valves that may trap gas or liquid to prevent rotation of the compressor and serious injury and/or damage to equipment.

WARNING

Follow local lock-out/tag-out procedure. Compressors must be depressurized before attempting to do any work on them. Failure to comply may result in serious injury, death and/or damage to equipment.

NOTICE

Recover or transfer all gas vapor in accordance with local ordinances before opening the compressor unit to the atmosphere.

The compressor unit must be isolated and depressurized to atmosphere prior to servicing.

1. Shut down the compressor unit, refer to Stopping/ Restarting procedure in Section 4.
2. If equipped with equalizing solenoid to control suction by-pass, allow solenoid to remain open until pressures equalize, see Figure 5-1 (2 of 2).
3. Turn motor and oil pump starter disconnect switches into the OFF position. Lockout/tagout disconnect switches.
4. If equipped with manual suction by-pass valve and it is not open, open suction by-pass valve to allow oil separator pressure to vent to low-side system pressure, see Figure 5-1 (1 of 2). Close suction by-pass valve when complete.
5. Isolate the compressor unit by closing all valves to the house system. Lockout/tagout valves.

NOTE

If drain valves are installed on suction and discharge headers, open these valves too to remove build up of liquid during shut-down periods.

6. Open any other valves that may trap liquid. Lockout/ tagout valves.
7. Recover or transfer all gas vapors.
8. Open discharge pressure bleed valve at block and bleed assembly and allow remaining pressure in oil separator to equalize to atmospheric pressure.
9. Servicing the compressor unit can proceed at this point. After servicing, ensure to perform a leak check, see Compressor Unit Leak Check procedure.

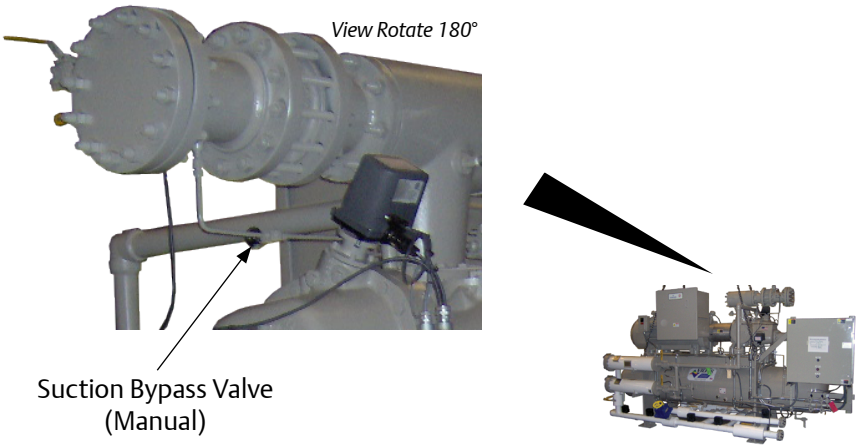


Figure 5-1. Suction By-Pass Valve Location (Manual) (1 of 2)

Compressor Unit Leak Check

The compressor unit must be checked for leaks after servicing to ensure a tight system. For additional leak testing information, refer to ASME B31.3 Process Piping Code.

CAUTION

Do not hydro test compressor unit. Failure to comply may result in damage to equipment.

1. If servicing the compressor unit was completed, proceed to Step 2. Otherwise, isolate the compressor unit from the house system, see Compressor Unit Isolation procedure.
2. Open all shut-off valves, check valves, control valves and solenoid valves in the system to be tested.
3. Slowly pressurize compressor unit through suction oil charging port with dry nitrogen.
4. Using appropriate leak test solution, check for leaks on joints and connections of the serviced component.
5. If leaks are found, depressurize system and fix leaks. Repeat steps 3 and 4 until all leaks are fixed.
6. Typically, no evacuation is required for open loop systems. If evacuation is required, evacuate from suction oil charging port. Otherwise, bleed nitrogen to atmosphere.
7. Close all valves previously opened in the system. Open suction and discharge shut-off valves. Remove tags as per local lockout/tagout procedure.
8. Turn motor and oil pump disconnect switches to the ON position.
9. The compressor unit can now be started, refer to Start-Up procedure in Section 4.

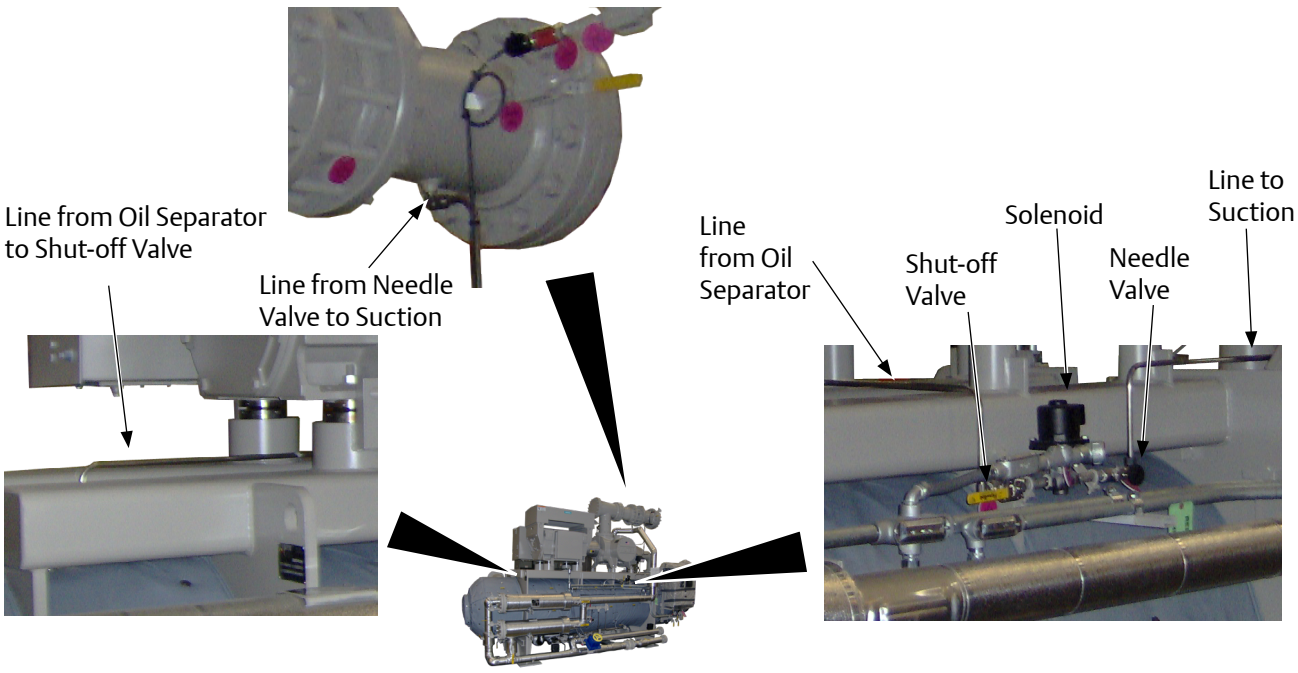


Figure 5-1. Suction By-Pass Valve Location (Equalizing Solenoid) (2 of 2)

Oil Sampling

WARNING

When working with LFG, NG or other dangerous/ flammable gases, ensure there are adequate ventilation and vapor detectors. Refer to national fire and building codes. Failure to comply may result in serious injury or death.

WARNING

Improper selection or application of fluid diagnostic products can cause serious injury or damage. The user is solely responsible for making the final selection of products to ensure that the overall system performance and safety requirements are met. These include reviewing fluid compatibility with materials and seals.

WARNING

Avoid skin contact with any condensate or oil. Wear rubber gloves and a face shield when working with condensate or oil. Failure to comply may result in serious injury or death.

DANGER

Sampling often releases hot fluid under high velocity/pressure.

1. Hot fluid can cause severe burn injuries.
2. Skin penetration from high-pressure fluid can occur, causing severe injury, gangrene and/or death. If this happens, immediate ly contact an experienced medical practi tioner.
3. Hot fluid escaping to the atmosphere can ignite if it comes into contact with an igni tion source. This can lead to severe property damage.

Recommendations

1. Make sure you´re aware of the risks associated with the fluid being sampled or worked with. Check with the manufacturer.
2. If you have not been trained to sample, service, repair, or troubleshoot a pressurized fluid system, especially a hydraulic system, you are at risk of suffering an accident. Seek the proper training before proceeding.

Installation of The Oil Sampler Valve

1. Lubricate the threads (1/4"-18 NPT) with Teflon tape.
2. Tighten to the max. torque 25 ft-lbs (34 N-m). Use 11/16" open wrench. Avoid over tightening.

Pre-Sampling

Use the Vilter Oil Analysis Kit (VPN 3097A) to collect an oil sample for analysis, see Figure 5-2.

Once the sample has been taken, the label must be filled out and pasted on the bottle, and both must be placed inside the mailing tube and sealed with the pre-addressed mailing label. Below are a few points to remember when taking a sample:

- Sample running compressor units, not cold units. Sample after minimum 30 minutes of compressor operating time.

Figure 5-2. Oil Analysis Kit (VPN 3097A)

- Sample after the oil filter.
- Sample according to the sampling procedure below.
- Ensure sampling valves and devices are thoroughly flushed prior to taking a sample.
- Ensure samples are taken as scheduled in the Maintenance and Service Schedule.
- Send samples to the oil analysis lab immediately after sampling, do not wait 24 hours.

Sampling Procedure

THE SAMPLING PRESSURE RANGE IS LIMITED FROM 5 TO 750 PSI (0.03 – 5.17 MPa). IF THE OPERATING PRESSURE IS ABOVE 750 PSI (5.17 MPa), THE OIL SAMPLING MUST BE DONE WHEN THE COMPRESSOR IS NOT RUNNING AND ENSURE THE SYSTEM PRESSURE IS WITHIN THE 5 TO 750 PSI (0.03 – 5.17 MPa) SAMPLING RANGE.

A 1/4" NPT oil sampling valve is provided either in the oil filter canister cover or in the piping after the filter (See Figure 5-3 or 5-4(a) according to application).

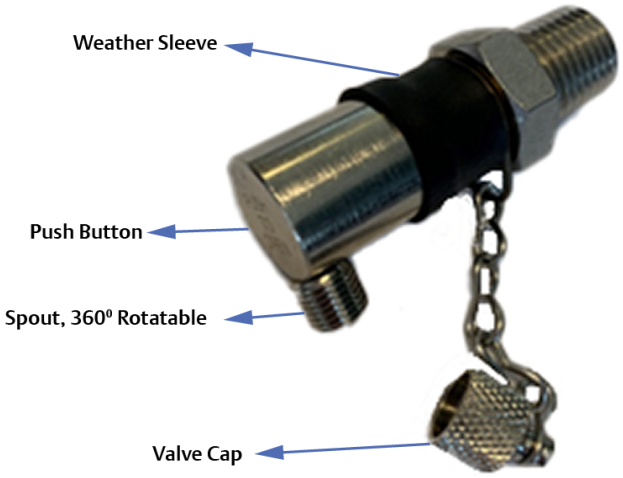


Figure 5-3. Oil Sampler Valve (VPN #3708A) For Gas Compression Applications

1. Unthread the oil sampling valve cap. For valve #3709A, you also need to turn the knurled locknut clockwise, see Figure 5-4(b).

NOTE
DO NOT remove the valve from the piping or filter housing.

2. Remove the cap of the oil analysis bottle and position it carefully under the valve spout. (Make sure the valve spout is rotated to the downward position) **SLOWLY AND VERY CAREFULLY** press the "PUSH BUTTON" with your finger to open the valve, and release the button to close it, see Figure 5-6.

WARNING

If the valve is opened too rapidly, a foamy pressurized jet of oil will gush out and splash outside the container.

In most cases there will be foam in the oil, so you must fill the bottle up to the top and then wait for the foam to dissipate. Repeat this step as many times as necessary (around 4 to 6 times) until the clear oil level reaches ¾ full, see sequence in Figure 5-6.

3. After all the foam dissipates, tighten the sample bottle cap.

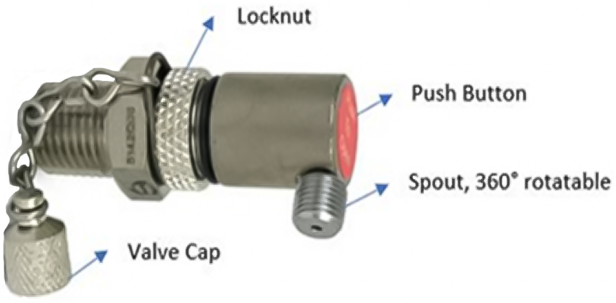
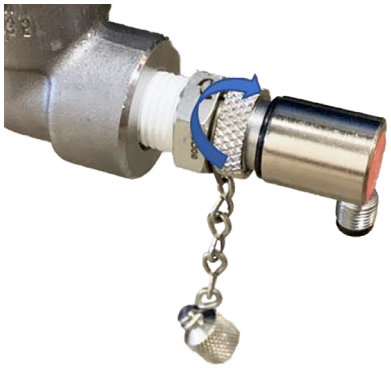


Figure 5-4. Oil Sampler Valve (VPN#3709A) For Ammonia and Refrigerants Compressors



(a) Valve Shown Ready for Oil Sampling

(b) Valve Shown in Lockout Position

Button being pressed, valve open

Button released, valve closed

Figure 5-5. Operating the Oil Sampling Valve

4. Tighten the oil sampling valve cap.
5. For valve #3709A only: back seat the knurled locknut by turning it counter-clockwise. This is to prevent any accidental release, see Figure 5-4(c).
6. Attach the filled sampling information label to the bottle and mail the sample out to the oil analysis lab immediately.

NOTE

Missing information from the sampling label may result in longer turnaround time as the laboratory will need to request the info before the sample can be tested.

Oil Sample Analysis Report

NOTE

A copy of the oil analysis report is also sent to Vilter. See Appendix B Oil Analysis Report for a sample of the oil analysis report.

An oil analysis report will show the physical properties of the oil, such as:

- Water content
- Viscosity
- Acid number
- Particle count
- Antioxidant level
- Wear metals
- Contaminating/additive metals

Figure 5-6. Stages of the Oil Sample Taking Process

Oil Charging

WARNING

Avoid skin contact with oil. Wear rubber gloves and a face shield when working with oil. Failure to comply may result in serious injury or death.

CAUTION

Do not add oil to the coalescent side of the oil separator. Failure to comply may result in damage to equipment.

Normal oil level operating range must be maintained for optimum performance and to prevent damage to equipment. See Figure 4-1 for normal operating levels. There are a couple of ways to maintain oil, while the compressor unit is in operation and during shutdown.

Tool Required:

- Oil Pump, Maximum 2-3 GPM with Motor approved for Division 1 or Division 2 and with ability to overcome suction pressure.

Charging During Operation

During operation, if the oil level is low, add oil to the operating compressor through the suction oil charging valve, see Figure 5-7. Pump oil into the compressor until the oil level reaches the normal operating level. Watch this level carefully to maintain proper operation. Never allow the oil to reach a level higher than the Maximum Operating Level, since this may impair the operation and efficiency.

1. Using a properly selected oil pump, connect oil pump to suction oil charging valve, see Figure 5-7.
2. Open suction oil charging valve and fill oil separator to Normal Operating Level.
3. Once the Normal Operating Level has been reached, shut off the oil pump and close the valve. Disconnect and remove oil pump.

Charging During Shutdown

During shutdown, if oil is to be added, charging can be performed through the drain valve located underneath the oil separator, see Figure 5-7. During shutdown, oil can be added to the Maximum Non-Operating Level. For shutdown procedure, see Compressor Unit Isolation procedure.

1. Using a properly selected oil pump, connect oil pump to oil separator drain valve.
2. Open oil separator drain valve and fill oil separator to Maximum NON-Operating Level, see Figure 4-1 for Oil Operating Levels.
3. Once Maximum NON-Operating Level has been reached, shut off oil pump, close oil separator drain valve and remove oil pump.

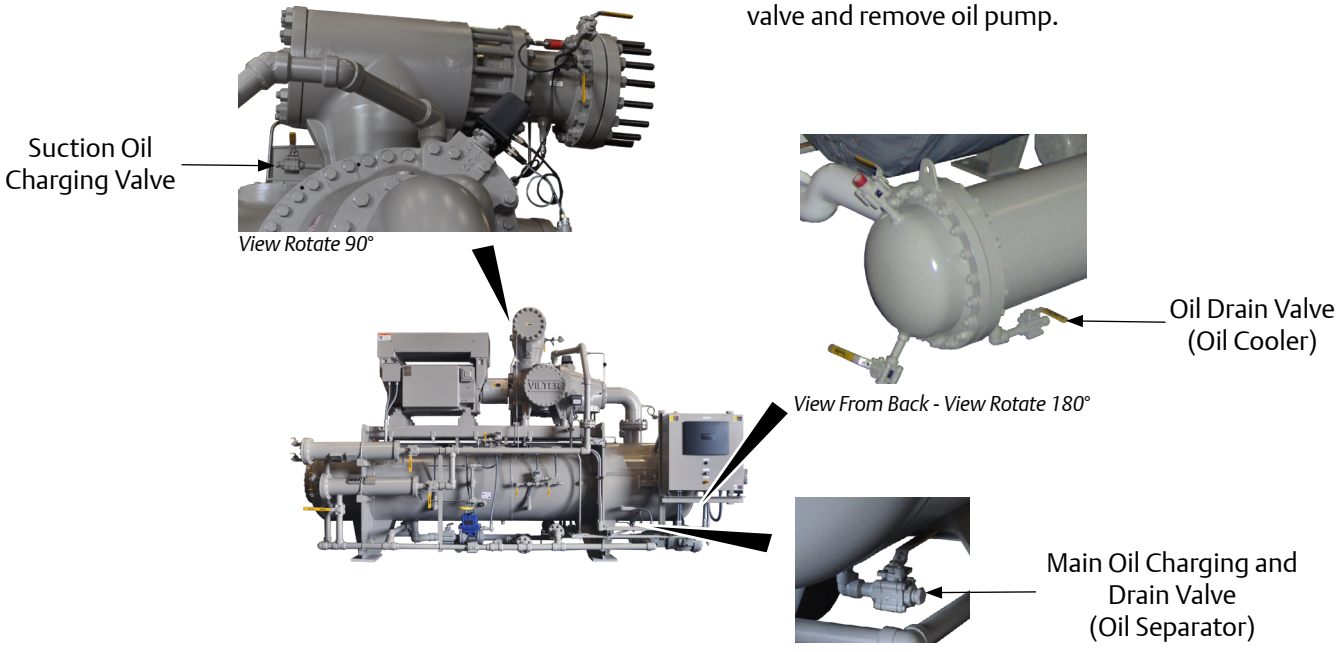


Figure 5-7. Suction Oil Charging Valve and Oil Drain Valves located at Oil Separator and Oil Cooler

Oil Draining

WARNING

Do not drain oil from drain valve while the compressor unit is running. Shutdown the unit and allow pressures to equalize to suction pressure prior to draining. Failure to comply may result in serious injury.

The compressor unit must be shut down prior to draining due to high pressures in the oil system, see Compressor Unit Isolation procedure.

Draining can be performed through the drain valve located underneath the oil separator, see Figure 5-7. A drain valve is also provided underneath the shell and tube oil cooler.

Draining of the remote oil cooler can be performed at the remote oil cooler drain valves. If equipped with lower level drains on the supply and return lines, these too can be utilized for draining. For additional information, see Appendix C • Recommended Remote Air Cooled Oil Cooler Piping.

Oil Filter Replacement

WARNING

Avoid skin contact with oil. Wear rubber gloves and a face shield when working with oil. Failure to comply may result in serious injury or death.

Change the oil filter as outlined in the Maintenance and Service Schedule, see Table 5-1. Maintenance & Service Schedule.

NOTE

Ensure to check the oil pressure drop and record it daily.

If the compressor unit is equipped with only a single oil filter, the compressor unit must be shut down prior to servicing, see Stopping/Restarting procedure in Section 4.

If the compressor unit is equipped with dual oil filters, then one oil filter can be isolated and serviced one at a time during operation. Each oil filter can have single or dual oil filter elements depending on the size of compressor used, see Table 5-2 and Figure 5-8.

Table 5-2. Oil Filter Elements and Compressor Models

Oil Filter Element Qty.	VSG/VSGC/ VSSG Models	Oil Filter Element VPN
Single Element	128 - 243	VPN 3007C
Single Element	301 - 701	VPN 1833G
Dual Elements	751 - 3001	VPN 1833G

To replace an oil filter element, have the element at hand and continue with the following steps:

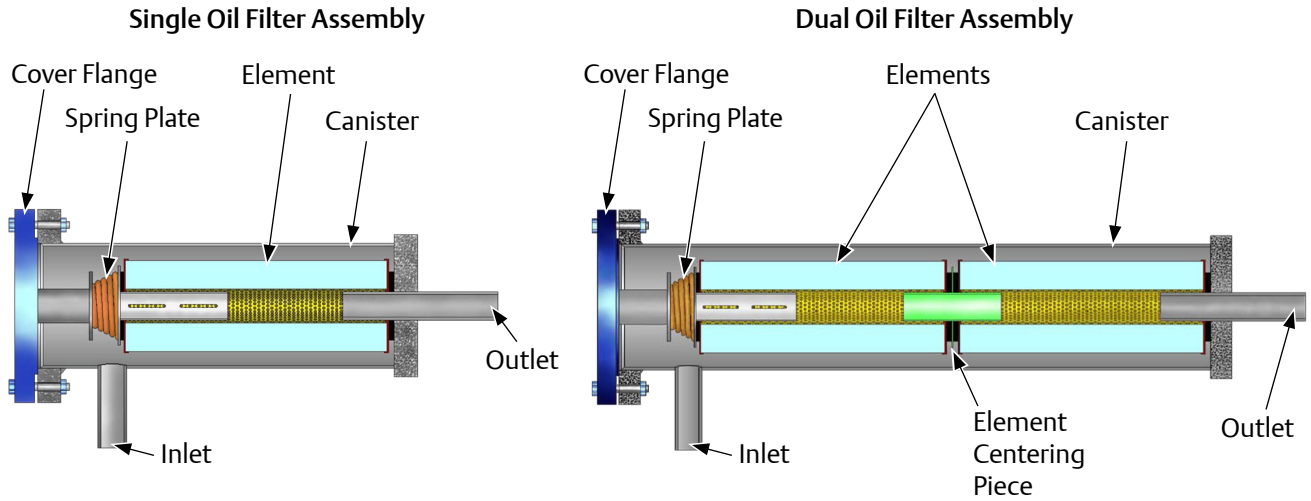


Figure 5-8. Oil Filter Assemblies (Single and Dual)

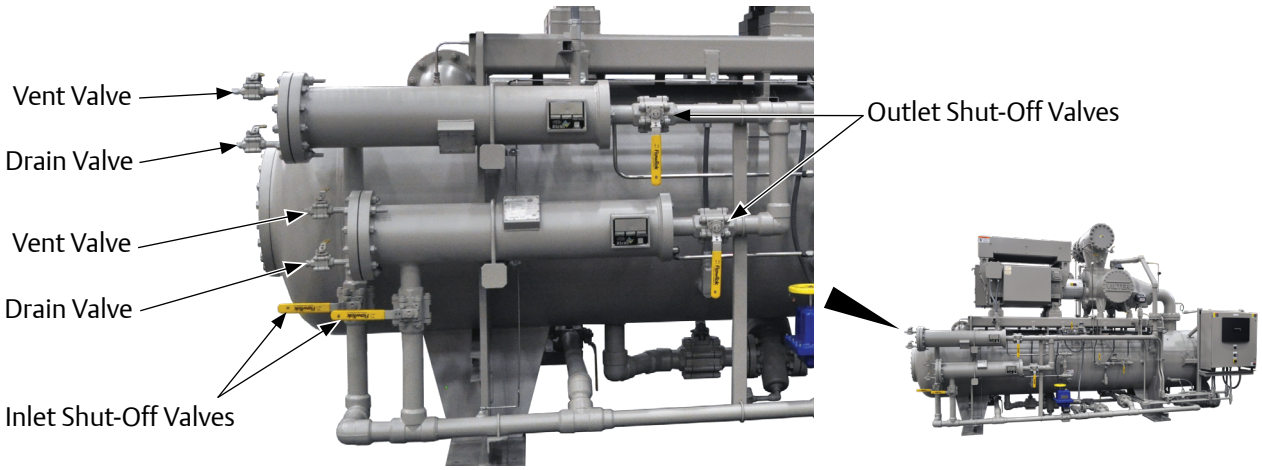


Figure 5-9. Oil Filter Drain, Vent and Shut-Off Valves

Removal

NOTE

Both outlet shut-off valves should be open. If the outlet valve is closed for the oil filter that is not in operation, slowly open the outlet shut-off valve until fully open. This will help reduce a sudden pressure drop when switching oil filters for servicing.

If equipped with dual oil filters, open inlet shut-off valve for non-operating oil filter to put it into operation, see Figure 5-9.

1. To isolate oil filter for servicing, close inlet and outlet shut-off valves for the oil filter.

NOTE

To reduce unwanted oil splash from a vent or drain valve, connect a hose to the valve port and direct the gas and oil into a drain pan.

2. Slowly release pressure in the oil filter canister by opening the vent valve. Allow pressures to equalize to atmosphere.

NOTICE

Dispose of used oil in an appropriate manner following all Local, State and Federal laws and ordinances.

3. Using an drain pan, open drain valve and allow the oil to completely drain from the oil filter canister.

NOTE

Note orientation of components to aid in installation.

4. Remove bolts and nuts securing cover flange to the oil filter canister. Remove cover flange and spring plate. Retain spring plate.
5. If equipped with a single oil filter element, remove filter element from oil filter canister.
6. If equipped with dual oil filter elements, remove two filter elements and filter element centering piece from oil filter canister. Retain filter element centering piece.
7. Thoroughly clean the oil filter canister, spring plate and centering piece. Inspect spring plate and centering piece, if damaged, replace as required.

Installation

NOTE

Ensure oil filter element on the outlet side is fully seated on the outlet pipe when installed.

1. If equipped with single oil filter element, install oil filter element in canister in orientation noted during removal.
2. If equipped with dual oil filter elements, install two oil filter elements and centering piece in orientation noted during removal.
3. Position spring plate in orientation noted during removal and install bolts and nuts to secure cover flange to oil filter canister.
4. Tighten nuts, see Table A-3. SA193 B7/SA320 L7 Bolts / Studs – Torque Requirements Per ASME Codes: B31.5 and B31.3 in Appendix A.
5. Using dry nitrogen gas, pressurize oil filter canister through vent valve and check for leaks.
6. Close the vent valve and drain valve.
7. Open outlet shut-off valve for the oil filter that is not in operation.
8. Repeat for second oil filter, as required.

Coalescing Filter Replacement

WARNING

Use appropriate lifting devices and additional personnel when lifting heavy components. Ensure lifting devices are capable of lifting the weight of the component. Use lifting points (i.e. bolt holes designated for lifting eye bolts) that are provided on the component. Failure to comply may result in serious injury.

WARNING

Avoid skin contact with any condensate or oil. Wear rubber gloves and a face shield when working with condensate or oil. Failure to comply may result in serious injury or death.

NOTE

For coalescing filters (11-7/8 in. O.D.), a tubing (3/4 in. O.D. x 6 ft. long) can be used to aid in removal and installation of the filter.

Change the oil filter as outlined in the Maintenance and Service Interval, see Table 5-1. Maintenance & Service Interval.

Removal

1. Isolate the compressor unit, see Compressor Unit Isolation procedure.
2. If required, install lifting eyes on oil separator manhole cover, see Figure 5-10.
3. Secure appropriate lifting device to oil separator manhole cover.
4. Remove all bolts except top four bolts securing oil separator manhole cover to oil separator vessel.
5. Adjust lifting device as needed to hold weight of oil separator manhole cover.
6. Remove remaining four bolts and oil separator manhole cover from oil separator vessel.
7. Remove nuts, flat washer and cover plate securing coalescing oil filter to hold-down rod.
8. With assistance of second person, remove coalescing filter from oil separator vessel.
9. Repeat steps 7 and 8 to remove additional coalescing filters, as required.

Installation

10. Install tubing over hold-down rod. Position tubing as far back as possible.
11. With assistance of second person, position coalescing filter over tubing and through hole of centering strap.
12. Push coalescing filter into vessel until fully seated on pipe stub.
13. Remove tubing.
14. Position cover plate and flat washer on hold-down rod on end of the coalescing filter.
15. Install nut to secure flat washer and cover plate to coalescing filter. Tighten nut to 25 ft-lbs.
16. Install second nut to prevent first nut from moving.
17. Repeat steps 10 to 16 for installing additional coalescing filters.
18. Position oil separator manhole cover on oil separator vessel.
19. Install bolts to secure oil separator manhole cover to oil separator vessel.
20. Tighten bolts, see Table A-3. SA193 B7/SA320 L7 Bolts / Studs – Torque Requirements Per ASME Codes: B31.5 and B31.3 in Appendix A.
21. Perform Compressor Unit Leak Check procedure.

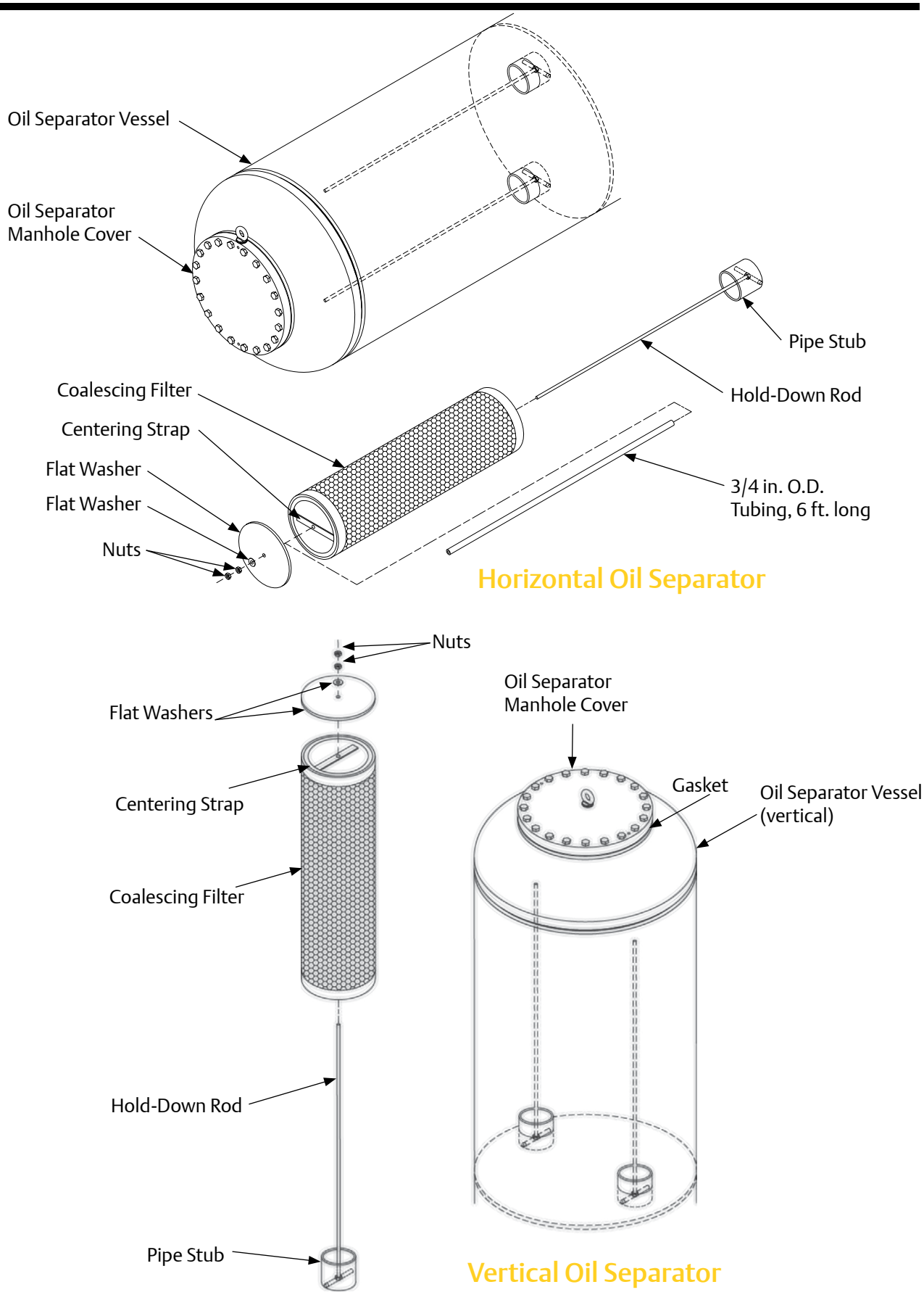


Figure 5-10. Oil Separators, Manhole Covers and Coalescing Filter Assemblies

Oil Pump Strainer

To clean the oil pump strainer, proceed with the following steps.

NOTICE

Dispose of used oil in an appropriate manner following all Local, State and Federal laws and ordinances.

WARNING

At shutdown, open valves that may trap gas or liquid to prevent rotation of the compressor and serious injury and/or damage to equipment.

WARNING

Follow local lock-out/tag-out procedure. Compressors must be depressurized before attempting to do any work on them. Failure to comply may result in serious injury, death and/or damage to equipment.

WARNING

Avoid skin contact with any condensate or oil. Wear rubber gloves and a face shield when working with condensate or oil. Failure to comply may result in serious injury or death.

1. Shut down the compressor unit, refer to Stopping/Restarting procedure in Section 4.
2. Turn disconnect switches to the OFF position for the compressor unit and oil pump motor starter, if equipped.
3. Close shut-off valves located before the strainer, at the oil filter inlet(s), oil cooler inlet and oil cooler outlet.
4. Position drain pan under drain valve.
5. Open strainer drain valve and allow oil to completely drain, see Figure 5-11.
6. Remove bolts securing strainer cover to strainer. Remove strainer cover, gasket and element. Retain gasket.
7. Inspect gasket for damage, replace as required.
8. Wash element in solvent and blow it with clean air.
9. Inspect element for damage, replace as required.
10. Clean strainer cavity with clean lint-free cloth.
11. Install in reverse order of removal. For torque specifications, see Table A-3. SA193 B7/SA320 L7 Bolts / Studs – Torque Requirements Per ASME Codes: B31.5 and B31.3 in Appendix A.
12. Close strainer drain valve.
13. Open shut-off valves.
14. Check replaced components for leaks.
15. Turn disconnect switches to the ON position for the compressor unit and oil pump motor starter, if equipped.
16. Start compressor unit.

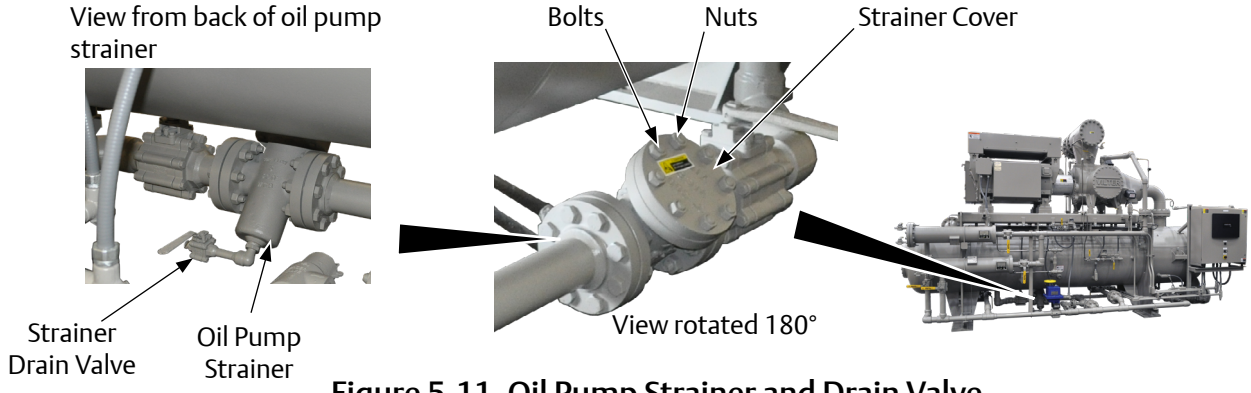


Figure 5-11. Oil Pump Strainer and Drain Valve

Drive Coupling (Form-Flex BPU) Hub Installation

On all single screw units, the coupling assembly is shipped loose and will have to be installed and aligned on site. This is to allow a check of proper electrical phasing and direction of motor rotation. The motor and compressor have been aligned from the factory with the coupling hubs already installed. Using a dial indicator for aligning is recommended.

NOTE

Drive coupling type and size can be determined by the information on the compressor nameplate when ordering; Order Number and Compressor Model Number.

To install the coupling, proceed with the following steps:

WARNING

Follow local lock-out/tag-out procedure. Compressors must be depressurized before attempting to do any work on them. Failure to comply may result in serious injury, death and/or damage to equipment.

1. Ensure disconnect switches are in the OFF position for the compressor unit and oil pump motor starter, if equipped.
2. If hubs are already installed on motor shaft and compressor shaft, proceed to Drive Center Member Installation and Alignment procedure.
3. If coupling assembly is already assembled, the lock nuts are not torqued. Remove lock nuts and bolts securing hubs to disc packs. Remove both hubs. Leave the disc packs attached to center member.
4. Clean hub bores and shafts. Remove any nicks or burrs. Measure bore and shaft diameters to ensure proper fitment. The keys should have a snug side-to-side fit in the keyway with a small clearance over the top.

NOTE

If hub position on shaft does not allow enough room to install bolts, install bolts and disc pack before mounting hub on shaft.

Straight Bore Hubs

1. For straight bore hubs, install key in keyway of shaft.
2. Install hub on shaft. If installing straight bore hubs on motor and compressor shafts, allow 1/16" gap between the outer face of the hub to the outer face of the shaft for both hub installation. This will allow some play when installing the spacer. If installing a straight bore hub and a taper bore hub, allow a 1/8" gap between the outer face of the straight bore hub to the outer face of the straight shaft, see Table 5-3.
3. Install clamping bolts in hub.
4. Tighten clamping bolts, see Table 5-4.
5. Install set screw in hub to secure key.
6. Tighten set screw, see Table 5-4. Repeat steps for second straight bore hub.

Table 5-3. Shaft and Hub Distances

Coupling Size	Shaft Gap for Straight Compressor & Straight Motor Shaft Combination	Distance Between Hub Faces
BP38U	5.125" (130.18 mm)	5.00" (127 mm)
BP41U		
BP47U		
BP54U		
BP54U		
BP56U		

Drive Center Member Installation and Alignment

NOTE

Always adjust motor to the compressor. The compressor is aligned to the frame.

1. Adjust motor position as needed to obtain a distance of 5" between both hub faces.
2. Soft Foot. The motor must sit flat on its base (+/- 0.002"). Any soft foot must be corrected prior to center member installation.

NOTE

If the driver or driven equipment alignment specification is tighter than these recommendations, the specification should be used. Also, be sure to compensate for thermal movement in the equipment. The coupling is capable of approximately four time the above shaft alignment tolerances. However, close alignment at installation will provide longer service with smoother operation.

The flex disc pack is designed to an optimal thickness and is not to be used for axial adjustments.

3. *Axial Spacing*. The axial spacing of the shafts should be positioned so that the flex disc packs are flat when the equipment is running under normal operating conditions. This means there is a minimal amount of waviness in the flex disc pack when viewed from the side. This will result in a flex disc pack that is centered and parallel to its mating flange faces. Move the motor to obtain the correct axial spacing, see Table 5-3 and Figure 5-12.
4. *Angular Alignment*. Rigidly mount a dial indicator on one hub or shaft, reading the face of the other hub flange. Rotate both shafts together, making sure the shaft axial spacing remains constant. Adjust the motor by shimming and/or moving so that the indicator reading is within 0.002" overall, see Figure 5-13.
5. *Parallel Offset*. Rigidly mount a dial indicator on one hub or shaft, reading the other hub flange outside diameter. Indicator set-up sag must be compensated for. Rotate both shafts together. Adjust the equipment by shimming and/or moving so that the indicator reading is within 0.002" overall, see Figure 5-13. With the coupling in good alignment the bolts will fit through the holes in the flanges and the disc packs more easily.

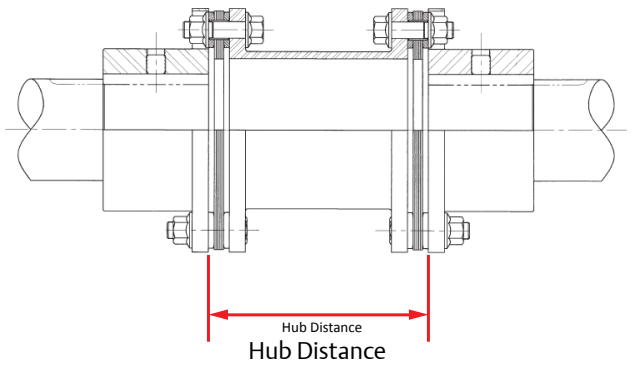
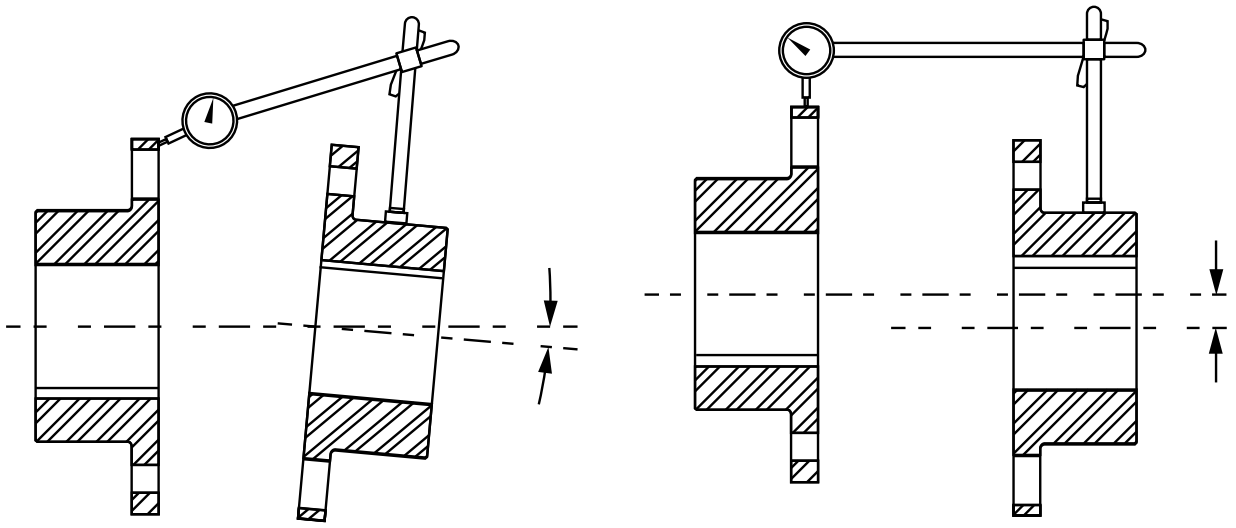


Figure 5-12. Hub Distance (Axial Spacing)

Table 5-4. Hub Clamp Bolt and Set Screw Torque Specifications

Coupling Series/Size	Clamping Bolt			Set Screw	
	# Bolts	Size-Pitch	Torque ft-lbs (Nm)	Size	Torque ft-lbs (Nm)
BP38U	4	1/4-28	12 (16)	3/8	10 (13)
BP41U	4	5/16-24	23 (31)	3/8	10 (13)
BP47U	4	3/8-24	49 (66)	1/2	20 (27)
BP54U	4	7/16-20	78 (106)	1/2	20 (27)
BP56U	4	1/2-20	120 (163)	5/8	40 (54)



Angular Alignment *Parallel Offset*

Figure 5-13. Angular Alignment and Parallel Offset

NOTE

All bolt threads should be lubricated. A clean motor oil is recommended. On size 226 and larger, a link must be put on bolt first. Remove the disc pack alignment bolt. Proceed to mount the second disc pack to the other hub in the same way.

Ensure that the beveled part of the washer is against the disc pack.

6. Install bolts and locking nuts to secure both disc packs to center member.
7. Tighten locking nuts.
8. If room is required to install center member, adjust hub position accordingly.
9. Using additional supports supporting center member. Install bolts and locking nuts to secure center member to compressor hub.
10. Tighten locking nuts.
11. Position hubs, ensure distance between face of both hubs is 5".

NOTE

If there is waviness with the disc pack installed, adjust distance accordingly until disc pack is straight.

12. Install bolts and locking nuts to secure disc pack to motor hub.
13. Tighten locking nuts, see Table 5-5.

Table 5-5. Disc Pack Installation Torque Specifications

Coupling Size	Lock Nut Size	Tightening Torque ft-lbs (Nm)
BP38U	5/16-24	22 (30)
BP41U	7/16-20	55 (75)
BP47U	9/16-18	120 (163)
BP54U	9/16-18	120 (163)
BP56U	9/16-18	120 (163)

14. Perform hot alignment. Run compressor unit and allow to warm up completely.
15. Power down compressor unit and re-check alignments. Loosen motor mounting nuts to add shims or to adjust alignments as required.
16. Install coupling guard.

Drive Coupling (Form-Flex BPU) Center Member and Hub Removal

To remove coupling assembly, proceed with the following steps:

WARNING

At shutdown, open valves that may trap gas or liquid to prevent rotation of the compressor and serious injury and/or damage to equipment.

WARNING

Follow local lock-out/tag-out procedure. Compressors must be depressurized before attempting to do any work on them. Failure to comply may result in serious injury, death and/or damage to equipment.

NOTE

Drive coupling type and size can be determined by the information on the compressor nameplate when ordering; Order Number and Compressor Model Number.

1. Shut down the compressor unit, refer to Stopping/Restarting procedure in Section 4.
2. Turn disconnect switches to the OFF position for the compressor unit and oil pump motor starter, if equipped.
3. Allow compressor, motor and surrounding components to cool prior to servicing.
4. Remove coupling guard.
5. Remove lock nuts and bolts securing disc pack to hub on compressor shaft.
6. If additional room is required to remove the center member, loosen clamping bolts on straight bore hub(s).
7. Move hub on shaft as required to allow center member removal.
8. Remove lock nuts and bolts securing disc pack to hub on motor shaft. Remove center member.
9. Remove clamping bolts and hub from shaft.

Drive Coupling (Type C Sure-Flex) Replacement

Drive couplings that are the Type C Sure-Flex type, are always installed with a C-flange between the compressor and motor. The coupling assembly alignments are built into the design and therefore, should not require alignment.

NOTE

Drive coupling type and size can be determined by the information on the compressor nameplate when ordering; Order Number and Compressor Model Number.

Removal

To remove Type C Sure-Flex coupling, proceed with the following steps:

WARNING

At shutdown, open valves that may trap gas or liquid to prevent rotation of the compressor and serious injury and/or damage to equipment.

WARNING

Follow local lock-out/tag-out procedure. Compressors must be depressurized before attempting to do any work on them. Failure to comply may result in serious injury, death and/or damage to equipment.

1. Shut down the compressor unit, refer to Stopping/Restarting procedure in Section 4.
2. Turn disconnect switches to the OFF position for the compressor unit and oil pump motor starter, if equipped.
3. Allow compressor, motor and surrounding components to cool prior to servicing.
4. Remove C-flange access cover.

NOTE

Mark locations of hubs prior to removal.

5. Loosen set screw in motor hub securing key in keyway.
6. Loosen clamping bolts securing hub to motor shaft.
7. Pry hub up motor shaft for space to remove coupling sleeve.
8. Remove coupling sleeve from hub.
9. Remove hub and key from motor shaft.
10. Loosen set screw in compressor hub securing key in keyway.
11. Loosen clamping bolts securing hub from compressor shaft.
12. Remove hub and key from compressor shaft.

Installation

1. Install key and hub on compressor shaft as noted during removal.
2. Install set screw in compressor hub to secure key in keyway, see Table 5-6.
3. Install clamping bolts to secure hub on compressor shaft. Tighten clamping bolts, see Table 5-6.
4. Install key and hub on motor shaft as noted during removal. Allow gap to install coupling sleeve.
5. Install coupling sleeve on hubs. Position hub on motor shaft on coupling sleeve as noted during removal.
6. Install set screw in compressor hub to secure key in keyway. Tighten set screw, see Table 5-6.
7. Install clamping bolts to secure hub to motor shaft. Tighten clamping bolts, see Table 5-6.

Compressor Replacement

Notify Vilter prior to performing a compressor replacement. See Warranty instructions in Section 7 .

Table 5-6. Clamping Bolts and Set Screw Torque Specifications

Coupling Size	Type C ft-lbs (Nm)	
	Clamping Bolts	Key Set Screw
6	13 (18)	13 (18)
7	13 (18)	
8	23 (31)	
9	23 (31)	
10	50 (68)	
11	50 (68)	

Removal

To replace a compressor on a unit, proceed with the following steps:

NOTICE

Dispose of used oil in an appropriate manner following all Local, State and Federal laws and ordinances.

WARNING

Follow local lock-out/tag-out procedure. Compressors must be depressurized before attempting to do any work on them. Failure to comply may result in serious injury, death and/or damage to equipment.

1. Shut down and isolate the compressor unit, see Compressor Unit Isolation for Maintenance and Service procedure.

NOTE
Note location of cables to aid in installation.

2. Disconnect all cables from sensors on compressor and actuators.
3. Remove drive coupling, see appropriate Drive Coupling Replacement procedure.
4. If equipped with C-flange, remove bolts securing C-flange to compressor.
5. Remove center member, see Drive Coupling Removal procedure.
6. Using appropriate drain pan, drain oil by removing drain plugs from under compressor housing and discharge manifold. Allow oil to completely drain.
7. Remove all oil lines from the compressor.
8. Support suction line with appropriate supporting equipment.
9. Remove nuts and bolts securing suction strainer/check valve assembly to suction stop valve and compressor.
10. Using appropriate lifting device, remove suction strainer/check valve assembly from compressor.
11. Remove nuts and bolts securing discharge pipe to compressor and oil separator, see Figure 5-19.
12. Remove discharge pipe and gaskets from compressor and oil separator.

13. Remove nuts, flat washers, lock washers and studs securing compressor to frame.
14. Remove any additional lines and/or components to allow removal of compressor as required.

WARNING

When rigging and lifting a bare shaft compressor, use proper lifting device capable of lifting and maneuvering the weight and size of the compressor. Use only qualified personnel and additional personnel and lifting equipment (i.e. spreader bar) as required. Failure to comply may result in death, serious injury and/or damage to equipment.

NOTE

Refer to Bare Shaft Compressor Lifting Points and Weights section for appropriate lifting hole sizes, weights and lifting points.

15. Install appropriate lifting eyes on top of compressor.
16. Using appropriate lifting device and additional personnel, remove compressor from frame.
17. Remove shims and spherical washers from compressor mounting locations.
18. Inspect shims and spherical washers for damage, replace as required.

Installation

1. Install shims and spherical washers on compressor mounting locations, see Figure 5-19.
2. Install appropriate lifting eyes on top of compressor.
3. Using appropriate lifting device, position compressor on compressor mounting locations on frame.
4. Loosely install studs, lock washers, flat washers and nuts to secure compressor to frame until alignment is correct.
5. Check compressor for soft foot. Add or remove shims as required until measurements are within +/- 0.002".
6. Tighten nuts to secure compressor to frame, refer to Appendix A.
7. If equipped with C-flange, install bolts to secure C-flange to compressor. Tighten bolts, see Appendix A.
8. If equipped with C-flange, install C-flange coupling, refer to C-flange Coupling Replacement procedure.
9. Install coupling, see Drive Coupling Installation and Alignment procedure .
10. Install coupling guard.
11. Install nuts and bolts to secure discharge pipe to oil separator and compressor.
12. Tighten nuts on 'discharge pipe-to-compressor flange' first, then tighten nuts on 'discharge pipe-to-oil separator flange', see Appendix A.
13. Install nuts to secure suction strainer/check valve assembly to compressor and suction stop valve.
14. Tighten nuts on 'suction strainer/check valve assembly-to-compressor' first, then tighten nuts on 'suction strainer/check valve assembly-to-suction stop valve', refer to Appendix A.
15. Install all lines to compressor.
16. Install all cables to sensors on compressor and actuator.
17. Perform leak check, see Compressor Unit Leak Check procedure.

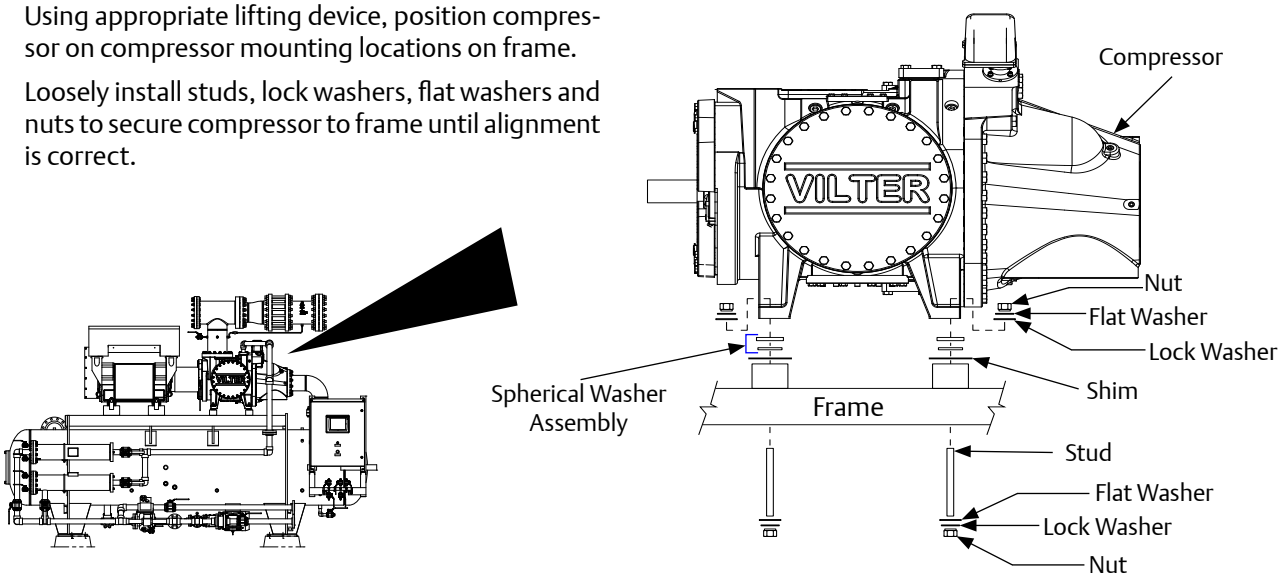


Figure 5-14. Compressor Replacement and Hardware Assembly (Models 2401-3001 Shown)

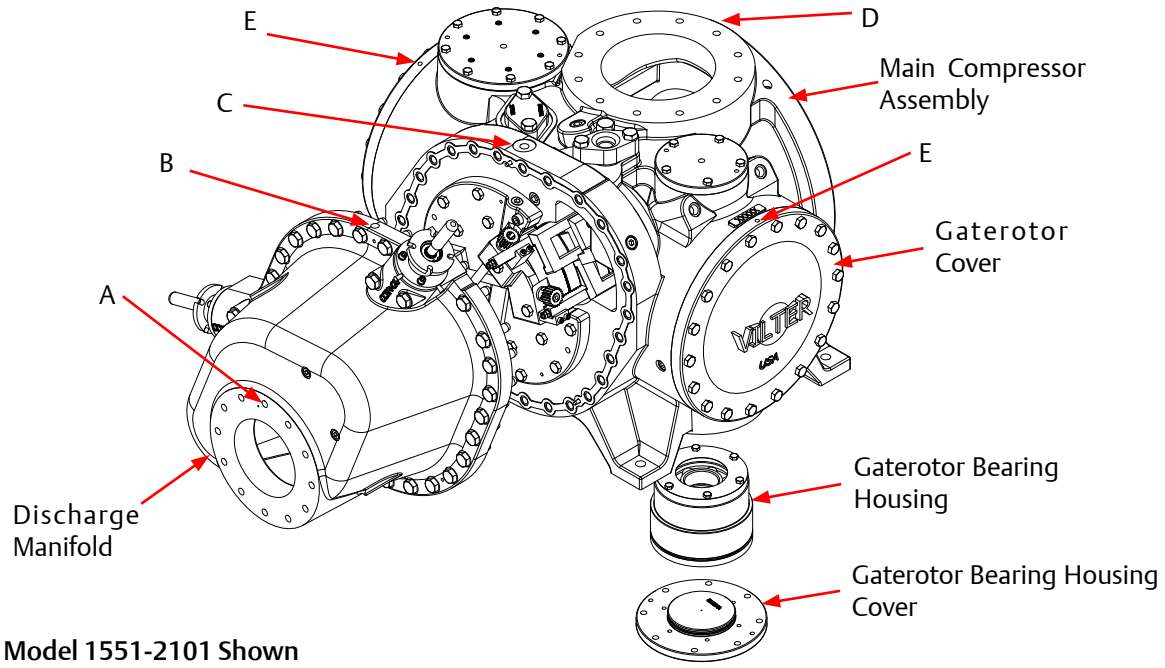
Bare Shaft Compressor Lifting Points and Weights

Table 5-7. Bare Shaft Compressor Component Weights

Models	Component Weights				
	Gaterotor Bearing Housing	Gaterotor Bearing Housing Cover	Discharge Manifold	Main Compressor Assembly ONLY	Gaterotor Cover
128-243	14 lbs (6.35 kg)	9 lbs (4.08 kg)	160 lbs (72.57 kg)	1095 lbs (498 kg)	26 lbs (11.79 kg)
291-601	19 lbs (9 kg)	11 lbs (5 kg)	125 lbs (57 kg)	1105 lbs (502 kg)	46 lbs (21 kg)
751-901	28 lbs (13 kg)	11 lbs (5 kg)	177 lbs (80 kg)	1450 lbs (658 kg)	33 lbs (15 kg)
791-1301	37 lbs (17 kg)	13 lbs (6 kg)	274 lbs (125 kg)	2006 lbs (910 kg)	42 lbs (19 kg)
1551-2101	54 lbs (24 kg)	19 lbs (9 kg)	349 lbs (158 kg)	3151 lbs (1429 kg)	70 lbs (32 kg)
2401-3001	58 lbs (27 kg)	32 lbs (15 kg)	788 lbs (358 kg)	4152 lbs (1883 kg)	150 lbs (68 kg)

Table 5-8. Bare Shaft Compressor Component Lifting Hole Sizes

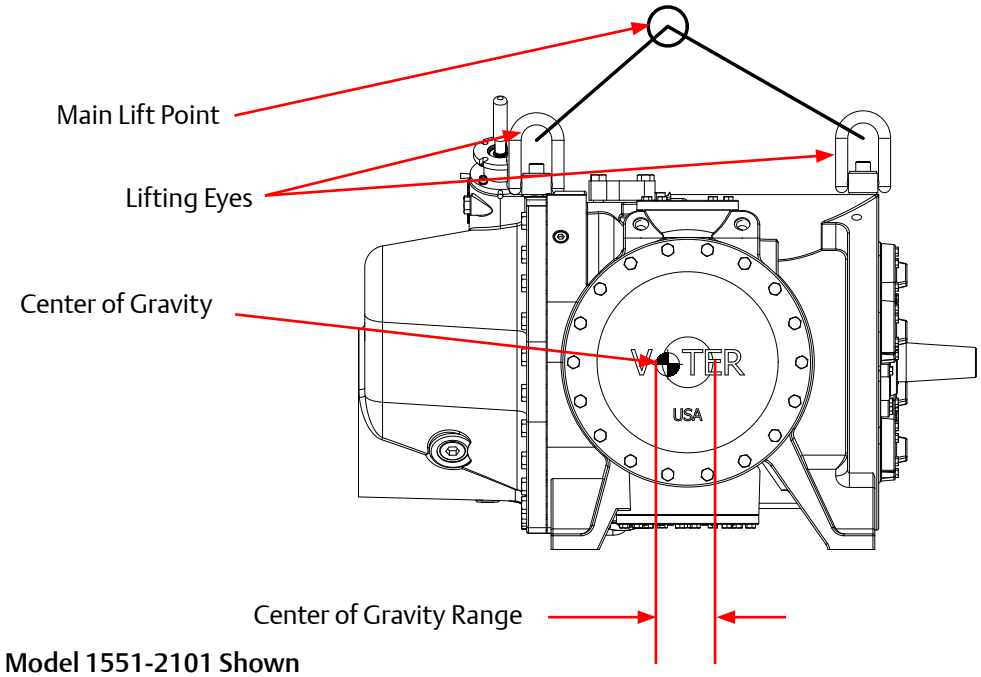
Models	Component Lifting Hole Sizes				
	A	B	C	D	E
	Discharge Manifold (Side)	Discharge Manifold (Top)	Main Compressor Assembly ONLY (Discharge)	Main Compressor Assembly ONLY (Suction)	Gaterotor Cover
128-243	-	1/2-13 UNC -2B	1/2-13 UNC -2B	1/2-13 UNC -2B	-
291-601	5/8-11 UNC - 2B	5/8-11 UNC -2B	5/8-11 UNC -2B	5/8-11 UNC -2B	3/8-16 UNC -2B
751-901	5/8-11 UNC - 2B	5/8-11 UNC -2B	5/8-11 UNC -2B	5/8-11 UNC -2B	-
791-1301	5/8-11 UNC - 2B	5/8-11 UNC -2B	3/4-10 UNC -2B	5/8-11 UNC -2B	3/8-16 UNC -2B
1551-2101	5/8-11 UNC -2B	5/8-11 UNC -2B	5/8-11 UNC -2B	5/8-11 UNC -2B	3/8-16 UNC -2B
2401-3001	5/8-11 UNC -2B	5/8-11 UNC -2B	5/8-11 UNC -2B	3/4-10 UNC -2B	5/8-11 UNC -2B



Model 1551-2101 Shown

Figure 5-15. Bare Shaft Compressor Lifting Points and Component Weights

Bare Shaft Compressor Center of Gravity (Models 291-2101)



Model 1551-2101 Shown

Figure 5-16. Bare Shaft Compressor Assembly Center of Gravity (Models 291-2101)

Center of gravity may differ slightly between models 291-2101. Adjust main lift point within the range to keep bare shaft compressor as leveled as possible when lifting.

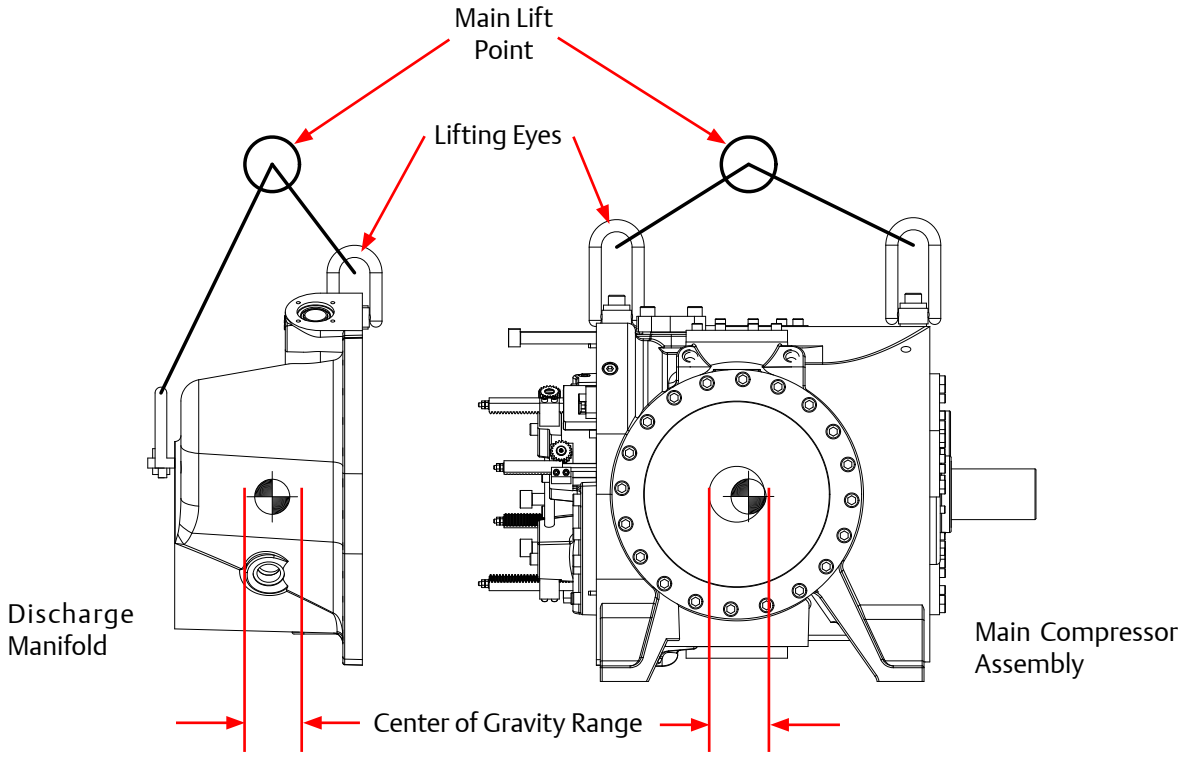


Figure 5-17. Bare Shaft Compressor Center of Gravity - Discharge Manifold and Main Compressor Assembly (Models 291-2101)

Bare Shaft Compressor Center of Gravity (Models 2401-3001)

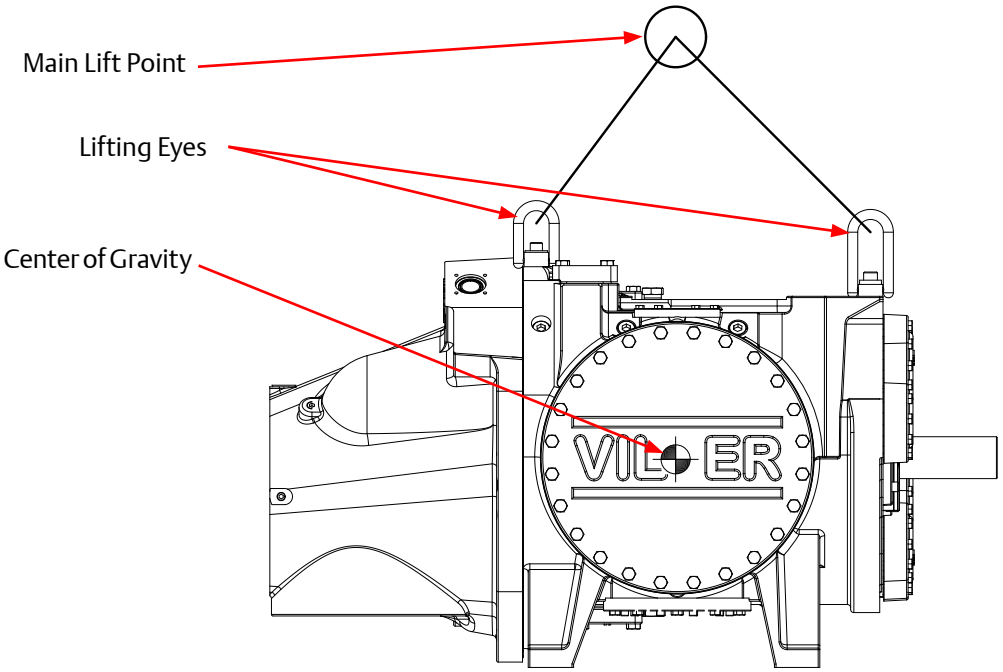


Figure 5-18. Bare Shaft Compressor Assembly Center of Gravity (Models 2401-3001)

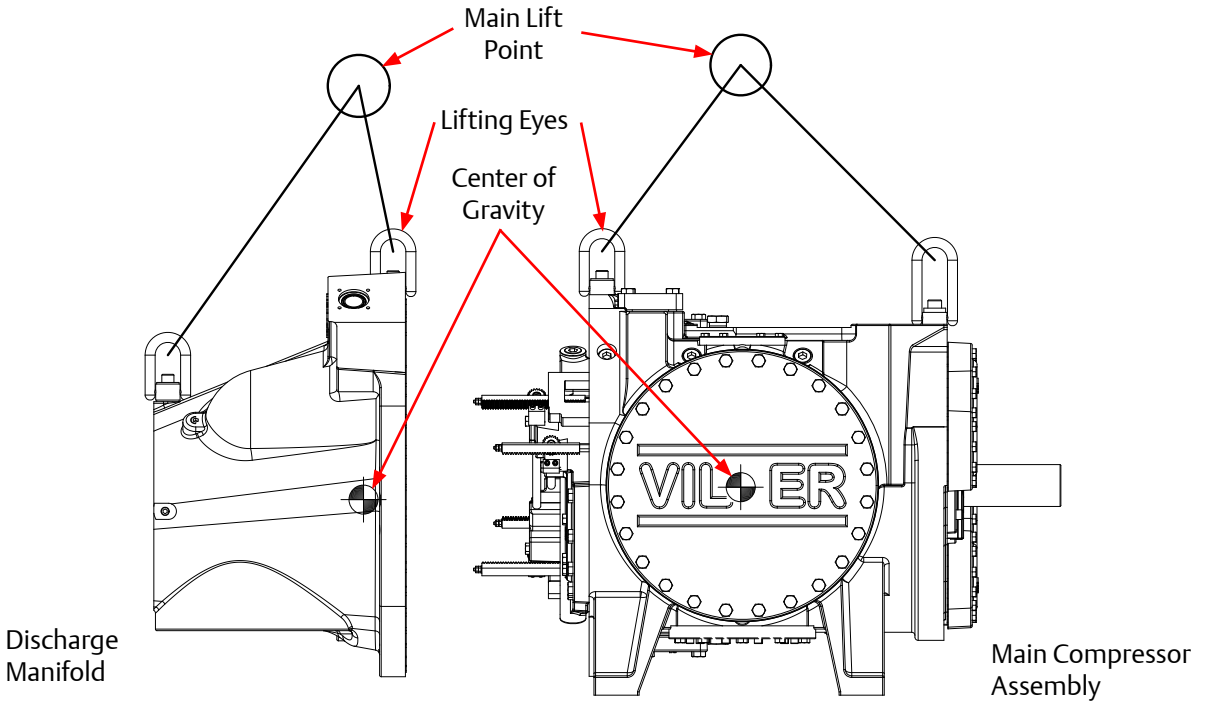


Figure 5-19. Bare Shaft Compressor Center of Gravity - Discharge Manifold and Main Compressor Assembly (Models 2401-3001)

Bare Shaft Compressor Center of Gravity (Models 128-243)

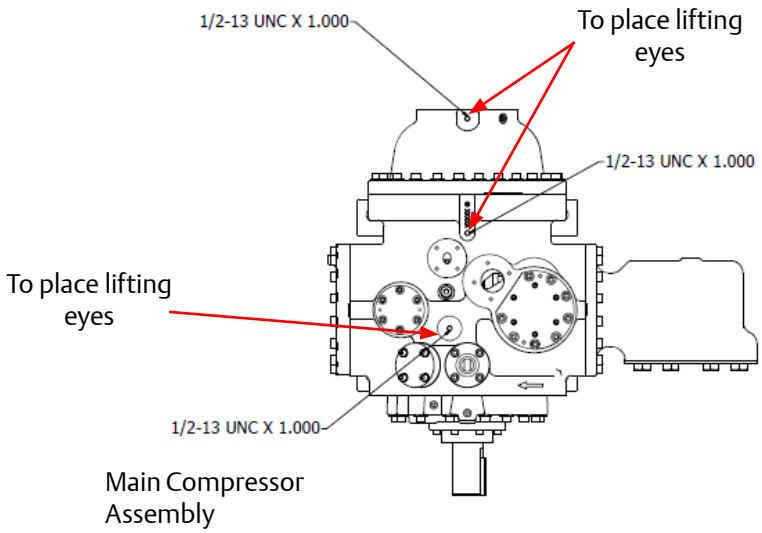


Figure 5-20. Bare Shaft Compressor Assembly Center of Gravity (Models 128-243)

Table 5-9. Bare Shaft Compressor Weights

COMPRESSOR MODEL	VSG 128	VSG 145	VSG 160	VSG 180	VSG 204	VSG 222	VSG 243
Weight	1095 LBS	1095 LBS	1095 LBS	1090 LBS	1090 LBS	1090 LBS	1090 LBS

Compressor Inspection

Vilter™ Single Screw VSG/VSSG Compressors are designed for long periods of trouble free operation with a minimum of maintenance. However, a yearly inspection is recommended so any irregular wear is noted and rectified. At this time, the bearing clearance is measured for the main rotor and gaterotors, and gaterotor backlash and float should also be inspected.

The following procedures are used when measuring the main rotor and gaterotor bearing clearance, gaterotor backlash and float.

Compressor Shaft Bearing Clearance Inspections

If clearance measurements are out of tolerance, contact Vilter™ Technical Support for further assistance.

CAUTION

When taking the measurements, do not exceed 300 lbs of force at point of contact or damage may result to the bearings.

Determine Maximum Applied Force

To determine maximum applied force, take maximum applied force at hub/shaft multiplied by length of A and divide by length B. This is the maximum force that should be applied on the lever.

(Applied Force x A)/B = Applied Force (Maximum)

So, using a 36" (or 1 m) lever with pivot space of 6" (or 15 cm) would make the maximum applied force to be 60 lbf (or 235 N). Calculation is as follows:

(300 lbf x 6")/30" = 60 lbf (Max. *Applied Force*)

(1335 N x 15 cm)/85 cm = 235 N (Max. *Applied Force*)

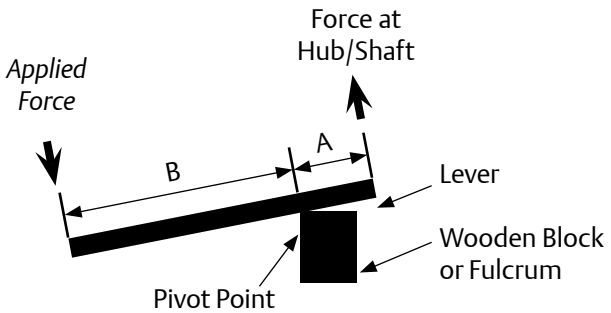


Figure 5-21. Maximum Applied Force

As a quick reference, Table 5-10 shows maximum applied forces for 36" lever with 6" pivot for all compressor models.

Main Rotor Bearing Axial Clearance Inspection

To inspect bearing axial clearance, proceed with the following steps:

1. Install dial indicator to the compressor frame and zero indicator, see Figure 5-22.
2. Place lever arm and fulcrum behind compressor coupling half and push the coupling towards the motor. Record measurement.
3. Re-zero indicator, now position the fulcrum on the motor and use the lever arm to push the input shaft towards the compressor. Record measurement
4. Add both measurements. If measurement is out of allowable tolerance shown in Table 5-10, the bearing may need to be replaced. Contact Vilter™ Technical Support.

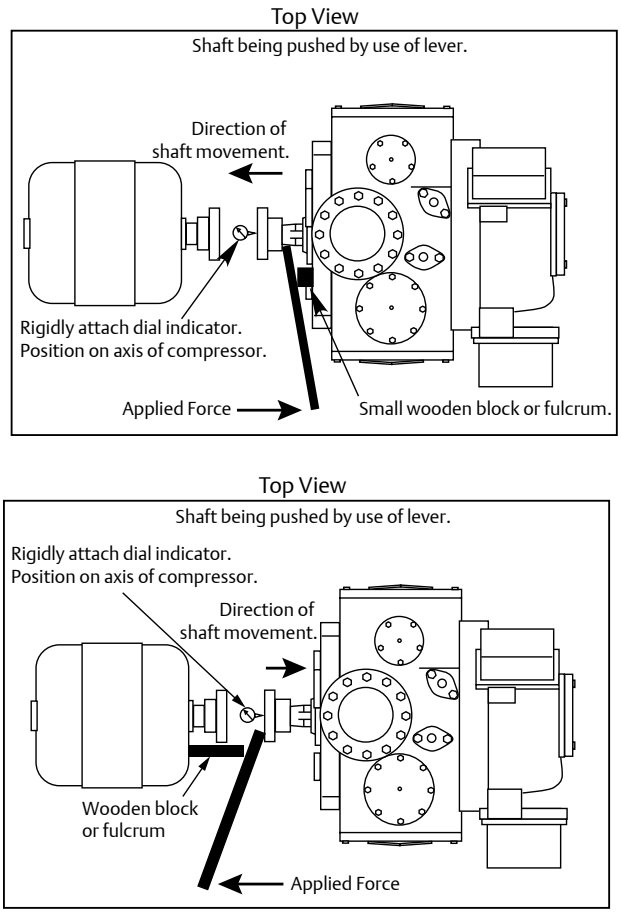


Figure 5-22. Bearing Axial Clearance Inspection

Main Rotor Bearing Radial Clearance Inspection

5. Install dial indicator to the compressor frame and zero indicator, see Figure 5-23.

NOTE

Do not exceed maximum applied force. For maximum applied forces of all compressor models, see Table 5-10.

6. Place lever arm and fulcrum underneath hub and push hub upwards. Record measurement.
7. If measurement is out of allowable tolerance shown in Table 5-10, the bearing may need to be replaced. Contact Vilter™ Technical Support.

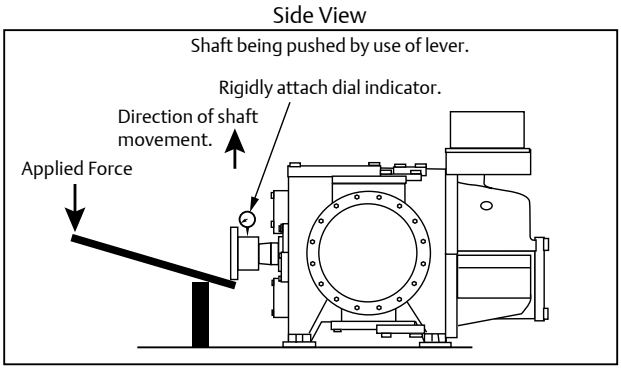


Figure 5-23. Bearing Radial Clearance Inspection

Table 5-10. Maximum Rotor Bearing Clearance

Compressor Model	Max. Axial Clearance in. (mm)	Max. Radial Clearance in. (mm)	Max. Force at Hub/Shaft lbf (N)	Max. Applied Force (36 Lever, 6 Pivot) lbf (N)
128, 145, 160, 180, 204, 222, 243	0.002 (0.051)	0.006 (0.152)	100 (444)	20 (89)
301, 361, 401		0.006 (0.152)	100 (444)	20 (89)
501, 601, 701		0.007 (0.178)	150 (667)	30 (133)
291, 341, 451, 601		0.007 (0.178)	150 (667)	30 (133)
751, 901		0.006 (0.152)	200 (890)	40 (178)
791, 891, 1051, 1201, 1301		0.006 (0.152)	300 (1335)	60 (267)
1501, 1551, 1801, 1851, 2101		0.007 (0.178)	400 (1780)	80 (356)
2401, 2601, 2801, 3001		0.006 (0.152)	600 (2670)	120 (534)

Gaterotor Bearing Inspection

1. Position a one gallon (at least) plastic oil collection bin beneath the side cover. Carefully pry open the side cover to allow the oil to drain before finally removing the side cover.
2. To measure the gaterotor radial bearing clearance, position a dial indicator to the gaterotor shaft as shown in Figure 5-24 (a) and zero the indicator. Put a hand as shown and firmly move the shaft in the direction shown in Figure 5-24 (a). Record the measurement. See Table 5-11 for the maximum radial clearance value.
3. To measure the gaterotor axial bearing clearance, position a dial indicator on the gaterotor, as shown in Figure 5-24 (b).
4. To check axial bearing clearance use a lever arm pivoting on a bolt with a small block of wood against the gaterotor to protect it, as shown in Figure 5-24 (b). Record the measurement. See Table 5-11 for the maximum axial clearance value.

Table 5-11. Maximum Gaterotor Bearing Clearance

Compressor Models	Max. Axial Clearance in (mm)	Max. Radial Clearance in (mm)
All Sizes	0.002" (0.051 mm)	0.004" (0.102 mm)

Figure 5-24 (a): Radial

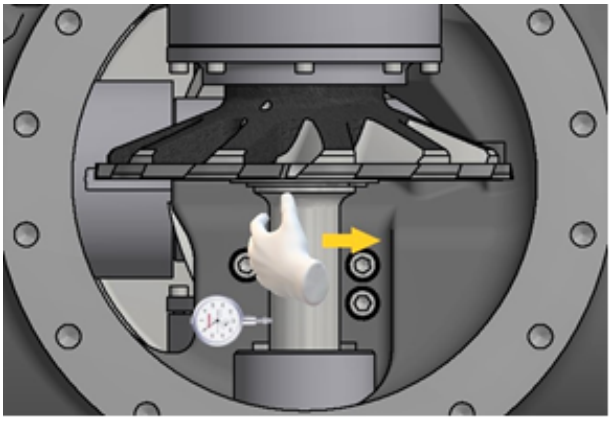


Figure 5-24 (b): Axial

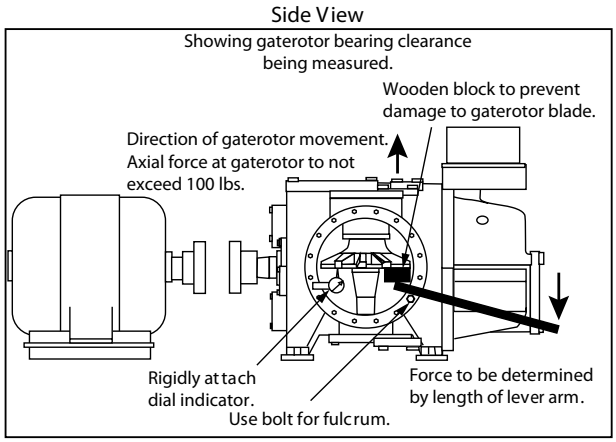


Figure 5-24. Gaterotor Bearing Clearance

Gaterotor Inspection

A) Gaterotor - Main Housing Shelf Clearance

Follow these steps to check the clearance between the gaterotor and the shelf, which should be between 0.003" – 0.004", see Figure 5-25.

1. Place a 0.003" feeler gauge between the gaterotor teeth, as shown in Figure 5-26 (a) and (b).

NOTE

Make sure the feeler gauge stays in the opening between the two teeth until it is on top of the shelf.

2. Without moving the feeler gauge, slowly rotate the gaterotor so that the feeler gauge tip stays between the gaterotor and the shelf. See Figure 5-26 (c).

CAUTION

Do not over rotate. If the rotor catches the feeler gauge, a piece can break and fall into the rotor groove.

3. Gently pull the feeler gauge out in the direction shown in Figure 5-26 (d).

Check for 0.003"-0.004" (0.076 - 0.102 mm) clearance between gaterotor blade and shelf.

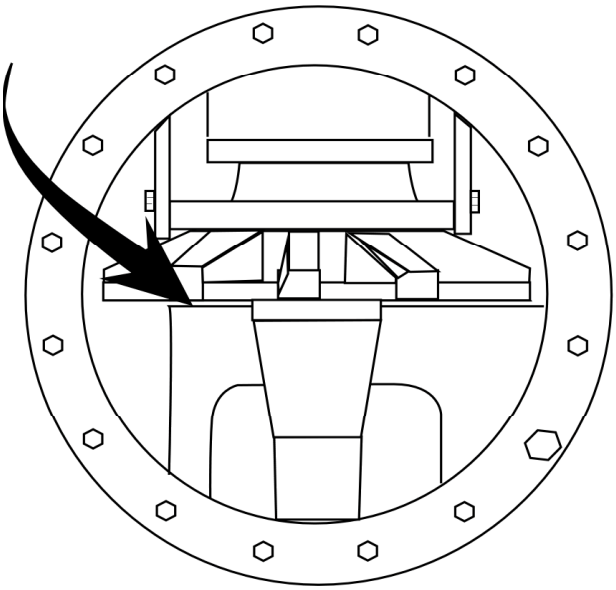
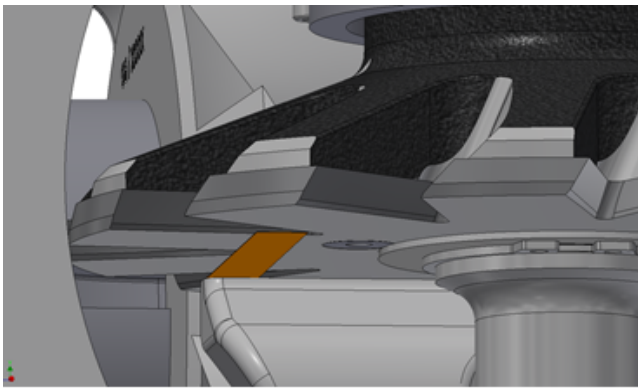
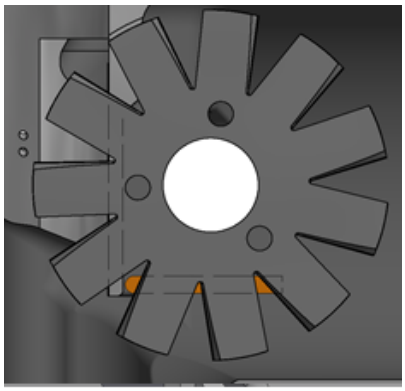


Figure 5-25. Gaterotor and Shelf Clearance

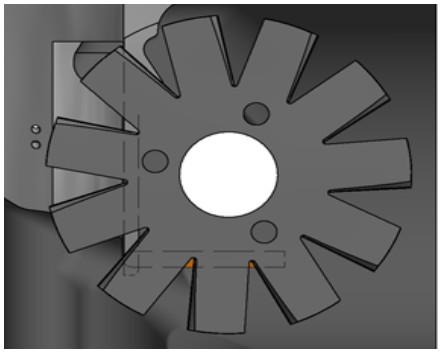
(a) Feeler Gauge Placement (Side View)

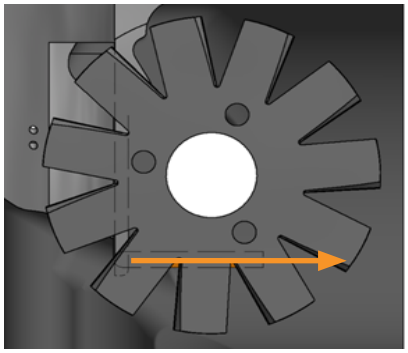




(b) Feeler Gauge Placement (Top View)

(c) Tip Of The Feeler Gauge Stays Between Gaterotor and Shelf While Rotating





(d) Feeler Gauge Must Be Pulled Out In This Direction

Figure 5-26. Gaterotor and Shelf Clearance Measurement Steps

4. If it is easy to pull out the feeler gauge, then increase the feeler gauge thickness by 0.001" and repeat above steps 1-3. If it is slightly tight to pull it out, then the clearance corresponds to the feeler gauge thickness.

NOTE

Replacement gaterotors are the same dimensionally as the gaterotors installed at the factory. Therefore, the same shims can be reused when replacement is needed to preserve the 0.003" – 0.004" clearance.

Clearance and Shims

Under 0.003"	0.003" – 0.004"	Over 0.004"
Remove shims (103 in Figure 5-46 & 5-49, 106 in Figure 5-36 & 5-38) to achieve 0.003" – 0.004"	Perfect!	Add shims (103 in Figure 5-46 & 5-49, 106 in Figure 5-36 & 5-38) to achieve 0.003" – 0.004"

B) Gaterotor Float Measurement

1. Before doing any measurements, first conduct a visual check to see if there is any noticeable clearance between the gaterotor and its bushing, see Figure 5-27. If there is noticeable clearance, please contact Vilter Service Department.

NOTE

The number of bushings on a gaterotor can be anywhere from one to three.

2. To measure the float between the gaterotor bushing and the support damper pin (see Figure 5-29), position a dial indicator at the tip of the support as shown in Figure 5-28. Hold the gaterotor in place, then gently move the support teeth back and forth with two fingers (and record measurement). Refer to Table 5-12 to find the maximum float value.

NOTICE

If clearance measurements are out of tolerance, contact Vilter Service Department for further assistance.

Table 5-12. Gaterotor Float

Model	Max. Float in. (mm)
VSSG/VSSGC 291 - 601	0.045 (1.143)
VSG/VSGC 128 - 243	0.065 (1.651)
VSG/VSGC 301 - 401	0.045 (1.143)
VSG/VSGC 501 - 701	0.045 (1.143)
VSG/VSGC 751 - 901	0.055 (1.397)
VSG /VSGC 791 - 1301	0.060 (1.524)
VSG/VSGC 1551 - 2101	0.060 (1.524)
VSG/VSGC 2401 - 3001	0.060 (1.524)

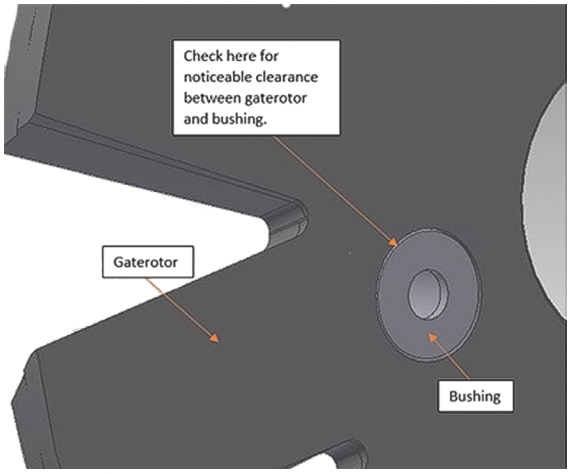


Figure 5-27. Visual Inspection Between Gaterotor and Bushing

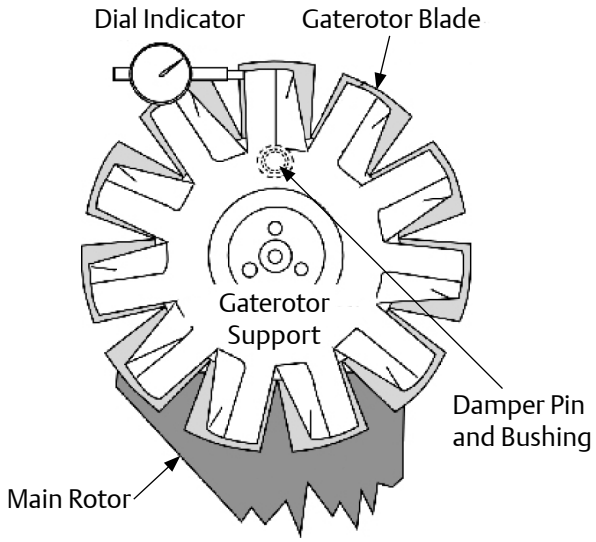


Figure 5-28. Gaterotor Float Dial Location

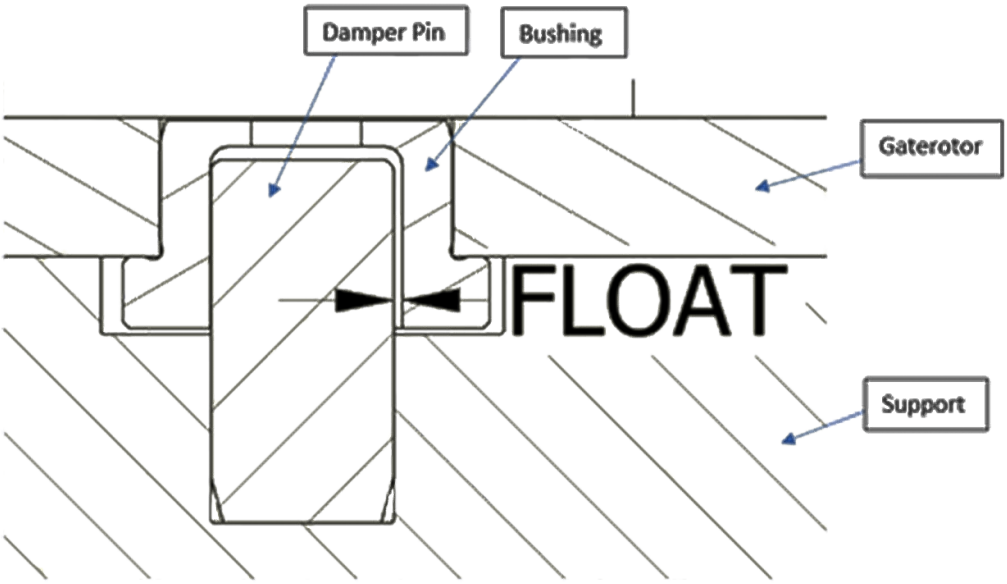


Figure 5-29. Gaterotor Float

C) Gaterotor Backlash Inspection

Gaterotor Backlash is the clearance between the gaterotor teeth width and the main rotor groove.

Follow these steps to perform the gaterotor backlash inspection:

1. The Gaterotor should be aligned so that a tooth in the rotor is perpendicular to the Main Axis as shown in Figure 5-30. The tooth should be in the center axis of the housing.
2. A dial indicator with magnetic base can be used (Vilter part numbers 9994ARE or 9994ARJ for the dial indicator, and 9994ARD for the magnetic base). See Figure 5-31 for location.
3. Place the Dial Indicator as square as possible on the Gaterotor tooth as shown on Figure 5-32.

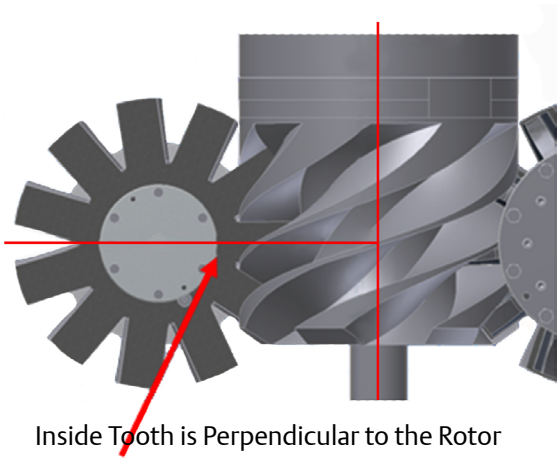


Figure 5-30. Alignment of Gaterotor

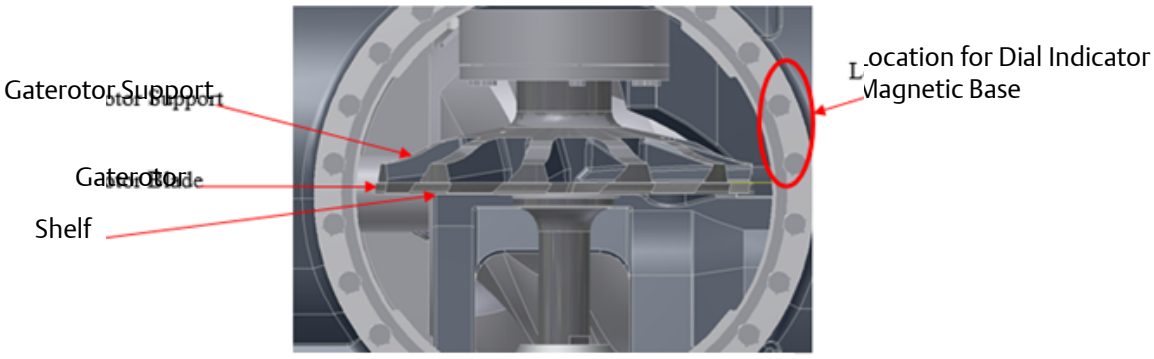


Figure 5-31. Location of Dial Indicator Magnetic Base

4. To measure the backlash (see Figure 5-33), move the gaterotor with two fingers back and forth rapidly several times while reading the dial indicator to see what the displacement range is. This displacement range will be the total backlash.

Contact Vilter Service Department if the measurement is above the ranges shown in Table 5-13.

Table 5-13. Backlash Range

Compressor Model	Normal Backlash
VSG/VSGC 97 - 1301	0.008" to 0.012"
VSG/VSGC 1501 - 3001	0.008" to 0.015"

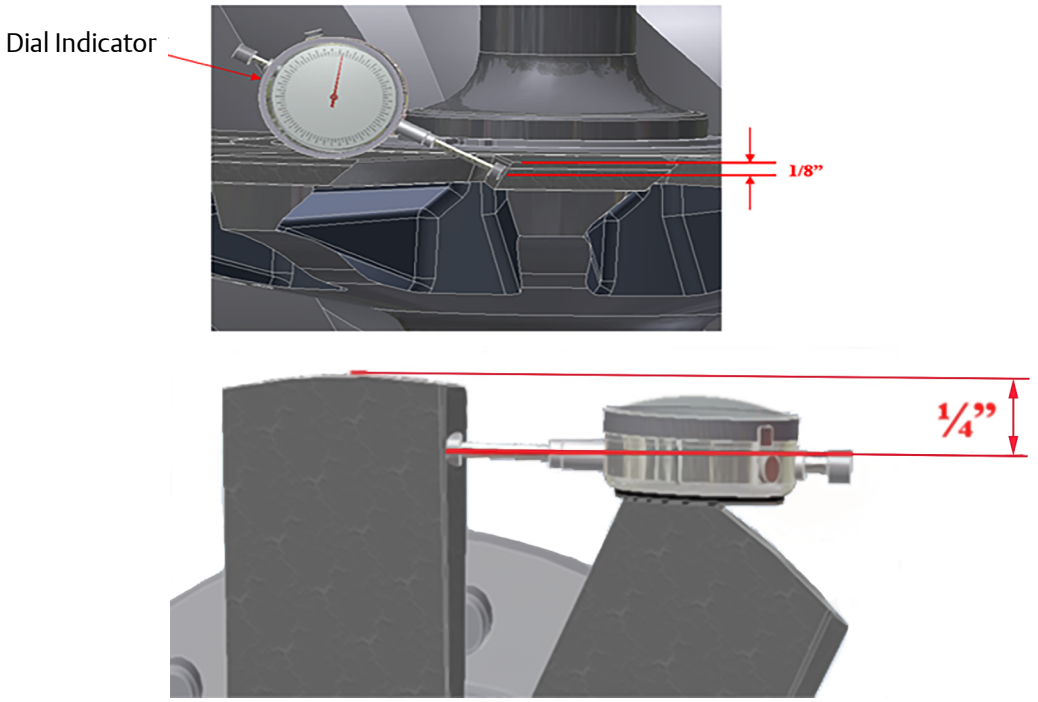


Figure 5-32. Placement of Dial Indicator

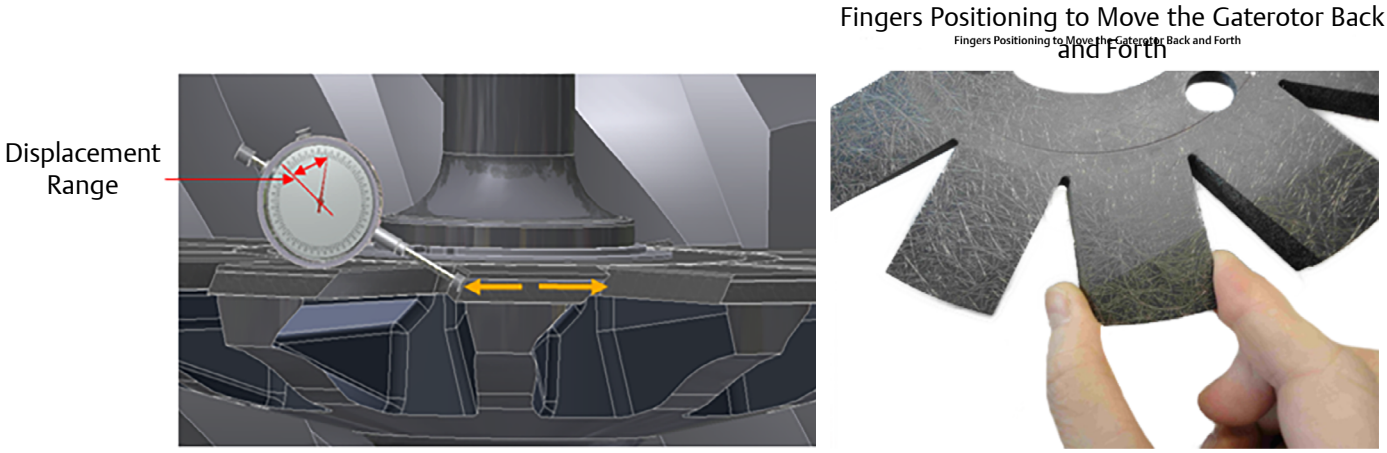


Figure 5-33. Measuring Backlash

Important Notes

1. Backlash cannot be checked if:

- The gaterotor is damaged in any way.
- The clearance between the gaterotor and the shelf is too tight.

2. Make sure you check the backlash, not the float:

- The backlash is the clearance between the gaterotor teeth width and the rotor groove.
- The float is the amount of play between the gaterotor bushing and the damper pins.

Additional Inspections

In addition, visually inspect the main rotor and gaterotors for signs of abnormal wear due to dirt or other contaminants.

If some chipping is present on the edges of the gaterotor, this will not influence the compressor performance. If chipping is more than what´s shown on Figure 5-34, take pictures and contact Vilter Service Department.

Post Inspection

After all the inspections are complete, the gaterotor cover, suction tee, coupling center member and coupling guard can be reinstalled and the unit can be evacuated and leak checked before starting.

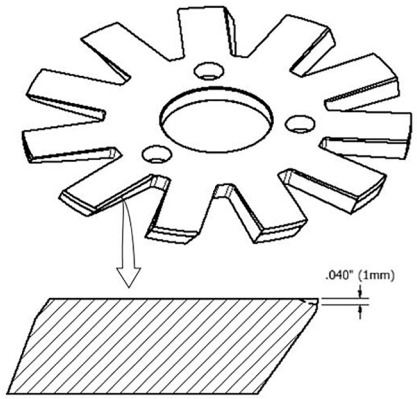


Figure 5-34. Chipped Edge of Gaterotor

Gaterotor Assembly Replacement (All VSG & VSSG Compressors Except VSG 301-701 and VSG 128 - 243 Compressors)

The following table lists the gaterotor tool sets needed to remove and install gaterotor assemblies.

Table 5-14. Gaterotor Tool Sets

Model	Tool Set VPN
VSSG/VSSGC 291 - 601	A25205B
VSG/VSGC 128 - 243	A25205G
VSG/VSGC 301 - 401	N/A
VSG/VSGC 501 - 701	A25205B
VSG/VSGC 751 - 1301	A2520 5C
VSG/VSGC 1551 - 2101	A25205E
VSG/VSGC 2401 - 3001	A25205F

Removal

WARNING

Follow local lock-out/tag-out procedure. Compressors must be depressurized before attempting to do any work on them. Failure to comply may result in serious injury, death and/or damage to equipment.

1. Remove center member, see appropriate Drive Coupling Replacement procedure.

NOTE

All parts must be kept with their appropriate side and not mixed when the compressor is reassembled.

2. Remove two upper bolts from side cover
3. Install guide studs in holes.

NOTE

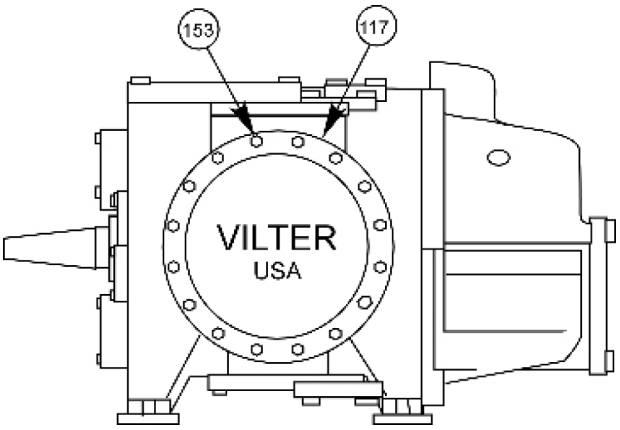
There will be some oil drainage when the cover is removed.

4. Remove remaining bolts and side cover.
5. Turn main rotor so a driving edge of any one of the main rotor grooves is even with the back of the gaterotor support.

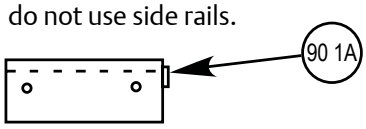
NOTE

The gaterotor stabilizer is designed to hold the gaterotor support in place and prevent damage to the gaterotor blade as the thrust bearings and housing is being removed.

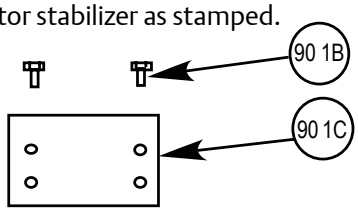
6. Insert gaterotor stabilizer. The side rails are not required on VSSG 291 thru 601. For the VSG 751 thru 901 and VSG 1051 thru 1301 compressors, use the side rails and assemble to the gaterotor stabilizer as stamped. For the VSG 1551 thru 3001, use the side rails and assemble to the gaterotor stabilizer.
7. Remove hex head bolts and socket head bolts from thrust bearing cover.
8. Re-install two bolts into the threaded jacking holes to assist in removing thrust bearing cover. Retain the shim pack.
9. Hold gaterotor support with a suitable wrench on the flats provided near the roller bearing housing.
10. Remove the inner retainer bolts and retainer.
11. To remove the thrust bearing housing, install thrust bearing removal and installation tool with smaller puller shoe. Turn the jacking screw clockwise. The thrust bearings and housing assembly will be pulled off the shaft and out of the frame.
12. Remove bolts from roller bearing housing.
13. Re-install two bolts into jack bolt holes provided in housing to aid in removal.
14. To remove the gaterotor support, carefully move support in the opposite direction of rotation and tilt roller bearing end towards the suction end of the compressor. The compressor input shaft may have to be turned to facilitate the removal of the gaterotor support. On dual gate compressor units, repeat the procedure for the remaining gaterotor support assembly.



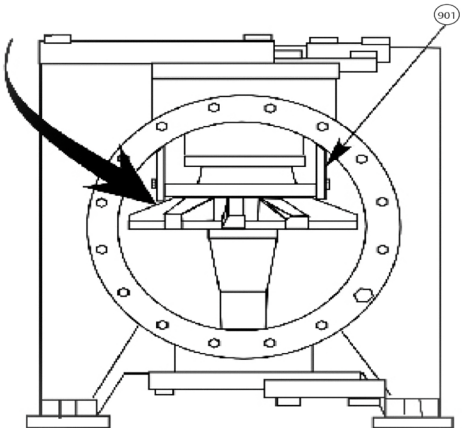
For VSSG 291-601 compressors, do not use side rails.



For VSG 751/901 and 1051-1301 compressors, use side rails and assemble gaterotor stabilizer as stamped.



Position leading edge of main rotor groove flush with or slightly below back of gaterotor support.



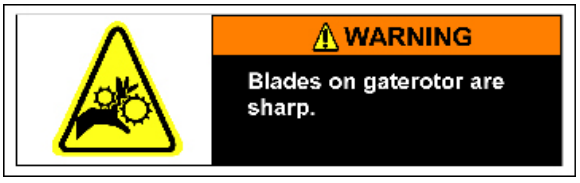
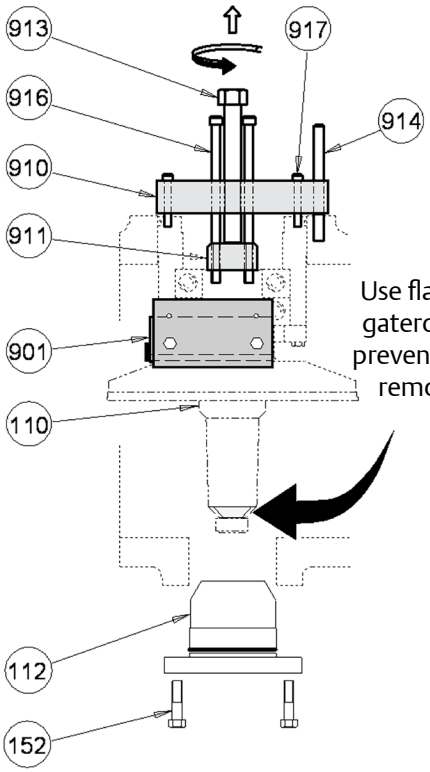


Figure 5-35 Gaterotor Assembly Removal and Tools



Use flats provided on gaterotor support to prevent rotation when removing bearing retainer.

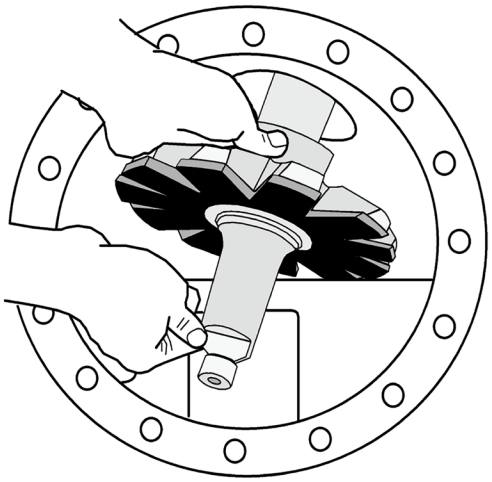


Figure 5-36. Gaterotor Assembly Removal

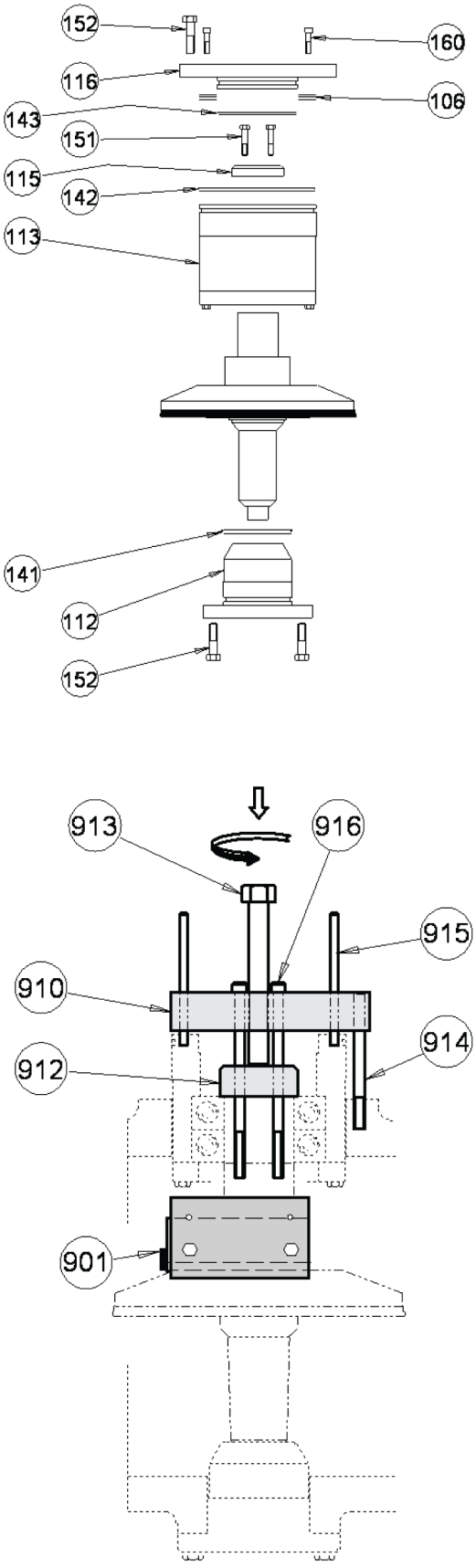


Figure 5-37. Gaterotor Assembly and Tools

Installation

1. Install gaterotor support by carefully tilting the roller bearing end of the gaterotor support towards the suction end of the compressor. The compressor input shaft may have to be rotated to facilitate the installation of the gaterotor support. Install gaterotor stabilizer. The gaterotor stabilizer (901) will hold the gaterotor support in place as the thrust bearing housing is being installed. If the gaterotor support is not restricted from moving, the gaterotor blade may be damaged. See Figure 5-37.
2. Install the roller bearing housing (112) with a new O-ring (141). See Figure 5-37.
3. Tighten bolts (152), see Appendix A.

Check for 0.003"-0.004" (0.076 - 0.102 mm) clearance between gaterotor blade and partition.

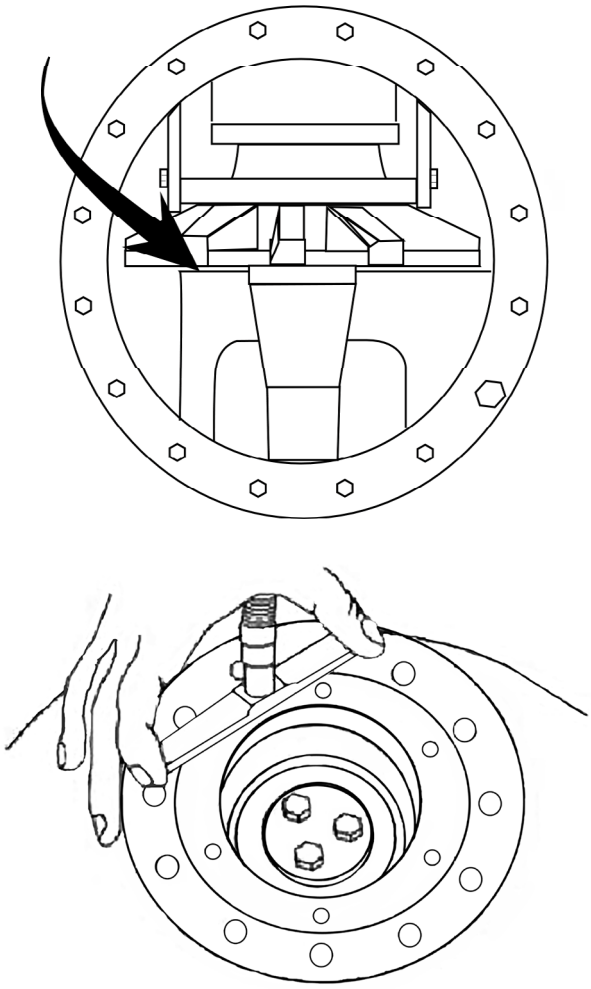


Figure 5-38. Gaterotor and Shelf Clearance

4. When installing the thrust bearing housing (113), a new O-ring (142) must be used when the housing is installed, see Figure 5-37. Lubricate the outside of the housing and bearings with clean compressor oil to aid in the installation. Due to the fit of the bearings on the gaterotor shaft, the thrust bearing removal and installation tool with the pusher shoe must be used. Turn the jacking screw clockwise. This will push the thrust bearings onto the shaft and push the housing assembly into the frame. Install the inner retainer (115) and bolts (151) using Loctite® 242 thread locker. Tighten bolts, see Appendix A.
5. Set clearance between gaterotor blade and shelf.
6. Place a piece of 0.003"-0.004" shim stock between gaterotor blade and shelf.

NOTE

This measurement determines the amount of shims needed for the correct clearance.

7. Measure depth from top of compressor case to top of thrust bearing housing.
8. Use factory installed shim pack (106) and bearing housing cover (116) without the O-ring (143).

NOTE

Replacement blades are precisely the same dimensionally as blades installed originally at factory: Therefore, the same amount of shims will be required for replacement blades.

9. Check the clearance between the entire gaterotor blade and the shelf, rotate the gaterotor to find the tightest spot. It should be between 0.003"-0.004" (0.076-0.102 mm). Make adjustments, if necessary. It is preferable to shim the gaterotor blade looser rather than tighter against the shelf, see Figure 5-38.
10. After clearance has been set install a new O-ring (143) on bearing housing cover, install cover and tighten the bolts to the recommended torque value. See Figure 5-37.
11. Install side cover with a new gasket. Tighten the bolts to the recommended torque value. The unit can then be evacuated and leak checked.

Gaterotor Assembly Replacement (VSG 301-701 Compressors ONLY)

Removal

The removal of the gaterotor assembly for the VSG 301-701 compressors is similar for the VSG 901 - 2101 compressors except that the inner races are secured to the stationary bearing spindle.

1. Remove center member, see appropriate Drive Coupling Replacement procedure.
2. Remove the upper bolt from the side cover and install a guide stud in the hole.
3. Remove remaining bolts and side cover. There will be some oil drainage when the cover is removed.

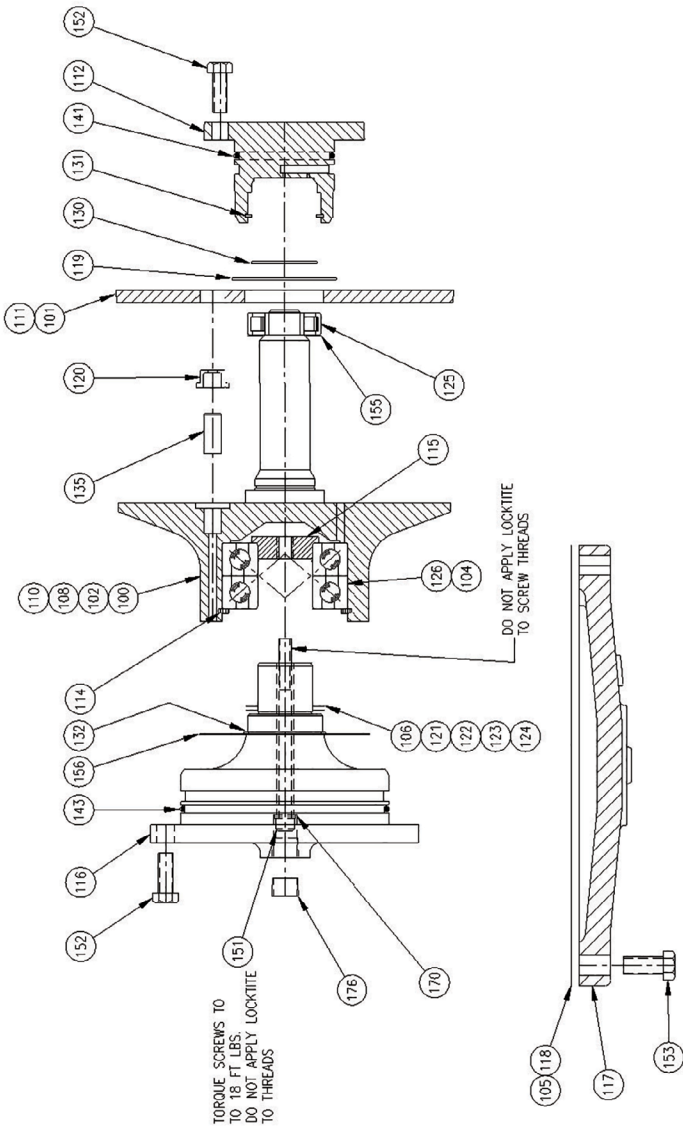


Figure 5-39. Gaterotor Assembly Breakdown

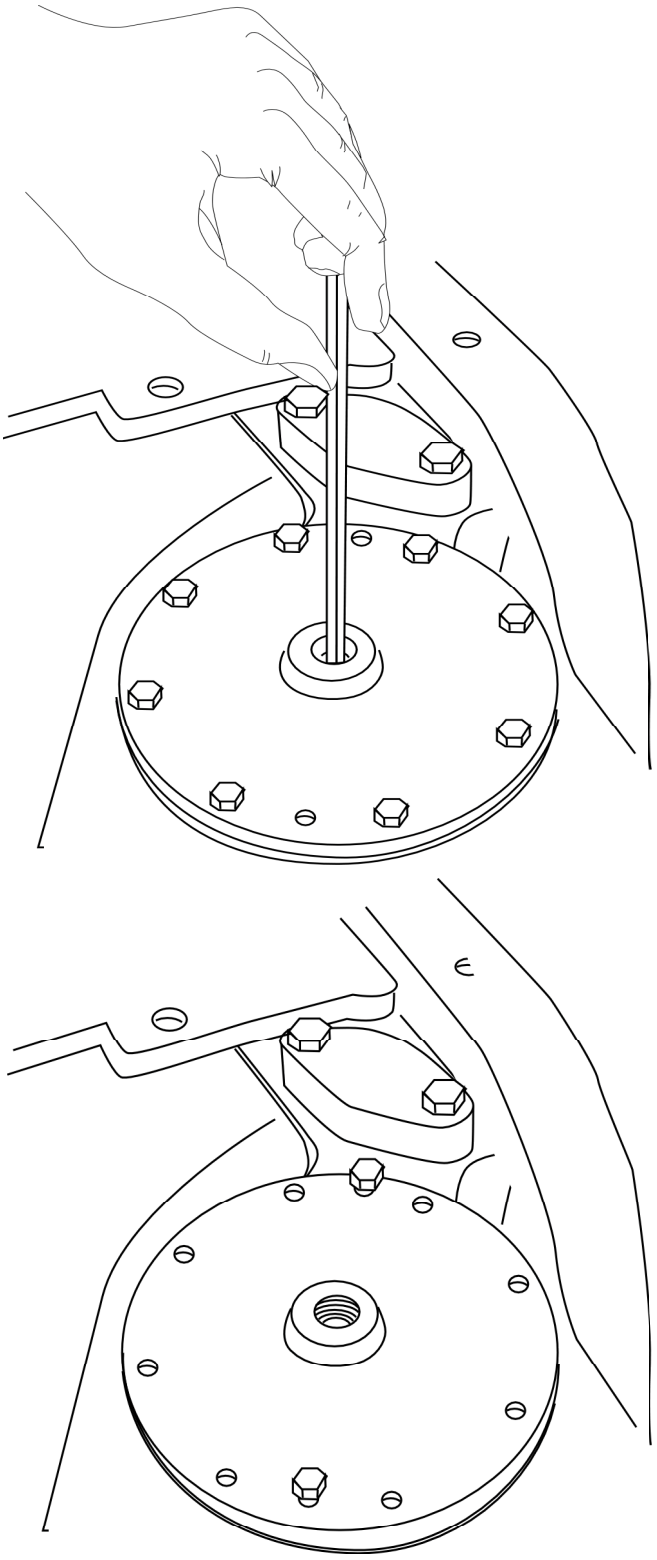
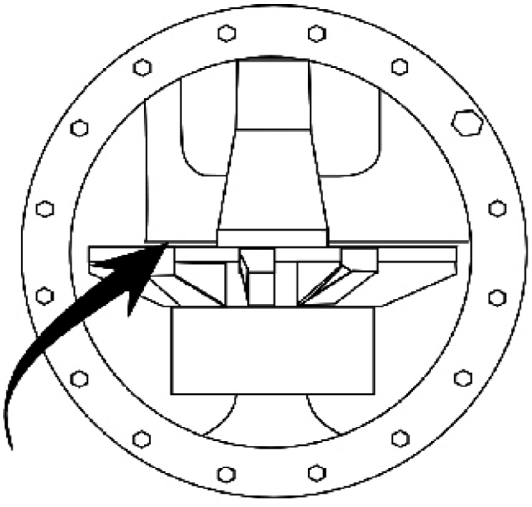


Figure 5-40. Gaterotor Thrust Bearing

4. The side cover that contains the suction strainer should have the suction line properly supported before the bolts securing the line to the cover can be removed. After the line is removed, the cover can be removed per paragraph 2.
5. Turn the main rotor so the driving edge of the groove is between the top of the shelf or slightly below the back of the gaterotor support. At this point install the gaterotor stabilizing tool.
6. Remove plug on the thrust bearing housing. Loosen the socket head cap screw that is located underneath the plug. This secures the inner races of the thrust bearings to the spindle.
7. Remove bolts that hold the thrust bearing housing to the compressor. Insert two of the bolts into the threaded jacking holes to assist in removing the bearing housing from the compressor. When the housing is removed, there will be shims between the spindle and thrust bearings. These control the clearance between the shelf and gaterotor blades. These must be kept with their respective parts for that side of the compressor.
8. Remove the bolts from the roller bearing housing. After the bolts have been removed, the housing can be removed from the compressor.
9. To remove the gaterotor support, carefully move the support opposite the direction of rotation and tilt the roller bearing end towards the suction end of the compressor. The compressor input shaft may have to be turned to facilitate the removal of the gaterotor support. On dual gate versions, repeat the procedure for the remaining gaterotor support assembly.



Check for 0.003"-0.004" (0.076 - 0.102 mm) clearance between gaterotor blade and partition.

Figure 5-41. Gaterotor and Shelf Clearance

Installation

1. Install the gaterotor support. Carefully tilt the roller bearing end of the gaterotor support towards the suction end of the compressor. The compressor input shaft may have to be rotated to facilitate the installation of the gaterotor support.
2. Install the roller bearing housing with a new O-ring. Tighten the bolts to the recommended torque value.
3. Install the spindle with shims and O-ring, tighten bolts, see Appendix A • Torque Specifications. Measure the clearance between the shelf and blade.
4. Check the clearance between the entire gaterotor blade and the shelf, rotate the gaterotor to find the tightest spot. It should be between 0.003"-0.004" (0.076-0.102 mm). Make adjustments, if necessary. It is preferable to shim the gaterotor blade looser rather than tighter against the shelf.
5. Once the clearance is set remove the spindle. Install new O-ring, apply Loctite 242 thread locker to the socket head cap screw clamping the thrust bearings to the spindle. Torque all bolts, see Appendix A.
6. Install side covers with new gaskets. Tighten bolts, see Appendix A • Torque Specifications. The unit can now be evacuated and leak checked.

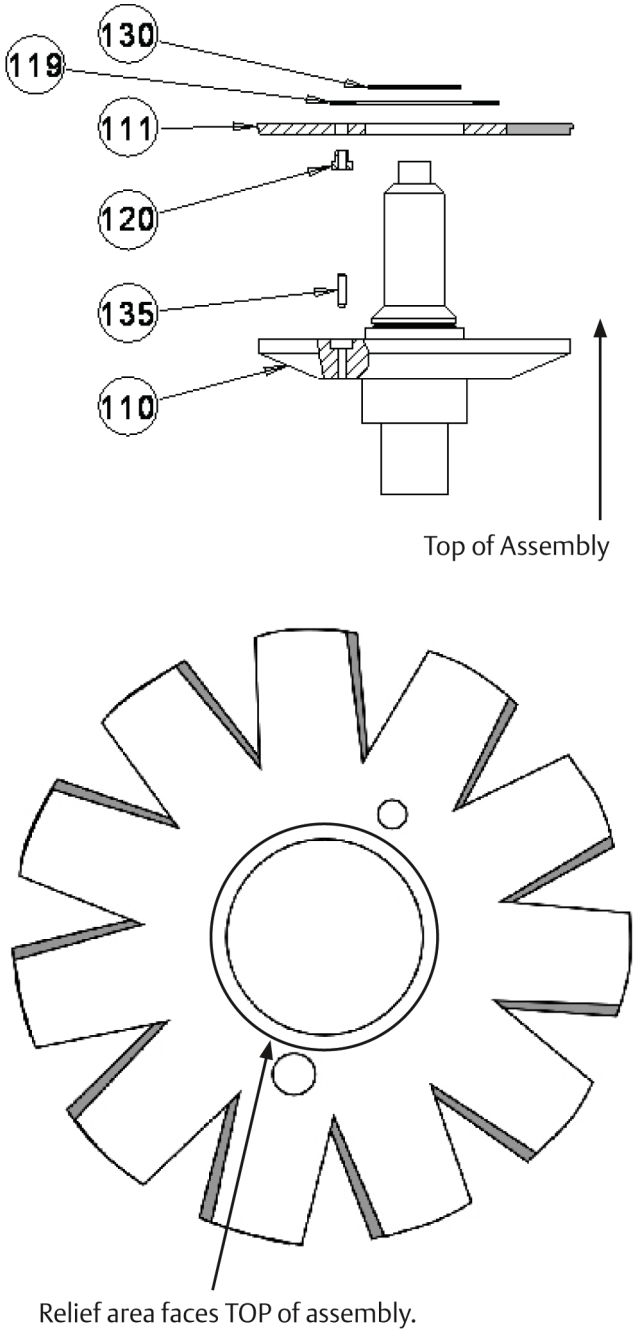


Figure 5-42. Gaterotor Blade Assembly

Gaterotor Disassembly

To perform gaterotor disassembly, remove gaterotor from compressor, see Gaterotor Assembly Replacement procedure (All VSG-VSSG Compressors Except VSG 301-701 Compressors) or Gaterotor Assembly procedure (VSG 301-701 Compressors ONLY).

Gaterotor Blade Removal

1. Remove the snap ring and washer from the gaterotor assembly. Lift gaterotor blade assembly off the gaterotor support, see Figure 5-42.
2. Check damper pin and bushing for excessive wear. Replace if required.

Gaterotor Blade Installation

1. Install damper pin bushing (120) in gaterotor blade (111) from the back side of the blade. Be sure bushing is fully seated.
2. Place blade assembly on gaterotor support. Locating damper over pin.
3. Install washer (119) and snap ring (130) on gaterotor assembly. The bevel on the snap ring must face away from the gaterotor blade. After the gaterotor blade and support are assembled, there should be a small amount of rotational movement between the gaterotor and support.

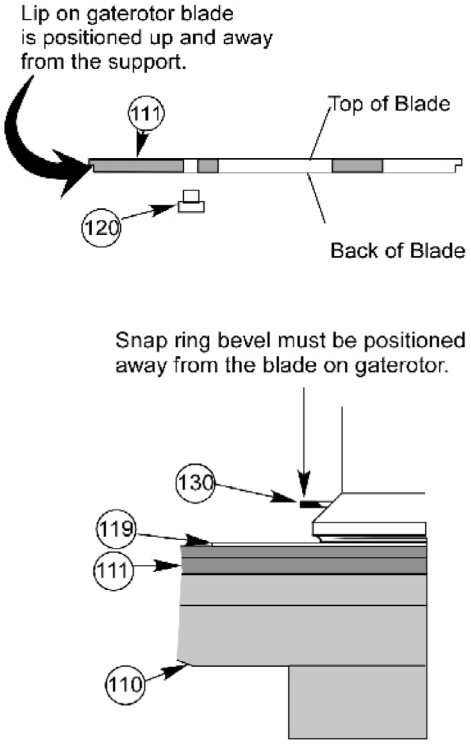


Figure 5-43. Gaterotor Blade Installation

Gaterotor Thrust Bearing Removal

For removal of thrust bearings on VSG units:

1. Remove bolts (150) from the clamping ring (114), see Figure 5-44.
2. Remove thrust bearing clamping ring.
3. Remove thrust bearings (126) from housing (113).

For removal of thrust bearings on VSSG units:

4. Remove retaining ring from gaterotor support.
5. Remove bearings from support.
6. Remove bearing retainer from inner race.

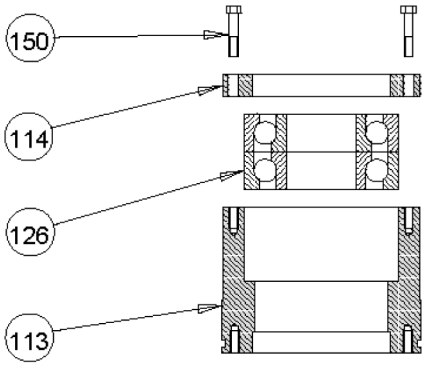


Figure 5-44. Gaterotor Thrust Bearing

Gaterotor Thrust Bearing Installation

For installation of thrust bearings on VSG and VSSG units:

1. Install thrust bearings (126) in the housing so the bearings are face to face. The larger sides of the inner races are placed together. A light application of clean compressor lubricating oil should be used to ease the installation of the bearings into the housing.
2. Center the bearing retainer ring on housing, use Loctite® 242-thread locker and evenly tighten the bolts to the recommended torque value, see Figure 5-41.

For installation of thrust bearings on VSG 301 - 701 units:

1. Install retainer in the back of the inner race of one of the thrust bearings. The back of the inner race is the narrower of the two sides.
2. The bearing with the retainer should be placed in the housing first, retainer towards the support. Install the second bearing. The bearings should be positioned face to face. This means that the larger sides of the inner races are placed together. A light application of clean compressor lubricating oil should be used to ease the installation of the bearings into the gaterotor support.
3. Install the bearing retaining snap ring.

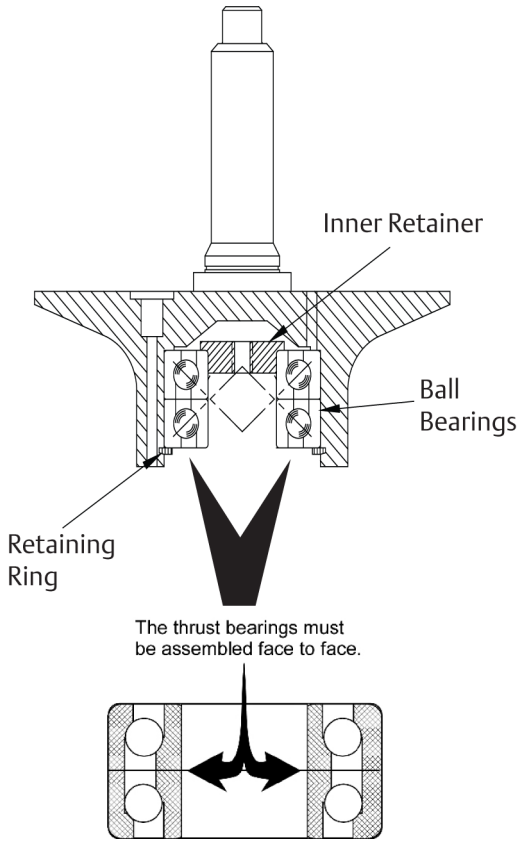


Figure 5-45. Thrust Bearing Installation

Gaterotor Roller Bearing Removal

1. Remove the snap ring (131), which retains the roller bearing in the bearing housing, see Figure 5-45.
2. Remove the roller bearing (125) from the bearing housing (112).
3. Use a bearing puller to remove the roller bearing race (125) from the gaterotor support (110).

Gaterotor Roller Bearing Installation

1. Match up the part numbers on the inner race to the part numbers of the outer race. Press the bearing race (numbers visible) onto the gaterotor support.
2. Install the outer bearing into the bearing housing so the numbers match the numbers on the inner race. Install the snap ring retainer in the housing. The bevel on the snap ring must face away from the roller bearing.

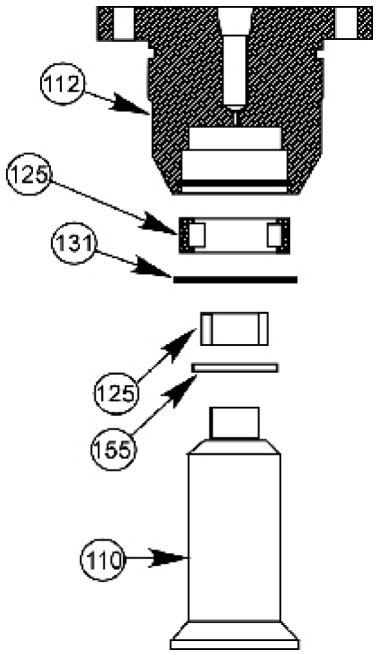


Figure 5-46. Roller Bearing Assembly

Gaterotor Removal and Installation (VSG 128 - 243 Compressors ONLY) Use gaterotor tool set: A25205G

WARNING

Follow local lock-out/tag-out procedure. Compressors must be depressurized before attempting to do any work on them. Failure to comply may result in serious injury, death and/or damage to equipment.

Removal

1. Prepare the compressor for servicing (please see Compressor Unit Isolation For Maintenance/Service on page 5-3 for procedure details).

NOTE

Each gaterotor assembly must be reassembled on the same side that it is disassembled from.

2. Position at least a one gallon plastic oil collection bin beneath the side cover. Carefully pry open the side cover to allow the oil to drain before finally removing the side cover.
3. Rotate the main rotor to the position indicated in Figure 5-47.

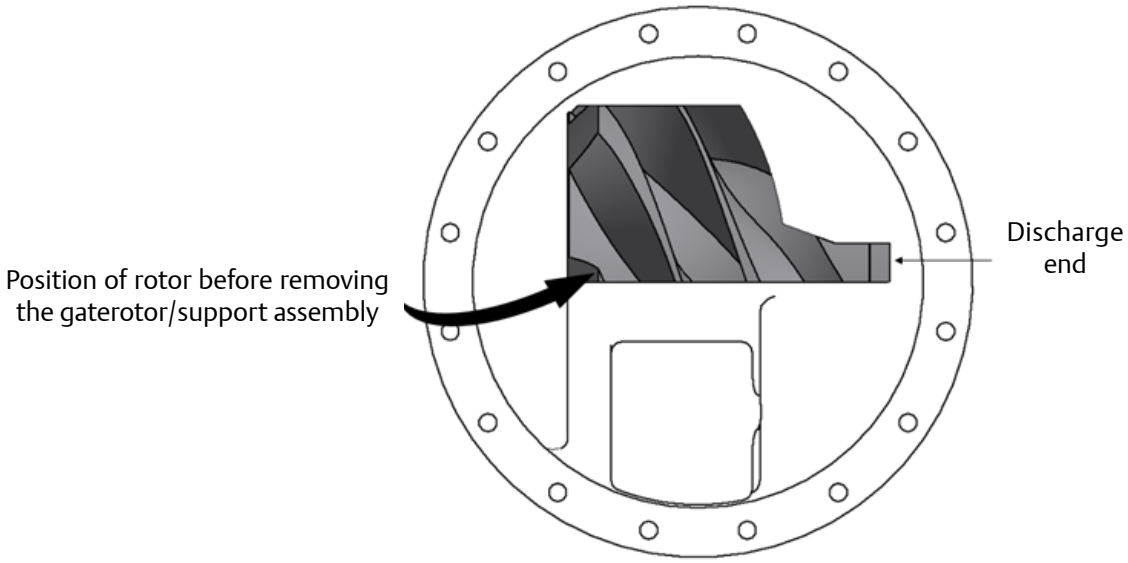


Figure 5-47. Rotor Position for Gaterotor/Support Assembly Removal

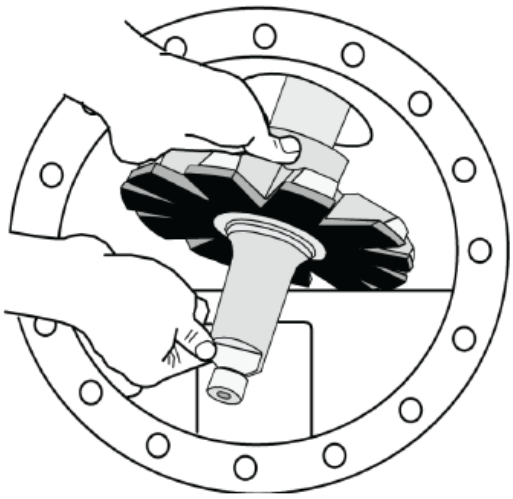


Figure 5-48. Gaterotor/Support Assembly Removal

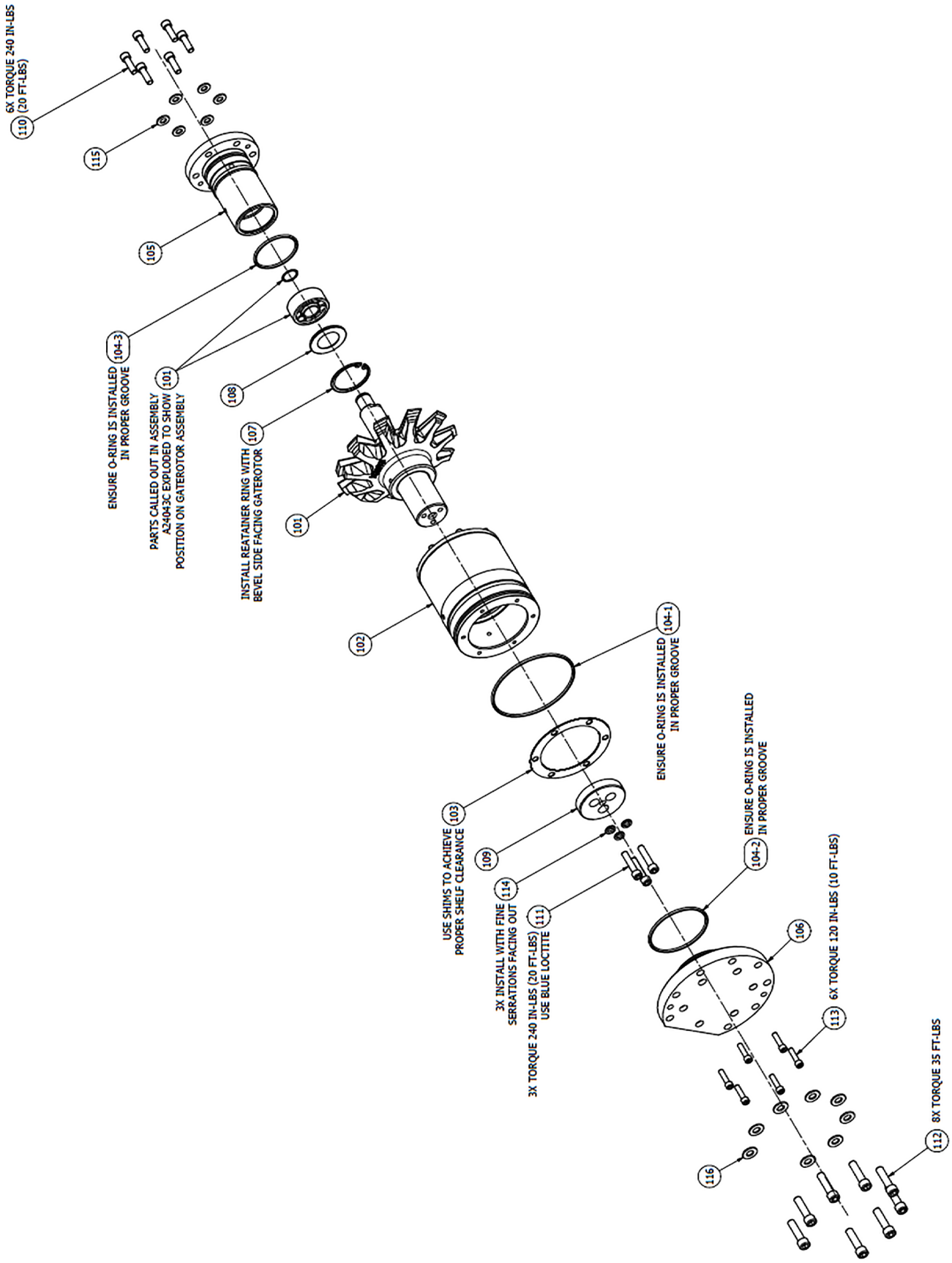


Figure 5-49. Gaterotor Assembly

4. Using Figure 5-49 as a guide, remove the screws (110), and the washers (115).
5. Remove ball bearing housing cover screws (112 & 113), washers (116) and cover (106).
6. Remove ball bearing retainer screws (111), washer (114), and retainer (109).
7. Remove shim pack (103) and O-ring (104-2).
8. Remove roller bearing housing (105).
9. Remove O-ring (104-3).
10. Use the tool set A25205G (shown in Figure 5-51) to remove ball bearing housing (102 in Figure 5-49): Install the tool set as shown in Figure 5-50 by hand tightening the bolt (109) - this will hold the gaterotor support in place. Turn the jacking screw (105 in Figure 5-51) clockwise. The ball bearing housing assembly will be pulled off the gaterotor support. Remove entire tool set.
11. Remove O-ring (104-1 in Figure 5-49).
12. Make sure the rotor is in position as shown in Figure 5-47. Remove support assembly (101 in Figure 5-49) as shown in Figure 5-48.

NOTE
O-rings and Nord-Lock washers (114 in Figure 5-49) will need to be replaced each time.

Note on Tool
Make sure that gaterotor is not in contact with the housing shelf while installing and removing the bearing housing assembly.

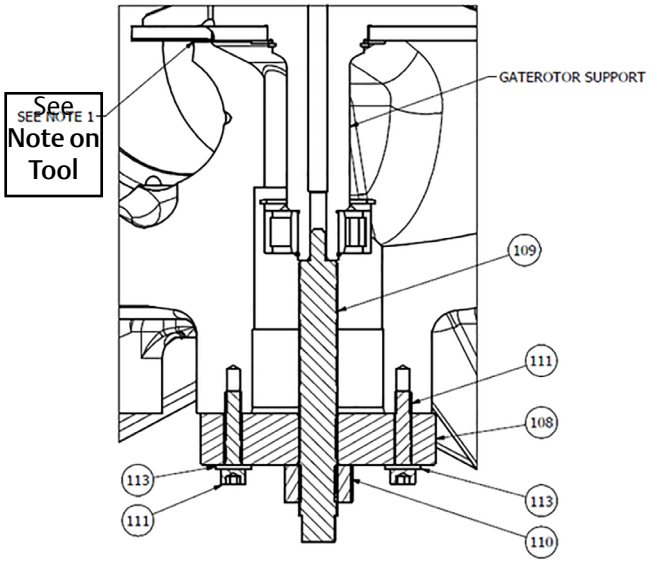


Figure 5-50. Tool To Install and Remove Bearing Housing Assembly

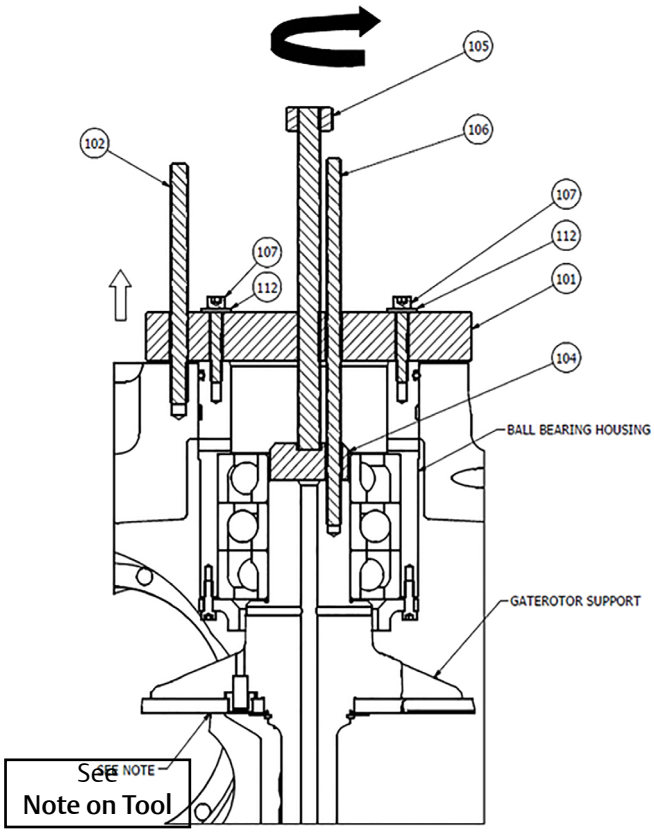


Figure 5-51. Tool To Remove Bearing Housing Assembly

Installation

(Refer to Figure 5-49)

Torque values for screws:
- 110: 20 ft-lbs
- 112: 35 ft-lbs
- 113: 10 ft-lbs
- 111: 20 ft-lbs (use blue Loctite)

- The beveled side of the retaining ring (101.14) must face away from gaterotor, see Figure 5-54.
- Make sure O-rings are placed in the proper grooves, see Figure 5-49.
- Washer 114 has fine and coarse serrations, and those fine serrations must be facing out. See "NORD-LOCK Washers" on page 5-65 for more details.

1. Install gaterotor support by carefully tilting the roller bearing end of the gaterotor support towards the suction end of the compressor, see Figure 5-48. The compressor input shaft may have to be rotated to facilitate the installation of the gaterotor support, see Figure 5-47.
2. When installing the ball bearing housing (102), a new O-ring (104-1) must be used when the housing is installed, see Figure 5-49. Lubricate the outside of the housing and bearings with clean compressor oil to aid in the installation. Due to the way the bearings fit on the gaterotor support, the gaterotor tool set (A25205G) must be used. Assemble the tool set according to Figure 5-52 and 5-47 by hand tightening the bolt (109) - this will hold the gaterotor support in place. Evenly turn the jacking studs (102) clockwise. This will push the ball bearing housing onto the gaterotor support. Remove entire tool set.
3. Install the inner retainer (109), washers (114) and bolts (111) using Loctite® 242 thread locker. Tighten bolts to 20 ft-lbs.
4. Install the roller bearing housing (105) with a new O-ring (104-3).
5. Tighten bolts (110) to 20 ft-lbs.
6. Set clearance between gaterotor blade and shelf.
7. Place a piece of 0.003"-0.004" shim stock between gaterotor blade and shelf.

NOTE

This measurement determines the number of shims needed for the correct clearance.

8. Measure depth from top of compressor case to top of ball bearing housing.
9. Use factory installed shim pack (103) and ball bearing housing cover (106) without the O-ring (104-2).

NOTE

Replacement blades are precisely the same dimensionally as blades installed originally at factory. Therefore, the same number of shims will be required for replacement blades.

Note on Tool

Make sure that gaterotor is not in contact with the housing shelf while installing and removing the bearing housing assembly.

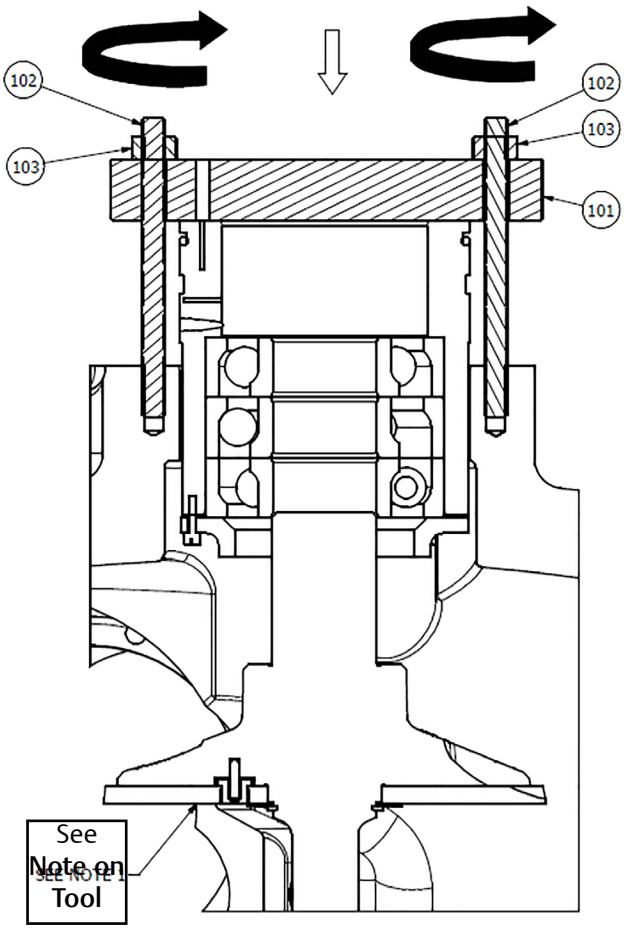


Figure 5-52. Tool To Install Bearing Housing Assembly

10. Check the clearance between the entire gaterotor blade and the shelf, rotate the gaterotor to find the tightest spot. It should be between 0.003"-0.004" (0.076-0.102 mm). Make adjustments, if necessary. It is preferable to shim the gaterotor blade looser rather than tighter against the shelf, see Figure 5-53.
11. After clearance has been set install a new O-ring (104-2) on ball bearing housing cover, install cover (106), and tighten the bolts (112 and 113) to the recommended torque values.
12. Install side cover with a new gasket. Tighten the bolts to the recommended torque value. The unit can then be evacuated, and leak checked.

Torque values for screws:
- 110: 20 ft-lbs
- 112: 35 ft-lbs
- 113: 10 ft-lbs
- 111: 20 ft-lbs (use blue Loctite)

Check for 0.003"-0.004" (0.076 - 0.102 mm) clearance between gaterotor blade and partition.

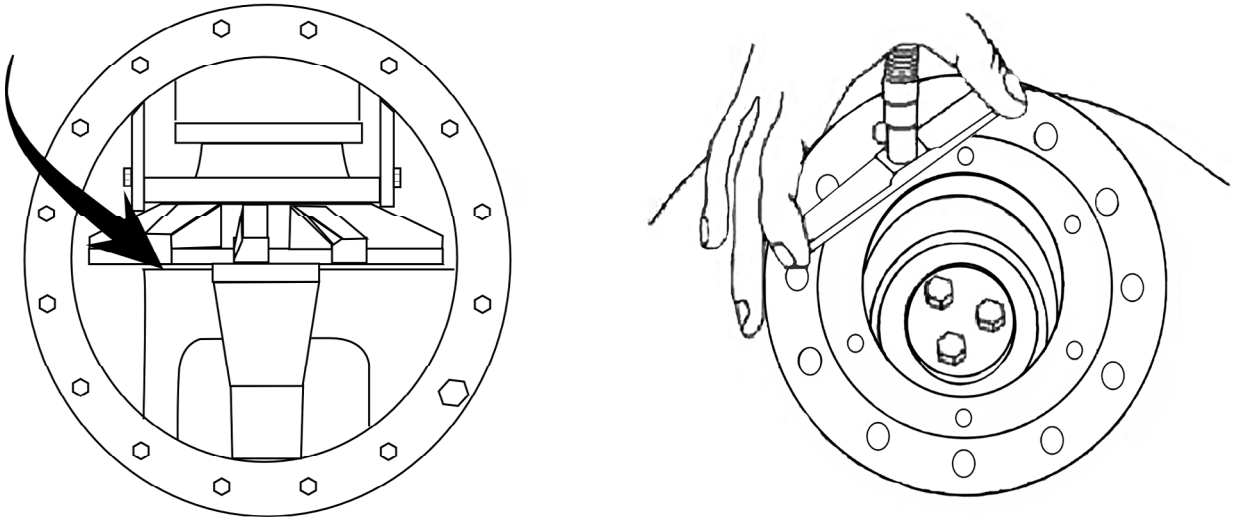


Figure 5-53. Check the Clearance Between the Gaterotor and Shelf

Gaterotor Blade Removal

1. Remove the retaining ring (101.14) and washer (101.13) from the assembly, see Figure 5-54.
2. Lift gaterotor blade assembly (101.12) off the gaterotor support (101.11).
3. Check damper pin and bushing for excessive wear. Replace if required (see Page 5-28 for gaterotor float details).

Gaterotor Blade Installation

1. Install bushings (101.12b) in gaterotor blade (101.12a) from the back side of the blade. Be sure bushing is fully seated and torqued to 5 ft-lbs. using red Loctite, see Figure 5-55.
2. Place blade assembly (101.12) on gaterotor support (101.11). Locate bushing over pin, see Figure 5-54.
3. After the gaterotor and support are assembled, there should be a small amount of rotational movement between the gaterotor and support.
4. Install washer (101.13) and retaining ring (101.14).

NOTE

Retaining ring (101.14) must be installed with bevel side facing away from the gaterotor, see Figure 5-54.

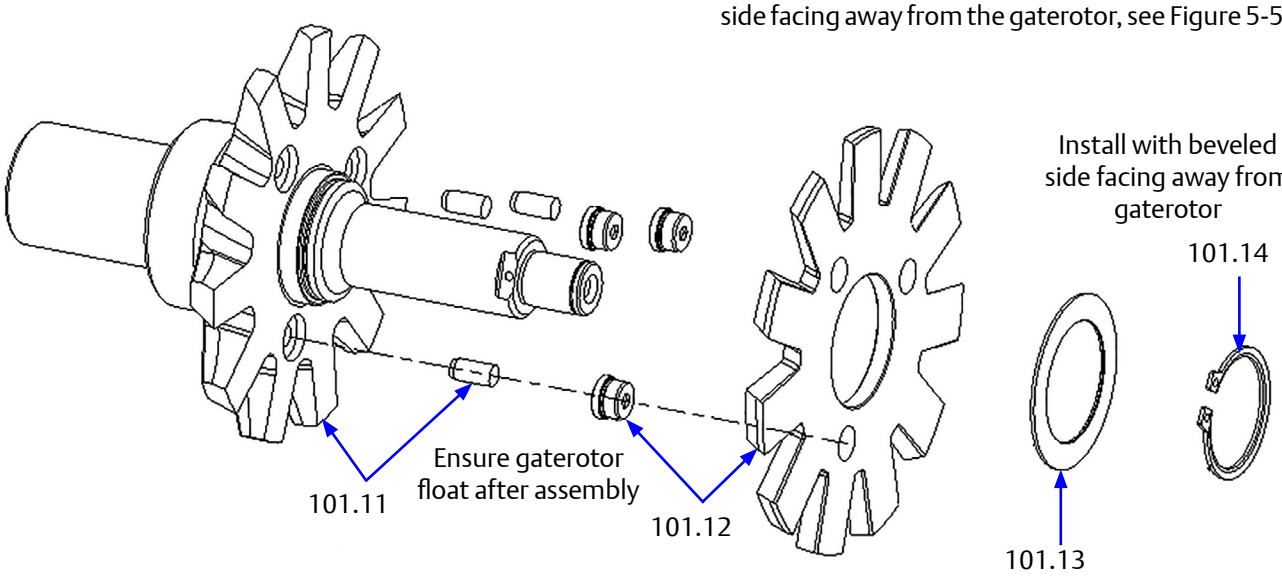


Figure 5-54. Gaterotor and Support Assembly

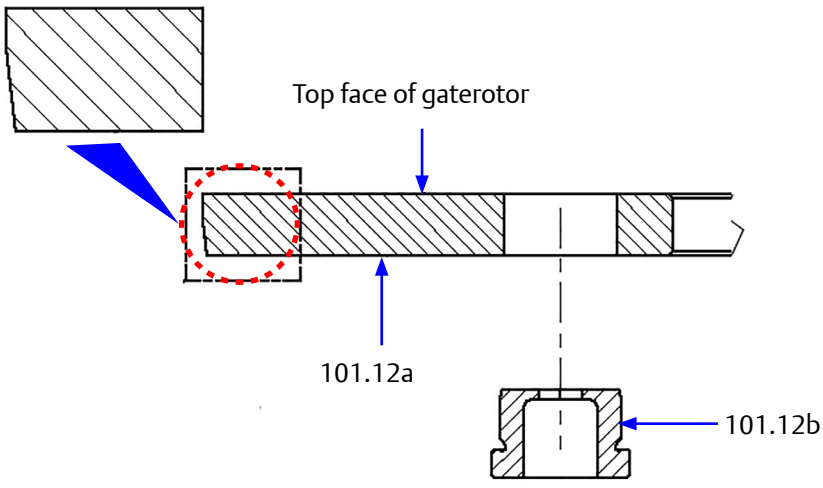


Figure 5-55. Gaterotor Top Face Identification

Gaterotor Ball Bearing Removal

1. Remove bolts (102.4) from the outer retainer (102.3), see Figure 5-56.
2. Remove ball bearing outer retainer (102.3).
3. Using a press, remove ball bearings (102.2) from housing (102.1).

Gaterotor Ball Bearing Installation

1. Install three ball bearings (102.2) in the housing (102.1) so the first two bearings are back to back, and the second and third bearings are face to face (the larger sides of the inner races are placed together, as shown in Figure 5-56). A light application of clean compressor lubricating oil should be used to ease the installation of the bearings into the housing.
2. Center the bearing outer retainer (102.3) on housing (102.1), use Loctite® 242-thread locker and evenly tighten the bolts (102.4) to the recommended torque value (4 lb-ft), see Figure 5-56.

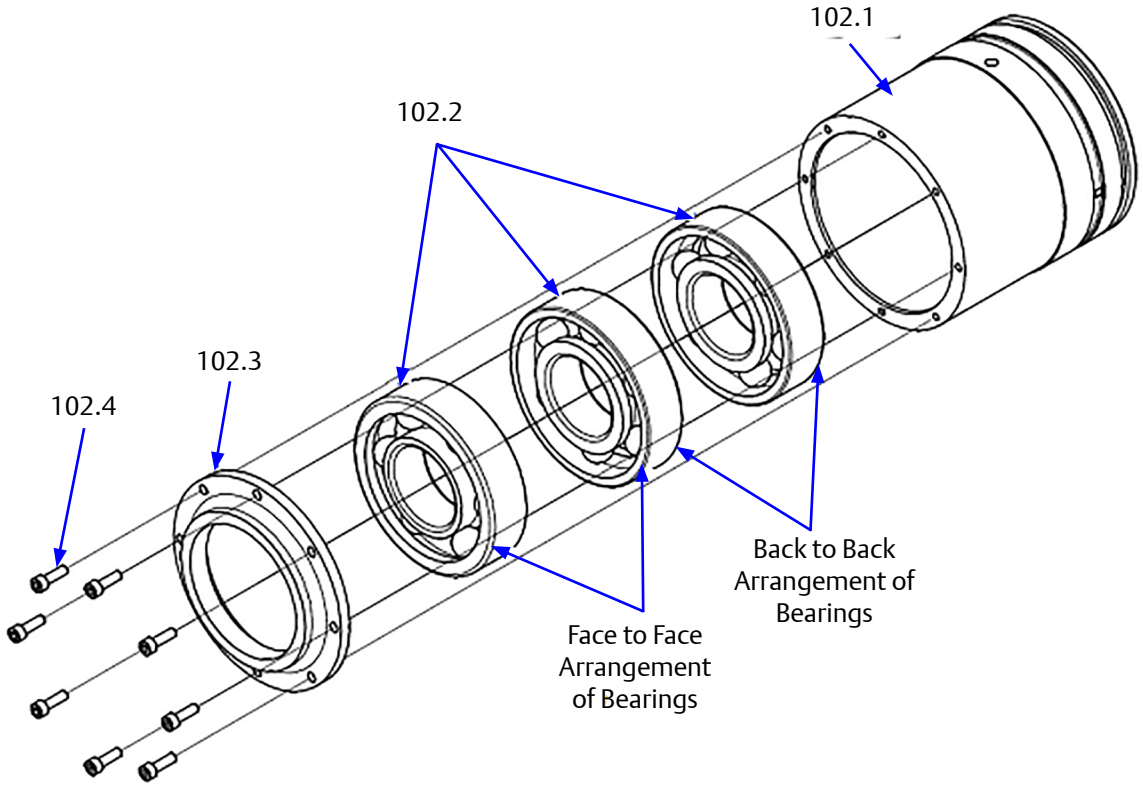


Figure 5-56. Gaterotor Ball bearing

Gaterotor Roller Bearing Removal

1. Remove the snap ring (107), which retains the roller bearing in the bearing housing, see Figure 5-57.
2. Remove the baffle washer (108) and the roller bearing (101.3b) from the bearing housing (105).
3. Remove the retaining ring (101.2) from the gaterotor support (101.1). Use a bearing puller to remove the roller bearing inner race (101.3a) from the gaterotor support (101.1).

Gaterotor Roller Bearing Installation

1. Match up the part numbers on the inner race and outer race of the bearing (101.3a & 101.3b).
2. Install the outer race (101.3b) into the bearing housing (105). Install baffle washer (108) with inner bevel facing the bearing rollers (101.3b). Install the snap ring retainer (107) in the housing. The bevel on the snap ring must face away from the roller bearing.
3. Heat Roller bearing inner race (101.3a) to 250°F, then quickly install on gaterotor support (101.1). Once cool, install retaining ring (101.2).

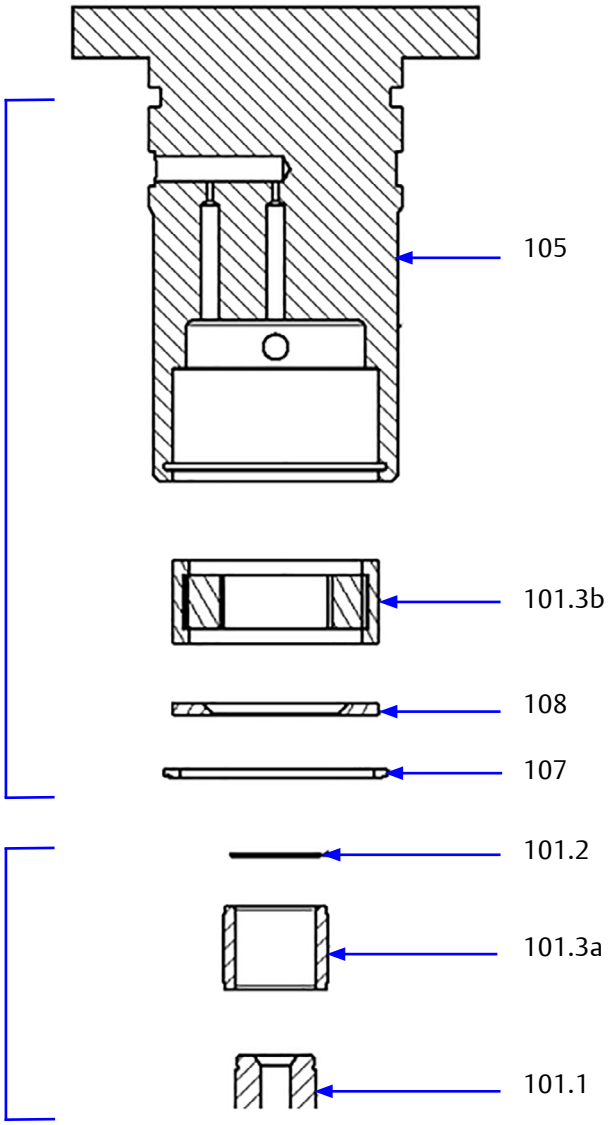


Figure 5-57. Gaterotor Roller Bearing Assembly

Gaterotor Removal (VSG 301-701 Models)

The removal of the gaterotor assembly for the VSG 301-701 compressors is similar for the VSG 901-2101 compressors. The inner races are secured to the stationary bearing spindle.

1. Prepare The Compressor For Servicing
2. Remove the upper bolt from the side cover and install a guide stud in the hole. Remove the remaining bolts and side cover. There will be some oil drainage when the cover is removed.
3. The side cover that contains the suction strainer should have the suction line properly supported before the bolts securing the line to the cover can be removed. After the line is removed, the cover can be removed according to Step 2.
4. Turn the main rotor so the driving edge of the groove is between the top of the shelf or slightly below the back of the gaterotor support. At this point install the gaterotor stabilizing tool.
5. Remove plug on the thrust bearing housing. Loosen the socket head cap screw that is located underneath the plug. This secures the inner races of the thrust bearings to the spindle.
6. Remove bolts that hold the thrust bearing housing to the compressor. Insert two of the bolts into the threaded jacking holes to assist in removing the bearing housing from the compressor. When the housing is removed, there will be shims between the spindle and thrust bearings. These control the clearance between the shelf and gaterotor blades. These must be kept with their respective parts for that side of the compressor.

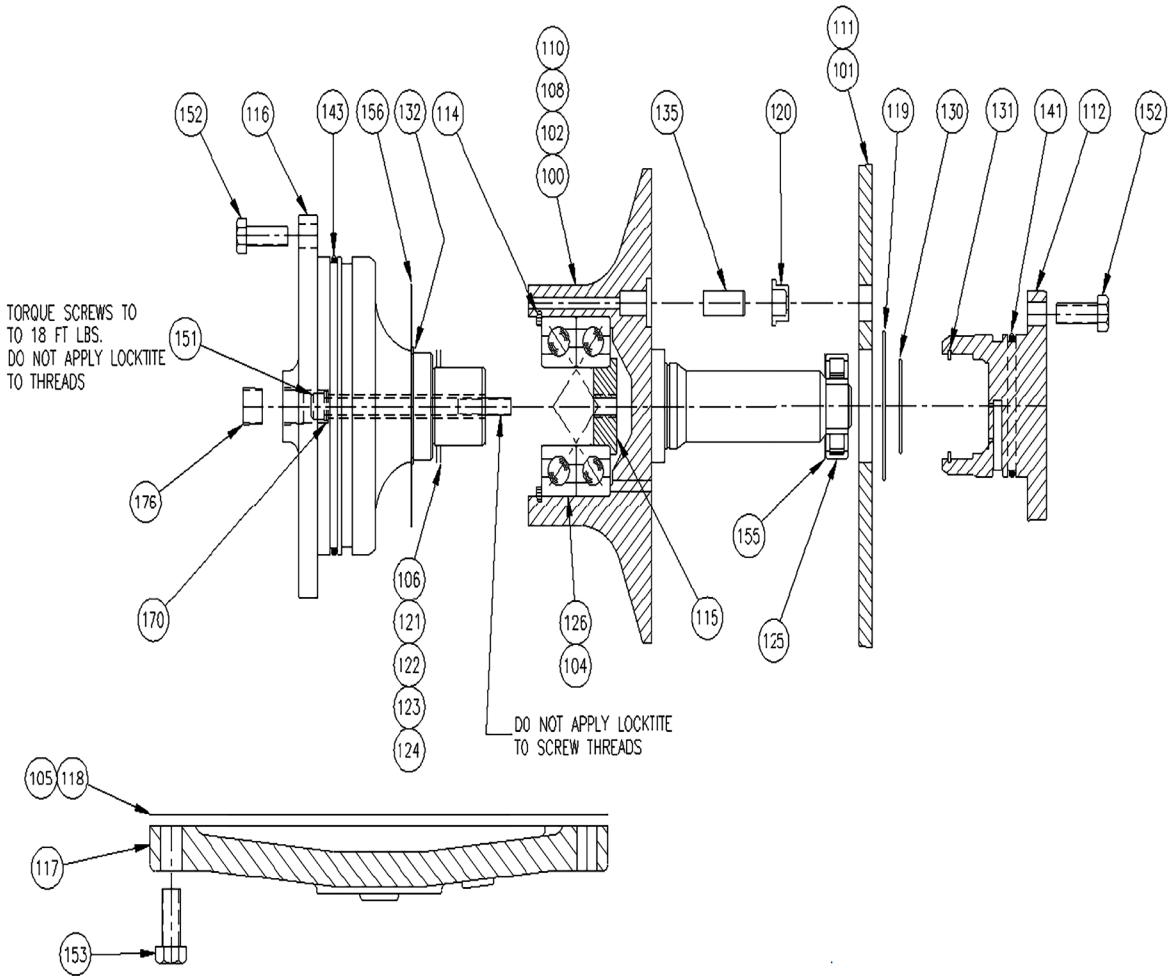


Figure 5-58. Gaterotor Removal (VSG 301-701 Models)

7. Remove the bolts from the roller bearing housing. After the bolts have been removed, the housing can be removed from the compressor.
8. To remove the gaterotor support, carefully move the support opposite the direction of rotation and tilt the roller bearing end towards the suction end of the compressor. The compressor input shaft may have to be turned to facilitate the removal of the gaterotor support. On dual gate versions, repeat the procedure for the remaining gaterotor support assembly.

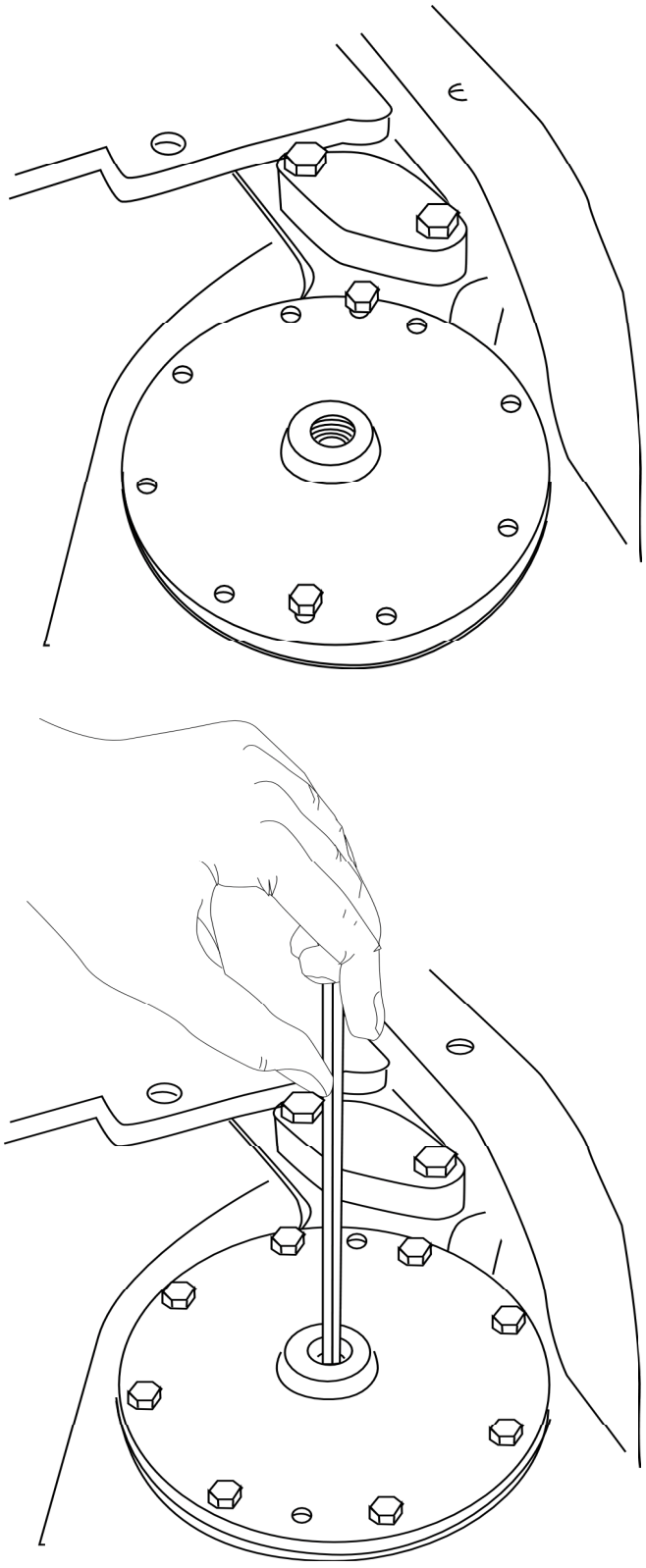


Figure 5-59. Gaterotor Thrust Bearing (VSG 301-701 Models)

Slide Valve Actuator Assembly Replacement

To replace slide valve actuator assembly, proceed with the following steps:

Removal

WARNING

At shutdown, open valves that may trap gas or liquid to prevent rotation of the compressor and serious injury and/or damage to equipment.

WARNING

Follow local lock-out/tag-out procedure.

NOTE

This procedure is applicable to both capacity and volume slide valve actuator assemblies.

1. Shut down the compressor unit, refer to Stopping/Restarting procedure in Section 4.
2. Turn disconnect switches to the OFF position for the compressor unit and oil pump motor starter, if equipped.
3. Allow compressor, motor and surrounding components to cool prior to servicing.
4. Disconnect connectors from actuator.

NOTE

Note orientation of components to aid in installation.

5. First remove E-clips, then remove Locking Retainers, next loosen and remove Grooved Bolts and Washers that secure actuator assembly to actuator mount. See Figure 5-60 for parts details.
6. Remove actuator assembly from actuator mount.

Installation

CAUTION

When installing the slide valve actuator assembly, loosen locking collar down the shaft. Do not use a screwdriver to pry locking collar into position.

7. Position actuator assembly on mount as noted in removal.
8. Install washers and grooved bolts to secure actuator assembly to actuator mount, torque them to 6 lb-ft. Then install locking retainers. Last push E-clips into grooved bolt heads. Refer to Actuator Installation Using Anti-Rotation Bolts (see next page) for details.
9. Tighten screws, see Appendix A • Torque Specifications.

CAUTION

If installing new actuator, do not connect connectors of power cable or position transmitter cable to new actuator once installed. Connecting connectors to new actuator will occur during calibration procedure. Failure to comply may result in damage to equipment.

10. Leave connectors disconnected to actuator assembly.
11. Calibrate actuator assembly, see Slide Valve Calibration procedure in Section 4.

Actuator Installation Using Anti-Rotation Bolts

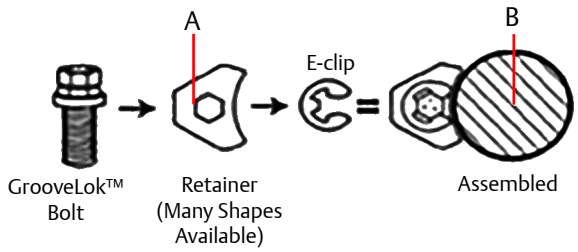
Tools Needed: A 7/16" open wrench or torque wrench with 7/16" crowfoot wrench adapter.

Part #: The parts come with the actuator. Retrofit kit # is 25972R (Includes 4 sets of bolts, washers, retainers & E-clips).

1. Install the Grooved Bolt and Washer and torque them to 6 lb-ft. See figure 5-60 (a).

NOTE

It may be necessary to adjust the bolt position so that one of the bolt edges is parallel to line A and B, then the retainer will drop-on easily. If required, tighten bolt further for this alignment.

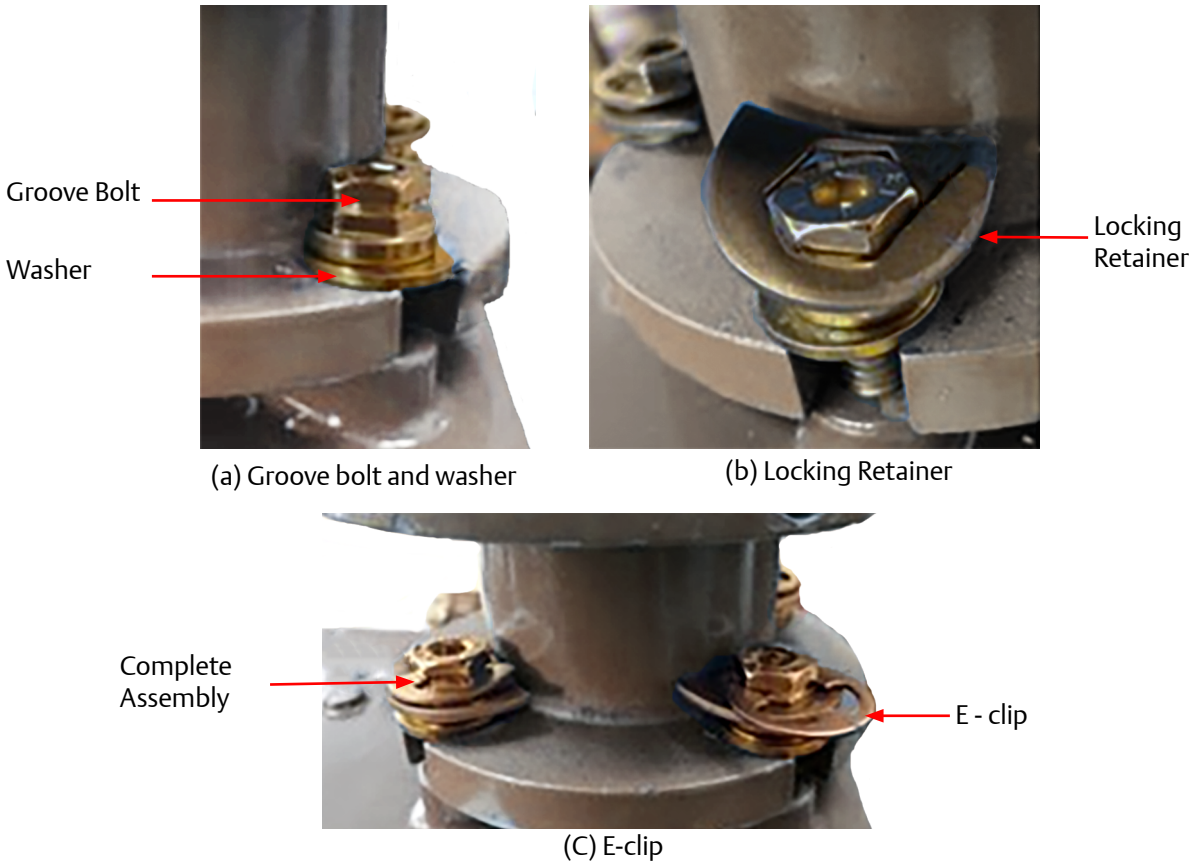


2. Position Locking Retainer over Grooved Bolt, with the shallow curved edge toward the center of the command shaft housing. See figure 5-60 (b).

NOTE

The locking retainer hex hole is offset 3° so flipping it over gives it new positioning.

3. Push E-Clip into Grooved Bolt Head. Once E-clip is on make sure it rotates back and forth freely. This will ensure E-Clip is completely seated. See figure 5-60 (c).



(a) Groove bolt and washer

(b) Locking Retainer

(C) E-clip

Figure 5-60. Actuator Installation Using Anti-Rotation Bolts

Inspection of Slide Valve Assemblies In The Compressor

WARNING

Follow local lock-out/tag-out procedure. Compressors must be depressurized before attempting to do any work on them. Failure to comply may result in serious injury, death and/or damage to equipment.

Prepare The Compressor For Servicing

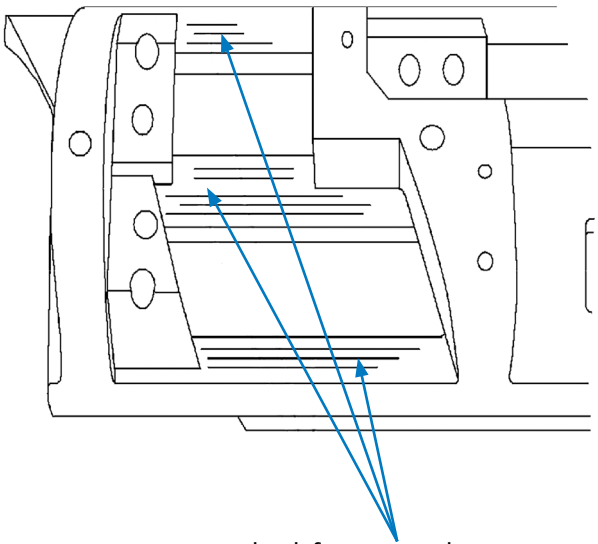
1. Remove the gaterotor access covers. Using a mirror and flashlight, visually inspect the slide valve carriage through the gas bypass opening. Look for any significant signs of wear on the slide valve carriage
2. To check the clearance of the slide valve clamps, the gaterotor support must be removed. Refer to removal of the gaterotor support
3. Using a feeler gauge, inspect the clearance between capacity and volume slide valve clamps and slide valve carriage through the gas bypass opening. The clearance should be less than 0.002"
4. If the slide valves are worn in excess of the tolerances, the factory should be contacted.

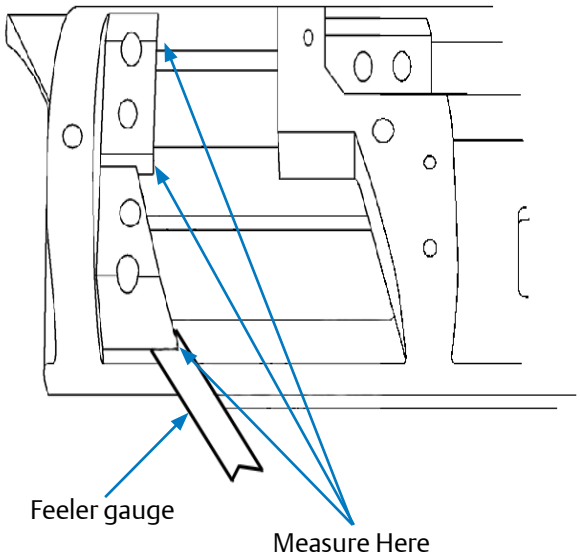
Removal of Slide Valve Carriage Assemblies

1. Prepare the compressor for servicing.
2. If only one of the slide valve carriages is removed only the corresponding gaterotor support needs to be removed. If both carriages are removed both gaterotors must be removed. Remove the gaterotor assemblies.
3. Remove the capacity and volume actuators. Remove the discharge manifold, capacity and volume cross shafts and the slide valve racks.
4. Locate and remove the socket head plugs above the slide valve carriage attachment bolts. Remove the bolts located under the plugs.
5. The slide valve carriage may now be removed. On newer carriages there is a threaded hole in the back of the slide valve carriage to aid in its removal. Use a threaded tip slide hammer to aid in the removal of the carriage.

NOTE

Slide Valves may be re-positioned to aid in removal of assembly.





Installation of Slide Valve Carriage Assemblies

1. Position the slide valves to the center of the carriage. Place the slide valve assembly in the bore of frame and use the slide hammer to slowly tap the carriage into position. Re-positioning slide valves once inside bore may aid installation. Adjust the carriage so that the 3-holes line up.
2. Install the 3 socket head cap screws with new Nord-Lock washers beneath the heads, but do not tighten them.
3. Work a piece of 0.005"shim stock between the slide valves and the main rotor to help position the carriage. See Figure 5-61.
4. Tighten, to the correct torque the hold down bolts to secure the carriage in the frame. The edges of the slide valves themselves should be at or slightly below the main rotor bore.
5. Re-Install the capacity and volume slide valve cross shafts, slide valve racks and discharge manifold.
6. Re-install the gaterotor assemblies.

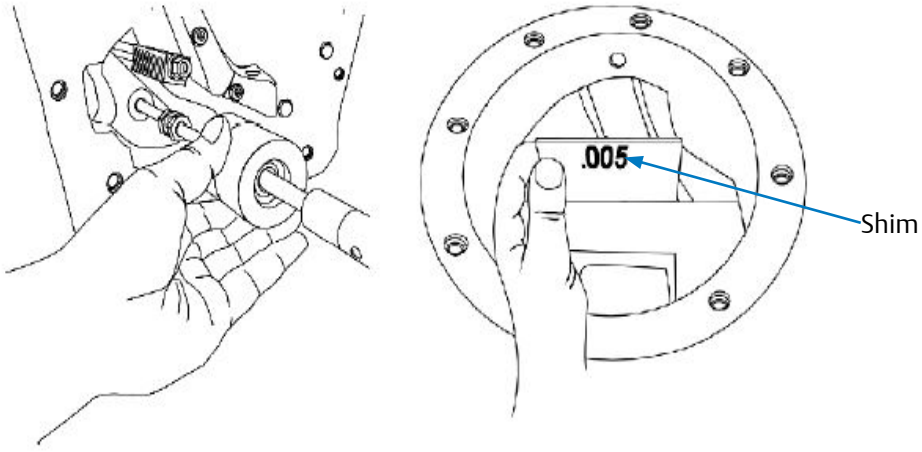


Figure 5-61. Installation of Slide Valve Carriage Assembly

Slide Valve Command Shaft Assembly Replacement

WARNING

Follow local lock-out/tag-out procedure. Compressors must be depressurized before attempting to do any work on them. Failure to comply may result in serious injury, death and/or damage to equipment.

Removal

NOTE

The following steps can be used to remove or install either the capacity or volume command shaft assemblies.

1. Shut down and isolate compressor unit, see Compressor Unit Shutdown and Isolation procedure.
2. Remove actuator, see Actuator Assembly Replacement procedure.
3. Remove four socket head cap screws (457) and Nord-Lock washers (477) securing the command shaft assembly to the discharge manifold.
4. The command shaft and mounting plate may now be removed from the compressor.

Installation

5. Install a new o-ring (446) into the groove on the compressor discharge manifold. You may use clean compressor lubricating oil on the O-ring.
6. Install the command shaft onto the compressor discharge manifold. Ensure that the command shaft tongue is engaged in the cross-shaft slot inside the compressor discharge manifold. Rotate the command shaft assembly so that the vent holes point downward. This will prevent water and dust from entering the vent.
7. Secure the command shaft assembly to the discharge manifold using the four socket head cap screws and Nord-Lock washers and apply the proper torque.
8. Perform leak check, see Compressor Unit Leak Check procedure on Page 5-4.

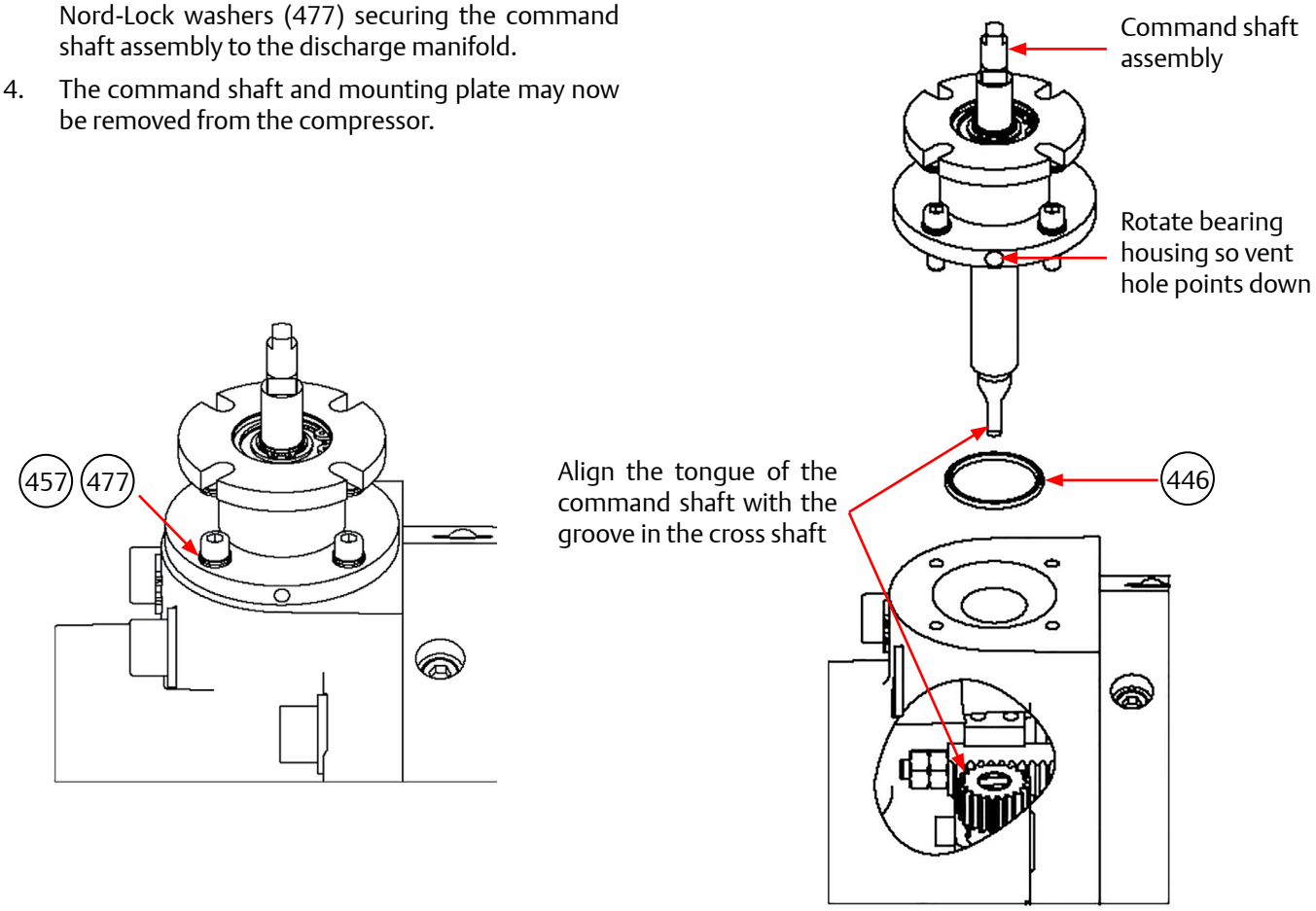


Figure 5-62. Command Shaft Assembly Replacement

Discharge Manifold Removal

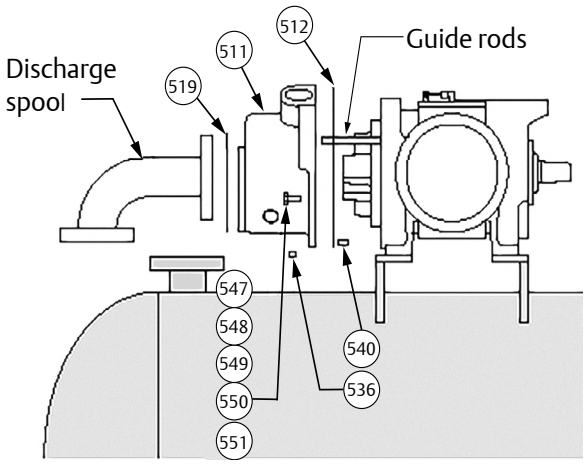
WARNING

Follow local lock-out/tag-out procedure. Compressors must be depressurized before attempting to do any work on them. Failure to comply may result in serious injury, death and/or damage to equipment.

1. Remove both control actuators and command shaft assemblies.
2. On VSG 751-3001 and VSSG 291-601 compressors, remove the discharge spool between the manifold and separator. Remove one bolt from each side of the discharge manifold and install (2) guide rods approximately 6" long, to support the manifold. Remove the remaining bolts (note length and location of bolts) and take off the discharge manifold.

NOTE

The manifold has dowel pins to locate it on the compressor housing. Therefore, remove manifold straight back approximately 1" as not to break dowel pins.



NOTE

When removing the discharge manifold on VSG 301-701 compressor the compressor must be properly supported to keep the compressor from moving when the manifold is removed.

3. On VSG 301-701 compressors unbolt the discharge flange from the discharge manifold.
4. Remove one bolt from each side of the discharge manifold and install (2) guide rods approximately 6" long, to support the manifold. Remove the remaining bolts (note length and location of bolts) and take off the discharge manifold.

Discharge Manifold Installation

5. Install (2) guide rods to position the discharge manifold. Install a new manifold gasket and the discharge manifold. Install the dowel pins and bolts, tighten manifold bolts to the recommended torque value.
6. On VSG 751-3001 and VSSG 291-601 compressors install the discharge spool or elbow between the discharge manifold and oil separator with new gaskets. When installing the discharge elbow tighten the bolts to the correct torque on the manifold flange first before tightening the separator flange bolts. Install the drain plug in the bottom of the discharge manifold.
7. On VSG 301-701 compressors install the bolts in the discharge flange. Install the drain plug in the bottom of the discharge manifold.
8. Install both command shaft assemblies and control actuators.

Compressor Shaft Seal Replacement

Shaft Seal Assembly

The shaft seal is made up of a mating ring and a carbon or silicon carbide (SC) component.

The mating ring is the rotating part of the seal and is installed against the shaft shoulder. It has a drive notch on one end which aligns with the drive pin inserted in the shaft.

Carbon or SC component is the stationary part of the seal and is installed into the shaft seal housing using an O-ring.

The shaft seal housing with the stationary part is assembled in the compressor main housing using an O-ring, see Figure 5-63.

The shaft seal needs to be carefully handled and installed to function properly. See Figure 5-64 for details.

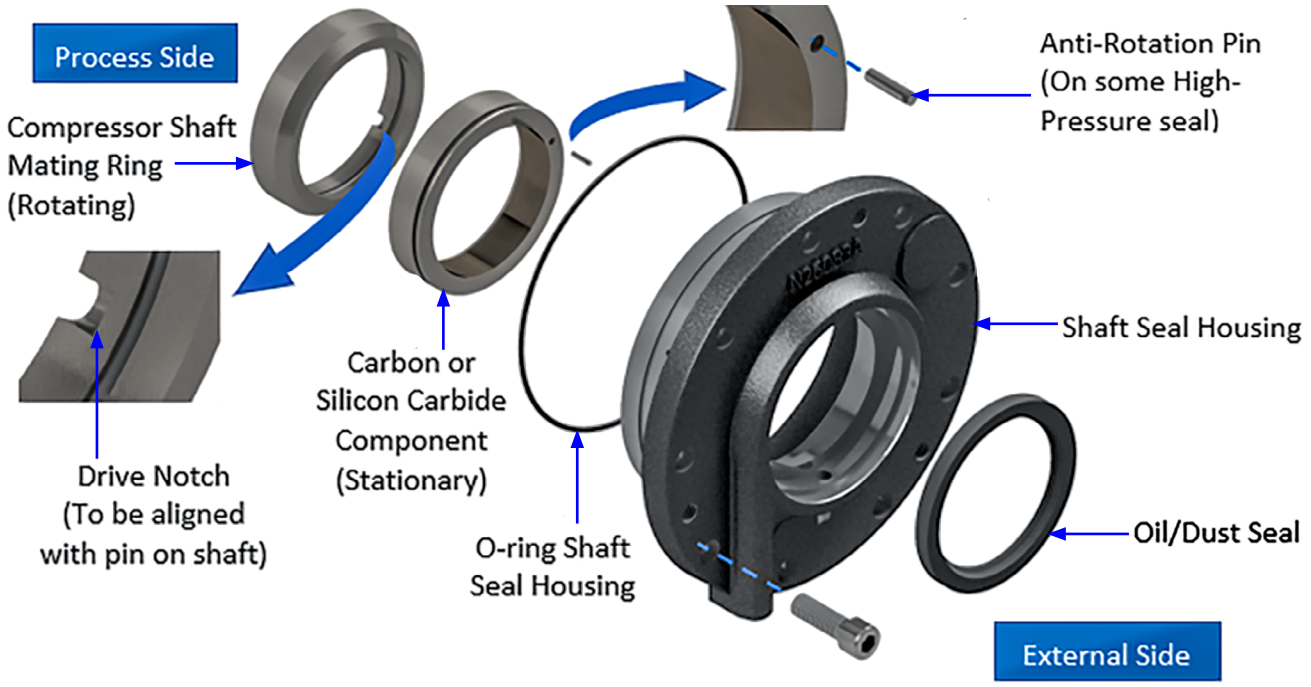


Figure 5-63. Shaft Seal Assembly

Handling Seal Face with Care

- Avoid touching seal faces as much as possible during installation.
- Be sure to always keep seal faces face-up, rather than face-down, see image on the right.

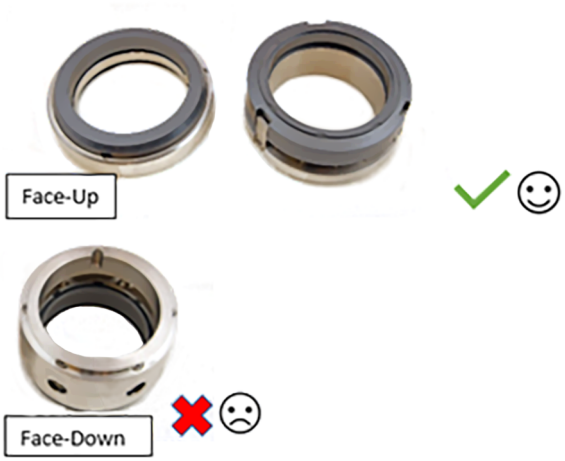


Figure 5-64. Handling Seal Face with Care

Compressor Shaft Seal Replacement (All VSG Models Except VSG 128 -243)

WARNING

Follow local lock-out/tag-out procedure. Compressors must be depressurized before attempting to do any work on them. Failure to comply may result in serious injury, death and/or damage to equipment.

Removal

1. Remove bolts (281) securing shaft seal housing (218) to compressor (see Figure 5-65).

NOTE

There will be a small amount of oil drainage as the shaft seal housing is removed.

2. Insert two of bolts (281) into threaded jacking holes to assist in removing shaft seal housing (218).
3. Remove mating ring (219C) from compressor shaft.
4. Remove oil seal (230) from shaft seal housing (218).
5. Using a brass drift and hammer, tap out cup assembly (219B) from the back side of shaft seal housing (218).
6. Remove O-ring (260).

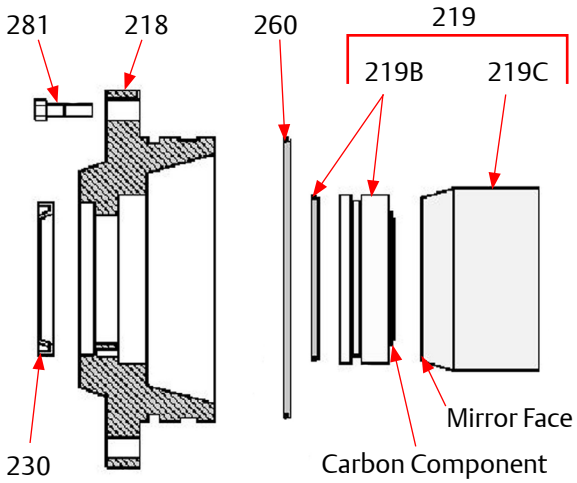


Figure 5-65. Compressor Shaft Seal Assembly

Installation

CAUTION

Care must be taken when handling the cup assembly and mating ring when installing. See Figure 5-70 for handling seal faces with care. Do not touch the carbon component of the cup assembly or mirror face on the mating ring as body oil and sweat will cause corrosion.

NOTE

On VSSG 291-601 and VSG 128-243 compressors equipped with a Anti-rotation pin in the shaft seal housing, when replacing the cup assembly (219B) the Anti-rotation pin in the housing must be removed. See Figure 5-65.

Suggestion

A spray bottle filled with clean compressor oil may be used to lubricate the faces of the seals without touching the seal.

1. Install new oil seal (230) in housing (218).
2. To install the carbon cartridge part of the seal in the seal housing: clean inside shaft seal housing (218) where cup assembly (219B) meets inside shaft seal housing.
3. If applicable, remove protective plastic from cup assembly (219B). **DO NOT** wipe or touch carbon component of cup assembly.
4. If carbon component of cup assembly (219B) needs cleaning, use alcohol and a lint-free cloth to clean.
5. Apply clean compressor lubricating oil to O-ring on cup assembly (219B).
6. If applicable, align the hole on the back of the carbon cartridge with the Anti-rotation in the seal housing. Using shaft seal tool or similar, install cup assembly (219B) in shaft seal housing (218).

Follow these steps to verify the integrity of a shaft seal:

7. Check lead chamfer and outer diameter of shaft for deep scratches that may potentially damage the O-ring on the inner diameter of the shaft seal, see Figure 5-66.

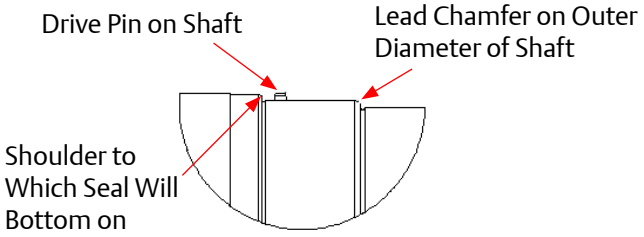


Figure 5-66. Shaft with Pin

8. Check lead chamfer and inner diameter of shaft seal housing for burrs and/or deep scratches that may potentially damage the O-ring on the outer diameter of the shaft seal, see Figure 5-67.
9. For shaft seal 25985R and 25985T, shim 24022A needs to be assembled in shaft seal housing before shaft seal. To assemble the shim, align the slot on it with the anti-rotation pin during installation. Visually verify that the back of the shim is abutted against the shaft seal housing, see Figure 5-67.
10. Clean compressor shaft and shaft seal cavity in compressor housing.
11. Apply clean compressor lubricating oil to mating ring (219C) seating area on compressor shaft.
12. Apply clean compressor lubricating oil to inside area of mating ring (219C). See Figure 5-68.

IMPORTANT

DO NOT wipe or touch the face of the mating ring (219C) where face meets the carbon component of the cup assembly (219B).

Table 5-15. Shaft Seals with Anti-Rotation Pins

Shaft Seal	Pressure (PSI)		O-ring Material
	Static	Dynamic	
25985Y	1800	1350	Aflas
25985T	1200	600	Viton
25985R	1200	600	Aflas
25985W	1800	1350	Fluoroelastomer

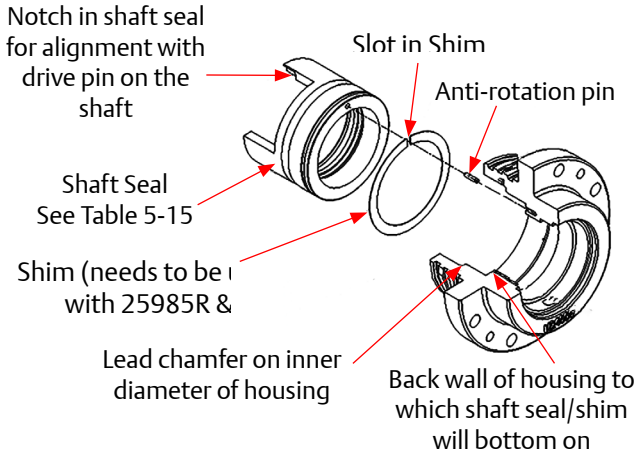


Figure 5-67. Shaft Seal and Its Housing

CAUTION

Ensure the mating ring (219C) is fully seated against the shoulder of the compressor shaft. If the mating ring is not fully seated aganist the shoulder, the carbon component of the cup assembly (219B) will be damaged when the shaft seal housing (218) is installed. See Figure 5-68.

13. Align slot in mating ring (219C) with drive pin on compressor shaft. Carefully push mating ring on while holding onto outside area of mating ring until mating ring is fully seated against shoulder on compressor shaft. See Figure 5-74.
14. Install a new O-ring (260) on the seal housing (218), making sure the O-ring is placed in the O-ring groove and not the oil gallery groove. Lubricate both seal faces with clean compressor lubricating oil. See Figure 5-74.
15. Carefully install the seal housing (218) on the compressor shaft, evenly tightening the bolts to the recommended torque values.
16. Install the coupling and coupling guard. The unit can then be evacuated and leak checked.

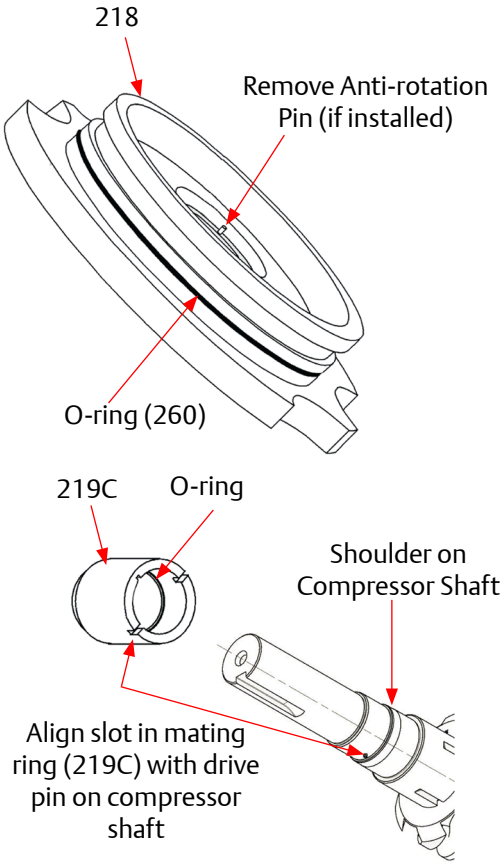


Figure 5-68. Compressor Shaft Seal Installation

Shaft Seal Removal - For Model 25985Y

(See Table 5-15 and Figure 5-69)

WARNING

Follow local lock-out/tag-out procedure. Compressors must be depressurized before attempting to do any work on them. Failure to comply may result in serious injury, death and/or damage to equipment.

NOTE

There will be a small amount of oil drainage as the shaft seal housing is removed.

1. Remove bolts (281) securing shaft seal housing (218) to compressor.
2. Insert two bolts (281) into threaded jacking holes to assist in removing shaft seal housing (218).
3. Remove silicon carbide rotating face (219.6) & O-ring (219.7) from shaft.
4. Remove spring holder (219.8) from shaft.
5. Remove oil seal (230) from shaft seal housing (218).
6. Remove retaining ring (219.5) from seal housing.
7. Flip the seal housing over and carefully tap the stationary silicon carbide piece (219.3), retainer (219.4), and O-ring (219.2) out of the seal housing using brass drift and hammer.
8. Remove O-ring (260).

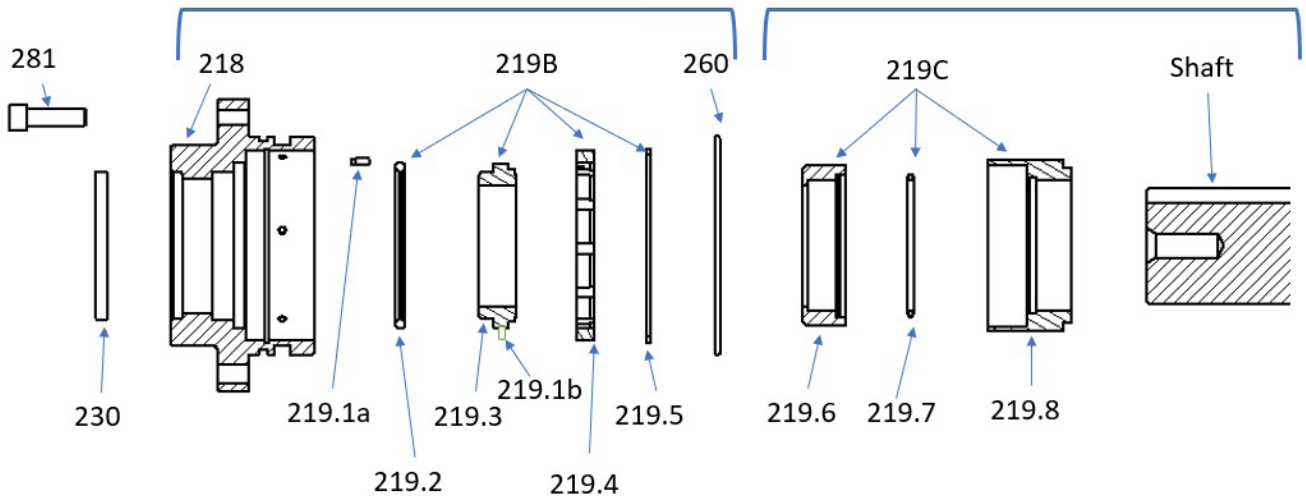


Figure 5-69. Shaft Seal Breakdown (25985Y Model)

Shaft Seal Removal – For Part# 25985W

(See Table 5-15 and Figure 5-70)

WARNING

Follow local lock-out/tag-out procedure. Compressors must be depressurized before attempting to do any work on them. Failure to comply may result in serious injury, death and/or damage to equipment.

NOTE

There will be a small amount of oil drainage as the shaft seal housing is removed.

1. Prepare compressor for disassembly (standard nomenclature from other area of manual.
2. Loosen and remove screws (281) mounting shaft seal housing (218) to main compressor housing.
3. Carefully thread three screws (281) into the jacking holes in the shaft seal housing (218) to push it out of the main compressor housing. Do not go more than one-half turn on any screw at a time.
4. Once the shaft seal housing (218) has been removed from the compressor housing, loosen the 4 small socket cap screws (303) holding the shaft seal retainer (304) to the shaft seal housing (218).
5. When using a hammer and punch, carefully tap the seal cartridge (305) out of the shaft seal housing (218).
6. Remove oil seal (230) from shaft seal housing (218).
7. Remove the O-ring (260) from the shaft seal housing (218).
8. The rotating assembly (219C) can be firmly pulled off the compressor shaft as one assembly. Be sure to note the location of the drive pin in the main compressor shaft for re-assembly. See Figure 5-68.

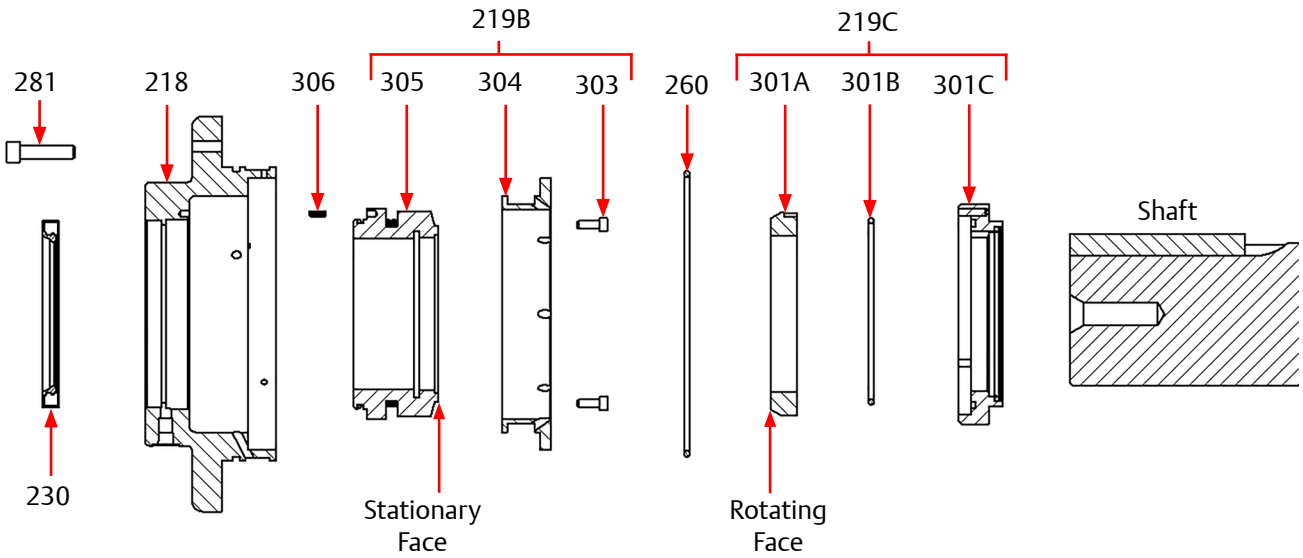


Figure 5-70. Shaft Seal Breakdown (25985W Only)

Prior To Shaft Seal Installation (For 25985Y and 25985W Shaft Seal Models)

WARNING

Follow local lock-out/tag-out procedure. Compressors must be depressurized before attempting to do any work on them. Failure to comply may result in serious injury, death and/or damage to equipment.

NOTE

Care must be taken when handling the cup assembly and mating ring when installing. See Figure 5-64 for Handling Seal Face with Care.

Suggestion

A spray bottle filled with clean compressor oil may be used to lubricate the faces of the seals without touching the seal.

Follow these steps to verify the integrity of a shaft seal:

1. Check lead chamfer and outer diameter of shaft for deep scratches that may potentially damage the O-ring on the inner diameter of the shaft seal, see Figure 5-71.
2. Check lead chamfer and inner diameter of shaft seal housing for burrs and/or deep scratches that may potentially damage the O-ring on the outer diameter of the shaft seal, see Figure 5-72.
3. For shaft seals 25985R and 25985T, shim 24022A needs to be assembled in shaft seal housing before shaft seal. To assemble the shim, align the slot on it with the anti-rotation pin during installation. Visually verify that the back of the shim is abutted against the shaft seal housing, see Figure 5-72.
4. Clean compressor shaft and shaft seal cavity in compressor housing.
5. Apply clean compressor lubricating oil to the compressor shaft in mating ring seating area, see Figure 5-73.

Once these steps have been performed, the installation procedure will depend on the shaft seal model of the compressor, so check the section relevant to yours.

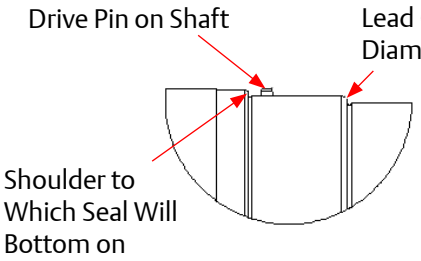


Figure 5-71. Shaft with Pin

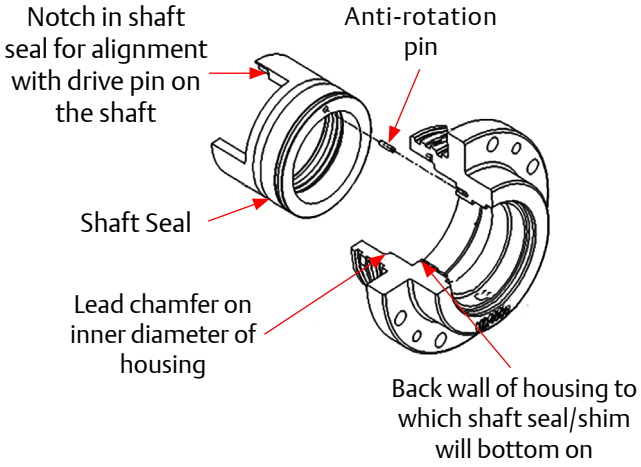


Figure 5-72. Shaft Seal Housing

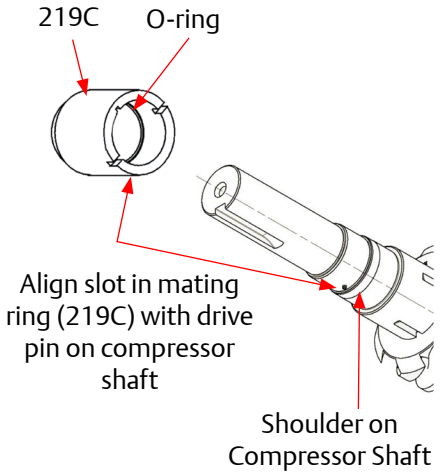


Figure 5-73. The Alignment of Compressor Shaft and Mating Ring

Shaft Seal Installation - For Model 25985Y

(See Table 5-15 and Figure 5-69)

NOTE

Follow the "Prior to Shaft Seal Installation" steps before starting this procedure.

WARNING

Follow local lock-out/tag-out procedure. Compressors must be depressurized before attempting to do any work on them. Failure to comply may result in serious injury, death and/or damage to equipment.

NOTE

Care must be taken when handling the cup assembly and mating ring when installing. See Figure 5-64 for Handling Seal Face with Care.

Suggestion

A spray bottle filled with clean compressor oil may be used to lubricate the faces of the seals without touching the seal.

CAUTION

Do not wipe or touch the face of the mating ring (219C) where the face meets the carbon component of the stationary assembly (219B).

1. Apply clean compressor lubricating oil to inside area of spring holder (219.8), rotating Silicon carbide piece (219.6) and O-ring (219.7).
2. Carefully fit spring holder (219.8) onto shaft until it is fully seated against shoulder on compressor shaft. Be sure to align slot in spring holder (219.8) with drive pin on compressor shaft, see Figure 5-73.

CAUTION

Ensure the spring holder (219.8) is fully seated against the shoulder of the compressor shaft. If the spring holder (219.8) is not fully seated against the shoulder, the carbon component of the stationary assembly (219B) will be damaged when the shaft seal housing (218) is installed.

3. Place O-ring (219.7) inside rotating silicon carbide piece (219.6) and carefully assemble onto shaft. You should feel some resistance in sliding this onto the shaft shoulder.
4. Install a new oil seal (230) in seal housing (218).
5. If necessary, Install anti-rotation pin (219.1a) in hole in shaft seal housing (218).
6. Install O-ring (219.2) into shaft seal housing.
7. Install stationary silicon carbide piece (219.3) in shaft seal housing with anti-rotation pin (219.1b) aligned 180 degrees away from the pin (219.1a) in Step 4. You should feel some resistance to fit the stationary piece into the O-ring.
8. Fit the retainer (219.4) over the stationary piece while aligning the slots on the anti-rotation pins.
9. Install retaining ring (219.5) into groove in shaft seal housing.
10. Install a new O-ring (260) on the seal housing (218), making sure the O-ring is placed in the O-ring groove and not the oil gallery groove. Lubricate both seal faces with clean compressor lubricating oil.
11. Carefully install the seal housing (218) on the compressor shaft, evenly tightening the bolts (281) to the recommended torque values (36 ft-lbs.).
12. Install the coupling and coupling guard. The unit can then be evacuated and leak checked.

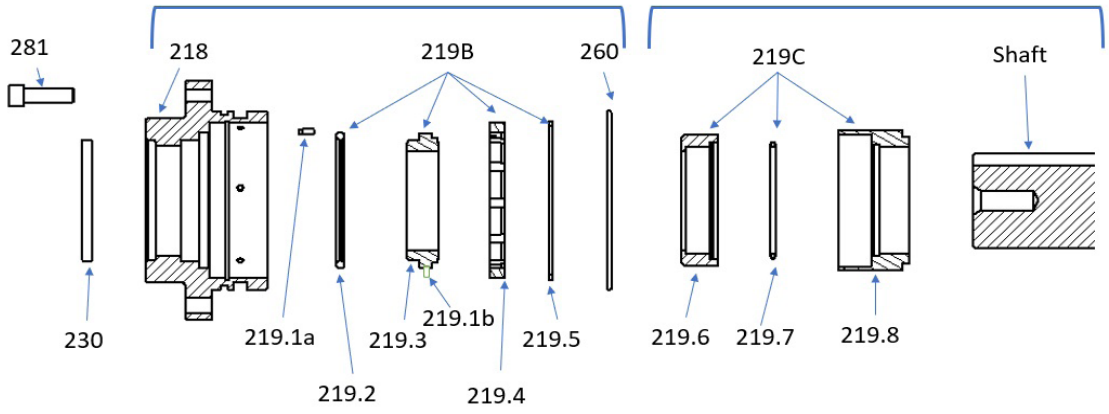


Figure 5-69. Shaft Seal Breakdown (25985Y Model)

Shaft Seal Installation – For Part# 25985W

(See Table 5-15 and Figure 5-70)

NOTE

Follow the "Prior to Shaft Seal Installation" steps before starting this procedure.

WARNING

Follow local lock-out/tag-out procedure. Compressors must be depressurized before attempting to do any work on them. Failure to comply may result in serious injury, death and/or damage to equipment.

NOTE

Care must be taken when handling the cup assembly and mating ring when installing. See Figure 5-64 for Handling Seal Face with Care.

Suggestion

A spray bottle filled with clean compressor oil may be used to lubricate the faces of the seals without touching the seal.

CAUTION

Do not wipe or touch the face of the mating ring (219C) where the face meets the carbon component of the stationary assembly (219B).

1. Install a new oil seal (230) in seal housing (218).
2. Ensure compressor shaft is clean and free from marks and scratches.
3. Remove seal rotating face (301A) and O-ring (301B) from rotating assembly portion of the seal (assembly 219C).
4. Apply clean compressor lubricating oil to seal seating area on the compressor shaft and inside area of rotating face support (301C).
5. Gently assemble the rotating face support (301C) onto main compressor shaft, taking care to align the drive pin in the main shaft with the keyway on the rotating face support (301C).
6. Using a small amount of Flowserve supplied grease, carefully re-assemble O-ring (301B) and rotating face (301A) over the compressor shaft, onto the rotating face support (301C).
7. Moving onto the stationary portion of the seal (219B), gently press the stationary face (305), into the seal housing (218) ensuring it is fully seated. Make sure to align the hole on the back of the stationary face (305) with the Anti-rotation pin (306) in the seal housing (218). See Figure 5-72.
8. Assemble retaining ring (304) over the seal into the shaft seal housing (218), aligning the mounting holes with the threaded holes in the shaft seal housing.
9. Apply blue Loctite 242 to the bolts (303) and tighten them down evenly in a star pattern until snug, then torqueing each to 48 in-lbs (6 N-m).
10. Apply clean compressor lubricating oil to both seal faces (305 and 219C).
11. Ensure a new O-ring (260) is installed in proper groove of shaft seal housing (218).
12. Carefully assemble shaft seal housing (218) onto main compressor shaft into main compressor housing, evenly tightening the bolts (281) and torqueing to their appropriate value as specified by compressor specific drawing.
13. Install the coupling and coupling guard. The unit can then be evacuated and leak checked.

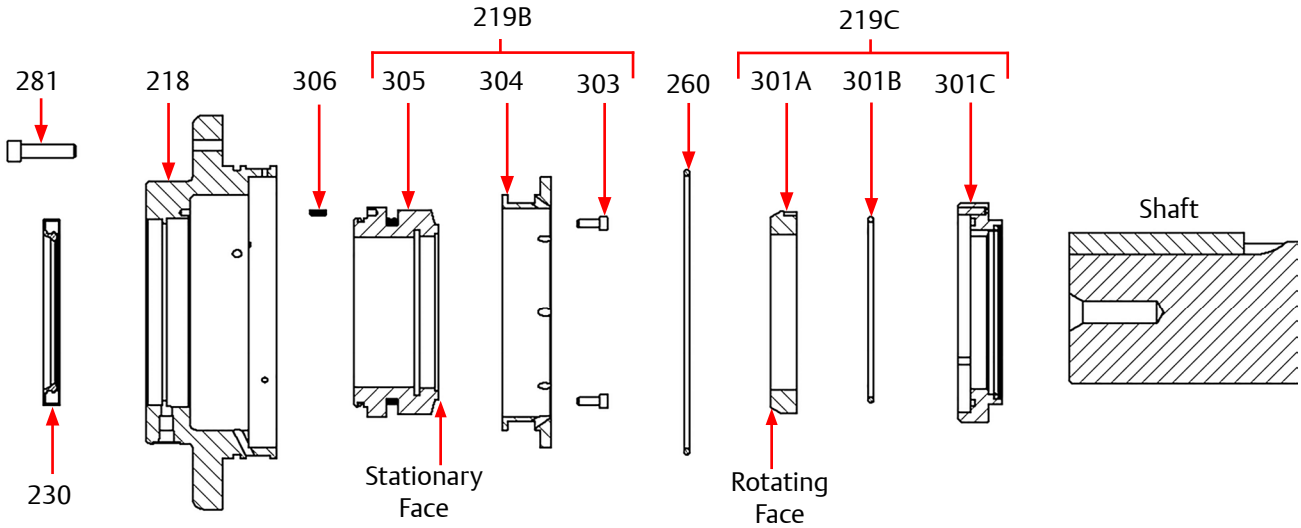


Figure 5-70. Shaft Seal Breakdown (25985W Only)

Main Rotor Assembly

Due to the procedures and tools involved in the disassembly and reassembly, the main rotor assembly must be performed by qualified individuals. Please consult the factory if maintenance is required.

Torque Specifications

Refer to the following table for torque specifications.

Table 5-16. Torque Specifications (ft-lbs) (For Compressors Only)

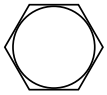
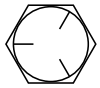
TYPE BOLT	HEAD MARKINGS	NOMINAL SIZE NUMBERS OR INCHES									
		#10	1/4"	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	3/4"	7/8"
SAE GRADE 2 COARSE (UNC)			5	10	18	29	44	63	87	155	150*
SAE GRADE 5 COARSE (UNC)			8	16	28	44	68	98	135	240	387
SAE GRADE 5 FINE (UNF)				16							
SAE GRADE 8 COARSE (UNC)			11	22	39	63	96	138	191	338	546
SOCKET HEAD CAP SCREW (ASTM A574) COARSE (UNC)		5	13	26	46	73	112	155	215	380	614
Notes:	1) Torque values on this sheet are not to override those given on the individual drawings.										
	2) When using loctite, the torque value on this sheet are only accurate if bolts are tightened immediately after loctite is applied.										
	* The proof strength of Grade 2 bolts is less for sizes 7/8 and above and therefore the torque values are less than smaller sizes of the same grade.										

Table 5-17. SA193 B7/SA320 L7 Bolts / Studs – Torque Requirements Per ASME Codes: B31.5 and B31.3

Nominal Bolting Diameter	Nominal Torque (ft.lbs.)	Maximum Torque (ft.lbs.)	Torque (ft.lbs) Using Flexitallic Gasket
3/8"	17	20	25
7/16"	19	22	28
1/2"	20	25	30
5/8”	40	50	60
3/4"	65	83	100
7/8”	100	133	160
1"	120	204	245
1-1/4"	150	454	500

Notes:

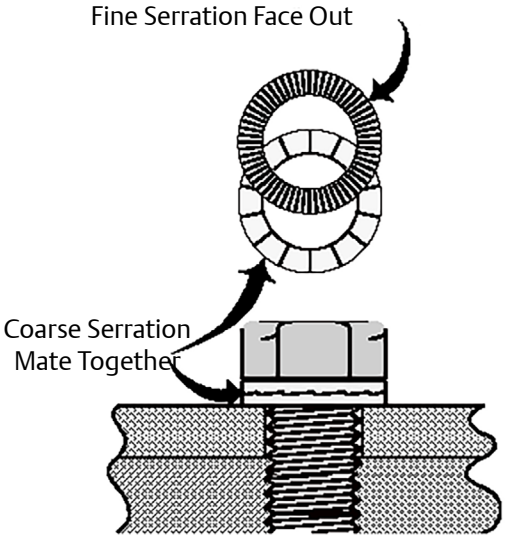
1. The above torque values apply unless otherwise specified on drawing.
2. Bolting to be tightened incrementally in a diametrically staggered pattern to the nominal torque value.
3. If necessary, torque can be increased in 10% increments; do not exceed the maximum torque values.
4. For other materials please consult Vilter Engineering Department for torque values.

Using A Torque Wrench Correctly

TORQUE WRENCHES

Using A Torque Wrench Correctly Involves Four Primary Concerns:

1. A smooth even pull to the break point is required. Jerking the wrench can cause the pivot point to break early leaving the bolt at a torque value lower then required. Not stopping when the break point is reached results in an over torque condition.
2. When more than one bolt holds two surfaces together there is normally a sequence that should be used to bring the surfaces together in an even manner. Generally bolting is tightened incrementally in a diametrically staggered pattern. Some maintenance manuals specify a tightening scheme. If so, the manual scheme shall be followed. Just starting on one side and tightening in a circle can cause the part to warp, crack, or leak.
3. In some cases threads are required to be lubricated prior to tightening the bolt/nut. Whether a lubricant is used or not has considerable impact on the amount of torque required to achieve the proper preload in the bolt/stud. Use a lubricant, if required, or not if so specified.
4. Unlike a ratchet wrench a torque wrench is a calibrated instrument that requires care. Recalibration is required periodically to maintain accuracy. If you need to remove a bolt/nut do not use the torque wrench. The clockwise/counterclockwise switch is for tightening right hand or left hand threads not for loosening a fastener. Store the torque wrench in a location where it will not be bumped around.



Nord-Lock® Washers

1. The Nord-Lock® lock washer sets are used in many areas in VSG screw compressors that require a vibration proof lock washer.
2. The lock washer set is assembled so the course serrations that resemble ramps are mated together.
3. Once the lock washer set is tightened down, it takes more force to loosen the bolt that it did to tighten it. This is caused by the washers riding up the opposing ramps.

Slide Valve Actuator 25972XP Troubleshooting Guide

Table 6-1. Slide Valve Actuator 25972XP Troubleshooting Guide (1 of 2)

Problem	Reason	Solution
The actuator fails to calibrate or calibrate correctly	An over-torque condition is causing the span to be too small	Test slide travel or balance piston.
	The actuator is too hot	Allow it to cool.
	The span is greater than 8 turns of the output shaft	Defect in slide travel.
	The input voltage is too low	Test power supply in controller.
	The actuator is not actually driving the command shaft	Inspect compressor slides.
	There are damaged or broken gears	Replace the actuator.
	The position sensor magnets are not rotating with the shaft	Replace the actuator.
	Circuit board failure	Replace the actuator.
The actuator only works intermittently. See Note 2.	Bad signal wire connection	Inspect and/or replace cabling between controller and actuator.
	The supply voltage is too low	Increase controller Power supply output or replace .
	Input position signal problems	Inspect and/or replace cabling between controller and actuator.
	Intermittent over-torque condition	See Note 1.
	The actuator is too hot	Allow it to cool.
	The position sensor magnets are not rotating with the shafts.	Replace actuator.
The actuator does not respond to the input position signal	The configuration switch is not set correctly	Refer to actuator manual for proper configuration.
	Something is causing an over-torque condition	See Note 1.
	The actuator is too hot	Allow it to cool.
	Bad signal wire connection	Inspect and/or replace cabling between controller and actuator.
	Low supply voltage	Test and/or replace controller power supply.
	Actuator mechanical problems	Replace actuator.
	Circuit board failure	Replace actuator.

Table 6-1. Slide Valve Actuator 25972XP Troubleshooting Guide (2 of 2)

Problem	Reason	Solution
The actuator runs continuously back and forth independent of the input position signal	Over-voltage has blown the DAC on the circuit board	Replace actuator.
Modbus LEDs	If Modbus is not used, these light(s) can stay on indefinitely or turn on and off randomly	No Action needed.
Bad or no output signal	The configuration switch is not set correctly	Refer to actuator manual for proper configuration.
	Bad signal wire connection	Inspect and/or replace cabling between controller and actuator.
	The output circuit protection in blown on the circuit board	Replace actuator.

Note 1 : Possible High Torque Testing Procedure

If you notice the commanded position does not match the actuate position while the compressor is running, the actuator my be encountering a high torque condition. The actuators are limited to 75lbs torque in order to prevent damage to the internal slide mechanism. To test if high torque occurring, please follow the steps below:

1. Turn off the compressor
   a. If the slide returns to approximately 0%; Then move on to Step 2.
   b. If the slide DOES NOT return to 0%; The actuator is likely faulty and should be replaced.
2. Go to the calibration screen
3. Using the "+" button, move the slide to its Max position.
   a. If max position can be reached, then the actuator is likely to be ok, procced to Step 4.
   b. If the actuator fails to reach max position; remove the actuator and manually move the command shaft using a wrench.
      I. If the slide can be move with wrench easily, the actuator is likely faulty and should be replaced.
      II. If the slide can not be moved any further in the increase direction, than the slide is either stuck or it is at is max position. Please contact customer service.
4. If the actuator can move through its full range freely while the compressor is off, then the actuator is mostly likely working as expected. The mostly likely reason the actuator is failing to reach its commanded position while running is because it is requiring more than the allow amount of torque to move the slides. There could be a number of reasons for this high torque so please contact customer service for additional trouble shooting steps.

Note 2 : Intermittent Actuator Signal

If while operation the actuators, you notice the large jump in the position in a very short amount of time then the cabling to the actuator is probably damages and should be replaced. The actuator is a slow-moving motor and a position jump of 10% or more in less than a second is physically impossible. A common source of this connectivity issue is the connector that connects to the actuator. If this connector was over tightened, the connector can break and will fail to maintain a solid connection. Please inspect this connection for damage.

Slide Valve Actuator (25972XP) Status LED Blink Codes

The actuator communicates status information to the operator by blink codes through the status LED. In the blink codes **1 = LED** on and **0 = LED** off. Time increases from left to right and the pattern repeats once the end of a sequence is reached.

Table 6-2. Slide Valve Actuator 25972XP Status LED Blink Codes

Blink Code	Meaning
‘0011001100110011 (uniform blink)	The actuator is in the process of auto calibrating.
‘0000000000000001	The actuator is not calibrated. Possible causes: 1. Automatic calibration failed because the span was too small. This can be caused by a sticking valve. 2. Automatic calibration was stopped before it was completed. 3. EEPROM memory failure is preventing stored calibration data from being read.
‘1111111111111111 (steady glow)	Hardware error. Possible causes: 1. Excessive backlash from worn or broken gears. 2. Shaft magnets are too close or too far from position sensor chips. 3. Position sensor chip failure.
‘0000000000010101	The actuator temperature exceeds 100°C. Normal operation resumes after it cools.
‘0000000000000101	The actuator torque limit has been exceeded. The actuator will pause 6 seconds and then try to move again.
‘1111111111111110	An emergency stop command has been issued through either Modbus or the CAL/STOP push button.

Slide Valve Actuator 25972D Troubleshooting Guide

Table 6-3. Slide Valve Actuator 25972D Troubleshooting Guide (1 of 2)

Problem	Reason	Solution
The actuator cannot be calibrated or exit calibration mode	Dirt or debris is blocking one or both optocoupler slots	Clean the optocoupler slots with a Q-Tip and rubbing alcohol.
	The photochopper fence extends less than about half way into the optocoupler slots	Adjust the photochopper so that the fence extends further into the optocoupler slots. Make sure the motor brake operates freely and the photochopper will not contact the optocouplers when the shaft is pressed down.
	The white calibrate wire in the grey Turck cable is grounded	Tape the end of the white wire in the panel and make sure that it cannot touch metal
	Dirt and/or condensation on the position sensor boards are causing it to malfunction	Clean the boards with an electronics cleaner or compressed air.
	The calibrate button is stuck down	Try to free the stuck button.
	The position sensor has failed	Replace the actuator.
	Push button is being held down for more that ¾ second when going through the calibration procedure	Depress the button quickly and then let go. Each ¾ second the button is held down counts as another press.
The actuator goes into calibration mode spontaneously	The white calibrate wire in the grey Turck cable is grounding intermittently	Tape the end of the white wire in the panel and make sure that it cannot touch metal.
	A very strong source of electromagnetic interference (EMI), such as a contactor, is in the vicinity of the actuator or grey cable	Increase the distance between the EMI source and the actuator. OR Install additional metal shielding material between the EMI source and the actuator or cable.
	There is an intermittent failure of the position sensor	Replace the actuator.
The actuator goes into calibration mode every time power is restored after a power loss	The motor brake is not working properly (see theory section above.)	Get the motor brake to where it operates freely and recalibrate.

Table 6-3. Slide Valve Actuator 25972D Troubleshooting Guide (2 of 2)

Problem	Reason	Solution
The actuator does not transmit the correct position after a power loss	The motor was manually moved while the position sensor was not powered.	Recalibrate.
	The motor brake is not working properly	Get the motor brake to where it operates freely and then re-calibrate.
	The position sensor's EEPROM memory has failed	Replace the actuator.
There is a rapid clicking noise when the motor is operating	The photochopper is misaligned with the slotted optocouplers	Try to realign or replace the actuator.
	The photochopper is positioned too low on the motor shaft.	Adjust the photochopper so that the fence extends further into the optocoupler slots.
	A motor bearing has failed	Replace the actuator.
The motor operates in one direction only	There is a loose connection in the screw terminal blocks	Tighten.
	There is a loose or dirty connection in the yellow Turck cable	Clean and tighten.
	The position sensor has failed	Replace the actuator.
	There is a broken motor lead or winding	Replace the actuator.
The motor will not move in either direction	The thermal switch has tripped because the motor is overheated	The motor will resume operation when it cools. This could be caused by a malfunctioning control panel. Consult the factory.
	Any of the reasons listed in "The motor operates in one direction only"	See above.
	The command shaft is jammed	Free the command shaft.
	Broken gears in the gearmotor	Replace the actuator.
	Blown relay or fuse.	Check and replace blown relay and/or fuse.
The motor runs intermittently, several minutes on, several minutes off	Motor is overheating and the thermal switch is tripping	This could be caused by a malfunctioning control panel. Consult the factory.
The motor runs sporadically	Bad thermal switch	Replace the actuator.
	Any of the reasons listed in "The motor will not move in either direction"	See above.
The motor runs but output shaft will not turn	Stripped gears inside the gear motor or the armature has come unpressed from the armature shaft	Replace the actuator.

Slide Valve Actuator 25972D LED Blink Codes

Slide Valve Actuators communicate problems discovered by internal diagnostics via LED blink codes. Only one blink code is displayed, even though it is possible that more than one problem has been detected.

Table 6-4. Slide Valve Actuator 25972D LED Blink Codes* (1 of 2)

Flash Pattern	Meaning
*=ON _=OFF	
*_*_*_*_*_*_*_*_*_*_*_*_*_	Calibration Step 1
*___*___*___*___*___	Calibration Step 2
*__*_____	This indicates a zero span. This error can only occur during calibration. The typical cause is forgetting to move the actuator when setting the upper limit of the span. If this is the case, press the blue button to restart the calibration procedure. This error can also occur if either or both of the slotted optocouplers are not working. If this is the case, the slide valve actuator will have to be replaced. The operation of the slotted optocouplers is tested as follows: 1. Manually rotate the motor shaft until the aluminum photochopper fence is not blocking either of the optocoupler slots. 2. Using a digital multi-meter, measure the DC voltage between terminal 3 of the small terminal block and TP1 on the circuit board.(1) You should measure between 0.1 and 0.2 Volts. 3. Next, measure the DC voltage between terminal 3 and TP2 on the circuit board. You should measure between 0.1 and 0.2 Volts.
*_____	This indicates a skipped state in the patterns generated by the optocouplers as the motor moves. This error means that the slide valve actuator is no longer transmitting accurate position information. The actuator should be recalibrated as soon as possible. This code will not clear until the actuator is recalibrated. This code can be caused by: 1. The motor speed exceeding the position sensors ability to measure it at some time during operation. A non-functioning motor brake is usually to blame. 2. The actuator is being operated where strong infrared light can falsely trigger the slotted optocouplers, such as direct sunlight. Shade the actuator when the cover is off for service and calibration. Do not operate the actuator with the cover off.

(1) TP1 and TP2 are plated-thru holes located close to the slotted optocouplers on the board. They are clearly marked on the board silkscreen legend.

Table 6-4. Slide Valve Actuator 25972D LED Blink Codes (2 of 2)

Flash Pattern	Meaning
*__*__*_____	The motor has overheated. The actuator motor will not run until it cools. Once the motor cools, the actuator will resume normal operation. Motor overheating is sometimes a problem in hot and humid environments when process conditions demand that the slide valve reposition often. Solutions are available; consult your Vilter authorized distributor for details. Another possible cause for this error is a stuck motor thermal switch. The thermal switch can be tested by measuring the DC voltage with a digital multi-meter between the two TS1 wire pads.(2) If the switch is closed (normal operation) you will measure 0 Volts.
**********	The 24V supply is voltage is low. This will occur momentarily when the actuator is powered up and on power down. If the problem persists, measure the voltage using a digital multi-meter between terminals 3 and 4 of the small terminal block. If the voltage is >= 24V, replace the actuator.
_**********	The EEPROM data is bad. This is usually caused by loss of 24V power before the calibration procedure was completed. The actuator will not move while this error code is displayed. To clear the error, calibrate the actuator. If this error has occurred and the cause was not the loss of 24V power during calibration, possible causes are: The EEPROM memory in the micro-controller is bad. The large blue capacitor is bad or has a cracked lead.
*****____*_____	Micro-controller program failure. Replace the actuator.

*There are two versions of slide valve actuators, version A and B. Only version B is able to display LED blink codes. Slide valve actuator version B can be distinguished by only having a single circuit board as supposed to two circuit boards in version A.

(2) The TS1 wire pads are where the motor thermal switch leads solder into the circuit board. They are clearly marked on the board silkscreen legend and are oriented at a 45 degree angle.

Compressor Troubleshooting Guide - General Problems & Solutions

Table 6-5. Compressor Troubleshooting Guide - General Problems & Solutions (1 of 3)

Problem	Solution
Low Oil Pressure at Start	• After failing to start compressor with “Prelube Oil Pump Inhibit”, first allow Discharge pressure, Oil Filter In pressure and Out pressure to equalize. Then restart compressor. If compressor fails to start due to low oil pressure, continue troubleshooting with items below. • Reset Prelube Oil Pressure Setpoint in Alarms and Trip Setpoints screen to lowest recommended setpoints. • Check calibration of oil manifold transmitter, discharge pressure transmitter, and suction transmitter. • Check for correct oil pump motor rotation and operation. • Ensure transmitter isolation valves are open. • Verify that the correct transmitter ranges are selected. • Check to see all oil line valves are open except the oil dump valve used to fill the lines and oil cooler. • Check oil strainer for dirt. • Check oil filter pressure drop. • Check “Prelube Oil Pump Time Limit” setpoint is sufficient in Compressor Timer Setpoints screen. • Prelube pressure is manifold pressure minus discharge pressure.
Low Run Oil Pressure	• Check solutions in “Low Oil Pressure at Start”. • Check that there is proper discharge pressure ratio to create differential pressure, otherwise oil pressure can’t be maintained. Oil pressure is manifold oil pressure minus the suction pressure. It is a net pressure. • If the oil pump is selected to be a part time oil pump in the “Setup” menu, then ensure that it only shuts off at an appropriate pressure ration that takes into account pressure drops through the oil cooler. This is a set point in the “Compressor Control Setpoints” menu called “Oil Pump Restart”. It is a pressure ratio. (discharge pressure in psia/suction pressure in psia) Default ratio is a pressure ratio of 3.00:1 that stops the pump and 2.80:1 that restarts the pump. This ratio can be increased. Do not decrease without consulting Vilter.
Oil flow or oil pressure problems	• Clean oil strainer screen. • Change oil filter, maybe plugged or collapsed. • Oil pump gears worn internally, excessive end-clearance. • Oil priming valve used on air-cooled cooler units is open. • Relief in-line check valve stuck open. • Pressure ratio too low, oil pump should be on.

Table 6-5. Compressor Troubleshooting Guide - General Problems & Solutions (2 of 3)

Problem	Solution
Faulty pressure or temperature readings	• Check that the correct pressure or temperature range is selected in the Instrument Calibration menu. • Check cable connections at device, terminal strips, and PLC input card for correct wiring and shielding (RF noise). • Check calibration of RTDs/TTs and transmitters.
Oil Loss Issues	• Oil return line from coalescing side of oil separator to suction is closed, not open enough (0.75 turns should be sufficient), or plugged with debris. • The check valve in the oil return line could be stuck closed or the flow is in the wrong direction. • There may be water in the oil affecting the coalescing elements. • Coalescent elements in need of replacement due to age or damage (water contamination). • The operating conditions are not correct (too high of suction and/or too low discharge pressure) This creates increased gas flow which could make the oil separator too small. • The suction or discharge check valve is not working correctly causing oil to escape when the unit stops. • Viscosity of oil incorrect; send sample for testing. • There is an oil leak somewhere in the system.
High oil temperature (liquid injection)	• Check for correct setting of all manual values. • Check for correct operation of 2-way automatic oil mixing valve. • In the “Vilter Only” menu, ensure that you select “Yes this unit has the oil mixing valve” to enable it. • If your are controlling a step type oil cooler or a VFD oil cooler, verify the correct one is selected in the “Vilter Only” menu and the amount of steps are entered in the menu screen “Oil Cooler Step Control” menu. • Check the oil cooler and associated piping to make sure it is full of oil before starting. • Check the oil strainer for debris and clean if necessary. • Verify that the volume slide actuator is functioning correctly and that the correct compressor size (type) is selected in the “Vilter Only” menu. • Check that all fans are working. • Check for correct fan rotation on the oil cooler. • Check that your operating conditions are within the “As Sold” design conditions.

Table 6-5. Compressor Troubleshooting Guide - General Problems & Solutions (3 of 3)

Problem	Solution
Capacity/Volume Slide Actuator Alarms/Trips/ Symptoms:	• Calibration method not correct. • Actuator or Gear motor not working, or off on overload. • Slide valve carriage assembly out of position, slides binding. • Cross-shaft gears, broken pins. • Command shaft broken. • Slide valve rack or rack shaft damaged. • Check balance piston movement. • Reference Slide Valve Actuator Troubleshooting Guide. • Check I/O fusing.
High Amp Draw	• Check Main Motor Amps scaling and PLC.
Vibration	• Check that unit is leveled and secured to mounting pad or floor. • Check supported pipes (i.e. suction and discharge pipe) and make sure they are adequately supported. • Check for loose bolts and nuts. • Check condition of compressor and motor (i.e. alignments).
Excessive Motor Backspin	• If there is more than normal motor backspin at shutdown, check suction check valve for proper operation.

Warranty Claim Processing

This section explains how the warranty claim is processed and to help clear any questions that may arise prior to contacting customer service. For additional warranty information, refer to the Terms and Conditions of your order. Vilter™ contact information can be found on page iii.

1. The warranty process starts with contacting a Vilter Life Cycle Services (LCS) department representative. *Ensure to have the original Vilter sales order number for the equipment available to better assist you.*
2. Our Vilter LCS representative will confirm if the equipment is within the warranty time frame as described in the warranty statement.

If the equipment (Part/Compressor/Compressor Motor) is within the warranty time frame, proceed to the following section regarding the type of equipment:

Process For Returning Products Covered By the Warranty

STEP 1. To return a defective Product or part under this warranty, you will need to provide the Vilter™ compressor order number on all submitted documents.

For a parts warranty request, please fill out the form in Table 7-1, you will also need to provide:

- The Vilter™ serial number of the compressor;
- A detailed and accurate description of the issue;
- A valid purchase order for the new part(s)—you must pay the freight;
- One copy of Return Merchandise Authorization (RMA) sent to you for your records;
- One copy of RMA sent to you to include in the return shipment of parts back to Vilter™ for warranty consideration.

STEP 2. Return the parts (freight prepaid) to:

VILTER MANUFACTURING CORPORATION
5555 South Packard Avenue
Cudahy, WI 53110-8904

STEP 3. Upon receipt of the returned part(s), Vilter™ will complete a timely evaluation of the part(s).

STEP 4. You will be contacted with Vilter's decision once the final report is completed.

STEP 5. If approved, the approved warranty will be credited (excluding freight) to your account. Vilter™ will retain the returned part(s) for final disposition. If a warranty request is not approved, you will be provided with a written response and the parts will be held for 30 days. After such time, Vilter™ will dispose of the parts. If you wish to have the part(s) returned, you will need to contact Vilter™ and the part(s) will be returned freight collect.

Procedure For Parts Not Manufactured By Vilter™

Although Vilter™ does not provide any warranty for parts and products that are not manufactured by Vilter™, Vilter™ does pass through any manufacturer's warranty to you (to the maximum extent permitted by the manufacturer). Vilter™ will work with you in facilitating your warranty claim with the manufacturer.

To facilitate your warranty claim, please follow the following four steps:

STEP 1. Determine if the part or product is within the OEM's warranty.

STEP 2. If the defective part or product is not a motor, send a description containing the specifications of the part/product and the defect to:

Service.Vilter@Copeland.com

If the defective part or product is a motor or starter, please complete the form in Table 7-1 and return it to:

Service.Vilter@Copeland.com

STEP 3. Vilter™ will communicate with you, if necessary, to ascertain additional information and will reasonably assist with the OEM to determine the part/product's warranty status.

VILTER by COPELAND

Table 7-1. General Warranty Claim Tag

To facilitate your warranty claim, please follow the steps outlined below:

To be filled out by Vilter Administrator:
RMA #: _____
Submitted by: _____

Please complete the following and return to Service.Vilter@Copeland.com, along with any pictures or additional information.

Company Name: _____
Contact Phone/Email: _____
Ship To (Name/Address): _____

SO #: _____
Part #: _____
Serial #: _____
Customer P.O#: _____
Please send a valid purchase order for the replacement parts(s)

When did it happen:
- ☐ During Shipment
- ☐ After _____ hours running
- ☐ Initial Startup
- ☐ Other: _____

Equipment affected:
- ☐ Screw
- ☐ Recip
- ☐ Starter Control
- ☐ Controller
- ☐ Motor
- ☐ Other: _____

Startup or intallation Date:
____/____/_____
Month Day Year

Reported Date:
____/____/_____
Month Day Year

This form must be completed and any technical reports and/or pictures attached when sending in your warranty claim.

Detailed Description of Issue (Mandatory)

Upon receipt of the returned part(s), Vilter Manufacturing will complete a timely evaluation of the part(s). You will be contacted with Vilter's decision once the final report is completed.
Approved warranty will be credited (excluding freight) to your account. Vilter Manufacturing will retain the returned part(s) for final disposition.
If warranty is not approved, you will be provided with a written response and the parts will be held for 30 days. After such time, Vilter will dispose of them. If you wish to have the part(s) returned, you will need to contact Vilter and the part(s) will be returned freight collect.

Warranty claims are pursuant to Vilter's standard terms and conditions of sale.
Labor charges for repairs and freight charges for new part(s) and returned part(s) are not covered under warranty.
Customer PO is required for all replacement parts, freight and labor (includes: travel and expense).

Clear Form

VILTER
by COPELAND

Table 7-2. Motor Warranty Procedure

To facilitate your warranty claim, please follow the steps outlined below:
1. Determination if motor is within the OEM warranty.
2. Please complete the following and return to Service.Vilter@Copeland.com, along with a picture of the motor's nameplate.
3. Vilter will assist with the motor OEM to determine the motor's warranty status.

Model: _____
Serial Number: _____
Manufacturer: _____
Run Hours: _____

Start Date: _____/_____/____
Month Day Year

Grease Type: _____

Starter Type:
- ☐ Soft Start
- ☐ Across the Line
- ☐ VFD

Alignment Data Available:	☐ Yes, please include with information	☐ No
Lubrication Records Available:	☐ Yes, please include with information	☐ No
Vibration Report:	☐ Yes, please include with information	☐ No

Describe Motor Symptoms:

4. If the motor falls within the OEM's warranty time frame:
- The motor will need to be taken to a manufacturer approved shop for diagnosis. Vilter can help with locating motor shops that are manufacturer approved in your area. The shop will diagnose the root cause, submit a report to the OEM, and the motor OEM will make the determination of warranty coverage.
- If warranty is approved, the OEM will either have the motor repaired by the motor shop or send a new replacement motor to the site.

Note: Motor warranty is a "pass thru warranty" as stated in Vilter Manufacturing's standard warranty statement which means that the original motor OEM is the provider of the warranty. Vilter does assist with the expediting of the claim but any dispensation of warranty is provided solely by the motor OEM.
Motor manufacturer warranty covers only repair or replacement of the motor. It does not cover removal and installation charges, incidental charges associated with the removal and installation process, loss of product or shipping to and from the manufacturer or approved shop. This is standard motor manufacturer warranty policy regardless of brand or application. If the end user requires additional information regarding warranty coverage, the individual motor manufacturer warranty terms can be found on their associated websites.

STEP 4. For defective motor or starter claims, if the motor or starter falls within the OEM's warranty time frame:

- The motor or starter will need to be taken to a manufacturer approved shop for diagnosis. Vilter™ can help you locate motor shops in your area that are manufacturer approved. The shop will diagnose the root cause, submit a report to the OEM, and the motor OEM will make the determination of warranty coverage.
- If a warranty claim is approved, the OEM will either have the motor or starter repaired by the motor shop or send a new replacement motor to the site.

On-Site Service Support

If on site support is required, contact a Vilter LCS department representative to start this process.

Warranty does not cover labor or expenses.

1. A quote, a service rate sheet, and the service terms and conditions will be provided.
2. Submit a PO.
3. Schedule the service visit.

Remanufactured Gas Bare Shaft Single Screw Compressor Process

These instructions are an overview of how the process works when a bare shaft compressor is in need of being remanufactured. This is to help clear any questions that may arise prior to contacting customer service.

The process begins by contacting Vilter's Customer Service Department. Vilter contact information can be found on page iii.

- Request a "VSG/VSSG Single Screw Compressor Rebuild Form".
- Submit the Rebuild Form and a Purchase Order (PO) for the inspection. A fee is required for the initial inspection and tear down report; contact Vilter Customer Service representative for the latest fee.
- A Return Material Authorization (RMA) number will be provided.
- Send the compressor to Vilter in the condition as stated on the Rebuild Form (i.e. no oil in the compressor). Charges may apply if conditions are not met.
- A report will be sent to you after the inspection has been completed explaining what level of rebuild is necessary along with the cost.

NOTE

Inspection and rebuild times will vary, contact Vilter Customer Service representative for further details.

- Submit a new PO for the amount that will be needed for the rebuild. The inspection cost will be waived upon receipt of the new PO. Make sure to provide your "Ship to Address" and "Billing Address".

Explanation of Rebuild Levels

Level 1

Compressor is in good condition. Replace bearings, gaskets, shaft seal and O-rings. All hardware is intended to be re-used (when possible). Parts are organized in part kit form.

Level 2

Compressor is in good condition, but requires new gate rotor blades. Replace all items in Level 1 plus new gate rotor blades and bushings.

Level 3 - Current Reman Compressor requires complete rebuilding and re-conditioning to "as-new" condition. All the components listed in Level 2 are replaced plus all hardware, slide assemblies, pistons, and a main rotor (if damaged) and/or gate rotor supports.

NOTE

A Level 1 and Level 2 rebuild will include washing the housing and repainting over the current paint. A Level 3 rebuild will include blasting all the current paint off before repainting.

Bare Shaft Compressor Description

Single Screw Bare Shaft Compressor features include:

- Cast grey iron, ductile iron, or steel frame with cast ductile iron discharge manifold and gate rotor covers with discharge connection.
- Drive shaft is straight.
- Standard slide assembly.
- Crating with Purge & Gauge.
- Does not include hand wheels or slide valve motors.

How to Read a Parts List and Illustration

A parts list consist of the following information:

Item Number

Item number associated with the number shown in the parts illustration.

Description

A description of an item.

Model Number

Compressor type and size.

VPN

VPN stands for Vilter™ Part Number.

Quantity

A quantity used for respective model or series of models.

Assembly and Kit Information

For assembly and kit, included items are added in parenthesis after part description.

Example-

ITEM	DESCRIPTION	MODEL NUMBER	
		VSSG 451	
		QTY	VPN
100	SUPPORT ASSEMBLY (110 and 135B)	2	A25159BB
110	SUPPORT	2	25606A
135B	DOWEL PIN, LG, 0.4375" O.D.	2	25910A

VPN A25159BB – SUPPORT ASSEMBLY includes items (110 and 135B).

Terms and Abbreviation Used

Term	Description
SM	Small
LG	Large
O.D.	Outer Diameter
BRG	Bearing
HSG	Housing
VOL.	Volume
CAP.	Capacity
AR	As Required
QTY	Quantity
W/O	Without
W/	With

Important Notes

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor.

Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Additional note/information of part/item/quantity shown at the bottom of parts table.

Vilter™ Aftermarket Parts Contact Information

Phone: 1-800-862-2677

Fax: 1-800-862-7788

E-mail: Parts.Vilter@Copeland.com

Website: Copeland.com/Vilter or Vilter.com

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

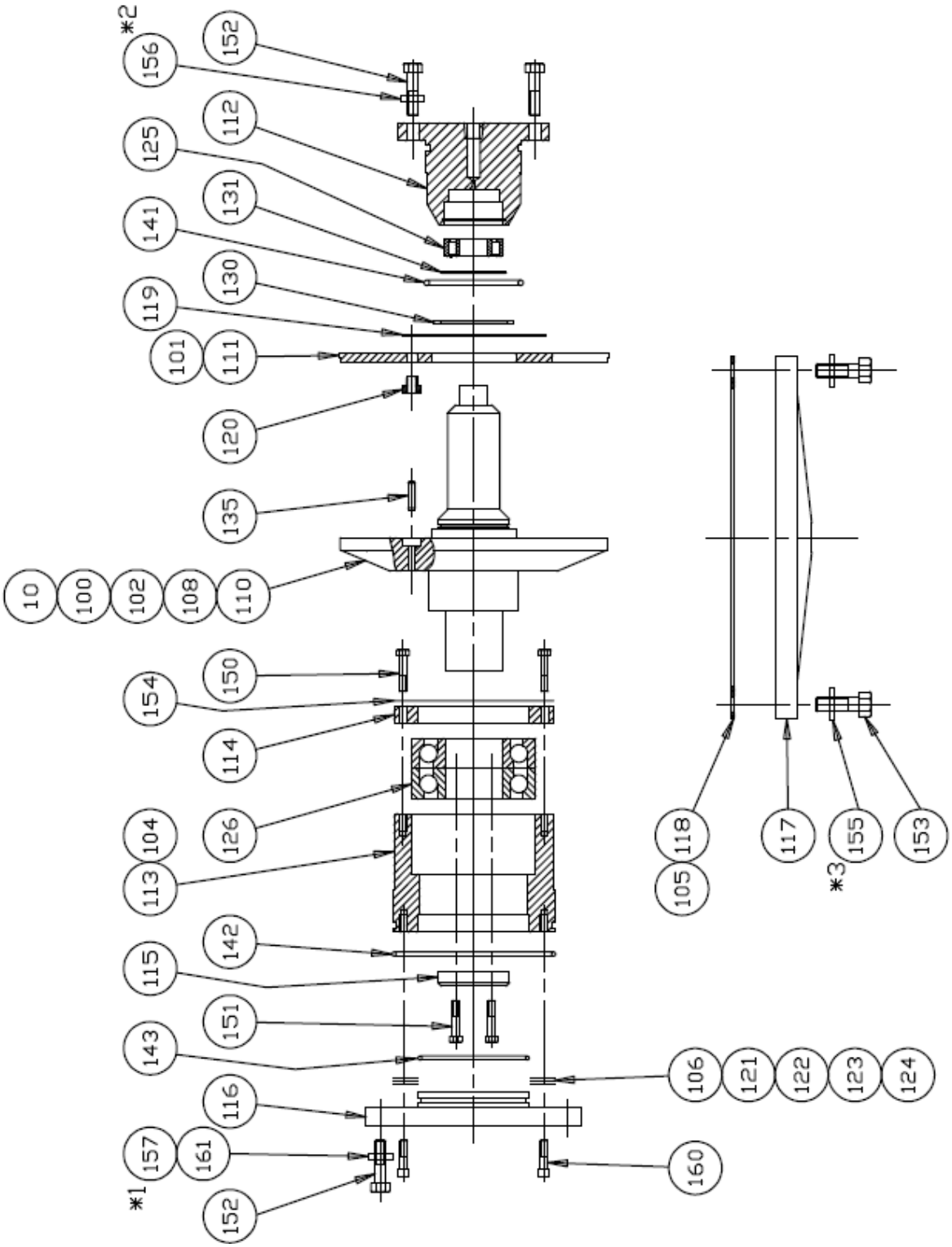
VSSG 291 thru 601 and VSG/VSGC 451 thru 3001 Recommended Spare Parts List

Refer to the Custom Manual Spare Parts Section for Specific Applications

Please have your Model # and Sales Order # available when ordering. These are found on the compressor's Name Plate.

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Gaterotor (VSSG 451 - VSG/VSGC 2101)



*For VSG/VSGC Models from 451 to 2101

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Gaterotor (VSSG 451 - VSG/VSGC 751)

ITEM	DESCRIPTION	MODEL NUMBER					
		VSSG 451		VSSG 601		VSG/VSGC 751	
		QTY	VPN	QTY	VPN	QTY	VPN
-	GATEROTOR BLADE AND BEARING REPLACEMENT KIT (111, 118, 120A, 120B, 121, 122, 123, 124, 125, 126, 130, 131, 141, 142, 143)	AR	KT712AV	AR	KT712B	AR	KT712C
-	GATEROTOR BLADE REPLACEMENT KIT (111, 118, 120A, 120B, 121, 122, 123, 124, 130, 141, 142, 143)	AR	KT713A	AR	KT713B	AR	KT713C
100	SUPPORT ASSEMBLY 110 & 135B.	2	A25159BB	2	A25159BA	2	A25159CB
102	GATEROTOR SUPPORT ASSEMBLY (100, 111, 120B, 119, 130)	2	A25161BB	2	A25161BA	2	A25161CB
105	GATEROTOR GASKET SET (118, 141, 142, 143)	2	A25164B	2	A25164B	2	A25164C
106	SHIM PACK SET ((2) 121, (2) 122, (1) 123, (1) 124)	2	A25165B	2	A25165B	2	A25165C
110	SUPPORT	2	25606A	2	25520A	2	25612A
111	GATEROTOR	2	25557A	2	25534A	2	25608A
112	SMALL BEARING HOUSING	2	25518D	2	25518D	-	N/A
113	LARGE BEARING HOUSING	2	25517A	2	25517A	-	N/A
114	RETAINER	2	25008A	2	25008A	-	N/A
115	RETAINER	2	25009A	2	25009A	-	N/A
116	BALL BEARING COVER	2	25258A	2	25258A	-	N/A
117	GATEROTOR COVER	2	25519A	2	25519A	-	N/A
118	GATEROTOR COVER GASKET	2	25259A	2	25259A	2	25088A
119	WASHER	2	25007A	2	25007A	2	25086A
120A	BUSHING, SMALL DOWEL PIN	2	25006A	2	25006A	2	25087A
120B	BUSHING, LARGE DOWEL PIN	2	25760A	2	25760A	2	25760B
121	SHIM 0.002"	AR	25010AA	AR	25010AA	AR	25089AA
122	SHIM 0.003"	AR	25010AB	AR	25010AB	AR	25089AB
123	SHIM 0.005"	AR	25010AC	AR	25010AC	AR	25089AC
124	SHIM 0.010"	AR	25010AD	AR	25010AD	AR	25089AD
125	ROLLER BEARING	2	2864B	2	2864B	2	2864C
126	BALL BEARING	4	2865BP	4	2865BP	4	2865A
130	RETAINING RING	2	2866A	2	2866A	2	2866B
131	RETAINING RING	2	2867A	2	2867A	2	2867E
135A	DOWEL PIN, SM, 0.250" O.D.	2	2868B	2	2868B	2	2868F
135B	DOWEL PIN, LG, 0.4375" O.D.	2	25910A	2	25910A	2	25910B
141	O-RING ROLLER BEARING HOUSING	2	2825D	2	2825D	2	2825E
142	O-RING BALL BEARING HOUSING	2	2825G	2	2825G	2	2825X
143	O-RING BRG HSG COVER	2	2825E	2	2825E	2	2825T
150	HEX HEAD CAP SCREW (1/4-20 NC X 1-1/4)	12	2796AJ	12	2796AJ	-	N/A
151	HEX HEAD CAP SCREW (5/16-18 NC X 1-1/4)	6	2796B	6	2796B	-	N/A
152	HEX HEAD CAP SCREW (3/8-16 NC X 1-1/4)	40	2796CJ	40	2796CJ	-	N/A
153	HEX HEAD CAP SCREW (1/4-20 NC X 1)	32	2795E	32	2795E	-	N/A
160	SOCKET HEAD CAP SCREW	12	2795E	12	2795E	-	N/A

Note: AR: As Required.

Gaterotor (VSG/VSGC 901 - 1301)

ITEM	DESCRIPTION	MODEL NUMBER							
		VSG/VSGC 901		VSG/VSGC 1051		VSG/VSGC 1201		VSG/VSGC 1301	
		QTY	VPN	QTY	VPN	QTY	VPN	QTY	VPN
-	GATEROTOR BLADE AND BEARING REPLACEMENT KIT (111, 118, 120A, 120B, 121, 122, 123, 124, 125, 126, 130, 131, 141, 142, 143)	AR	KT712DV	AR	KT712E	AR	KT712FV	AR	KT712Y
-	GATEROTOR BLADE REPLACEMENT KIT (111, 118, 120A, 120B, 121, 122, 123, 124, 130, 141, 142, 143)	AR	KT713D	AR	KT713E	AR	KT713F	AR	KT713Y
100	SUPPORT ASSEMBLY 110 & 135B.	2	A25159CA	2	A25159DB	2	A25159DA		
102	GATEROTOR SUPPORT ASSEMBLY (100, 111, 120B, 119, 130)	2	A25161CA	2	A25161DB	2	A25161DA	2	A25161DH
105	GATEROTOR GASKET SET (118, 141, 142, 143)	2	A25164C	2	A25164D	2	A25164D	2	A25164D
106	SHIM PACK SET ((2) 121, (2) 122, (1) 123, (1) 124)	2	A25165C	2	A25165C	2	A25165C	2	A25165C
110	SUPPORT	2	25553A	2	25614A	2	25587A	2	25587A
111	GATEROTOR	2	25554A	2	25610A	2	25588A	2	25588F
118	GATEROTOR COVER GASKET	2	25088A	2	25132A	2	25132A	2	25132A
119	WASHER	2	25086A	2	25086A	2	25086A	2	25086A
120A	BUSHING, SMALL DOWEL PIN	2	25087A	2	25104A	2	25104A	2	25104A
120B	BUSHING, LARGE DOWEL PIN	2	25760B	2	25760B	2	25760B	2	25760B
121	SHIM 0.002"	AR	25089AA	AR	25089AA	AR	25089AA	AR	25089AA
122	SHIM 0.003"	AR	25089AB	AR	25089AB	AR	25089AB	AR	25089AB
123	SHIM 0.005"	AR	25089AC	AR	25089AC	AR	25089AC	AR	25089AC
124	SHIM 0.010"	AR	25089AD	AR	25089AD	AR	25089AD	AR	25089AD
125	ROLLER BEARING	2	2864C	2	2864G	2	2864G	2	2864G
126	BALL BEARING	4	2865A	4	2865A	4	2865A	4	2865A
130	RETAINING RING	2	2866B	2	2866B	2	2866B	2	2866B
131	RETAINING RING	2	2867E	2	2867L	2	2867L	2	2867L
135A	DOWEL PIN, SM, 0.250" O.D.	2	2868F	2	2868H	2	2868H	2	2868H
135B	DOWEL PIN, LG, 0.4375" O.D.	2	25910B	2	25910B	2	25910B	2	25910B
141	O-RING ROLLER BEARING HOUSING	2	2825E	2	2825AB	2	2825AB	2	2825AB
142	O-RING BALL BEARING HOUSING	2	2825X	2	2825AC	2	2825AC	2	2825AC
143	O-RING BRG HSG COVER	2	2825T	2	2825T	2	2825T	2	2825T

Note: AR: As Required.

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Gaterotor (VSG/VSGC 1551 - 2101, 1 of 2)

ITEM	DESCRIPTION	MODEL NUMBER					
		VSG/VSGC 1551		VSG/VSGC 1851		VSG/VSGC 2101	
		QTY	VPN	QTY	VPN	QTY	VPN
-	GATEROTOR BLADE AND BEARING REPLACEMENT KIT (111, 118, 120A, 120B, 121, 122, 123, 124, 125, 126, 130, 131, 141, 142, 143)	AR	KT712LV* KT712LAF* KT712LNV** KT712LNAF**	AR	KT712MV* KT712MAF* KT712MNV** KT712MNAF**	AR	KT712KNV** KT712KNAF**
-	GATEROTOR BLADE REPLACEMENT KIT (111, 118, 120A, 120B, 121, 122, 123, 124, 130, 141, 142, 143)	AR	KT712TV* KT712TAF* KT712TNV** KT712TNAF**	AR	KT713UV* KT713UAF** KT713UNV** KT713UNAF**	AR	KT713LNV** KT713LNAF**
101	GATEROTOR ASSEMBLY (111, 120)	2	A25160EB	2	A25160EA	2	A25160EA
102	GATEROTOR SUPPORT ASSEMBLY (100, 111, 120B, 119, 130)	2	A25161EB	2	A25161EA	2	A25161EC
104	SHIM 350MM GATEROTOR BALL BRG VSS	2	25977U	2	25977U	2	25977U
105	GATEROTOR GASKET SET (118, 141, 142, 143)	2	A25164E	2	A25164E	2	A25164E
106	SHIM PACK SET ((2) 121, (2) 122, (1) 123, (1) 124)	2	A25165E	2	A25165E	2	A25165E
110	SUPPORT	2	25665C	2	25665E	2	25665D
111	GATEROTOR	2	25647A	2	25645A	2	25744D
112	SMALL BEARING HOUSING	2	26507A	2	26507A	2	26507A
113	LARGE BEARING HOUSING	2	26506A	2	26506A	2	26506A
114	RETAINER	2	25141A	2	25141A	2	25141A
115	RETAINER	2	25789A	2	25789A	2	25789A
116	BALL BEARING COVER	2	25351A	2	25351A	2	25351A
117	GATEROTOR COVER	2	26508B	2	26508B	2	26508B
118	GATEROTOR COVER GASKET	2	26509A	2	26509A	2	26509A
119	WASHER	2	25788A	2	25788A	2	25788A
120A	BUSHING, SMALL DOWEL PIN	-	N/A	-	N/A	-	N/A
120B	BUSHING, LARGE DOWEL PIN	2	25760C	2	25760C	2	25760C
121	SHIM 0.002"	AR	25791AA	AR	25791AA	AR	25791AA
122	SHIM 0.003"	AR	25791AB	AR	25791AB	AR	25791AB
123	SHIM 0.005"	AR	25791AC	AR	25791AC	AR	25791AC
124	SHIM 0.010"	AR	25791AD	AR	25791AD	AR	25791AD
125	ROLLER BEARING	2	2864K	2	2864K	2	2864K
126	BALL BEARING	4	2865K	4	2865K	4	2865K
130	RETAINING RING	2	2866G	2	2866G	2	2866G
131	RETAINING RING	2	2867R	2	2867R	2	2867R
135A	DOWEL PIN, SM, 0.250" O.D.	-	N/A	-	N/A	-	N/A
135B	DOWEL PIN, LG, 0.4375" O.D.	2	25910C	2	25910C	2	25910C
141	O-RING ROLLER BEARING HOUSING	2	2825T	2	2825T	2	2825T
142	O-RING BALL BEARING HOUSING	2	2825V	2	2825V	2	2825V
143	O-RING BRG HSG COVER	2	2825S	2	2825S	2	2825S
150	HEX HEAD CAP SCREW (1/4-20 NC X 1-1/4)	12	2796CJ	12	2796CJ	12	2796CJ

Notes: AR: As Required. *: For Serial Numbers Before 5580. **: For Serial Numbers After 5580.

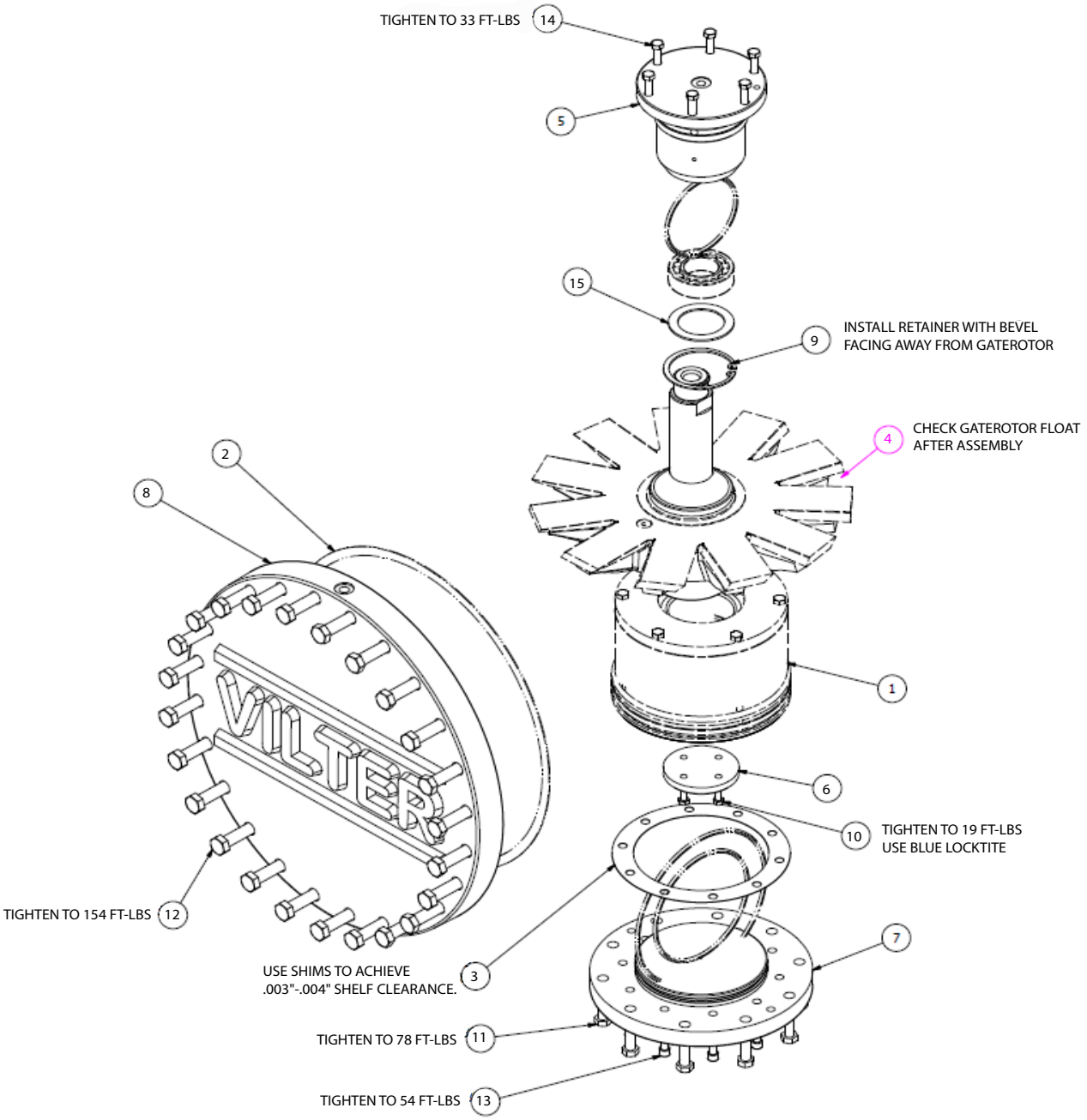
Gaterotor (VSG/VSGC 1551 - 2101, 2 of 2)

ITEM	DESCRIPTION	MODEL NUMBER					
		VSG/VSGC 1551		VSG/VSGC 1851		VSG/VSGC 2101	
		QTY	VPN	QTY	VPN	QTY	VPN
151	HEX HEAD CAP SCREW (5/16-18 NC X 1-1/4)	8	2796N	8	2796N	8	2796N
152	HEX HEAD CAP SCREW (3/8-16 NC X 1-1/4)	32	2796CJ	32	2796CJ	32	2796CJ
153	HEX HEAD CAP SCREW (1/4-20 NC X 1)	44	2796R	44	2796R	44	2796R
160	SOCKET HEAD CAP SCREW	16	2795G	16	2795G	16	2795G

Notes: AR: As Required. *: For Serial Numbers Before 5580. **: For Serial Numbers After 5580.

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Gaterotor (VSG/VSGC 2401 - 3001)



*VSG/VSGC 2401 - 3001 Only

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Gaterotor (VSG/VSGC 2401 - 3001)

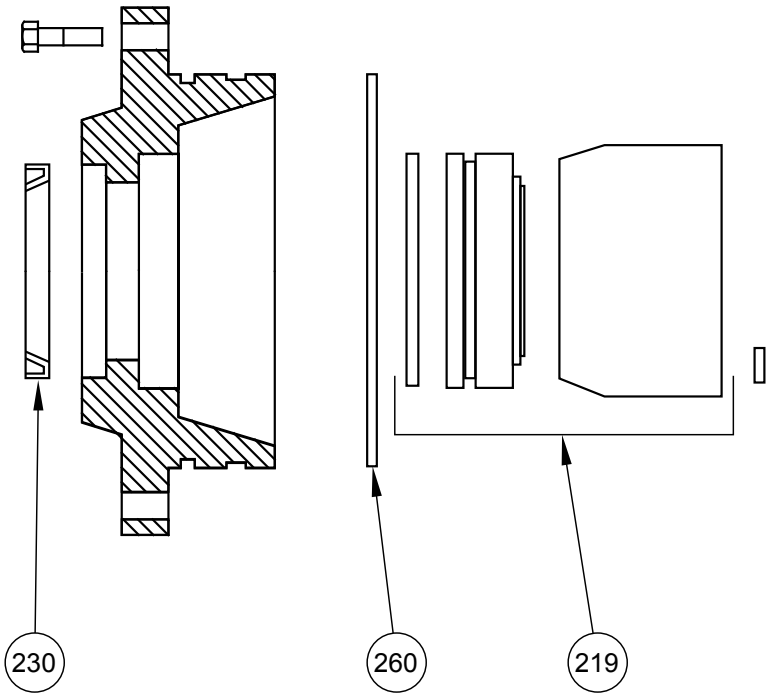
ITEM	DESCRIPTION	QTY	MODEL NUMBER			
			VSG/VSGC 2401	VSG /VSGC 2601	VSG/VSGC 2801	VSG/VSGC 3001
			VPN	VPN	VPN	VPN
-	GATEROTOR BLADE AND BEARING REPLACEMENT KIT	AR	KT712N	KT712P	KT712Q KT712QAF*	KT712R
-	GATEROTOR BLADE REPLACEMENT KIT	AR	KT713P	KT713Q	KT713R KT713RAF*	KT713S
001	BALL BEARING	1	A25163G	A25163G	A25163G	A25163G
002	SEAL GATEROTOR	1	A25164F	A25164F	A25164F	A25164F
003	SHIM	1	A25165F	A25165F	A25165F	A25165F
004	SUPPORT	1	A25222FH	A25222FG	A25222FF	A25222FE
005	BEARING HOUSING	1	26089B	26089B	26089B	26089B
006	GATEROTOR BEARING HOUSING COVER	1	25789B	25789B	25789B	25789B
007	GATEROTOR COVER	1	26087B	26087B	26087B	26087B
008	RETAINING RING (3.346 X 0.109) BEVELED	1	26132C	26132C	26132C	26132C
009	HEX HEAD CAP SCREW (5/16 -18 NC X 1-1/4)	1	2867R	2867R	2867R	2867R
010	HEX HEAD CAP SCREW (1/2-13 NC X1-3/4)	4	2796B	2796B	2796B	2796B
011	HEX HEAD CAP SCREW (5/8-11 NC X 2-3/4)	10	2796EL	2796EL	2796EL	2796EL
012	HEX HEAD CAP SCREW (3/8-16 NC X 1-3/4)	24	2796GQ	2796GQ	2796GQ	2796GQ
013	HEX HEAD CAP SCREW (3/8-16 NC X 1-1/4)	10	2795AH	2795AH	2795AH	2795AH
014	ROLLER BEARING SHIM	6	2796CJ	2796CJ	2796CJ	2796CJ
015	BEARING RETAINER	1	25977Z	25977Z	25977Z	25977Z

Notes: AR: As Required. *: AFLAS.

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Shaft Seal

Shaft Seal With Stationary Carbon Face

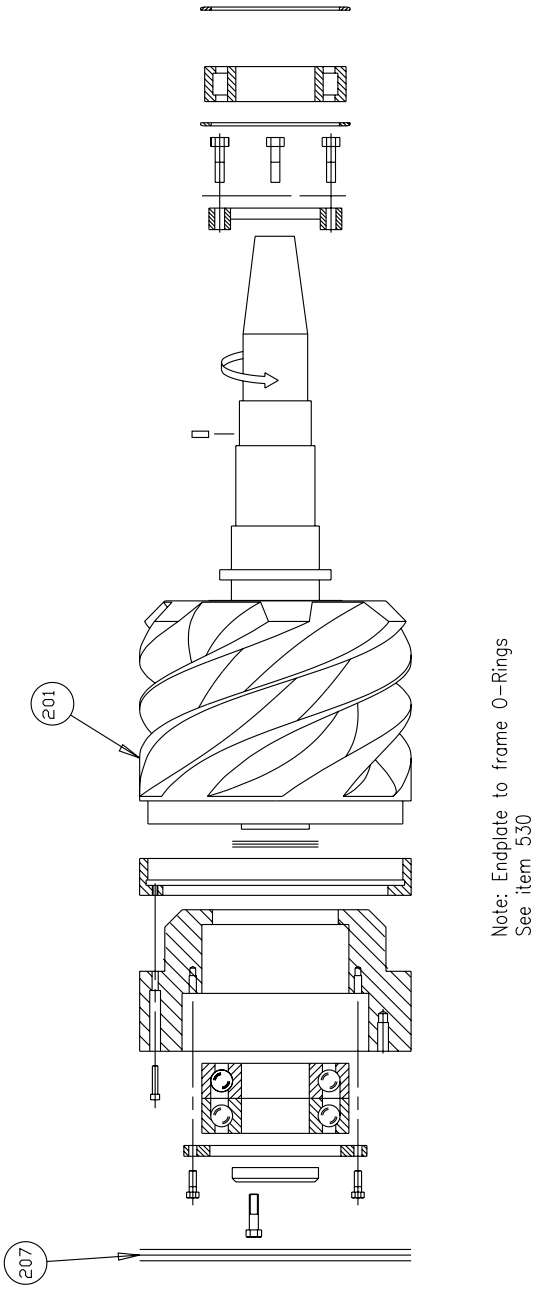


ITEM	DESCRIPTION	QTY	MODEL NUMBER			
			VSSG 291 - 601 VSG/VSGC 501 - 701	VSG/VSGC 751 - 1301	VSG/VSGC 1501 & 1801 VSG/VSGC 1551 - 2101	VSG/VSGC 2401 - 3001
			VPN	VPN	VPN	VPN
219	Ask Vilter Parts Dept to check T25263					
230						
260						

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Main Rotor

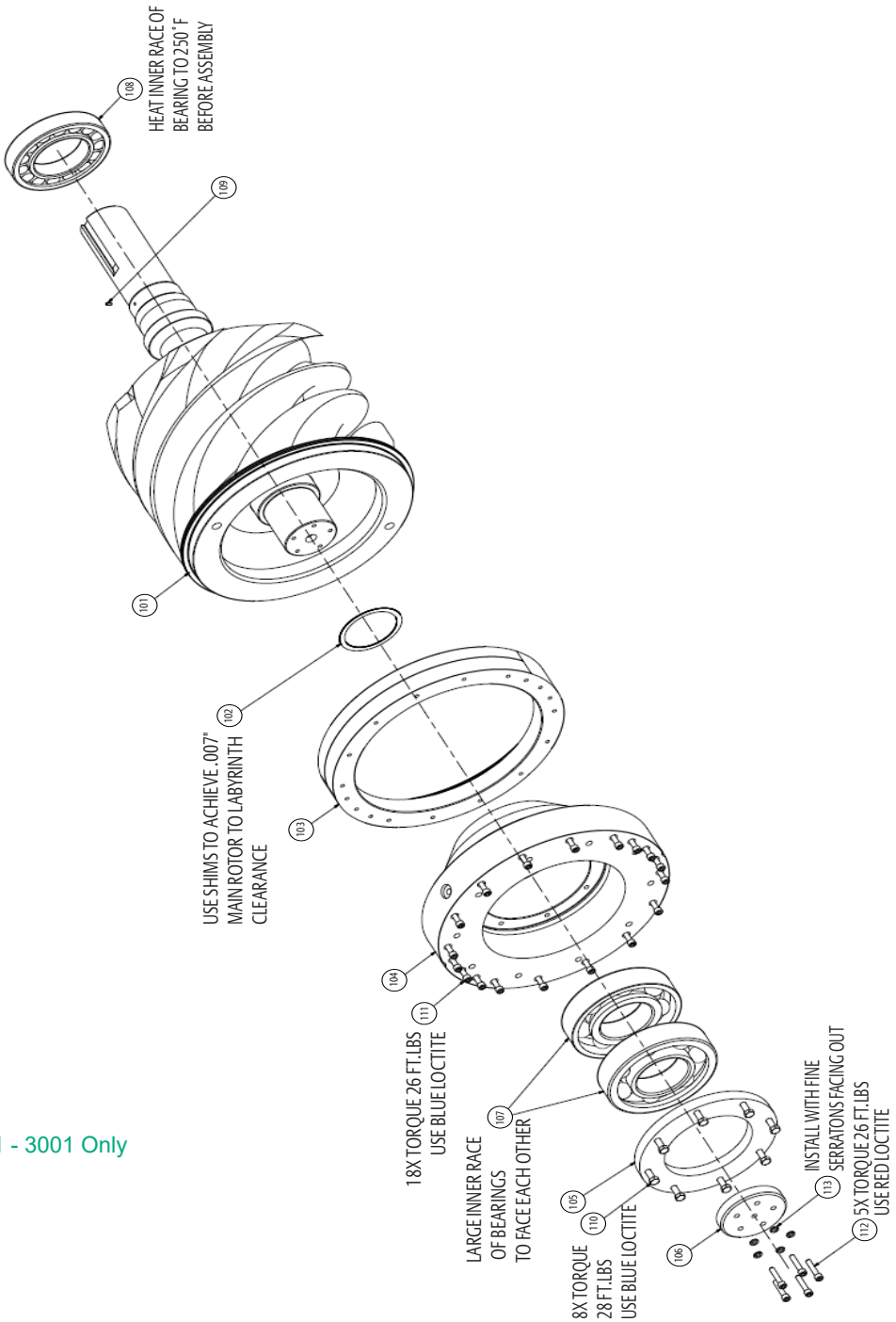
ITEM		207	201
MODEL NUMBER	QTY	DESCRIPTION	
		SHIM PACK	ROTOR ASSEMBLY
VSSG 451	1	A25177B	A25226BB
VSSG 601	1	A25177B	A25226BA
VSG/VSGC 751	1	A25177C	A25226CB
VSG/VSGC 901	1	A25177C	A25226CA
VSG/VSGC 1051	1	A25177D	A25226DB
VSG/VSGC 1201	1	A25177D	A25226DA
VSG/VSGC 1301	1	A25177D	A25752HA
VSG/VSGC 1501	1	A25177E	A25226EB
VSG/VSGC 1551	1	A25177E	A25226EC
VSG/VSGC 1801	1	A25177E	A25226EA
VSG/VSGC 1851	1	A25177E	A25226ED
VSG/VSGC 2101	1	A25177E	A25226EE



*For VSSG/VSG/VSGC Models from 451 to 2101

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

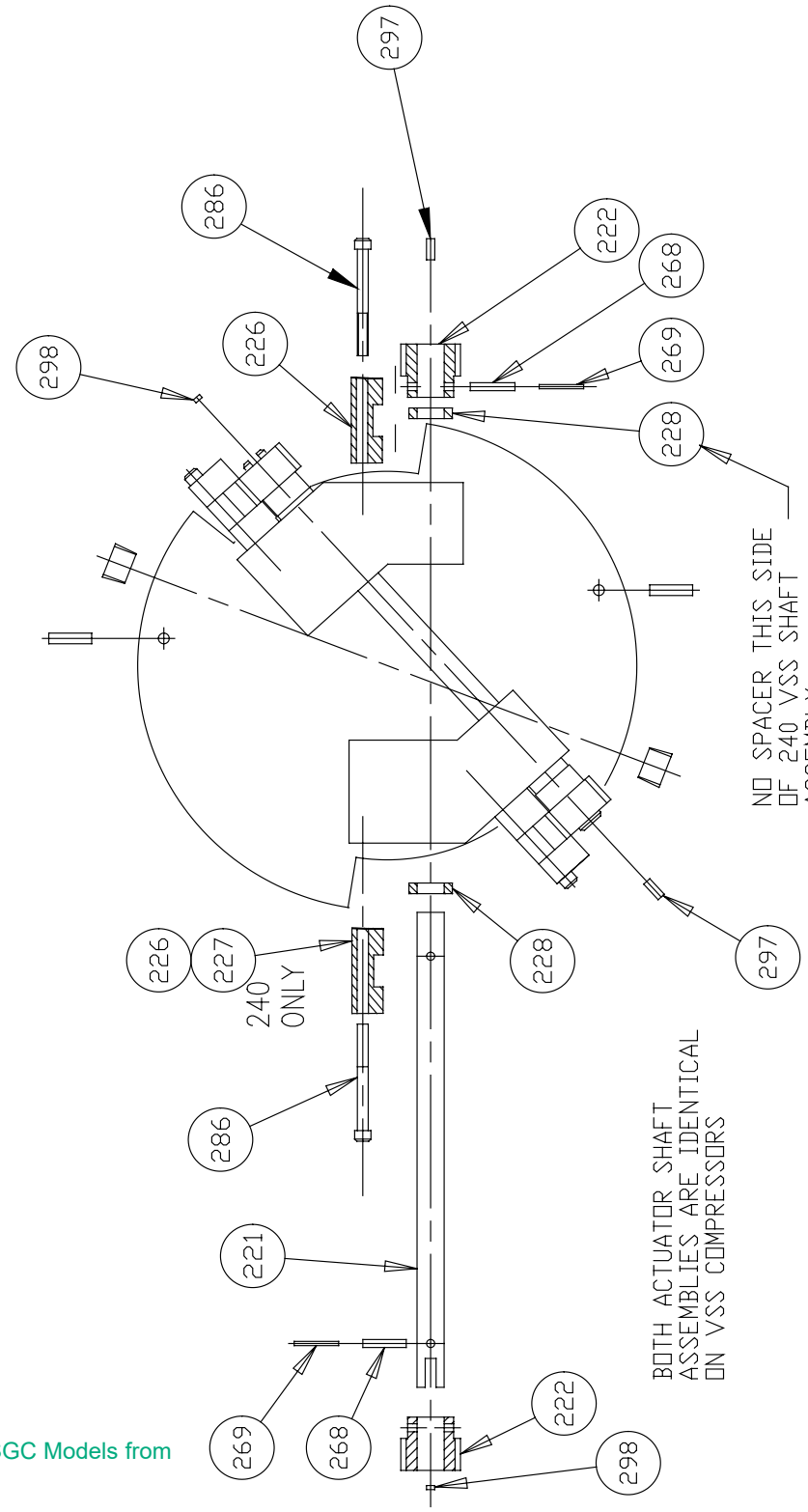
Main Rotor



*VSG/VSGC 2401 - 3001 Only

ITEM	DESCRIPTION	QTY	MODEL NUMBER			
			VSG/VSGC 2401	VSG/VSGC 2601	VSG/VSGC 2801	VSG/VSGC 3001
			VPN	VPN	VPN	VPN
	ROTOR ASSEMBLY	1	A25226AN	A25226AM	A25226AL	A25226AK
102	SHIM PACK	1	A25177G	A25177G	A25177G	A25177G

Slide Valve Cross Shafts and End Plate



*For VSSG/VSG/VSGC Models from 451 to 2101

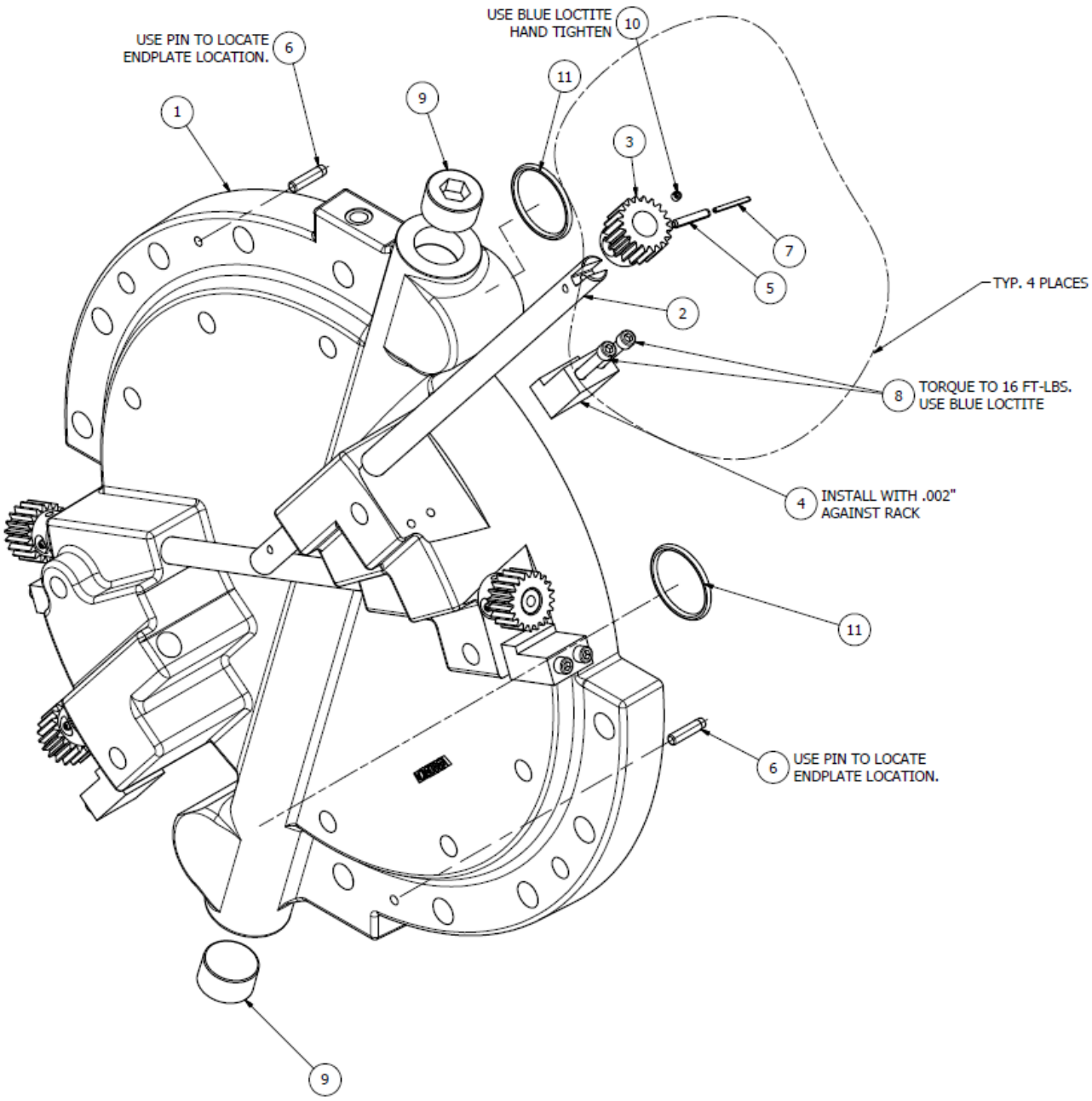
Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Slide Valve Cross Shafts and End Plate

ITEM	DESCRIPTION	MODEL NUMBER									
		VSSG 291 thru 601		VSG/VSGC 751 - 901		VSG/VSGC 1051 VSG/VSGC 1201 VSG/VSGC 1301		VSG/VSGC 1501 VSG/VSGC 1801		VSG/VSGC 1551 - 2101	
		QTY	VPN	QTY	VPN	QTY	VPN	QTY	VPN	QTY	VPN
220	END PLATE	-	N/A	1	25543A	1	25593A	1	25661A	1	25661A
221	SHAFT	2	25843A	2	25844A	2	25845A	2	25793A	2	25793A
222	GEAR	4	25027A	4	25027A	4	25027A	4	25027A	4	25027A
226	RACK CLAMP	2	25913A	4	25913C	4	25913C	4	25913C	4	25913C
227	RACK CLAMP	2	25913B	-	N/A	-	N/A	-	N/A	-	N/A
228	SPACER	2	25847A	4	25033C	4	25033C	4	25033C	4	25033C
267	DOWEL PIN	-	N/A	2	2868B	2	2868B	2	2868B	2	2868B
268	EXPANSION PIN	4	1193D	4	1193D	4	1193D	2	1193D	4	1193D
269	EXPANSION PIN	4	2981AA	4	2981AA	4	2981AA	2	2981AA	4	2981AA
270	PIPE PLUG	-	N/A	2	2606E	2	2606E	2	2606E	2	2606A
286	SOCKET HEAD CAP SCREW	8	2795F	8	2795F	8	2795F	8	2795F	8	2795F
297	SET SCREW	2	2060J	2	2060J	2	2060J	2	2060J	2	2060J
298	SET SCREW	2	2060H	2	2060H	2	2060H	2	2060H	2	2060H

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

End Plate (VSG/VSGC 2401 - 3001 Only)



Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

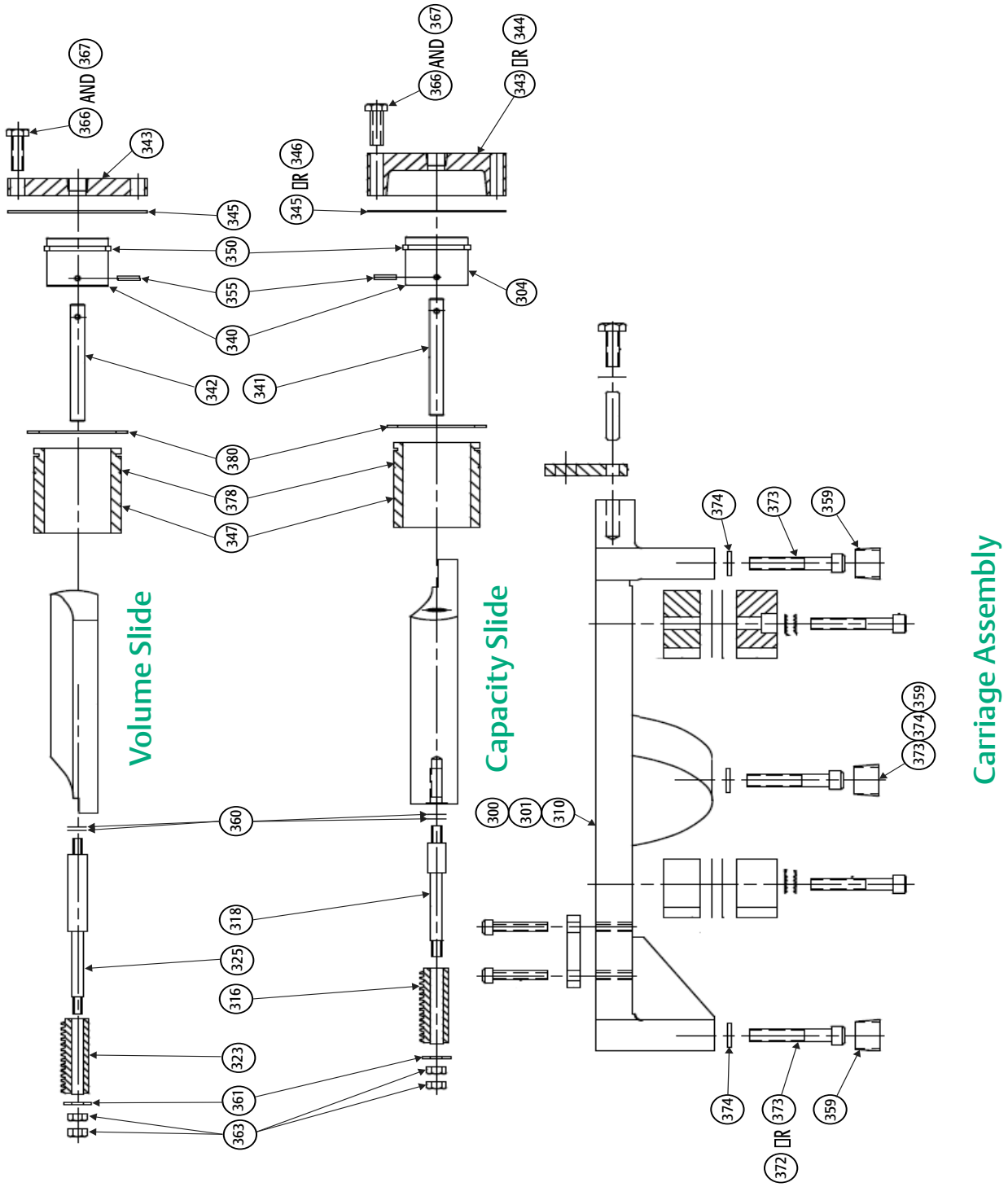
End Plate (VSG/VSGC 2401 - 3001 Only)

ITEM	DESCRIPTION	MODEL NUMBER VSG/VSGC 2401 - 3001	
		QTY	VPN
018	PIPE PLUG SOCKET HEX	2	13163F
019	O-RING (1.609 X 1.887) VITON	2	2825C
270	FLUSH SEAL PLUG 3/4-14 NPTF SOCKET HEAD	2	2606A
269	ROLL PIN (M2.5 X 26) STEEL	4	2981AA
286	SCREW (1/4-20 NC X 2) CAP SOCKET HEAD ASTM A574	8	2795Q
226	RACK CLAMP	4	25913E
298	SET SCREW (10-32 NF X 3/16) CUP PNT HEX	4	2060H
222	GEAR	4	25027A
220	END PLATE ASSEMBLY	1	A25849FAAF* A25849FAV**
221	COMMAND SHAFT	1	A25994FAF* A25994FV**
268	ROLL PIN (.187 X 1)	4	1193D
267	DOWEL PIN (1/4 X 1) STEEL	2	2868B

Notes: *: AFLAS. **: VITON.

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Slide Valve Carriage Assembly



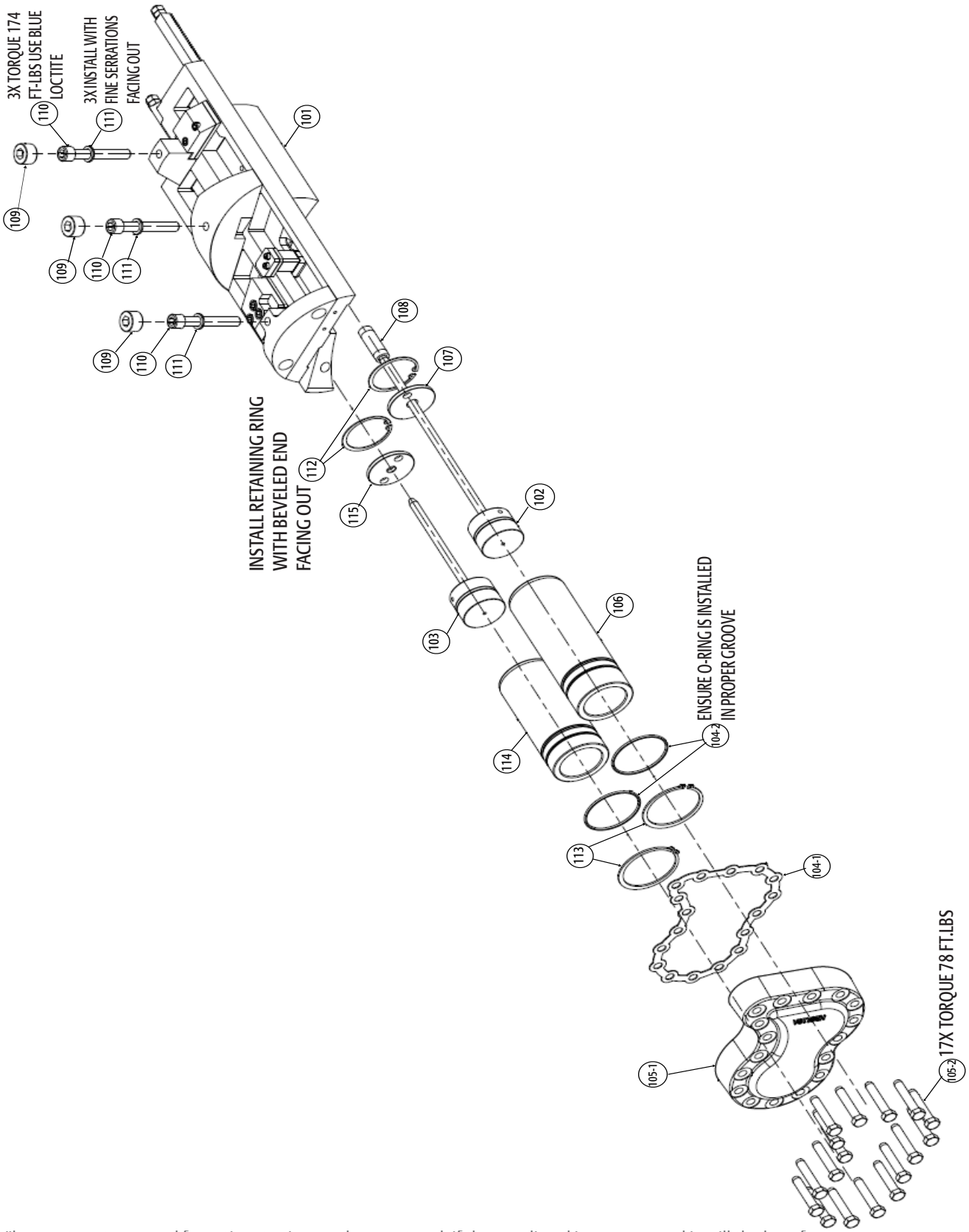
Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Slide Valve Carriage Assembly

ITEM	DESCRIPTION	MODEL NUMBER							
		VSSG 291 thru VSSG 601		VSG/VSGC 751 thru VSG/VSGC 901		VSG/VSGC 1051 VSG/VSGC 1201		VSG/VSGC 1501 thru VSG/VSGC 2101	
		QTY	VPN	QTY	VPN	QTY	VPN	QTY	VPN
300	CARRIAGE ASSEMBLY	2	A25179B	2	A25179C	2	A25179D	2	A25179E
304	CAPACITY PISTON (340, 341, 350, 355)	2	A25183B	2	A25183C	2	A25183D	2	A25183E
305	VOLUME PISTON (340, 342, 350, 355)	2	A25184B	2	A25184C	2	A25184D	2	A25184E
307A	GASKET (345)	2	25900A	-	N/A	-	N/A	2	A25200E
307B	GASKET SET (345, 378)	-	N/A	2	A25200C	2	A25200D	-	N/A
316	RACK	2	25024AH	2	25080AH	2	25080CH	2	25779AH
323	RACK	2	25023AH	2	25080BH	2	25080DH	2	25080DH
325	SHAFT	-	N/A	-	N/A	-	N/A	2	25778A
340	PISTON	-	N/A	4	25076A	4	25138A	4	25782A
341	CAPACITY PISTON SHAFT	-	N/A	2	25078A	2	25078E	2	25784A
342	VOLUME PISTON SHAFT	-	N/A	2	25078B	2	25078F	2	25783A
343A	COVER, SEPARATE VOL. & CAP.	4	25022A	2	25123B	4	25123D	-	N/A
343B	COVER, ONE PIECE CAST	2	25399D	2	25279A	2	25401A	2	25690A
344	COVER, SEPARATE VOL. & CAP.	-	N/A	2	25123A	-	N/A	-	N/A
345A	GASKET, SEPARATE VOL. & n/a CAP COVERS.	4	25021A	2	25124B	4	25124C	-	N/A
345B	GASKET, ONE PIECE CAST COVER	2	25900A	2	25902A	2	25901A	2	25384A
346	GASKET, ONE PIECE CAST COVER	-	N/A	2	25124A	-	N/A	-	N/A
347	PISTON SLEEVE	-	N/A	2	25079A	-	N/A	4	25786A
350	PISTON RING SET	4	2953AA	4	2953AB	4	2953AC	4	2953AD
355	EXPANSION PIN	4	1193PP	4	1193PP	4	1193PP	4	1193PP
359	PIPE PLUG	6	2606D	6	2606D	6	2606D	6	2606E
360	LOCK WASHER (PAIR)	4	3004C	4	3004C	4	3004C	4	3004C
361	WASHER	4	13265B	4	13265B	4	13265B	4	13265B
363	NUT	8	2797A	8	2797A	8	2797A	8	2797A
366A	HEX HEAD CAP SCREW, SEPARATE VOL. & CAP COVERS.	24	2796N	12	2796B	24	2796B	-	N/A
366B	HEX HEAD CAP SCREW, ONE PIECE CAST COVER.	24	2796B	12	2796P	24	2796P	28	3796BL
367	HEX HEAD CAP SCREW	-	N/A	12	2796BN	-	N/A	-	N/A
373	SOCKET HEAD CAP SCREW	-	N/A	6	2795N	6	2795P	6	2795AG
374	LOCK WASHER (PAIR)	-	N/A	6	3004C	6	3004D	6	3004D
378	O-RING	-	N/A	2	2825AN	-	N/A	4	2825U
380	RETAINER RING	-	N/A	2	2866C	-	N/A	4	2866G

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Slide Valve Carriage Assembly (VSG/VSGC 2401 - 3001 Only)



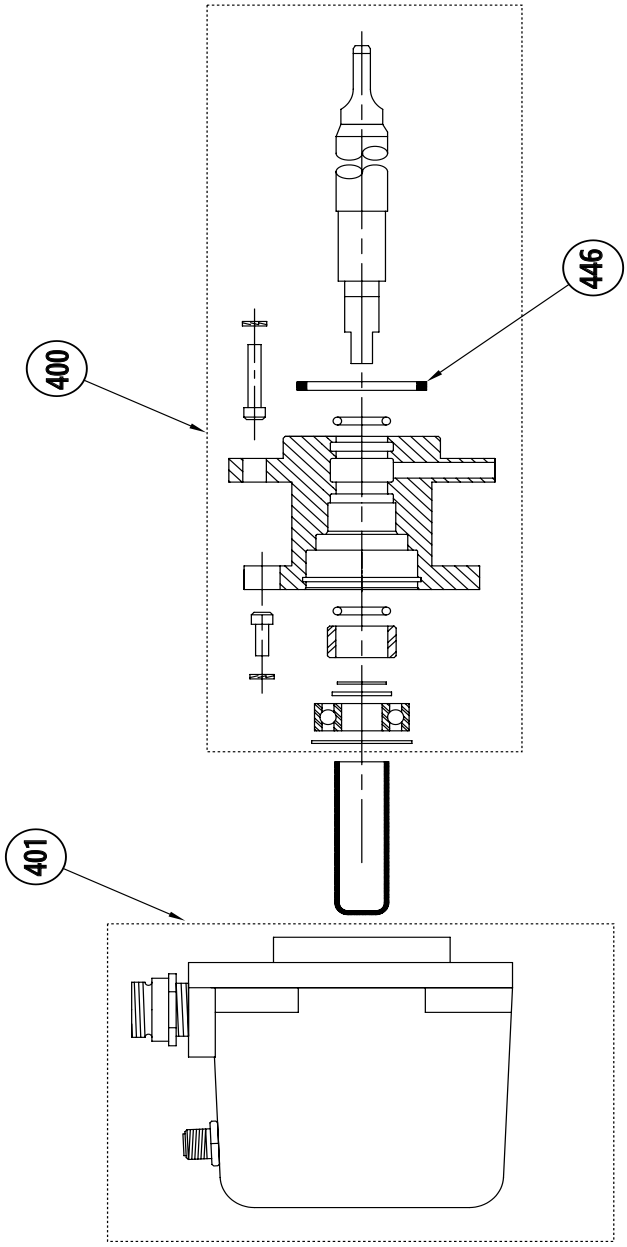
Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Slide Valve Carriage Assembly (VSG/VSGC 2401- 3001 Only)

ITEM	DESCRIPTION	MODEL NUMBER	
		VSG/VSGC 2401 thru VSG/VSGC 3001	
		QTY	VPN
101	CARRIAGE ASSEMBLY	1	A25179K
102	CAPACITY PISTON	1	A25183GS
103	VOLUME PISTON	1	A25184GS
104	SMALL PISTON SEAL	1	A25200FS
105	PISTON COVER	1	A25220F
106	SMALL CAPACITY PISTON SLEEVE	1	26113E
107	PISTON SHAFT GUIDE WASHER CAP SM	1	26115D
108	PIPE NIPPLE (1/2 X 2-1/2)	1	13189D
109	PIPE SOCKET PLUG HEX	3	13163F
110	SCREW (5/8-16 NC X 4) CAP SOCKET	3	2795BE
111	NORD LOCK WASHER (.625) PERMANENTLY TIGHT	3	3004H
112	RETAINING RING (2.875 X 0.093) INT BEVELED	2	2867AQ
113	RETAINING RING (3.500) EXTERNAL BASIC	2	2866AC
114	VOLUME PISTON SLEEVE	1	26114E
115	PISTON SHAFT GUIDE WASHER	1	26115C

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

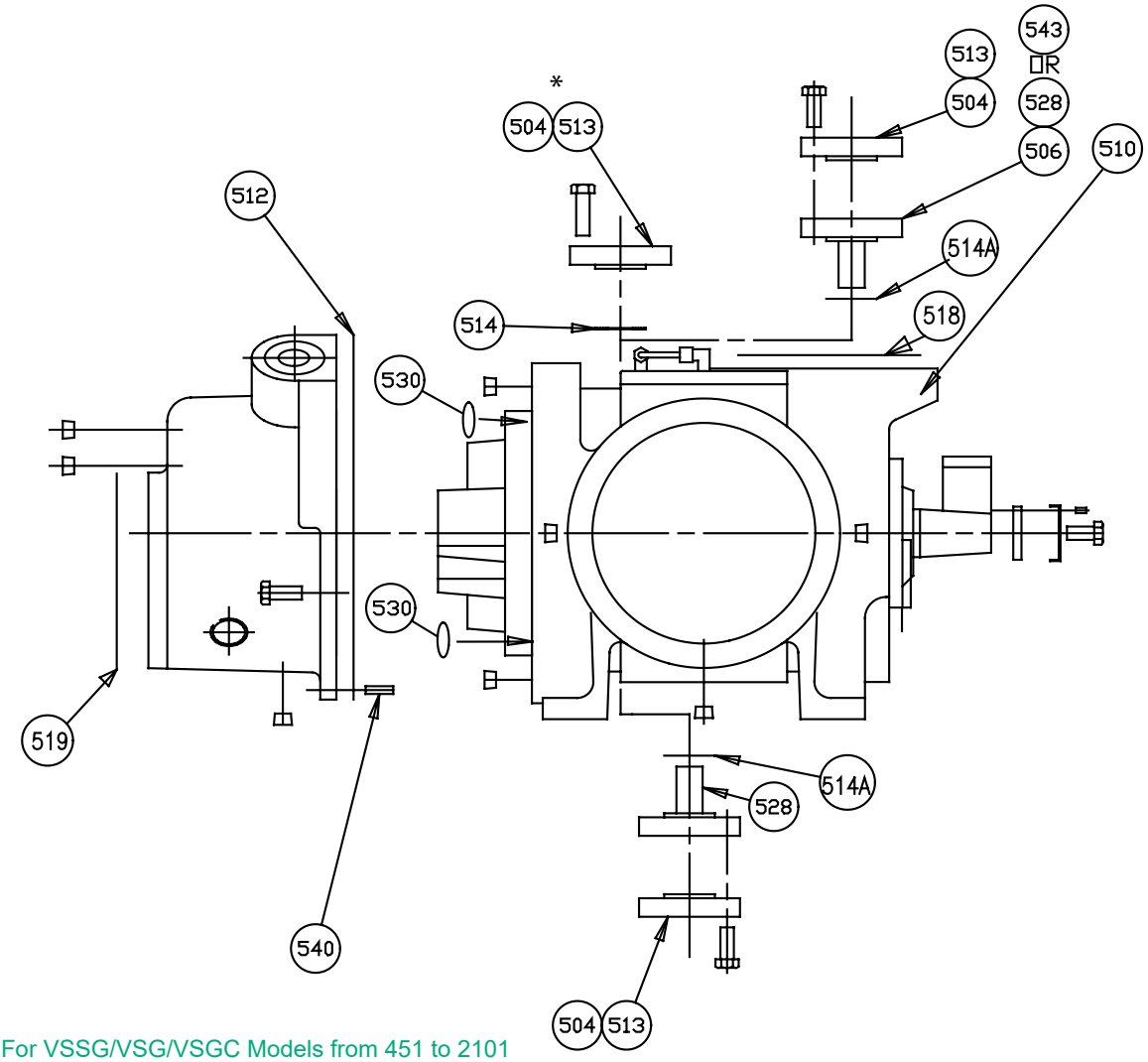
Actuator and Command Shaft



ITEM	DESCRIPTION	QTY	MODEL NUMBER				
			VSSG 291 thru VSSG 601	VSG/VSGC 751 thru VSG/VSGC 901	VSG/VSGC 1051 VSG/VSGC 1201 VSG/VSGC 1301	VSG/VSGC 1551 thru VSG/VSGC 2101	VSG/VSGC 2401 thru VSG/VSGC 3001
			VPN	VPN	VPN	VPN	VPN
400	COMMAND SHAFT ASSEMBLY	2	A25994B	A25994C	A25994D	A25994E	A25994F
401	SLIDE VALVE ACTUATOR	2	25972D or 25972XP	25972D or 25972XP	25972D or 25972XP	25972D or 25972XP	25972D or 25972XP
446	O-RING SEAL	2	2825C	2825C	2825C	2825C	2825C

Miscellaneous Frame Components (VSSG 451 - VSG/VSGC 2101)

VSG Screw Compressor



For VSSG/VSG/VSGC Models from 451 to 2101

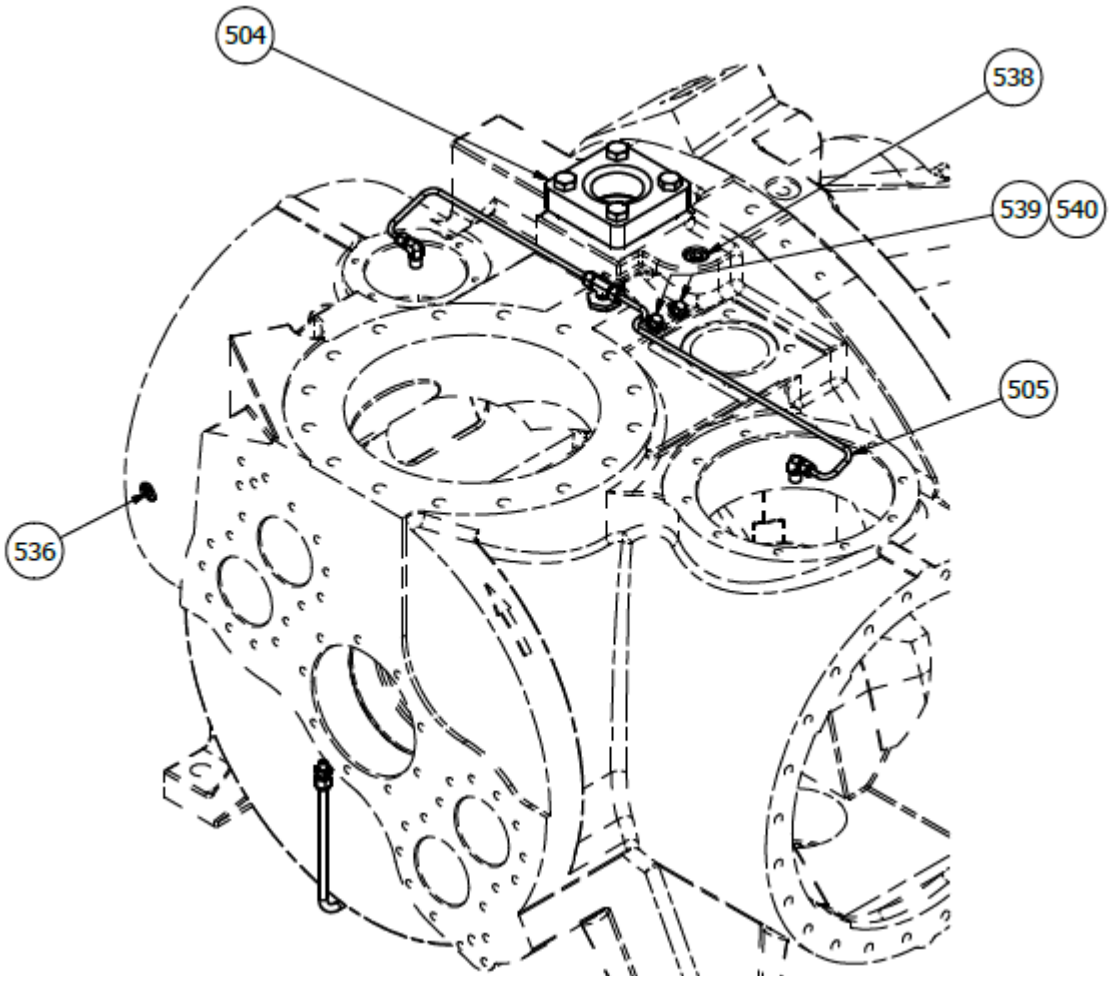
Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Miscellaneous Frame Components (VSSG 291 - VSG/VSGC 2101)

ITEM	DESCRIPTION	MODEL NUMBER							
		VSSG 291 Thru 601		VSG/VSGC 751 VSG/VSGC 901		VSG/VSGC 1051 VSG/VSGC 1201		VSG/VSGC 1551 thru VSG/VSGC 2101	
		QTY	VPN	QTY	VPN	QTY	VPN	QTY	VPN
-	GASKET & O-RING KIT	1	KT710AN	1	KT710B	1	KT710C	1	KT710D
504	FLANGE SET (513, 514, 547A)	1	A25190A	1	A25190A	1	A25190B	1	A25190C
504	FLANGE SET 513A, 514A & 547 ECON-O-MIZER PORT	-	N/A	-	N/A	-	N/A	2	A25190D
506	ECON-O-MIZER PORT	2	A25190B	-	N/A	-	N/A	-	N/A
512	MANIFOLD GASKET	1	25503A	1	25541A	1	25324A	1	25676A
513	FLANGE OIL	1	25058A	1	25058A	1	25058B	1	12477C
513	FLANGE ECON-O-MIZER	2	25058A	-	N/A	-	N/A	-	N/A
514	FLANGE GASKET OIL	1	11323D	1	11323D	1	11323E	1	11323F
514	FLANGE GASKET ECON-O-MIZER	2	11323D	-	N/A	-	N/A	-	N/A
518	SUCTION FLANGE GASKET	1	25199C	1	25199C	1	25199D	1	25199D
519	DISCHARGE FLANGE GASKET	1	25199B	1	25199B	1	25199C	1	25199C
526	ORIFICE PLATE	-	N/A	1	25223CB (751) 25223CA (901)	1	25223DB	-	N/A
527	INLET SCREEN	-	N/A	-	N/A	-	N/A	-	N/A
528	ECONOMIZER PLUG	-	N/A	-	N/A	-	N/A	-	N/A
529	WAVE SPRING	-	N/A	1	2912E	1	2912E		
530	O-RING	2	2825B	2	2825R	2	2825R	2	2825R
538	PIPE PLUG 3/4" MPT	-	N/A	-	N/A	6	2606A	3	2606A
539	PIPE PLUG	-	N/A	-	N/A	-	N/A	-	N/A
540	DOWEL PIN	2	2868B	2	2868B	2	2868B	2	2868K
542	PIPE PLUG 3/4" MPT	-	N/A	-	N/A	-	N/A	1	13163F
545	HEX HEAD CAP SCREW FOR OIL SUPPLY FLANGE	2	2796C	-	N/A	-	N/A	4	11397E
545	HEX HEAD CAP SCREW FOR ECON-O-MIZER FLANGE	4	2796C	-	N/A	-	N/A	-	N/A
547	HEX HEAD CAP SCREW	8	2796C	24	2796GP	24	2796GP	-	N/A
554	HEX HEAD CAP SCREW	-	N/A	1	2796U	1	2796U	-	N/A

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Miscellaneous Frame Components (VSG/VSGC 2401 - 3001)



*VSG/VSGC 2401 - 3001

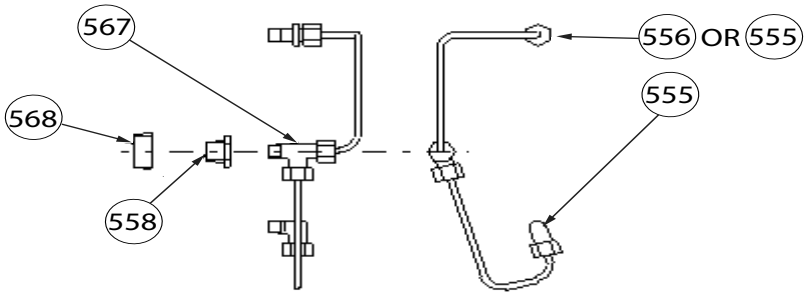
ITEM	DESCRIPTION	MODEL NUMBER VSG/VSGC 2401 - 3001	
		QTY	VPN
504	FLANGE SET (1.250)	1	A25190EA
505	TUBING	1	A25201F
536	FLUSH SEAL PLUG (1/2-14 NPTF) SOCKET HEAD	2	2606E
538	FLUSH SEAL PLUG (3/4-14 NPTF) SOCKET HEAD	3	2606A
539	PLUG, LIQUID INJECTION	4	26293A
540	O-RING (0.171 X 0.499) VITON	4	2825AT
*	GASKET & O-RING KIT	1	KT710EV
*	FLANGE	1	12478G
*	PLUG SET, ECONOMIZER	1	A25243BB

Note: N/A: Not Shown.

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

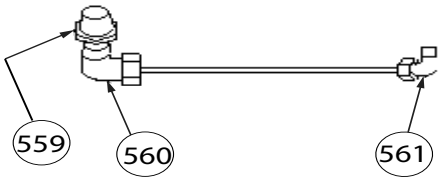
Miscellaneous Frame Components Tubing and Fittings (VSSG 291 - VSG/VSGC 1801)

Gaterotor Bearing Supply Lines



VSSG 291 - VSG/VSGC 1801

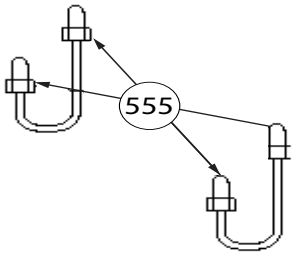
Seal Chamber Oil Line



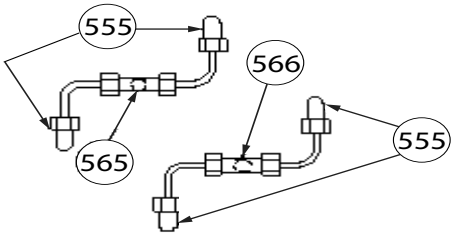
VSSG 291 - VSG/VSGC 1201

VSG/VSGC 1501 & VSG/VSGC 1801

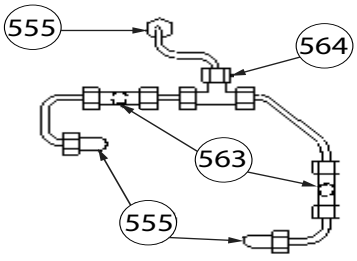
Slide Valve Balance Piston Equalizing Line



VSSG 291 & VSSG 601



VSG/VSGC 751 & VSG/VSGC 901



VSG/VSGC 1051 & VSG/VSGC 1201

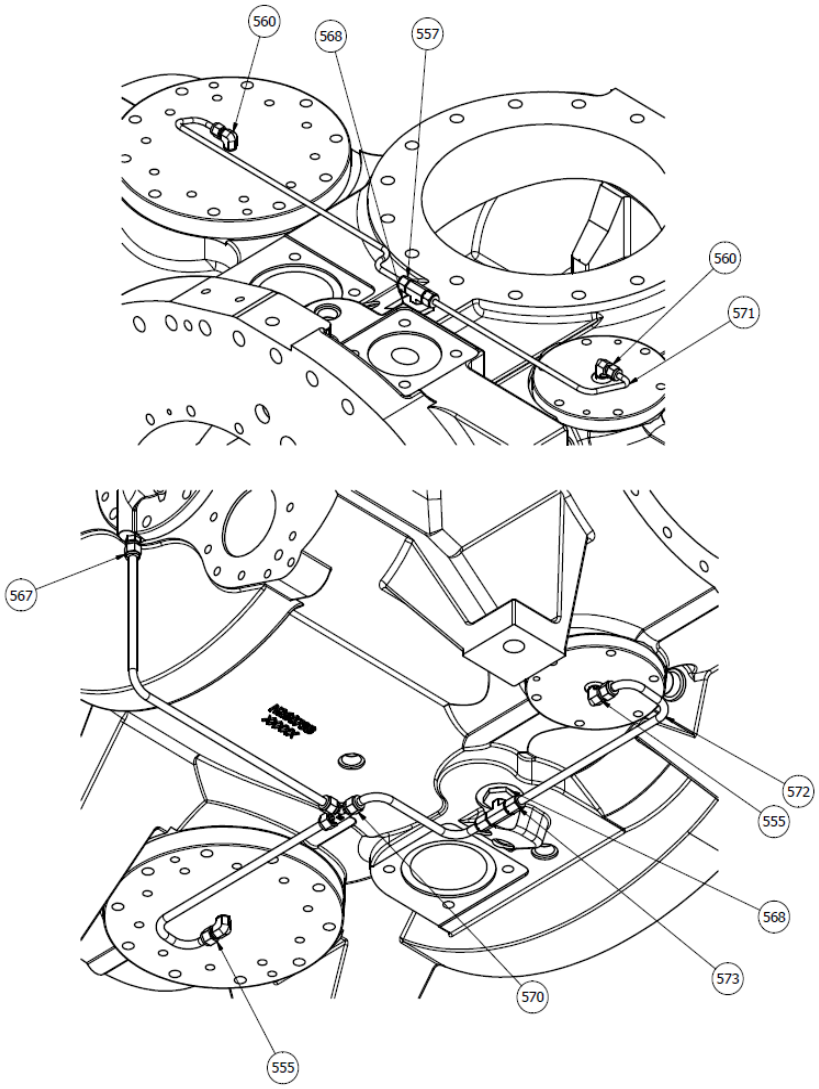
Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Miscellaneous Frame Components Tubing and Fittings (VSSG 291 - VSG/VSGC 1801)

ITEM	DESCRIPTION	MODEL NUMBER							
		VSSG 291 VSSG 601		VSG/VSGC 751 VSG/VSGC 901		VSG/VSGC 1051 VSG/VSGC 1201		VSG/VSGC 1501 VSG/VSGC 1801	
		QTY	VPN	QTY	VPN	QTY	VPN	QTY	VPN
555	MALE ELBOW (1/4 ODT X 1/4 MPT) 90°	5	13375D	5	13375D	3	13375D	2	13375D
556	STRAIGHT (1/4 ODT X 1/4 MPT)	1	13229D	1	13229D	2	13229D	-	N/A
557	TEE, MALE RUNNING (1/4 OD X 1/4 MPT)	1	1509A	1	1509A	1	1509A	1	13376D
558	HEX BUSHING	1	13231AA	1	13231AA	1	1101H	1	13231AA
559	HEX BUSHING	-	N/A	-	N/A	1	1101K	1	1101K
560	MALE ELBOW (3/8 ODT X 1/2 MPT) 90°	1	13375Z	1	13375Z	1	13375Z	1	13375Z
561	MALE ELBOW (3/8 OD X 1/4 MPT 90°)	1	13375F	1	13375F	1	13375F	-	N/A
562	PLUG	1	2606E	1	2606E	1	2606A	-	N/A
563	BRANCH TEE (1/4 ODT X 1/4 ODT X 1/4 MPT)	-	N/A	-	N/A	2	13376D	-	N/A
564	TEE (1/4)	-	N/A	-	N/A	1	13239C	-	N/A
565	FEMALE TEE (1/4T X 1/4T X 1/4 FPT)	-	N/A	2	1884A	-	N/A	-	N/A
566	PIPE NIPPLE (1/4 X 2-1/2)	-	N/A	2	13181D	-	N/A	-	N/A
567	CONNECTOR SET (1/2-13 NC-2 X 1)	-	N/A	-	N/A	-	N/A	1	13299C
568	REDUCING BUSHING (1 X 1/4)	-	N/A	-	N/A	-	N/A	1	1101M

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

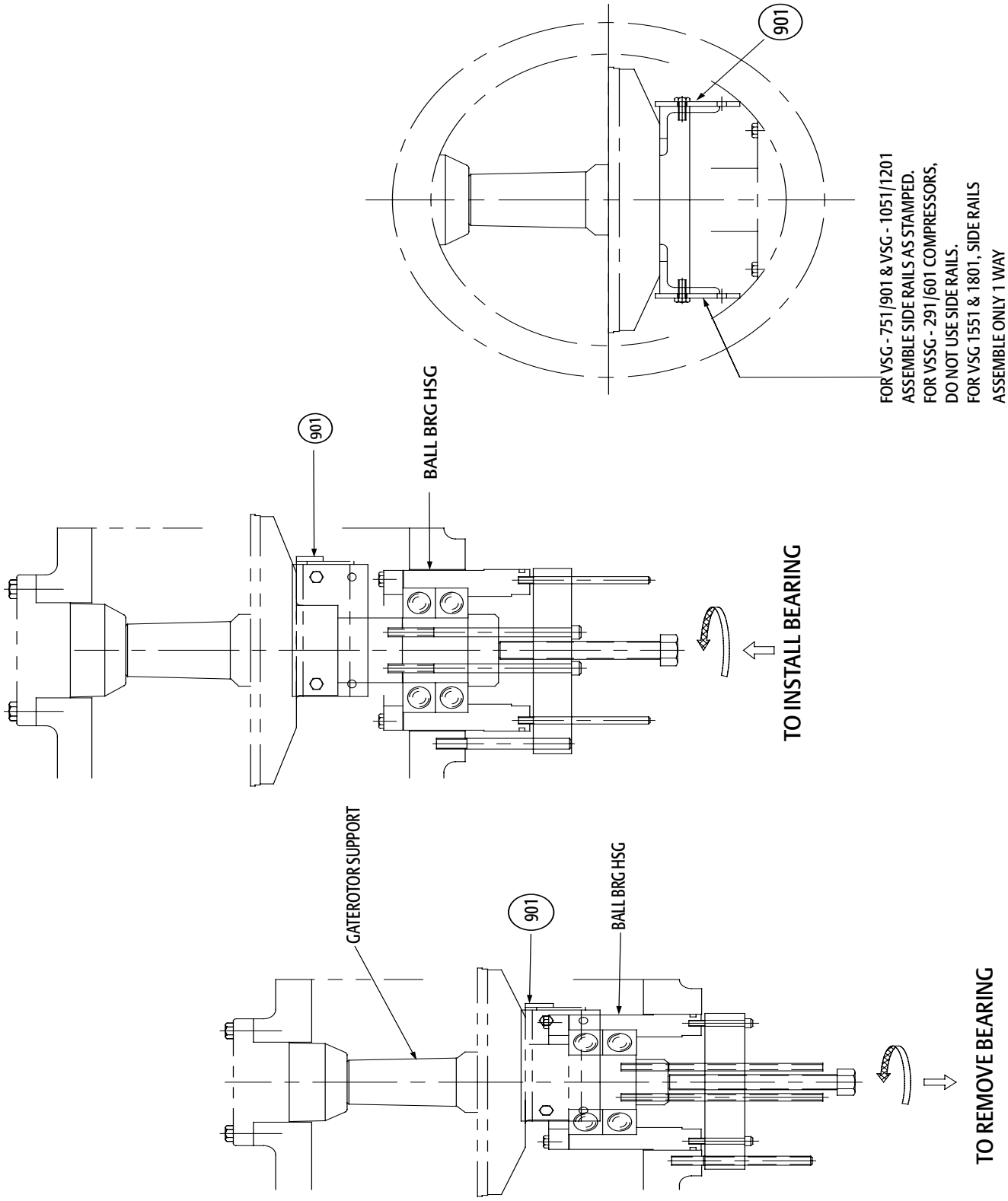
Miscellaneous Frame Components Tubing and Fittings (VSG/VSGC 2401 - 3001)



ITEM	DESCRIPTION	MODEL NUMBER	
		VSG/VSGC 2401- VSG/VSGC 3001	
		QTY	VPN
555	MALE ELBOW (3/8 ODX 1/4MPT) 90°	2	13375F
557	BRANCH MLE TEE (1/4ODTX1/4ODTX1/4MPT)	1	13376D
560	MALE ELBOW (1/4ODTX1/4MPT) 90°	2	13375D
567	COMPRESSION CONNECTOR (3/8 ODT X 1/8MPT)	1	13229W
568	BUSHING (1 X 1/4) HEXAGON	2	1101M
570	UNION TUBE TEE (3/8)	1	13239E
573	BRANCH MALE TEE (3/80 DT X 1/4MPT)	1	2084A
571	STEEL TUBING (1/4 X .035) SMLS	2	3509A
572	STEEL TUBING (3/8 X .035) SMLS	4	3509B

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Replacement Tools



Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Replacement Tools

ITEM	DESCRIPTION	QTY	MODEL NUMBER				
			VSSG 291 - 601	VSG/VSGC 751 & 901	VSG/VSGC 1051 - 1301	VSG/VSGC 1551 - 2101	VSG/VSGC 2401 - 3001
			VPN	VPN	VPN	VPN	VPN
900	GATEROTOR TOOLS (901, 910, 911, 912, 913, 914, 915, 916, 917)	1	A25205B	A25205C	A25205C	A25205E	A25205F
901A	GATEROTOR STABILIZER SET (901A, 901B, 901C)	1	A25698A	A25698A	A25698A	A25699A	N/A

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

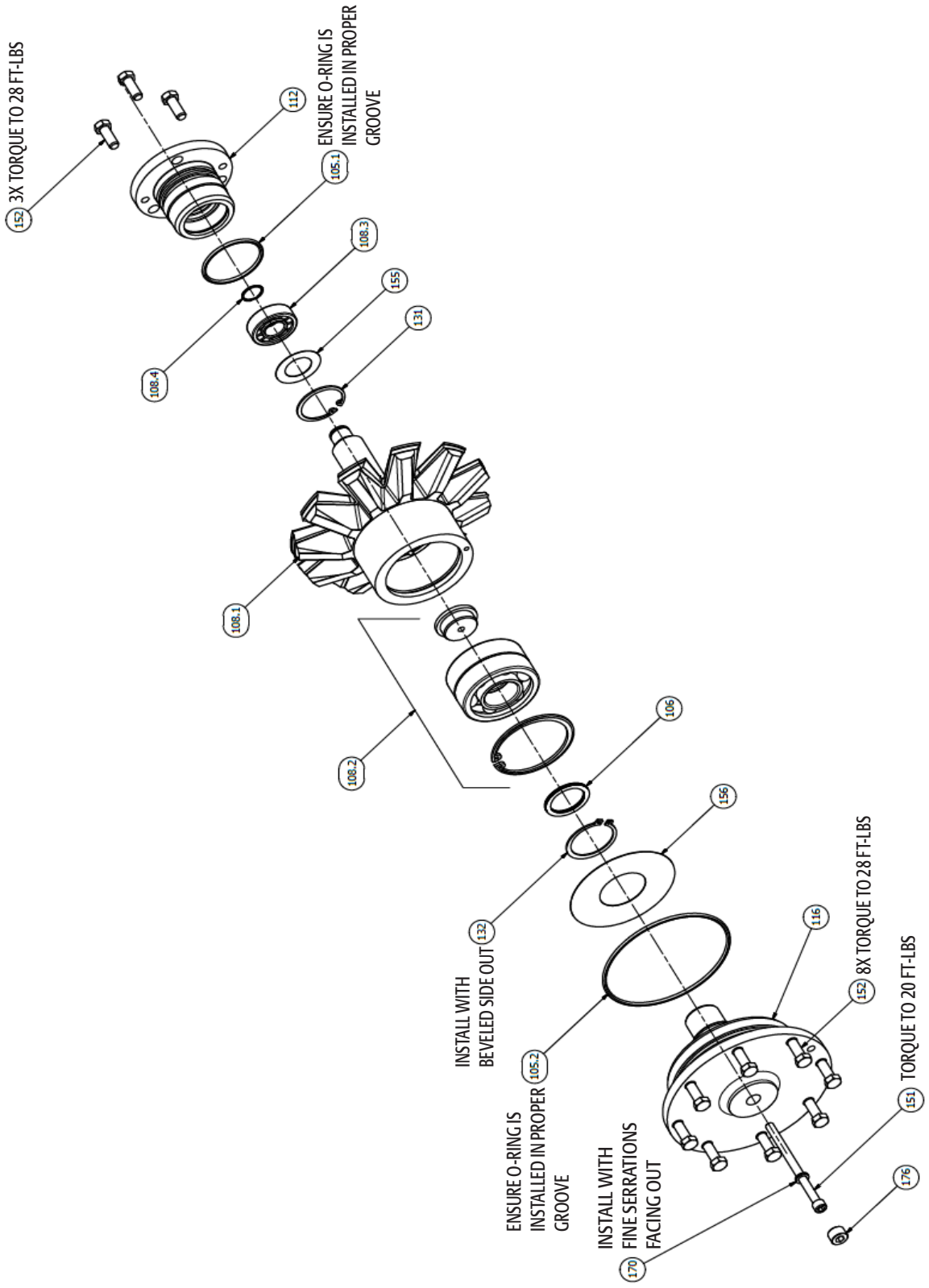
VSG/VSGC 301-701
Recommended Spare Parts List

Refer to the Custom Manual
Spare Parts Section for Specific Applications

Please have your Model # and Sales Order # available when ordering.
These are found on the compressor's Name Plate.

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Gaterotor Assembly



Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Gaterotor Assembly

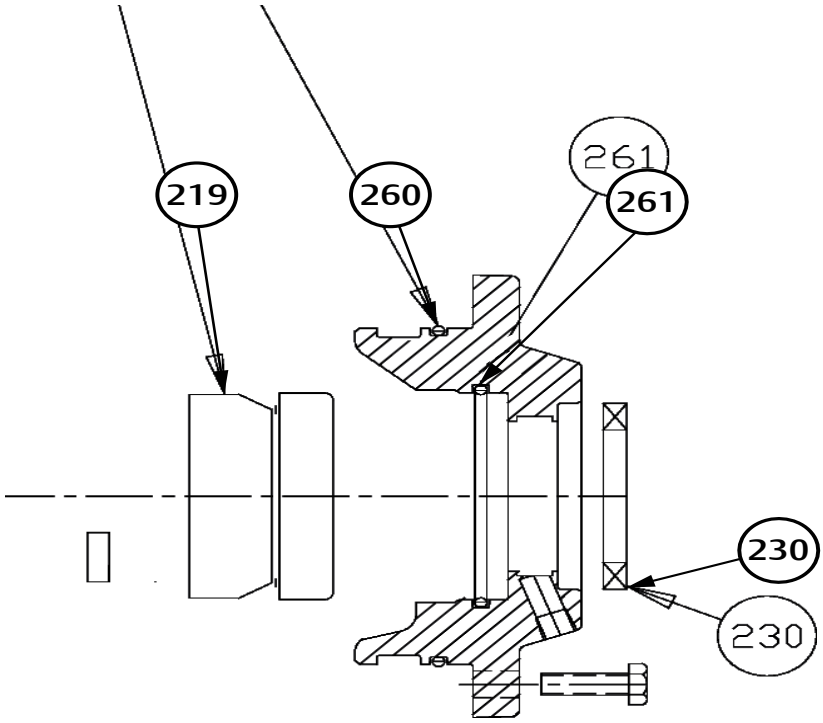
Part totals indicated are for one gaterotor assembly, machines with two gaterotors will require double the components listed below.

ITEM	DESCRIPTION	MODEL NUMBER							
		QTY	VSG/VSGC 301	VSG/VSGC 361	VSG/VSGC 401	QTY	VSG/VSGC 501	VSG/VSGC 601	VSG/VSGC 701
			VPN	VPN	VPN		VPN	VPN	VPN
	GATEROTOR BLADE REPLACEMENT KITS	1	KT1098A	KT1098B	KT1098C	1	KT1098D	KT1098E	KT1098F
	GATEROTOR BEARING REPLACEMENT KITS	1	KT759F	KT759G	KT759H	1	KT759BG (REMAN)	KT759BH (REMAN)	KT759BJ (REMAN)
105	SEAL GATEROTOR	1	A25164A A25164AV*	A25164A A25164AV*	A25164A A25164AV*	1	A25164B	A25164B	A25164B
105.1	O-RING	1	2825AL	2825AL	2825AL	1	2825D	2825D	2825D
105.2	O-RING	1	2825F	2825F	2825F	1	2825G	2825G	2825G
106	SHIM GATEROTOR	1	A25165A	A25165A	A25165A	1	A25165B	A25165B	A25165B
108	SUPPORT GATEROTOR	1	A25222AB	A25222AA	A25222AC	1	A25222BB	A25222BA	A25222BC
108.1	SUPPORT GATEROTOR	1	A25161AB	A25161AA	A25161AC	1	A25161BB	A25161BA	A25161BC
108.2	BALL BEARING	1	A25163A	A25163A	A25163A	1	A25163B	A25163B	A25163B
108.3	ROLLER BEARING	1	2864F	2864F	2864F	1	2864B	2864B	2864B
108.4	RETAINING RING 0.781 ID X .065 X .031	1	2928Y	2928Y	2928Y	1	2928W	2928W	2928W
112	HOUSING GATEROTOR ROLLER BEARING	1	25407B	25407B	25407B	1	25407C	25407C	25407C
116	SUPPORT GATEROTOR BALL BEARING	1	25408B	25408B	25408B	1	25408C	25408C	25408C
131	RETAINING RING	1	2867S	2867S	2867S	1	2867A	2867A	2867A
132	RETAINING RING 1.875 x 0.062 EXTERNAL BEVELED	1	2866J	2866J	2866J	1	2866K	2866K	2866K
151	SCREW	1	2795AP	2795AP	2795AP	1	2795AAA	2795AAA	2795AAA
152	SCREW 3/8-16 NC X 1	11	2796CG	2796CG	2796CG	12	2796CG	2796CG	2796CG
155	SHIM	AR	25977D	25977D	25977D	AR	25977G	25977G	25977G
156	SHIM	AR	25977C	25977C	25977C	AR	25977H	25977H	25977H
170	WASHER .312	1	3004C	3004C	3004C	1	3004C	3004C	3004C
176	PLUG 3/8-18 NPTF FLUSH SEAL SOC HD	1	2606D	2606D	2606D	1	2606D	2606D	2606D

Notes: AR: As Required. *: VITON.

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Shaft Seal



ITEM	DESCRIPTION	QTY	MODEL NUMBER	
			VSG/VSGC 301 - 401	VSG/VSGC 501 - 701
			VPN	VPN
*	SHAFT SEAL KIT GAS (219, 230, 260)	1	KT709DGV**	KT709AG**
219	SHAFT SEAL	1	A	A
230	OIL SEAL	1	2930C	25040A
244*	TEFLON SEAL	1	25939A	25939A
252*	RETAINER RING	1	2928M	2928M
260	O-RING	1	2825T	2176F
261	O-RING (205 Only)	1	2825AX	N/A

Notes: *: Not Pictured.

A: Sold Only As Kit.

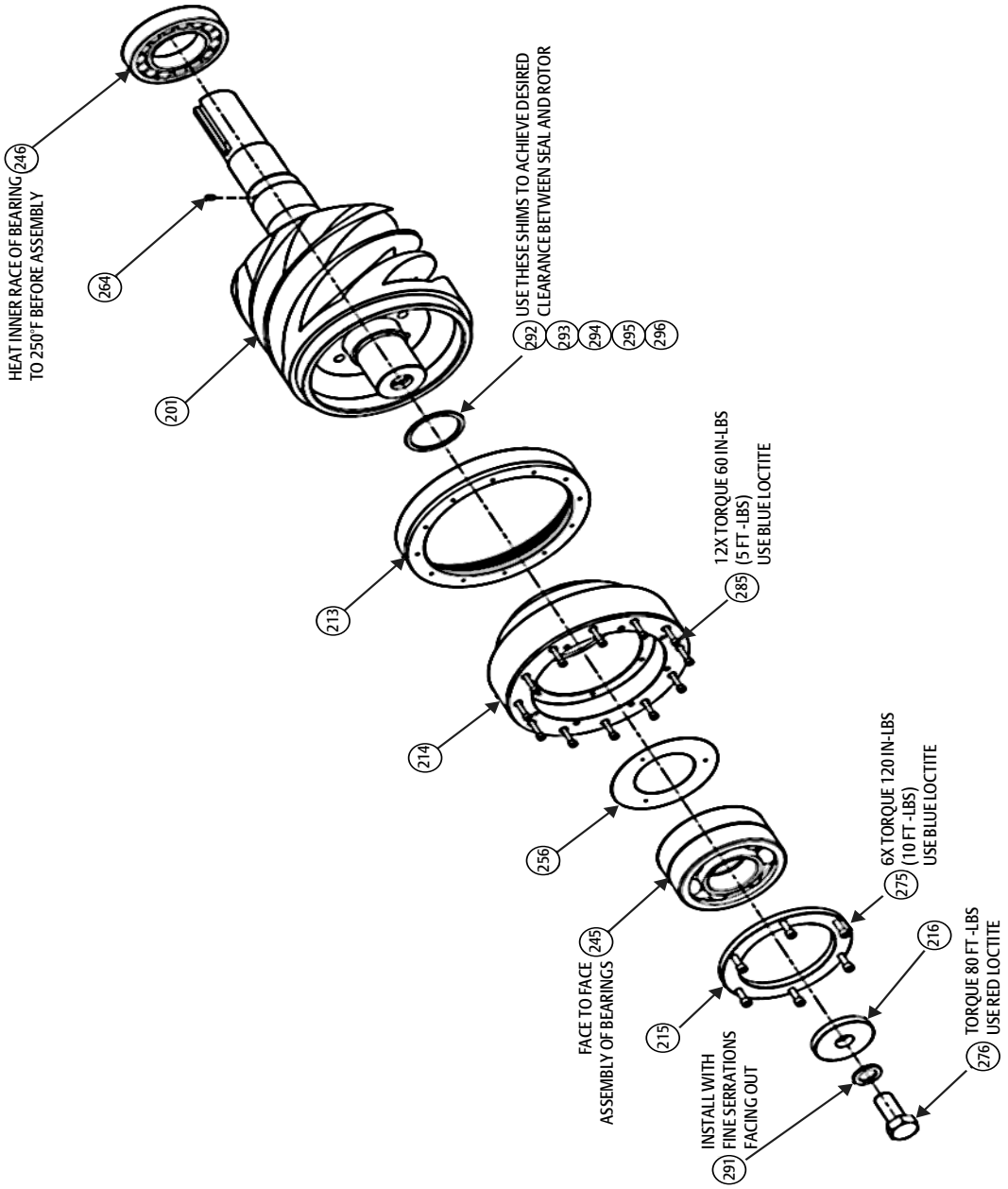
**: For Other Kit Choices, Please Ask Vilter Parts Dept To Check T25263.

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Main Rotor

Models VSG/VSGC 301-401 Counter Clockwise ONLY

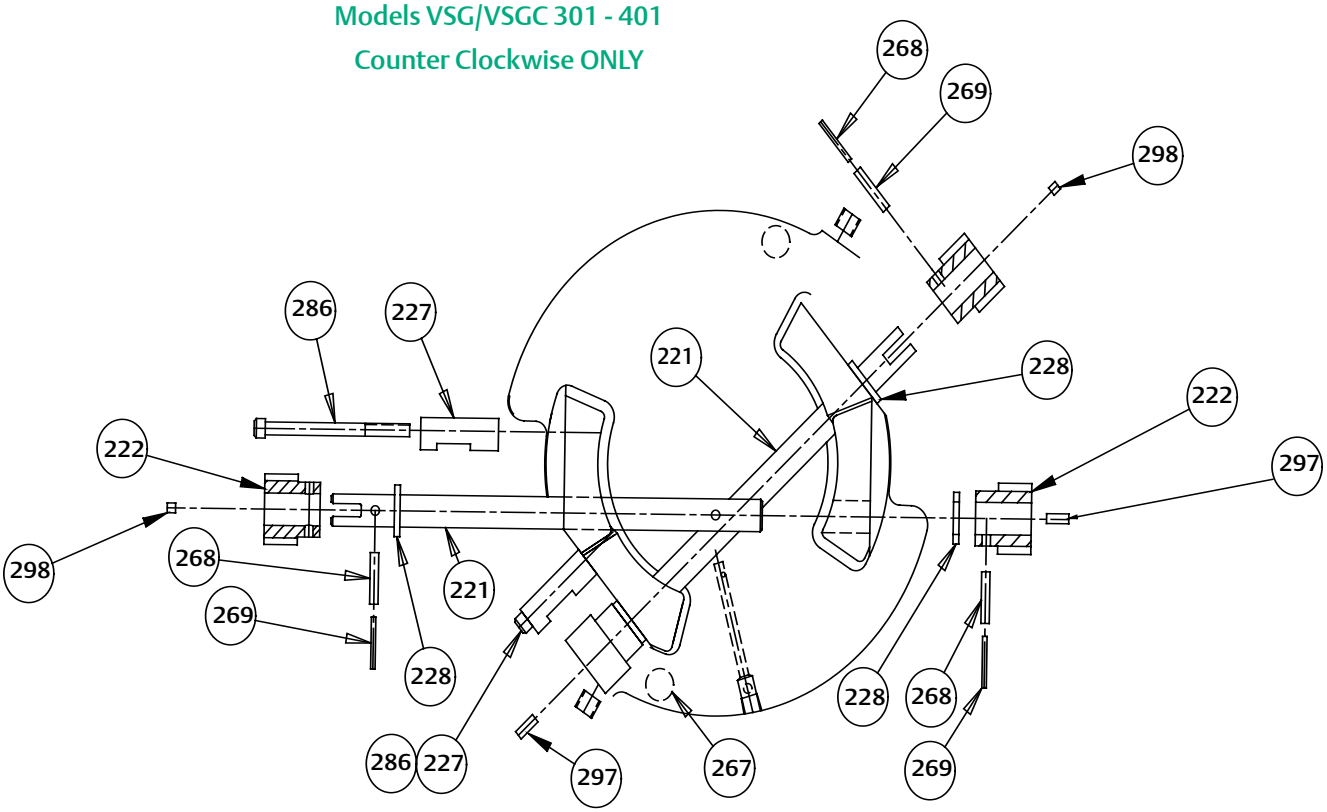
Models VSG/VSGC 501-701 Clockwise ONLY



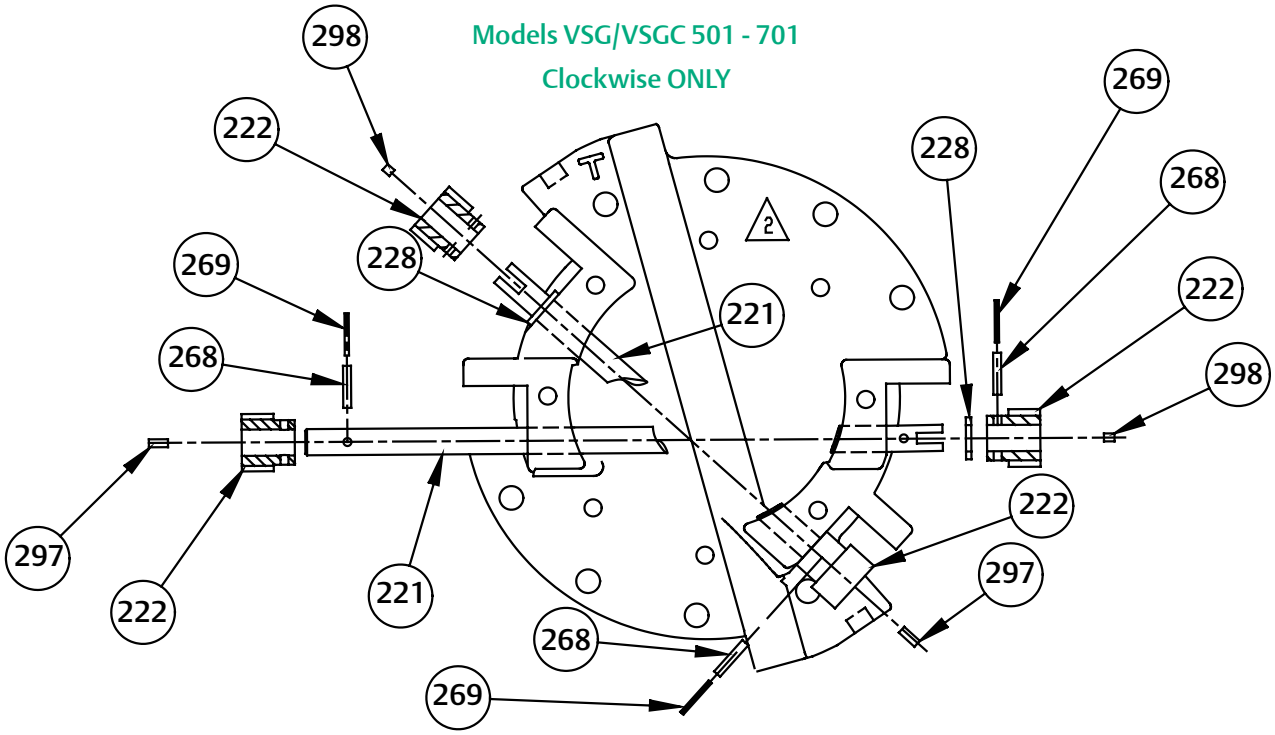
ITEM	DESCRIPTION	MODEL NUMBER							
		QTY	VSG/VSGC 301	VSG /VSGC 361	VSG/VSGC 401	QTY	VSG/VSGC 501	VSG/VSGC 601	VSG/VSGC 701
			VPN	VPN	VPN		VPN	VPN	VPN
	MAIN ROTOR ASSEMBLY	1	A25226AB	A25226AA	A25226AC	1	A26010BB	A26010BA	A26010BC
201	ROTOR	1	A25716AB	A25716AA	A25716AC	1	A26007BB	A26007BA	A26007BC
-	OIL BAFFLE ASSEMBLY	1	A25942AA	A25942AA	A25942AA	1	A26034B	A26034B	A26034B
292-296	SHIM ASSORTMENT	1	A25177A	A25177A	A25177A	1	A25177B	A25177B	A25177B

Slide Valve Cross Shafts and End Plate

Models VSG/VSGC 301 - 401
Counter Clockwise ONLY



Models VSG/VSGC 501 - 701
Clockwise ONLY



Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

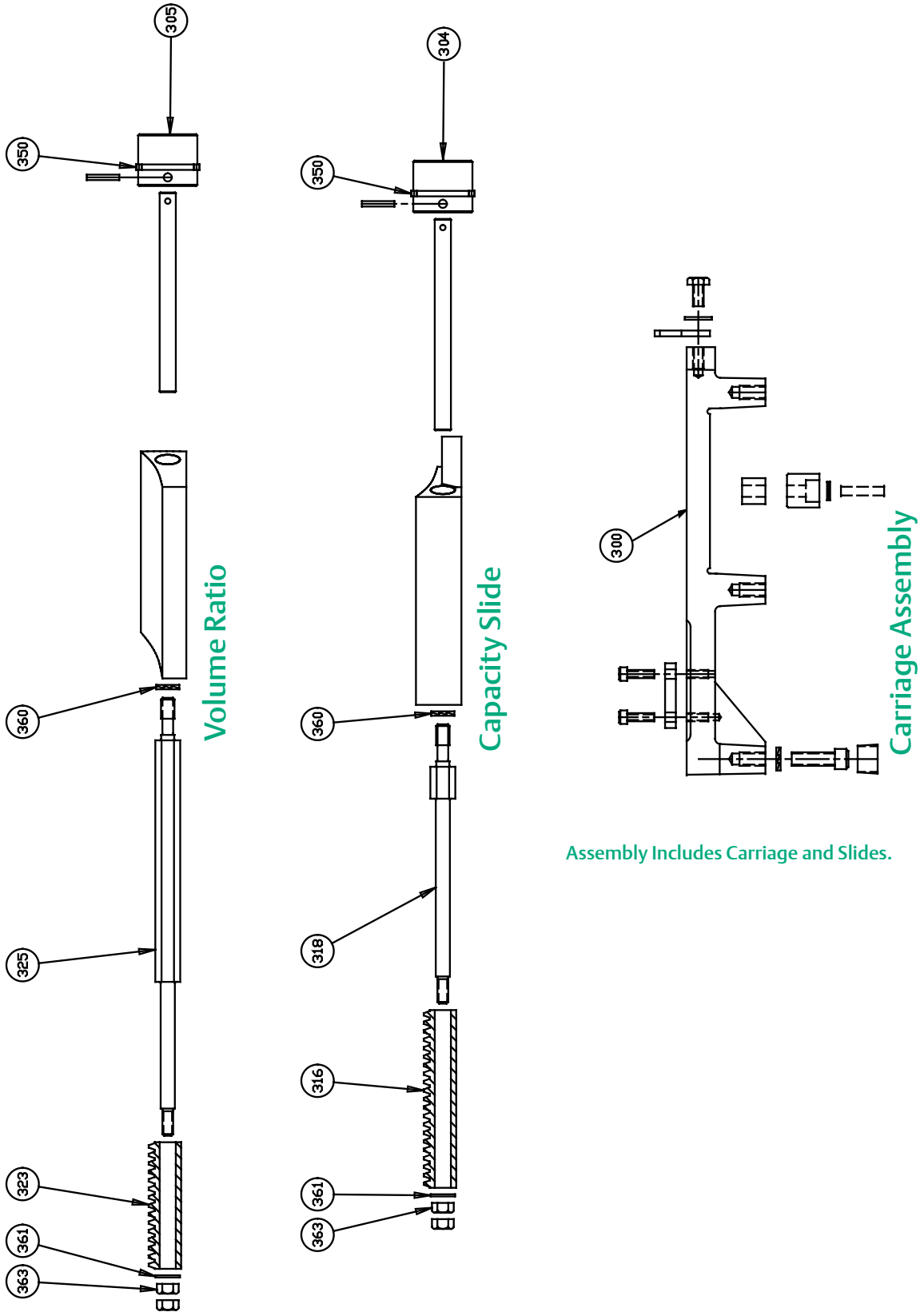
Slide Valve Cross Shafts and End Plate

ITEM	DESCRIPTION	MODEL NUMBER							
		QTY	VSG/VSGC 301	VSG/VSGC 361	VSG/VSGC 401	QTY	VSG/ VSGC 501	VSG/ VSGC 601	VSG/ VSGC 701
			VPN	VPN	VPN		VPN	VPN	VPN
-	OIL BAFFLE ASSEMBLY ((1) 217, (1) 244, (1) 248, (1) 249, (1) 252)	1	A25942AA	A25942AA	A25942AA	1	A26034B	A26034B	A26034B
	SHIM ASSORTMENT ((2) 240, (2) 241, (1) 242, (1) 243)	1	A25177A	A25177A	A25177A	1	A26035B	A26035B	A26035B
217	OIL BAFFLE PLATE	1	25938A	25938A	25938A		26045A	26045A	26045A
220	END PLATE	1	25719D	25719D	25719D	1	26025B	26025B	26025B
221	SHAFT	2	25941A	25941A	25941A	2	25843A	25843A	25843A
222	GEAR	4	25027A	25027A	25027A	4	25027A	25027A	25027A
227	CLAMP	4	25913A	25913A	25913A	-	N/A	N/A	N/A
228	SPACER	4	25847A	25847A	25847A	4	25847A	25847A	25847A
293	SHIM 0.002"	AR	25409AA	25409AA	25409AA	2	26027BA	26027BA	26027BA
294	SHIM 0.003"	AR	25409AB	25409AB	25409AB	2	26027BB	26027BB	26027BB
295	SHIM 0.005"	AR	25409AC	25409AC	25409AC	1	26027BC	26027BC	26027BC
296	SHIM 0.010"	AR	25409AD	25409AD	25409AD	1	26027BD	26027BD	26027BD
244	TEFLON RING	1	25939A	25939A	25939A	1	25929B	25929B	25929B
248	CHECK VALVE	1	3120A	3120A	3120A	1	3120A	3120A	3120A
249	CHECK VALVE	1	3120B	3120B	3120B	1	3120B	3120B	3120B
252	RETAINING RING	1	2829M	2829M	2829M	1	2928N	2928N	2928N
255	WASHER	-	N/A	N/A	N/A	2	25977E	25977E	25977E
256	WASHER	-	N/A	N/A	N/A	2	25977F	25977F	25977F
268	EXPANSION PIN	4	1193D	1193D	1193D	4	1193D	1193D	1193D
269	EXPANSION PIN	4	2981AA	2981AA	2981AA	4	2981AA	2981AA	2981AA
271**	PLUG SOLID	1	25422A	25422A	25422A	-	N/A	N/A	N/A
281	HEX HEAD CAP SCREW.	6	2796N	2796N	2796N	8	2796B	2796B	2796B
286	SOCKET HEAD CAP SCREW	8	2795F	2795F	2795F	2	2795D	2795D	2795D
297	SET SCREW	2	2060J	2060J	2060J	2	2060J	2060J	2060J
298	SET SCREW	2	2060H	2060H	2060H	2	2060H	2060H	2060H

Notes: **: Required At Top Locate Single Gaterotor Only. AR: As Required.

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Slide Valve Carriage Assembly



Assembly Includes Carriage and Slides.

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Slide Valve Carriage Assembly

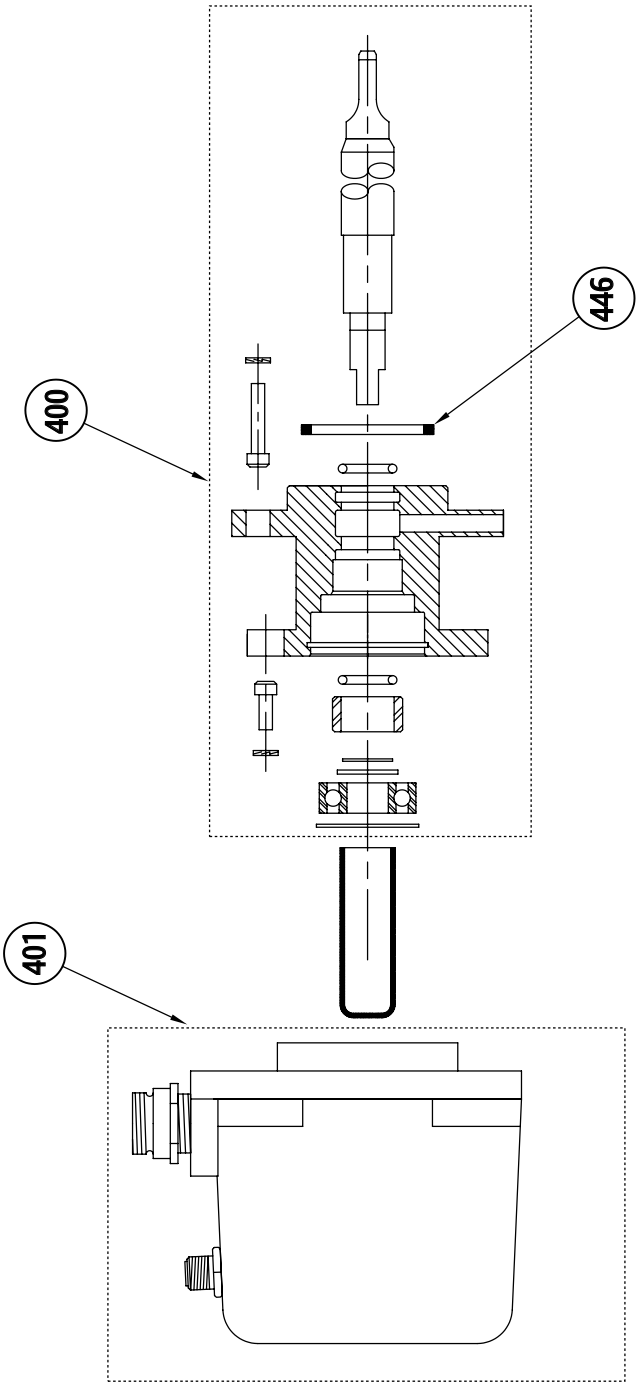
ITEM	DESCRIPTION	QTY	MODEL NUMBER	
			VSG/VSGC 301 - 401	VSG/VSGC 501 - 701
			VPN	VPN
300	CARRIAGE ASSEMBLY	1	A25179A	A26012B
304	CAPACITY PISTON (340, 341, 350 & 355)	1	A25183A	A25183B
305	VOLUME PISTON (340, 342, 350 & 355)	1	A25184A	A25184B
316	CAPACITY RACK	1	25023D	25024AH
318	CAPACITY RACK SHAFT	1	25772C	25772A
323	VOLUME RATIO RACK	1	25023CH	25023AH
325	VOLUME RATIO RACK SHAFT	1	25772D	25772B
350	PISTON RING SET	2	2953AE	2953AA
360	LOCK WASHER (PAIR)	2	3004C	3004C
361	WASHER	2	13265B	13265B
363	NUT	4	2797A	2797A
372*	SOCKET HEAD CAP SCREW	1	N/A	2795M

Notes: There are two slide valve carriages per compressor. Each one each has its own Volume Ratio and Capacity slide valves. The above totals are per side of the compressor, double the quantities if both slide valve carriages are being worked on.

*: Not Pictured.

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Actuator and Command Shaft

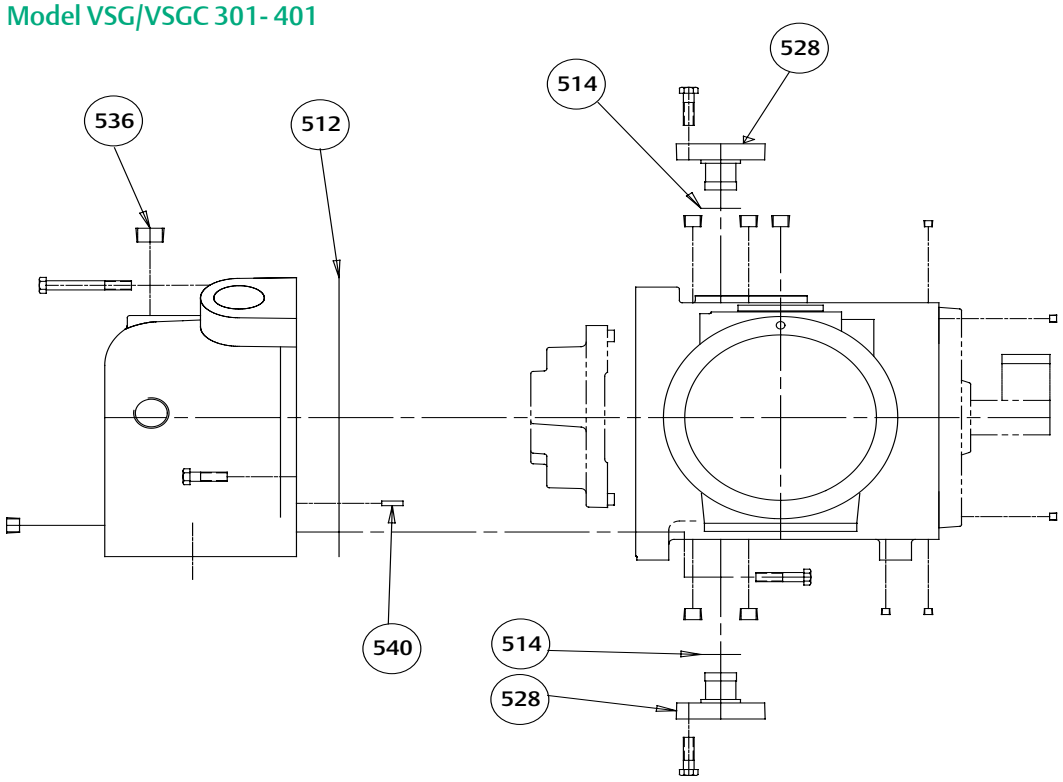


ITEM	DESCRIPTION	QTY	MODEL NUMBER	
			VSG/VSGC 301 - 401	VSG/VSGC 501 - 701
			VPN	VPN
400	COMMAND SHAFT ASSEMBLY	2	A25994A	A25994B
401	SLIDE VALVE ACTUATOR	2	25972D / 25972XP	25972D / 25972XP
446	O-RING SEAL	2	2825C	2825C

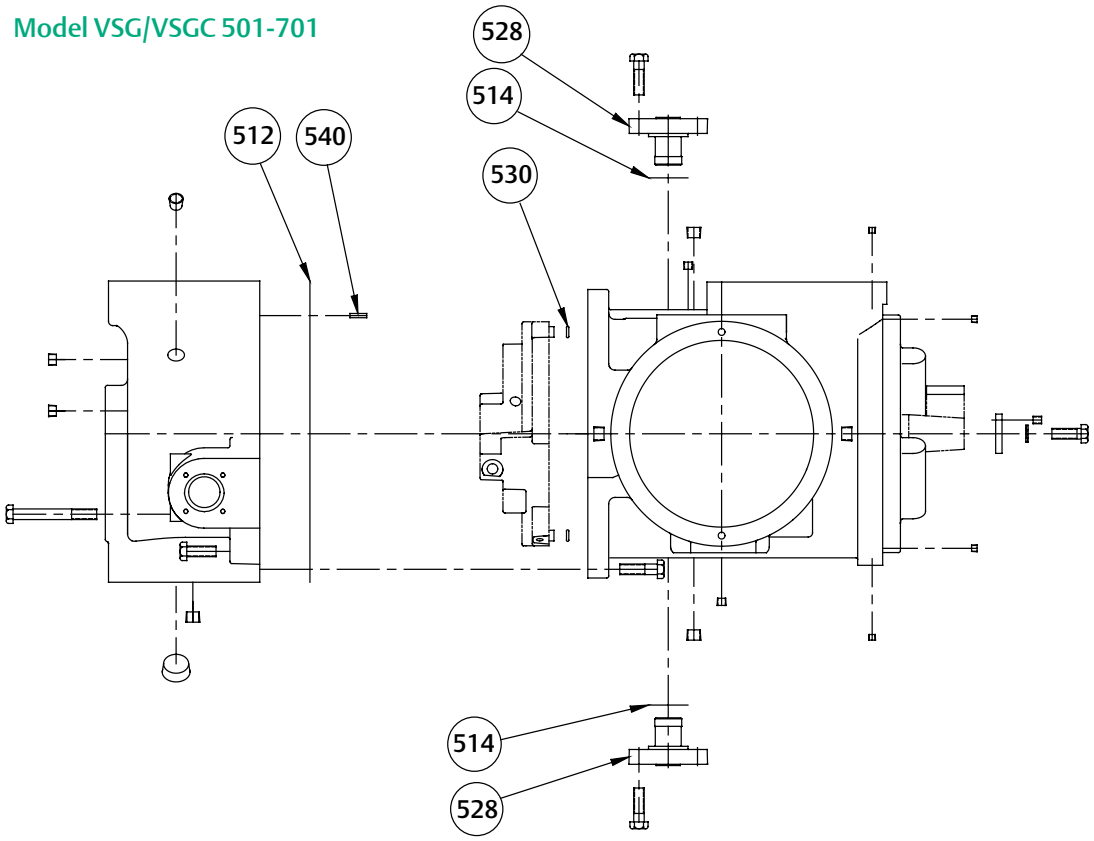
Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Miscellaneous Frame Components

Model VSG/VSGC 301- 401



Model VSG/VSGC 501-701



Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

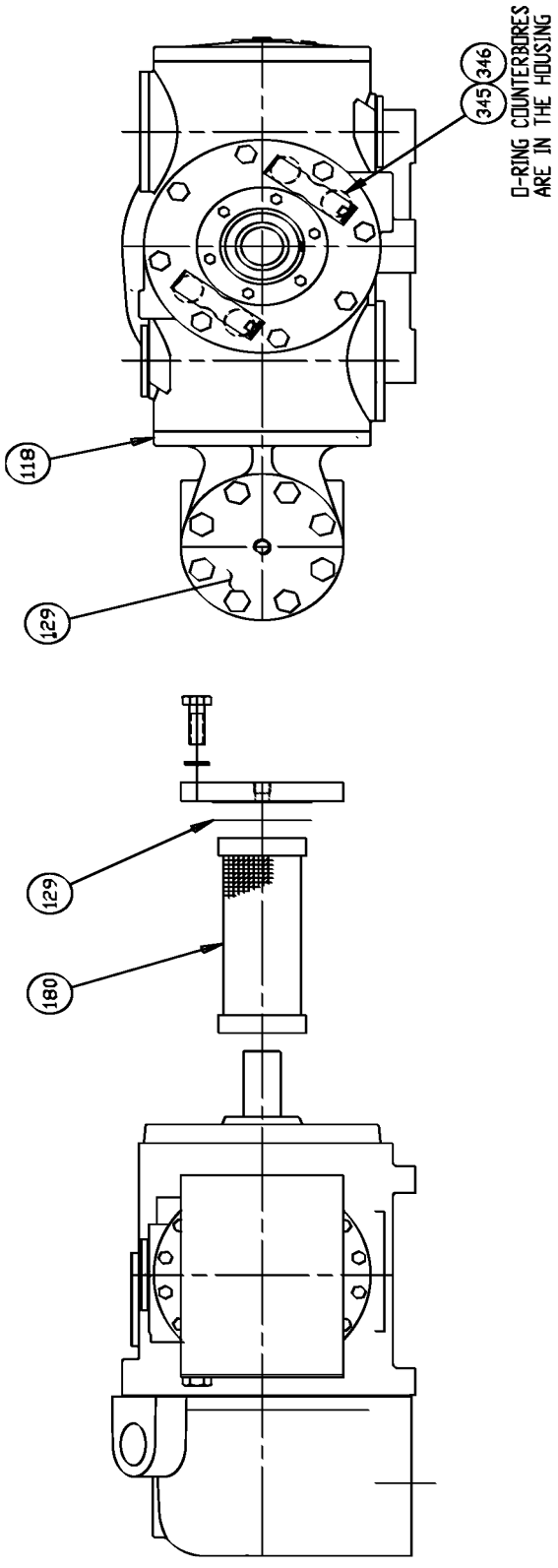
Miscellaneous Frame Components

ITEM	DESCRIPTION	MODEL NUMBER			
		VSG/VSGC 301 - 401		VSG/VSGC 501 - 701	
		QTY	VPN	QTY	VPN
512	MANIFOLD GASKET	1	25737A	1	26037A
514	ECON-O-MIZER GASKET	2	11323G	2	11323D
522	COUPLING LOCK PLATE	-	N/A	1	25004D
523	LOCK WASHER	-	N/A	1	3004H
528	ECON-O-MIZER PLUG	2	25419A	2	25397K
530	O-RING	-	N/A	2	3547AW
540	DOWEL PIN	2	2868B	2	2868B
542	PIPE PLUG	3	2606C	10	2606B
551	HEX HEAD CAP SCREW	-	N/A	2	2796C
570	BEARING OIL PLUG	1	25978A	-	N/A
571	PLUG	1	25979A	-	N/A
572	SPRING	1	3148A	-	N/A
*	GASKET / O-RING SET	1	KT1075A	1	KT1075B

Note: *: Not Pictured.

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Housing Accessories



Housing Accessories

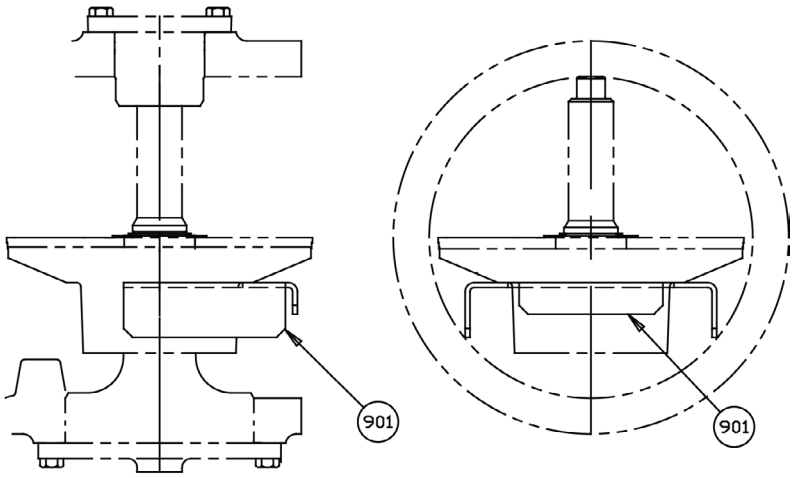
ITEM	DESCRIPTION	MODEL NUMBER VSG/VSGC 301 - 701	
		QTY	VPN
117	GATEROTOR COVER	1	25416B
118	COVER GASKET	2	25259B
129	GASKET	1	11323T
180	INLET SCREEN	1	25920A
343	PISTON COVER*	1	25724B

Note: *: Not Pictured.

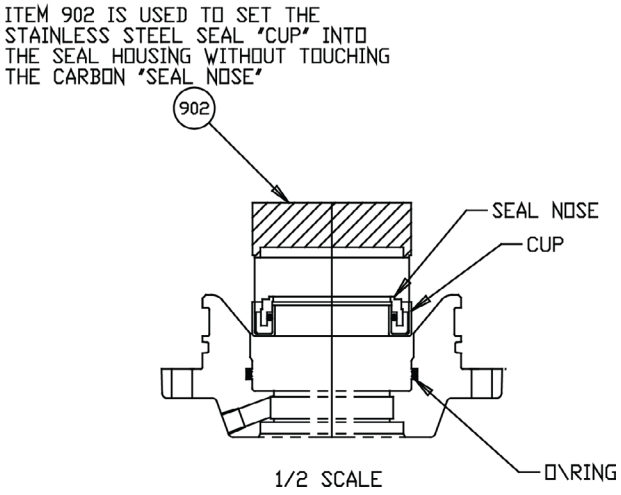
ITEM	DESCRIPTION	QTY	MODEL NUMBER VSG/VSGC 301 - 401	MODEL NUMBER VSG/VSGC 501 - 701
			VPN	VPN
345	O-RING	4	2825AY	3547AX
346	O-RING	2	2825AD	2825AD

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Replacement Tools



1/3 SCALE

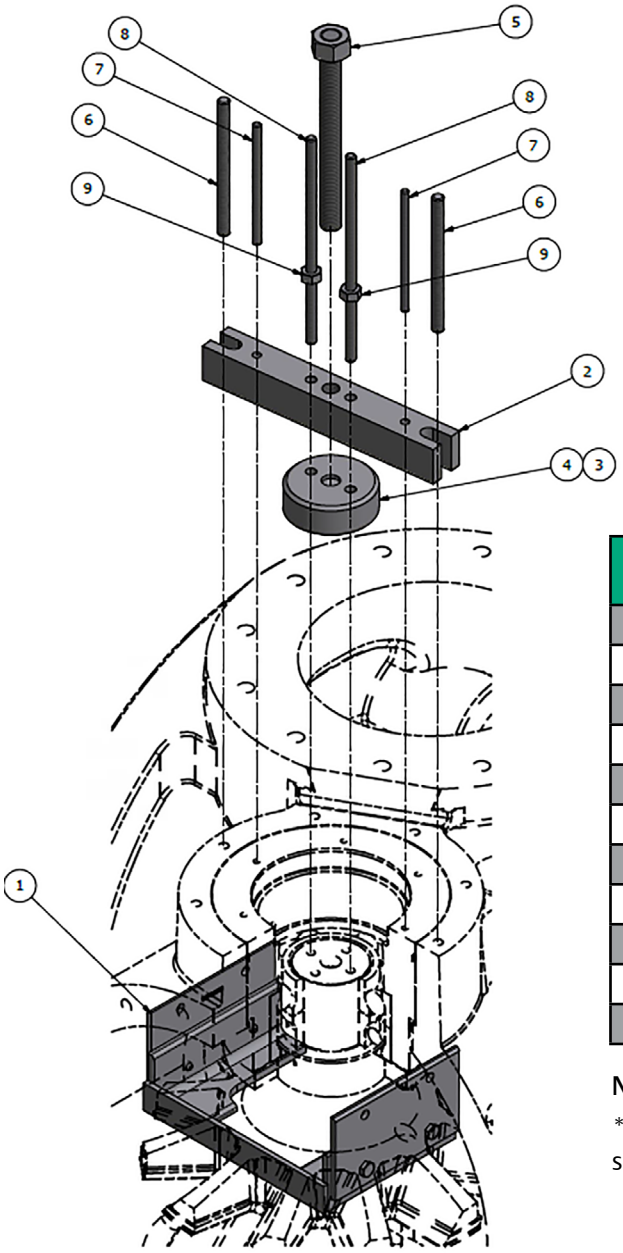


1/2 SCALE

ITEM	DESCRIPTION	QTY	MODEL NUMBER	
			VSG/VSGC 301 - 401	VSG/VSGC 501 - 701
			VPN	VPN
900	GATEROTOR TOOLS	1	A25205B	A25205B
901	GATEROTOR STABILIZER	1	25742A	25742B
902	SEAL INSTALLATION TOOL	1	25455A	25455B

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Replacement Tools



ITEM	DESCRIPTION	QTY	PART NUMBER
-	GATEROTOR TOOL SET	1	A25205B*
1	STABILIZER GATEROTOR ASSEMBLY	1	A25698A
2	BAR BEARING PULLER	1	25204A
3	SHOE PULLER 1.875	1	25157A
4	SHOE PULLER 2.500	1	25157B
5	JACKSCREW	1	A25156B
6	STUD .375-16 X 4.9	2	25908A
7	STUD .250-20 X 4.4	2	25908B
8	STUD .312-18 X 7.5	2	25908C
-	SCREW 1/4-20 NC X 1-3/4 CAP SOCK	2	2795W
9	PLAIN NUT 5/16-18NC-2B HEX	2	1726B

Note:

*: Assembly A25205B contains all parts listed. Parts are shown independently for illustration purposes only.

Vilter parts get renewed from time to time, so be sure to ask if the part listed in your manual is still the best for your compressor. Parts that appear on diagrams might be shown separately for reference, but are sold as an assembly or kit only.

Torque Specifications

Refer to the following tables for torque specifications.

Table A-1. Torque Specifications (ft-lbs) (For Compressors Only)

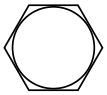
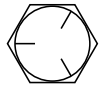
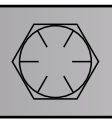
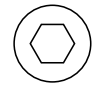
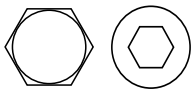
TYPE BOLT	HEAD MARKINGS	NOMINAL SIZE NUMBERS OR INCHES									
		#10	1/4"	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	3/4"	7/8"
SAE GRADE 2 COARSE (UNC)			5	10	18	29	44	63	87	155	150*
SAE GRADE 5 COARSE (UNC)			8	16	28	44	68	98	135	240	387
SAE GRADE 5 FINE (UNF)				16							
SAE GRADE 8 COARSE (UNC)			11	22	39	63	96	138	191	338	546
SOCKET HEAD CAP SCREW (ASTM A574) COARSE (UNC)		5	13	26	46	73	112	155	215	380	614
Notes:	1) Torque values on this sheet are not to override those given on the individual drawings.										
	2) When using loctite, the torque value on this sheet are only accurate if bolts are tightened immediately after loctite is applied.										
	* The proof strength of Grade 2 bolts is less for sizes 7/8 and above and therefore the torque values are less than smaller sizes of the same grade.										

Table A-2. Torque Specifications for 17-4 Stainless Steel Fasteners (ft-lbs) (For Compressors Only)

TYPE BOLT/NUT	HEAD MARKINGS	NOMINAL SIZE NUMBERS OR INCHES								
		#10	1/4"	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	3/4"
Hex & Socket Head Cap Screws		3	8	14	25	40	60	101	137	245
Nut		-	8	-	25	-	-	-	-	-

NOTE

Continue use of red loctite #271 (VPN 2205E) on currently applied locations. Use blue loctite #243 (VPN 2205F or 2205G) on all remaining locations.

Table A-3. SA193 B7/SA320 L7 Bolts / Studs – Torque Requirements Per ASME Codes: B31.5 and B31.3

Nominal Bolting Diameter	Nominal Torque (ft.lbs.)	Maximum Torque (ft.lbs.)	Torque (ft.lbs) Using Flexitallic Gasket
3/8"	17	20	25
7/16"	19	22	28
1/2"	20	25	30
5/8"	40	50	60
3/4"	65	83	100
7/8"	100	133	160
1"	120	204	245
1-1/4"	150	454	500

Notes:

1. The above torque values apply unless otherwise specified on drawing.
2. Bolting to be tightened incrementally in a diametrically staggered pattern to the nominal torque value.
3. If necessary, torque can be increased in 10% increments; do not exceed the maximum torque values.
4. For other materials please consult Vilter Engineering Department for torque values.

Oil Analysis Report

OIL SERVICES LABORATORIES
www.oil-services-lab.com

PRODUCT ANALYSIS REPORT

No Action Required

Report Date:	3/4/2013
Report Number:	*********
Customer	Customer
Comp. Mfr.	Vilter
Oil Type	VILTER METHANE 100
Serial Number	****-***
Model Number	VSG-1801
Hrs. on Fluid	6049
Hrs. on Machine	11239
Sample Date	Feb 21, 2013
Receive Date	Mar 01, 2013
I.D. #	*********

Customer Name
Customer Address

Evaluation:

The fluid is in good condition. Sample again in 6 months.

Physical Properties Results *

Sample Date (Lube Hours)	Feb 21, 2013 (6049)	Oct 19, 2012 (4809)	Jul 26, 2010 (5190)
Water by Karl Fischer (ppm)	19.5	147.7	41.4
Viscosity 40 C (cSt)	64.23	64.47	66.00
TAN Total Acid #	0.077	0.106	0.080
ISO Code	21/20/16	21/19/16	21/19/14

Spectrochemical Analysis

Wear Metals (ppm)			
Silver (Ag)	0	0	0
Aluminum (Al)	0	0	0
Chromium (Cr)	0	0	0
Copper (Cu)	0	0	0
Iron (Fe)	0	0	0
Nickel (Ni)	0	0	0
Lead (Pb)	0	0	0
Tin (Sn)	0	0	0
Titanium (Ti)	0	0	0
Vanadium (V)	0	0	0
Contaminant/Additive Metals (ppm)			
Barium (Ba)	0	0	0
Calcium (Ca)	0	0	0
Magnesium (Mg)	0	0	0
Molybdenum (Mo)	0	0	0
Sodium (Na)	0	0	0
Phosphorus (P)	0	0	0
Silicon (Si)	0	0	0
Zinc (Zn)	0	0	0

Thank you for this opportunity to provide technical assistance to your company. If you have any questions about this report, please contact us at 1-800-637-8628, or fax 1-989-496-2313 or email us at tslab@oil-services-lab.com

CC List

Accuracy of recommendations is dependent on representative oil samples and complete correct data on both unit and oil

* Property values should not be construed as specifications

Storage Guidelines For Vilter Lubricants

All Vilter lubricants are manufactured to meet strict requirements to ensure minimal water moisture content as shipped. The following guidelines are provided for the end-user of the equipment as a means to minimize the water content of lubricants in storage.

Guidelines

- Store all lubricant containers in a dry environment. Do not expose the lubricant to the atmosphere by opening the container until the compressor sump or separator is ready to be charged.
- Keep the lubricant in its original container. Some plastic containers allow water moisture to pass through the container itself.
- If possible, use container sizes appropriate to the compressor charge to avoid leaving partially containers for long period of times. Vilter lubricant is available in 5 and 55 gallon containers.

Table B-1. Cross Reference Index

VPN	Oil Type	Vilter Lube Type	Container Size	Applications
3143A	PAO-100	METHANE	5 gallon pail	Hydrocarbon/natural gas, Landfill gas, Turbine feed gas
3143B	PAO-100	METHANE	55 gallon drum	Hydrocarbon/natural gas, Landfill gas, Turbine feed gas
3143C	PAO-68	METHANE	5 gallon pail	Hydrocarbon/natural gas, Landfill gas, Turbine feed gas
3143D	PAO-68	METHANE	55 gallon drum	Hydrocarbon/natural gas, Landfill gas, Turbine feed gas
3143G	PAO-150	METHANE	5 gallon pail	Hydrocarbon/natural gas, Landfill gas, Turbine feed gas
3143H	PAO-150	METHANE	55 gallon drum	Hydrocarbon/natural gas, Landfill gas, Turbine feed gas
3143J	PAO-100	DIGESTER	5 gallon pail	Hydrocarbon/natural gas, Landfill gas, Turbine feed gas
3143K	PAO-100	DIGESTER	55 gallon drum	Hydrocarbon/natural gas, Landfill gas, Turbine feed gas
3339A	PAO	CO_2 GAS	5 gallon pail	CO_2, CO
3339B	PAO	CO_2 GAS	55 gallon drum	CO_2, CO
3636A	PAO	CO_2	5 gallon pail	Gas streams containing moisture, CO_2, CO and/or H_2S
3636B	PAO	CO_2	55 gallon drum	Gas streams containing moisture, CO_2, CO and/or H_2S
3643A	PAO	XG 105-100	5 gallon pail	Hydrocarbon/natural gas
3643B	PAO	XG 105-100	55 gallon drum	Hydrocarbon/natural gas
3653A	POE	POE-100	5 gallon pail	Air Compressor Lubricant
3653B	POE	POE-100	55 gallon drum	Air Compressor Lubricant

Compressor Suction Piping

Pitch the main back to the scrubber for proper drainage of header. To keep pressure drop low, change direction only when necessary, and use long radius elbows. Take branch line to the compressors off the top of the main (with the first horizontal leg perpendicular to the main). This will prevent any liquid in the main from entering the compressor suction. Drains on the suction header, between each compressor and at the end of the header, should be used for daily routine PM procedures to prevent liquid build up in the header where it can be swept into compressors as a liquid slug and damage the compressor.

Where possible use several 90° long radius elbows between the header and then drop to the equipment in each branch line. This can provide flexibility to accommodate thermal expansion or contraction and avoid stresses on the equipment. Two horizontal legs in the branch line, approximately 3 feet each, will normally be adequate. Other arrangements also work well.

NOTE

Avoid excessive piping loads when piping to equipment. Please see Flange loading Table 3-1 in this manual for allowable loads.

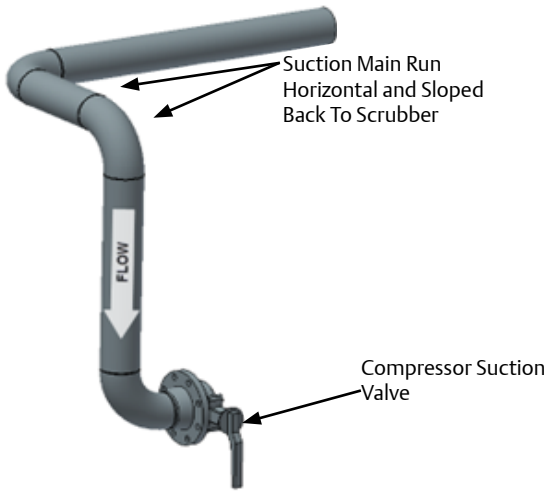


Figure C-1. Single Compressor Suction Piping

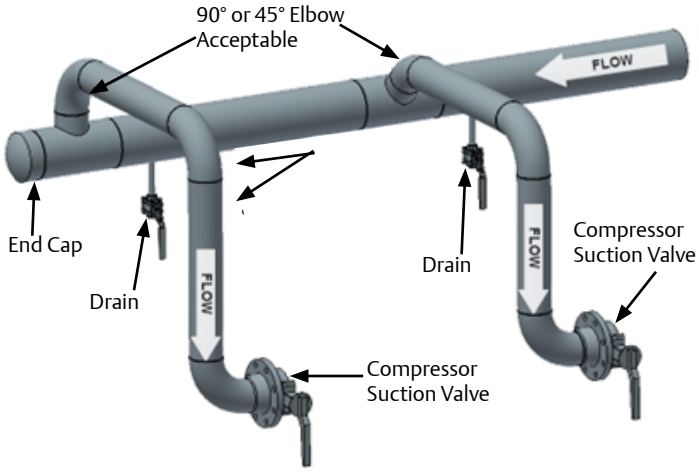


Figure C-2. Multiple Compressor Suction Piping

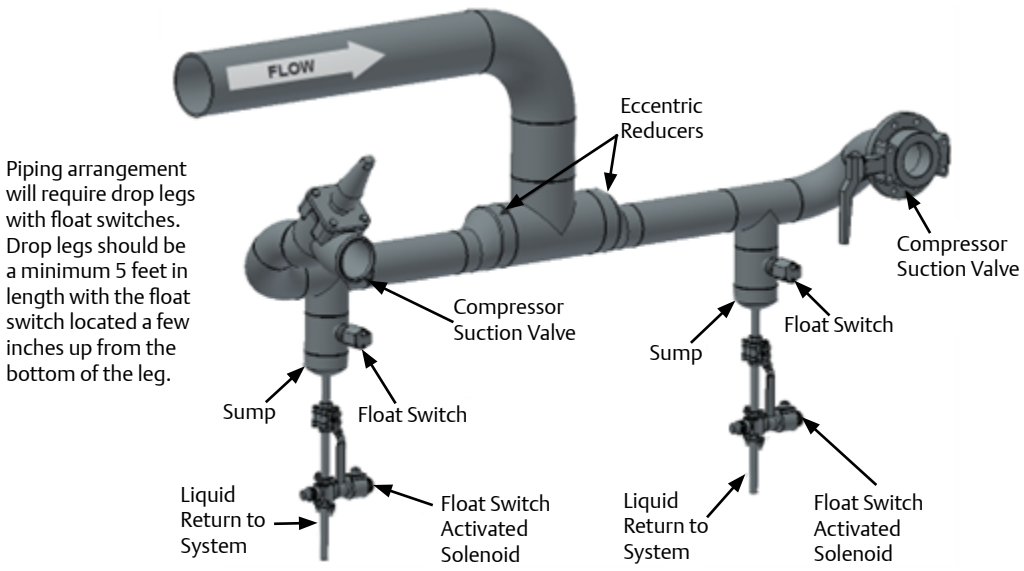


Figure C-3. Multiple Compressor Suction Piping Where Drain Back to Accumulator not Possible

Compressor Discharge Piping

Install discharge mains so all branch lines can enter from the top. Where permitted, individual compressor discharge branches should enter the discharge main via a lateral connection in the flow direction. Tees or saddled connections are acceptable entrances where laterals are prohibited by local codes.

Avoid bull heading discharge lines due to the creation of excessive pressure drop. Where the equipment room design and layout requires the riser to the condenser to be located between compressors, a lateral entering the riser in the direction of flow is preferable. The mixing of flows minimizes the pressure drop on those compressors entering the side branch.

When installing the compressor stop valve and check valve, leave a minimum of 1-2 pipe diameters in between the stop valve and check valve to allow the opening and closing of the stop and check valves. The disks of the stop valve and the check valve will collide if the two valves are mounted directly next to each other.

NOTE

Avoid excessive piping loads when piping to equipment. See Vilter technical data sheet T00511 or flange loading table in this manual for allowable flange loads.

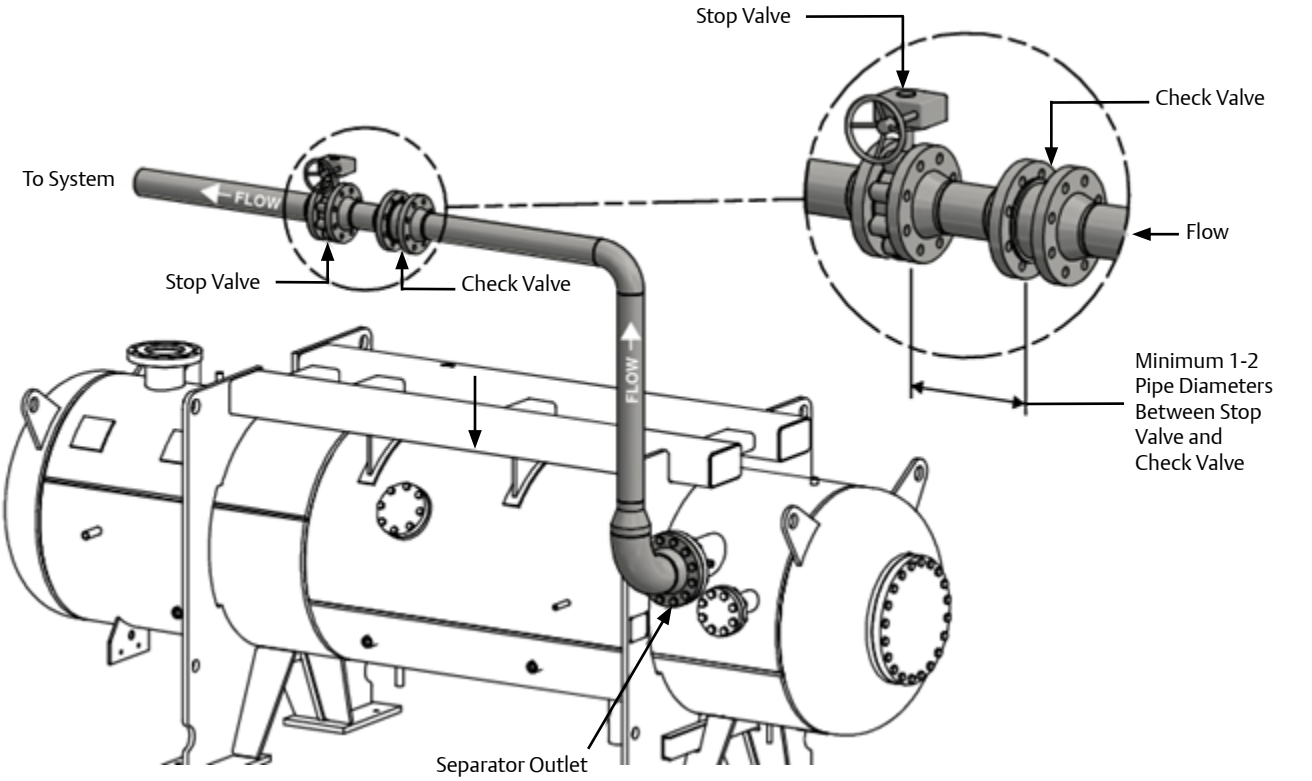


Figure C-4. Location of the Discharge Stop Valve and Check Valve

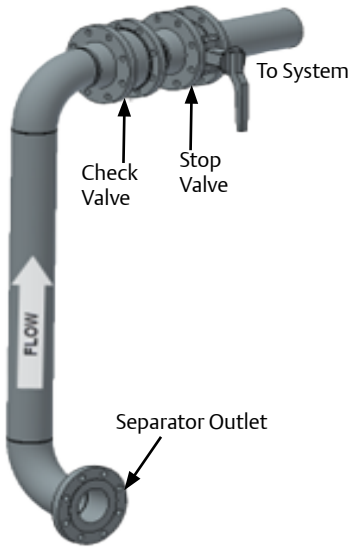


Figure C-5. Single Compressor Discharge Piping

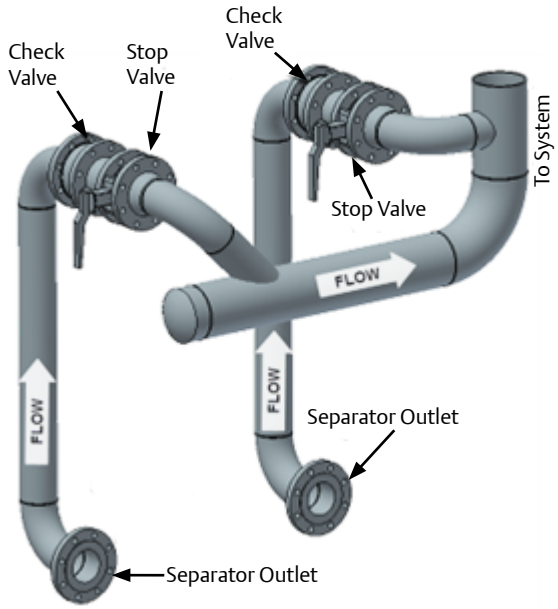


Figure C-6. Multiple Compressor Discharge Piping Vertical To System

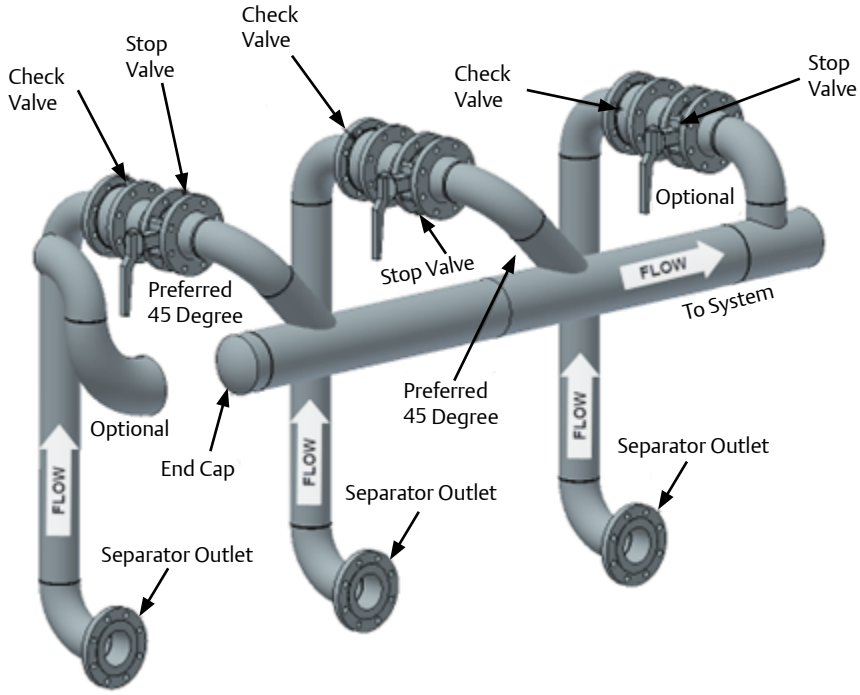
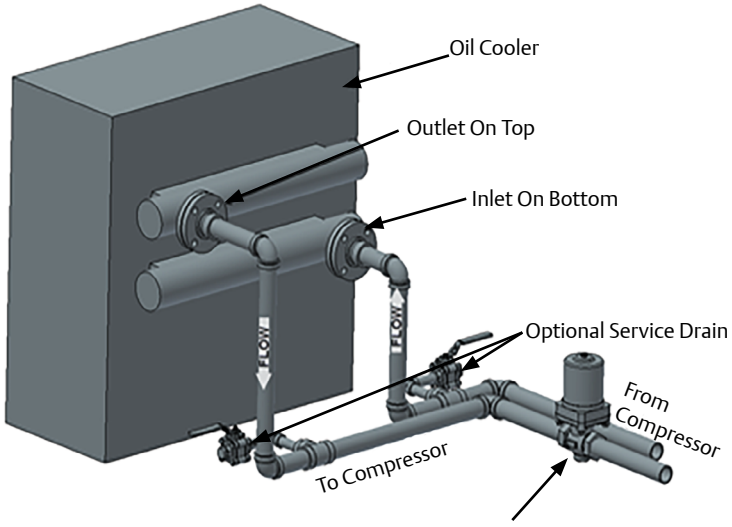


Figure C-7. Multiple Compressor Discharge Piping Horizontal to System with Options

Oil Line

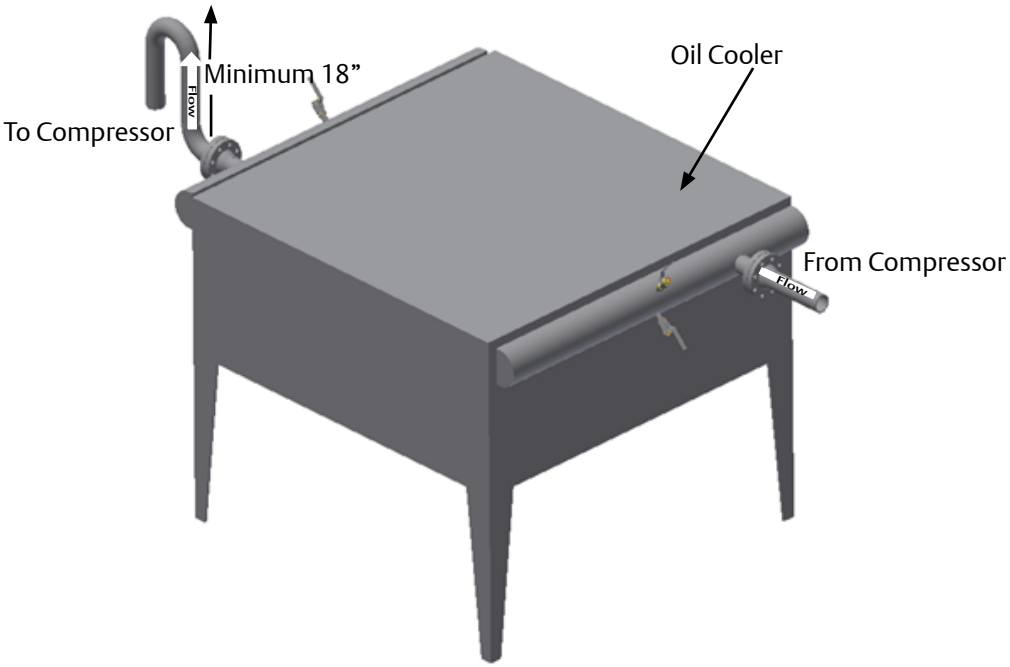
- Vertical drops should be no higher than 8 to 10 feet.
- In the event the vertical drop needs to be higher than 13 feet, an electronic service valve is to be installed in the return line to the compressor (consult factory).
- Install optional service drain valves on field oil lines from compressor to remote oil cooler if oil lines cannot be drained by equipment service valves.
- Ambient temperatures below 50°F, heat trace and insulation on oil lines and air cooler heads to be installed.
- Pressure drop not to exceed 5 to 10 PSI.

NOTE
Avoid excessive piping loads when piping to equipment.



Install Electronic Service Valve in Return if Cooler is Located Higher Than 13 Feet From Unit. Locate as Close as Possible to Compressor Unit. Consult Factory

Case A



Case B

Figure C-8. Compressor Oil Line Piping to Air Cooled Oil Cooler

Aftercooler Piping

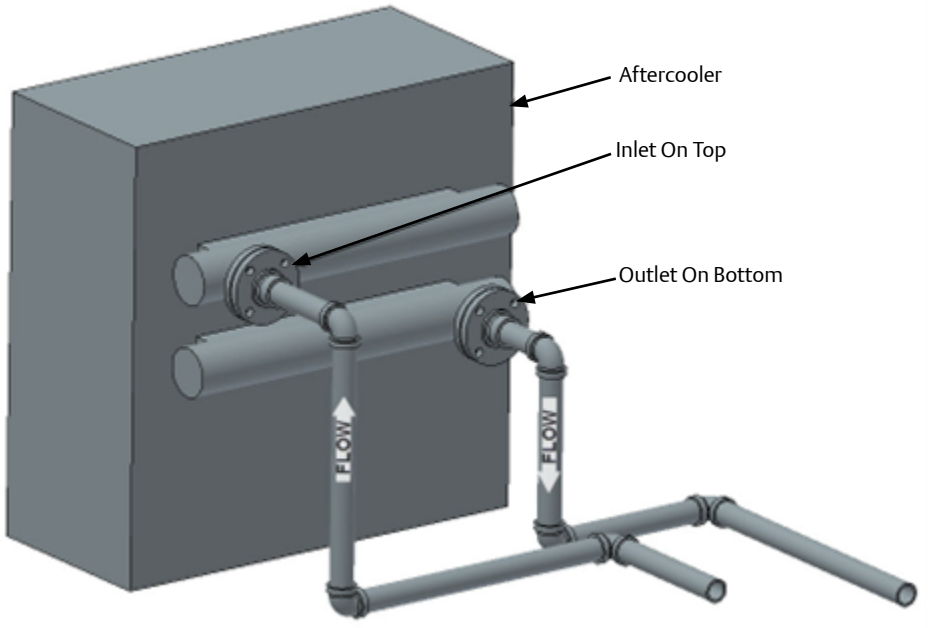


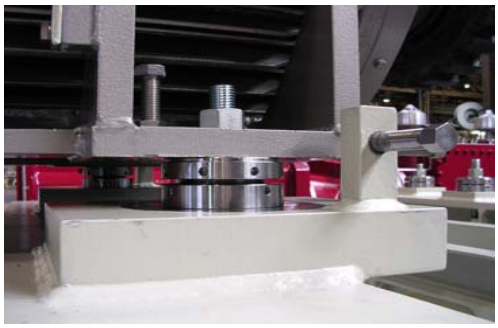
Figure C-9. Aftercooler Piping

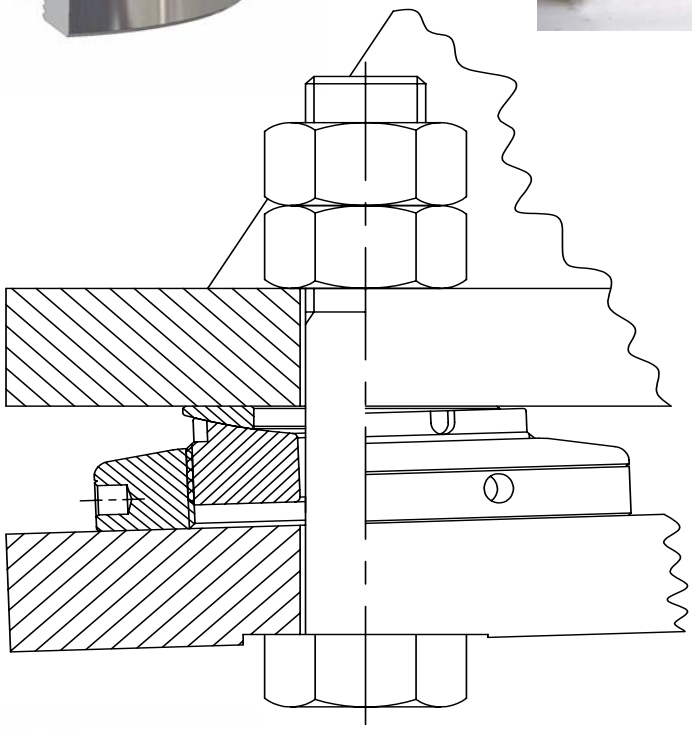
Appendix D
Vibracon® Installation Procedure

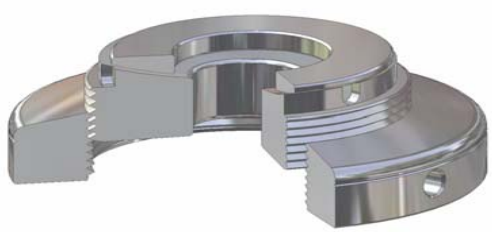
MACHINE SUPPORT
Laser Alignment, Mounting Services and Products

An SKF Group Company

Vibracon®
Installation Procedure







4 Vibracon® Installation Procedure

Step 1 Check foundation quality

a) The bottom ring area of the Vibracon® chock should be covered by the foundation for 100%. The spherical top part of the chock must have at least 75% contact with machine foot.
b) Foundation roughness should be sandblasted quality of Sa 2.5 minimum or machined Ra 6.3
c) The contact surface between foundation and bottom ring of the Vibracon® chock should be checked using the bottom ring of the element, until an evenly distributed bearing surface of a minimum which is given by the machinery manufacturer or classification society. In all other cases, we recommend a minimum bearing surface of 75 %.
d) The taper between foundation and machine feet should be less then 4°.
e) Foundation and machine foot should be free from paint and grease.

Step 2 The Vibracon® chocks' thread and spherical layers are protected with Molykote®. The chocks are ready for installation directly from the package!

Machine Support recommends the use of:

- Molykote® type P37 on the screw thread;
- Molykote® type TP42 on the convex / concave mating surface.

Step 3 Check if the Vibracon® chock is placed concentric with the bolt hole.

Step 4 Align the machine.

a) Keep in mind while aligning the machine to add 0.10 mm (0.004") to the target alignment because of the fact that the Vibracon® chock will lose height at the moment the foundation bolts are secured. This will happen only the first time the chock is used because of the grease inside of the thread.
b) Please remember: Vibracon® chocks are not designed for lifting machinery!
c) Height change after 1 cycle (pitch):

SM12	1 mm	0.039"
SM16	1.5 mm	0.059"
SM20 / SM42	2 mm	0.078"
SM48 / SM64	3 mm	0.118"

Step 5 Tighten the foundation bolts. Machine Support recommends doing this in two steps.

Step 6 During or after tightening of the foundation bolts recheck the alignment and check for "soft foot". A "soft foot" occurs if one or more of the Vibracon® chocks are not carrying the same load as the other elements.

Step 7 After installing the machinery apply corrosion protection to the chock by painting or alternative method.

Step 8 The bolt tension must be checked after the test run.

Machine Support recommends the use of spherical washers in the bolt connection.

If you have any questions, please contact Machine Support.
Phone: +31 (0)180 48 38 28

About Vilter

Vilter is a technology leader in energy-efficient, environmentally conscious solutions in its industry. The 150-year history of the Vilter brand tells a rich story of perseverance and drive to cultivate continuous innovation within the industrial refrigeration and gas compression industries. Vilter offers unprecedented efficiency, productivity and reliability in cooling, recovery, and compression. It combines best-in-class technology with proven engineering and design to create quality products and latest solutions for customers worldwide.

About Copeland

Vilter is a business segment of Copeland, a global leader in providing sustainable climate solutions for customers in industrial, commercial and consumer markets around the world. Copeland combines category-leading brands in compression, controls, software and monitoring for heating, cooling and refrigeration. With best-in-class engineering and design and the broadest portfolio of modulated solutions, we're not just setting the standard for compressor leadership; we're pioneering its evolution. Combining our technology with our smart energy management solutions, we can regulate, track, and optimize conditions to help protect temperature-sensitive goods over land and sea, while delivering comfort in any space. Through energy-efficient products, regulation-ready solutions, and expertise, we're revolutionizing the next generation of climate technology for the better. For more information please visit

Copeland.com

Copeland.com/Vilter

COPELAND. ENGINEERED FOR SUSTAINABILITY.