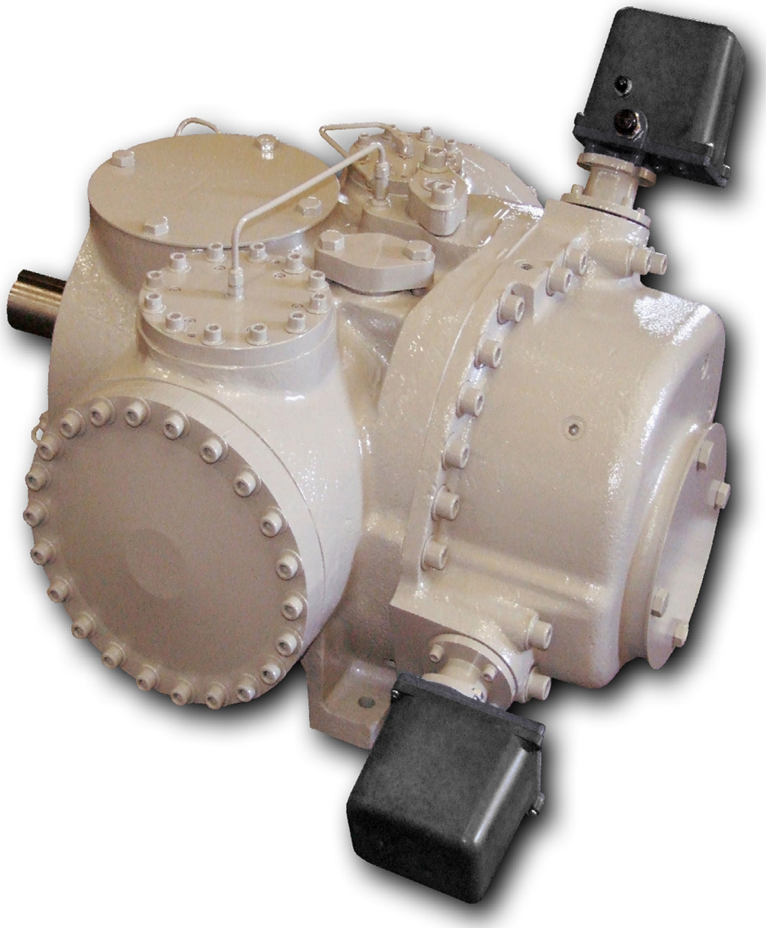
VSG & VSSG Single Screw Bare Shaft Compressor

Installation, Operation and Service Manual

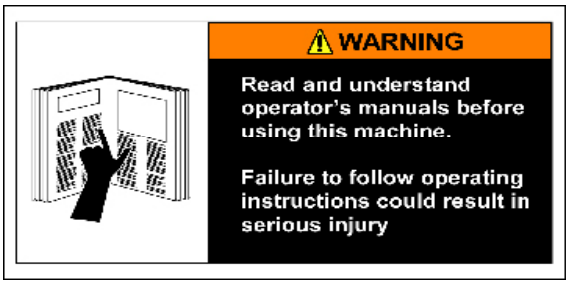


The World's Best Compressors™
For Gas Compression

VILTER™

EMERSON™

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:

Vilter Manufacturing LLC
Customer Service Department
5555 South Packard Ave
Cudahy, WI 53110-8904 USA
Telephone: 1-800-862-2677, Fax:1-414-744-3483
E-mail: info.vilter@emerson.com, Website: Emerson.com/Vilter

Equipment Identification Numbers:
Vilter Order Number: _____Compressor Serial Number: _____
Vilter Order Number: _____Compressor Serial Number: _____

VSG STANDARD VILTER™ WARRANTY STATEMENT

Seller warrants all new single screw gas compression units and bareshaft single screw compressors manufactured by it and supplied to Buyer to be free from defects in materials and workmanship for a period of (a) eighteen (18) months from the date of shipment or (b) twelve (12) months from the date of installation at the end user's location, whichever occurs first.

If within such period any such product shall be proved to Seller's satisfaction to be defective, such product shall be repaired or replaced at Seller's option. Such repair or replacement shall be Seller's sole obligation and Buyer's exclusive remedy hereunder and shall be conditioned upon (a) Seller's receiving written notice of any alleged defect within ten (10) days after its discovery, (b) payment in full of all amounts owed by Buyer to Seller and (c) at Seller's option, Buyer shall have delivered such products to Seller, all expenses prepaid to its factory. Expenses incurred by Buyer in repairing or replacing any defective product (including, without limitation, labor, lost refrigerant or gas and freight costs) will not be allowed except by written permission of Seller. Further, Seller shall not be liable for any other direct, indirect, consequential, incidental, or special damages arising out of a breach of warranty.

This warranty is only applicable to products properly maintained and used according to Seller's instructions. This warranty does not apply (i) to ordinary wear and tear, damage caused by corrosion, misuse, overloading, neglect, improper use or operation (including, without limitation, operation beyond rated capacity), substitution of parts not approved by Seller, accident or alteration, as determined by Seller or (ii) if the product is operated on a gas with an H2S level above 100 PPM. In addition, Seller does not warrant that any equipment and features meet the requirements of any local, state or federal laws or regulations. Products supplied by Seller hereunder which are manufactured by someone else are not warranted by Seller in any way, but Seller agrees to assign to Buyer any warranty rights in such products that Seller may have from the original manufacturer. Labor and expenses for repair are not covered by warranty.

THE WARRANTY CONTAINED HEREIN IS EXCLUSIVE AND IN LIEU OF ALL OTHER REPRESENTATIONS AND WARRANTIES, EXPRESS OR IMPLIED, AND SELLER EXPRESSLY DISCLAIMS AND EXCLUDES ANY IMPLIED WARRANTY OF MERCHANTABILITY OR IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

Any description of the products, whether in writing or made orally by Seller or Seller's agents, specifications, samples, models, bulletins, drawings, diagrams, engineering sheets or similar materials used in connection with Buyer's order are for the sole purpose of identifying the products and shall not be construed as an express warranty. Any suggestions by Seller or Seller's agents regarding use, application or suitability of the products shall not be construed as an express warranty unless confirmed to be such in writing by Seller.

VILTER

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EC Declaration of Incorporation

We hereby declare that the following machinery is intended to be incorporated into other machinery, and must not be put into service until the relevant machinery into which it is to be incorporated has been declared in conformity with the essential requirements of the Machinery Directive 2006/42/EC.

Machine Description:	*Industrial Compressor*
Make:	*Vilter*
Type:	*VSM / VSS / VSR /VSH / VSSH / VSG & VSSG Single Screw Compressor*
Model Size:	*71, 91, 97, 101, 111, 113, 127, 128, 145, 151, 160, 180, 204, 221, 222, 243, 152, 182, 202, 301, 361, 401, 501, 601, 701, 291, 341, 451, 601, 751, 901, 791, 891, 1051, 1201, 1301, 1501, 1551, 1801, 1851, 2101, 2401, 2601, 2801, 3001.*
Manufactured by:	Vilter Manufacturing, LLC.

The following transposed harmonised European Standards have been used:

EN ISO 12100-1: 2010	- Safety of Machinery - General principles for design-Risk assessment and risk reduction.
EN ISO 13857: 2008	- Safety of Machinery - Safety distances to prevent danger zones being reached by the upper and lower limbs.
EN349:1993 + A1: 2008	- Safety of Machinery - Minimum gaps to avoid crushing hazards.
EN ISO 13850: 2015	- Safety of Machinery - Emergency stop equipment - Principles for design.
IEC/EN60204-1 (2016)	- Safety of Machinery - Electrical equipment of machines - Specification for general requirements.

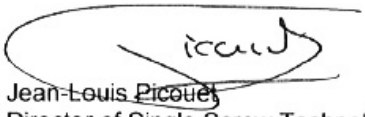
A technical construction file for this machinery is retained at the following address:

Vilter Manufacturing, LLC.
5555 South Packard Avenue
P.O. Box 8904, Cudahy
Wisconsin 53110-8904, USA

Vilter's Authorized Representative in Europe is Emerson S.R.L., company No J12/88/2006, Emerson 4 Street, Parcul Industrial Tetarom II, Cluj-Napoca 400638, Romania. For product compliance destination sales questions in Europe, contact the Regulatory Compliance Department: europeproductcompliance@emerson.com (+40 374 132 000).

In Great Britain, it is Emerson Process Management Ltd., Company No 00671801, Meridian East, Leicester, LE19 1UX, United Kingdom. For product compliance destination sales questions contact the Regulatory Compliance Department: ukproductcompliance@emerson.com (+44 11 6282 23 64).

Signed for and on behalf of Vilter Manufacturing, LLC.:



Jean-Louis Picouet
Director of Single Screw Technology
R&D Engineering

Last update: September 2021

Vilter Manufacturing, LLC.
5555 South Packard Avenue t P.O. Box 8904 t Cudahy, Wisconsin 53110-8904
001-414- 744-0111 t FAX: 001-414-744-3483

VILTER

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How To Use This Manual

This manual contains instructions for VSG & VSSG bare shaft compressors. 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 - Vibration Measurements - Single Screw Compressor

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

Figures and tables are included to illustrate key concepts.

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

NOTICE - Notice statements are shown when there are 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, will 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 are additional information pertaining to the instructions explained.

Additional Important Notes

- Installation, operation and maintenance instructions can be found in the associated software manual.
- Due to continuing changes and unit updates, always refer to the website Emerson.com/Vilter 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 i.

Bare Shaft Gas Compressor Model Designations

The compressor bare shaft model designation can be found on the nameplate.

VSG –1801–HPH–STR–LS–V–SS

Compressor Model
GVSG - Gear Driven Vilter™ Single Screw Compressor
VSG - Vilter™ Single Screw Compressor
VSSG - Vilter™ Single Screw Compressor (Compressor models 291, 341, 451 & 601 - these are 240mm diameter rotors with counter clockwise rotation)
VRSG - Vilter™ Twin Screw Compressor

Drive Shaft Type
STD - Standard Drive shaft is tapered on all models except (VSG-301, 361, 401, 2401, 2601, 2801, 3001
STR - Straight Compressor Shaft for Heavy Duty
SDS - Severe Duty Larger Diameter Straight Shaft

Seal Type
V - Viton O-rings
AF - Aflas O-rings
TV - Tandem Seal w/Viton O-rings
HV - High Pressure Design w/ Viton O-rings
AHF - Ammonia Service High Pressure Aflas O-ring

Size
CFM - Nominal CFM displacement of the compressor at 3600 rpm

Compressor Type
CIH - Standard Cast Iron Material w/ Discharge Connection Horizontal
CID - Standard Cast Iron Material w/ Discharge Connection Down
STH - Steel Compressor Material w/ Discharge Horizontal
HPH - High Pressure Cast Iron Option w/Discharge Connection Horizontal (This currently exists on only the VSG-1501/1801)
DIH - Ductile Iron(750MAWP) w/ Discharge Connection Horizontal
DID - Ductile Iron Material w/ Discharge Connection Down

Slide Design Type
SD - Standard Slide Assembly
LS - Landfill Service Slide (Slide with increased clearance,no piston ring)
LR - Low Ratio Slide (Additional Porting for below Compression Ratios of 2.5)
HR - Standard Slide (Balance Grooves for High Differentials above 325 PSID)
FR - Fixed Ratio Single Slide
HD - 4340 Material
RS - Reinforced Shaft Rack
FV - Fixed Volume
HPLD compressor - No slide.
205mm LITE compressor - Use alphabet of slide number used in compressor BOM.

Special Designations
SS - Stainless Steel Internal Hardware
C - Ceramic Bearings
x.xR - Gear Ratio of x.x (Internal Gear Drive Example: 2.0R - Gear Ratio of 2.0)
MV - Manual Volume slide
MCV - Manual Capacity and Volume slide
EO - External Oil Feed
VIB - Main Housing with Vibration Mounting
B - Balanced Main Rotor
BL - Balance Loading
PPS - Ryton Slide Clamp
PPC - Carbon Slide Clamp
N - 900# Flange
AF - Aflas O-rings
LT - 205mm LITE compressor

System Unit Identification

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

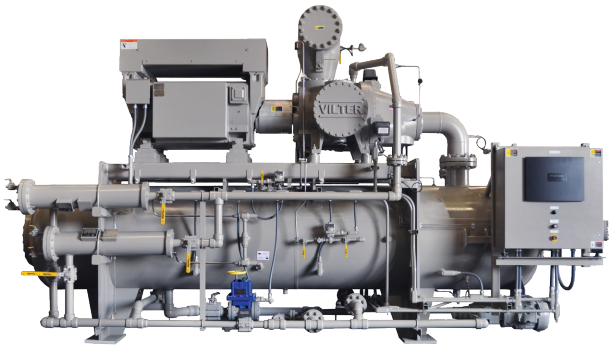
- Bare Shaft Compressor
- Compressor Unit
- Package Unit

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.

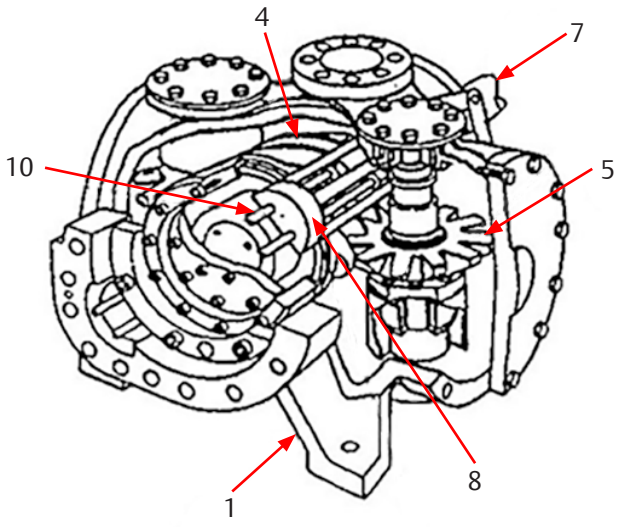


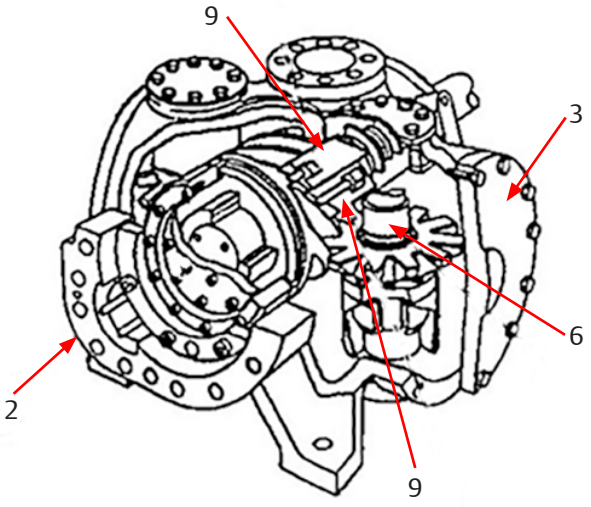
Package Unit

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

Table 1-1. VSG Standard Materials of Construction

Tag No.	Component Description	Material Type	Typical Specification Data
1	Compressor Frame	Cast Grey Iron	ASTM A-126
2	Discharge Manifold	Cast Ductile Iron	ASTM A-536
3	Gate Rotor Covers	Cast Ductile Iron	ASTM A-536
4	Main Rotor	Cast Grey Iron	Vilter Specification
5	Gate Rotors	PPS	Ryton
6	Gate Rotor Supports	Cast Ductile Iron	ASTM A-536
7	Main Drive Shaft	Steel	AISI 1045 or 1144
8	Slide Carriages	Cast Grey Iron	ASTM A-126
9	Volume / Capacity Slides	Cast Grey Iron	ASTM A-126
10	Slide Valve Drive Shafts	Steel	ASTM A-108
11	Bearings		Cylindrical Roller Type
12	Bearings		Angular Contact Ball
13	Bearing Cages		Steel & Polyamide





Compressor

The Vilter™ Single Screw Compressor is a positive displacement, capacity and volume controlled, oil flooded, rotary compressor which uses a single main screw intermeshed by two opposing gate rotors. Gas compression occurs when the individual teeth of each gate rotor sweep through the grooves, or flutes, of the main screw as the screw rotates. Compression occurs from the time the screw flute is first closed off by the gate rotor finger, until the time when the screw flute has rotated to the point of lining up with the discharge port in the compressor housing. A labyrinth type seal is used to prevent gas at discharge pressure from leaking past the end of the screw. Any discharge gas leakage past the labyrinth seal is vented back to suction via four longitudinal holes drilled through the body of the screw.

By venting the discharge end of the main screw back to suction, forces on each end of the screw are equal. This results in zero net axial forces on the main bearings. With twin opposing gate rotors, all radial forces are cancelled out also. Main shaft bearings have no net forces except the weight of the screw and the shaft assembly.

The VSG compressors are comprised of three rotating assemblies: the main screw assembly and the two gate rotor assemblies. Each of these rotating assemblies use a common bearing configuration consisting of a single, cylindrical rolling element bearing at one end, and a pair of angular contact ball bearings at the other end. The pair of angular contact ball bearings are used to axially fix one end of the rotating shafts, and to absorb the small amount of thrust loads on the shafts. The inner races of the ball bearings are securely clamped to the rotating shafts, while the outer races are securely held in the bearing housing, thus fixing the axial position of the shaft in relation to the bearing housings. The cylindrical roller bearings at the opposite end of the shafts allow for axial growth of the shafts while supporting the radial loads from the shafts.

The suction gas enters the compressor housing through the top inlet flange, at the driven end of the unit. The driven end of the compressor housing is flooded with gas at suction pressure. The gas enters the open end of the main screw flutes at the driven end, and becomes trapped in the screw flute as the screw rotates and the gate rotor tooth enters the end of the flute. At this point, the compression process begins. Directly after the screw flute is closed off by the gate rotor tooth, oil is injected into the groove.

The oil enters the compressor through a connection at the top of the compressor. The purpose of the injected oil is to absorb the heat of compression, to seal the gate rotor tooth in the groove, and to lubricate the moving parts.

Additional internal oiling ports are provided at the main and gate rotor bearings to cool and lubricate the bearings. The mechanical shaft seal housing also contains oiling ports to lubricate, cool and provide a sealing film of oil for the mechanical shafts seal. Excess oil flows through the check valves on the sealing baffle plate. This oil is directed at the main rotor roller bearing, which cools and lubricates the front roller bearing.

As the main screw rotates, the gate rotor is also driven, causing the gate rotor tooth to sweep the groove in the main screw. This sweeping action reduces the volume of the groove ahead of the gate rotor tooth and causes the trapped gas and oil to be compressed in the reduced volume. As the main screw continues to rotate, the gate rotor tooth continues to reduce the groove volume to a minimum, thus compressing the trapped gas to a maximum pressure. A labyrinth seal arrangement prevents the compressed gas from leaking past the end of the screw. As the gate rotor tooth reaches the end of the groove, the groove rotates to a position that lines up with the discharge port in the compressor housing and the gas/oil mixture is discharged from the screw at high pressure. This completes the compression cycle for a single flute of the main screw.

Once the gas is swept from the main screw flute through the discharge port, it passes into the discharge manifold of the compressor. From the discharge manifold, the gas/oil exits the compressor housing.

Capacity and Volume Control

The Vilter™ VSG compressors feature the exclusive Parallex™ Slide System, which consists of a pair of slides for each gate rotor assembly. These two independently operated slides are referred to as the capacity slide and the volume ratio slide. On the suction end of the screw, the capacity slide moves to vary the timing of the beginning of the compression process. With the slide moved all the way out to the suction end of the screw (the 100% position), the compression process begins immediately after the gate rotor tooth enters the screw flute and closes off the end of the groove. In this situation, the maximum volume of gas is trapped in the screw flute at the start of the compression process. As the slide is pulled back away from the suction end of the screw, the start of the compression process is delayed as some of the suction gas is allowed to spill back out of the screw flute until the screw rotates far enough to pass the end of the capacity slide and begin compressing. This causes a reduced volume of gas to be trapped in the screw flute when the compression process begins. In this way, the capacity of the compressor is reduced from 100% down to as low as 10% of the full rated capacity.

The capacity slide provides the means for controlling specific process set points. By continuously adjusting the flow of gas through the compressor, either suction or discharge pressure in a particular process can be controlled. When coupled with a microprocessor controller, the adjustable capacity slide allows for precise and continuous automatic control of any parameter in the process to a chosen set point.

The second slide for each gate rotor is the volume ratio slide. The purpose of the volume ratio slide is to maximize the efficiency of the compressor by matching the gas pressure within the screw flute at the point of discharge to the downstream process requirements. The volume ratio slide operates at the discharge end of the screw, and acts to vary the position of the discharge port. When the slide is extended fully to the discharge end of the screw (the 100% position), the compression process within the screw flute continues until the screw rotates far enough for the flute to pass the end of the volume ratio slide. At this point, the screw flute lines up with the discharge port and the compressed gas is expelled from the screw flute. As the volume ratio slide is pulled back away from the discharge end of the screw, the position of the discharge port is changed and the gas is allowed to escape the screw flute earlier in the compression process, at a reduced pressure.

The overall volume ratio within the compressor is determined by the distance between the front of the capacity slide (the start of compression) and the back of the volume ratio slide (the completion of compression). Therefore, the volume ratio slide must respond to changes in the downstream pressure measured in the oil separator and position itself for the required compression ratio based on the position of the capacity slide. By only compressing the gas within the screw as far as required to match the pressure in the downstream receiver, the compressor efficiency is maximized. Proper positioning of the volume ratio slide prevents either over compressing or under compressing of the gas within the screw flute. This allows the single screw compressor to efficiently handle a range of volume ratios from as low as 1.2 up to 7.0.

Description of a Gas System for a Standard Compressor Set

The gas passes through a stop valve and a check valve and then through a mesh strainer mounted directly to the inlet flange. The check valve is necessary to prevent reverse rotation and potential damage or oil loss at shut down. The suction gas enters the compressor housing through the top inlet flange, at the driven end of the unit.

After compression the gas is discharged from the discharge manifold directly into a oil separator tank. On the discharge of the oil separator tank another check valve is positioned to prevent the entry of gas or liquid refrigerant in to the separator when the compressor is shut down. The separator should be allowed to equalize slowly to suction pressure through a small bypass line around the suction check or combination stop/check valve. This will allow the compressor to start without a pressure differential across it, reducing the starting power requirements.

From the discharge manifold, the gas/oil exits the compressor housing and passes into the oil separator through a pipe elbow. The separator vessel serves to separate the oil from the gas as the gas stream moves from one end of the separator to the other. The majority of the oil is separated from the gas in the primary chamber of the vessel due to changes in direction and velocity reduction. Any remaining oil mist is separated from the gas stream as the stream passes through the coalescing elements and into the secondary chamber of the vessel. The gas at discharge pressure then exits at the far end of the separator.

Oil collected in the bottom of the separator is drained off to be recirculated in the oil injection system. The injection oil temperature is controlled by several means the first of which is a three-way mixing valve, which mixes hot oil directly from the separator with oil which has passed through the oil cooler to obtain oil at the desired temperature. This oil then passes through a filter to remove any contaminants, which may have been picked up from the process gas, and is injected back into the compressor.

Description of an Oil System for a Standard Compressor Set

At start oil at is drawn from the oil separator tank by the oil pump, and passes through a oil cooler and micronic filters to the oil supply inlet on the compressor frame. From there it internally lubricates all points internal to the compressor. After start-up when the compressor develops sufficient differential pressure the oil pump can be shut down and the oiling can take place without the use of the oil pump. On units with low pressure differentials such as booster and low pressure differential high stage compressors, the oil pump must remain on whenever the unit is running to maintain sufficient oil flow.

Critical Applications Guidelines

To ensure the successful operation of the VSG compressor, the guidelines described below should be followed.

1. Proper lubrication is critical to the operation of the VSG compressor. The compressor relies on the injected oil to absorb and remove the heat of compression, to seal the compression chambers formed in the flutes of the screw, and to lubricate all moving parts. For this reason, it is imperative that the oil chosen be of correct viscosity, and that sufficient oil flow be provided at all times, using an auxiliary oil pump when necessary. The oil chosen must be compatible with the process gas as well, to prevent absorption of the gas into the oil, which would dilute the oil and reduce the viscosity. Also, oil filtration to 25 micron nominal particle size is required to ensure that only clean oil is injected into the compressor. For assistance in choosing the correct oil for the application and in sizing an auxiliary oil pump, consult a Vilter™ representative.
2. Injection oil temperature must be closely controlled for optimum performance. Oil temperature must be maintained a minimum of 15 - 20°F above the gas mixture dewpoint at anytime to prevent condensation or liquid knockout from occurring within the compressor.
3. Gas composition plays a role in the performance of the VSG compressor as well. While the VSG is capable of handling a wide variety of gases, it is required that the concentration of H_2S in the process gas not exceed 100 PPM. If H_2S is present in the process gas in any concentration, special oil additives are required to protect the compressor from corrosion.

Notice on using Non-Vilter Oils

Oil and its additives are crucial in refrigeration system performance. Vilter™ Manufacturing will **NOT APPROVE** non-Vilter oils for use with Vilter™ compressors. Due to the innumerable choices available it is not possible for us to test all oils offered in the market place, and their effects on our equipment, as we can with our own lubricants.

We realize that customers may choose compressor lubricants other than Vilter™ branded oil. This is certainly within the customers' right as owners of the equipment. When this choice is made, however, Vilter™ is unable to accept responsibility for any detrimental affects those lubricants may have on the equipment or system performance and durability.

Should a lubrication related system issue occur with the use of non-Vilter oils, Vilter™ may deny warranty upon evaluation of the issue. This includes any parts' failure caused by inadequate lubrication.

Certainly, there are many good refrigeration lubricants in the market place. The choice of a lubricant for a particular application involves consideration of many aspects of the lubricant and how it and its additive package, will react in the various parts of the entire refrigeration system. It is a complex choice that depends on a combination of field experience, lab and field-testing, and knowledge of lubricant chosen. Vilter™ will not accept those risks other than for our own compressor lubricants.

Alarm and Shutdown Readings

The control system for the VSG compressor must protect the machine from damage caused by running outside of normal operating conditions by providing operators with alarms when operating parameters have reached an abnormal condition, and by automatically stopping the compressor before these conditions can cause a unit failure. Pressures and temperatures of the process gas and the oil, as well as motor amperage and slide positions must all be continuously monitored to ensure the compressor is operating properly.

1. Low Gas Suction Temperature - This point protects the compressor from suction gas entering the compressor at too low of a temperature, and is activated by a direct reading from the suction temperature RTD located in the suction "T".

2. High Gas Discharge Temperature - This point protects the compressor against high gas temperature at the discharge of the unit, and is activated by a direct reading from the RTD located in the compressor discharge manifold.

3. Low Oil Separator Start Temperature - This point protects the compressor from starting with low oil temperature in the separator, and is activated by a direct reading from the RTD located in the bottom of the oil separator.

4. Low Oil Separator Run Temperature - Similar to the Low Oil Separator Start Temperature described above, however this point only becomes active after a predetermined period of running time, and uses a higher setpoint.

5. Low Oil Injection Temperature - This point protects the compressor from running with cold oil being injected into the screw housing, and is activated by a direct reading from the RTD located in the oil injection line. This point is bypassed for a predetermined period of time after starting to allow the unit time to start and warm up.

6. High Oil Injection Temperature - This point protects the compressor from running with hot oil being injected into the screw housing, and is activated by a direct reading from the RTD located in the oil injection line.

7. Low Suction Pressure - This point protects the compressor from drawing low suction pressure and is activated by a direct reading from the suction pressure transducer, which reads the pressure from a tap located in the suction stop/check valve housing.

8. High Discharge Pressure - This point protects the compressor from developing high discharge pressure and is activated by a direct reading from the discharge pressure transducer, which reads the pressure from a tap located in the oil separator. In addition to this alarm and shutdown, the compressor package is ultimately protected from damage due to over pressurization by at least one discharge pressure relief valve located on the oil separator. The purpose of this safety setpoint is to allow for a lower setpoint to conform to a process requirement, and to prevent the relief valve from opening.

9. Prelube Oil Pressure - This point acts as a permissive to start the compressor, and protects against the compressor starting with no oil lubrication. If, during a start sequence, the prelube oil pressure fails to rise above 4.0 PSID, the compressor will fail to start. The prelube oil pressure is a calculated value obtained by subtracting the discharge pressure reading from the oil manifold pressure (oil filter outlet pressure) reading.

10. Low Oil Pressure - This point protects the compressor from running with insufficient lubrication pressure, and becomes active after a predetermined period of running, usually sixty seconds. The oil pressure is a calculated value obtained by subtracting the suction pressure from the oil manifold pressure (oil filter outlet pressure) reading, which results in the actual pressure under which the oil is entering the screw housing.

11. High Running Oil Filter Differential Pressure - This point alerts operators to clogging oil filters. When the oil filters develop a high differential pressure while running at normal operating temperatures, it is an indication that they are becoming dirty and must be changed. An alarm initially warns of dirty filters; if the situation worsens before the filters are changed a shutdown will stop the compressor.

In most cases, the safety setpoints described above will have settings which are dictated by process requirements, and not necessarily mechanical constraints of the compressor. Process pressures and temperatures may vary considerably depending on the application of the compressor, and the VSG compressor is designed to work well in a broad range of applications. For this reason, it is impractical to suggest “initial” setpoints to fit all applications. Instead, minimum and maximum values for each safety setpoint are provided, while precise settings for the safety setpoints must be derived for each installation.

VSG Package Requirements

Process Gas Circuit

1. Suction Gas Stop/Check Valve - The VSG compressor requires a manually operated stop valve on the suction line to the compressor to allow for isolating the compressor package from process gas. Also, a check valve is required in the suction line to limit reverse rotation of the compressor on shutdown.

2. Suction Line Strainer - Vilter™ strongly recommends the use of an inline suction gas strainer to protect the VSG compressor from foreign material which may enter the compressor with the suction gas. This strainer is generally of stainless steel mesh construction. Vilter™ can provide assistance in designing a strainer housing specifically suited to VSG applications.

3. Process Gas/Oil Separator - A separator vessel capable of removing the oil from the discharge gas stream with an efficiency down to at least 5 PPM oil carryover is required. Vilter's own available horizontal separator is an ASME-coded vessel which uses five stages of separation to achieve an oil loss of as little as 3 to 4 PPM.

4. Discharge Gas Relief Valve - To protect the compressor package from damage due to over pressurization, a relief valve must be installed inside of any discharge line hand block valves. The relief valve must be set to open at a pressure lower than the Maximum Allowable Working Pressure (MAWP) of the separator.

5. Oil Prelube Pump - Usually a direct driven gear type pump, the oil pump is required to prelube the compressor prior to starting and to maintain oil pressure during any periods of low compression ratio operation.

6. Oil Cooler/ Temperature Control Valve - An oil cooler, either air or water cooled, must be used to remove the heat of compression from the oil stream. A temperature control valve is used to maintain constant oil injection temperature to the compressor.

7. Oil Filtration - Large capacity micronic oil filters are required to filter the oil before injection into the VSG compressor. Filtration down to 25 microns nominal or less is generally acceptable. Dual filters are recommended to allow replacement of one cartridge while the compressor continues running with the other cartridge in service.

8. Oil Heater - An oil heater is generally required and must be sized to maintain oil temperature of at least 90°F when the compressor is not running. For outdoor installations, low ambient temperatures and winds must be considered when sizing the oil heater. Also, insulating the separator and oil piping may be required in low temperature ambient conditions.

NOTE

Because the oil system on the VSG compressor utilizes discharge gas pressure as the means to move the injection oil through the system, it must be remembered that all components of the oil system are exposed to full discharge pressure and must be pressure rated accordingly.

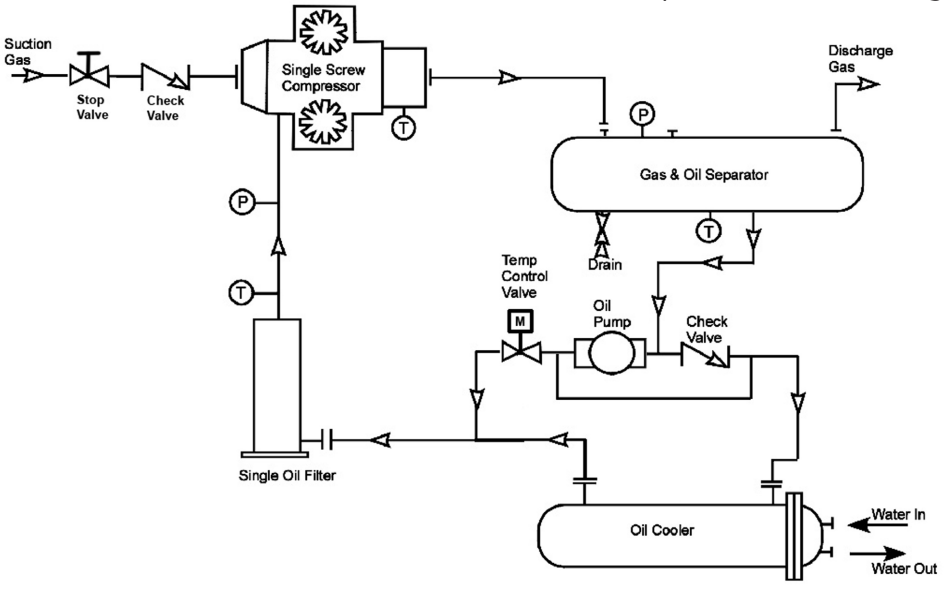


Figure 2-1. Basic Single Screw Compressor System

Long Term Storage Requirements

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.

NOTE

At the time of purchase Vilter™ Manufacturing must be notified.

1. The compressor(s) must be stored in a heated building, preferably air conditioned to control moisture, to prevent corrosion of the main rotor shaft and for the compressor. The slide valve(volume ratio& capacity) motors and gears.
2. The main rotor shaft must be coated with light grease to prevent rusting.
3. (For Screw Compressors) The volume and capacity slide valve motor enclosures should have corrosion inhibitors installed in them and the enclosures should be sealed. On a six month basis (depending on relative humidity), check and replace inhibitors as necessary, and check for signs of corrosion.
4. Before leaving Vilter™ Manufacturing the compressor is evacuated and pressurized, with dry nitrogen, to 5 psig (5 psi above atmospheric pressure). Pressure must be monitored with the gauge (provided by Vilter™) and checked on a regular basis (at least monthly).
5. The rotor shaft must be rotated every 3 months to prevent flat spots from developing on the bearing surfaces and to keep the shaft seal lubricated.
6. A log should be maintained indicating that the above procedures have been completed.

When the compressor is installed.

1. Look into the suction and discharge connections and inspect for any signs of corrosion on parts.
2. Prelube the compressor with the main oil pump and rotate by hand several revolutions prior to start.
3. Notify the Vilter™ 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 records.

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)

Instrumentation Requirements

Pressure

There are four pressure transducers required to read system pressures as listed below.

1. **Suction pressure transducer (-15.0 - 300 PSIG)** measures the gas suction pressure into the compressor housing, which provides the permissive to start for minimum suction pressure, and is used for annunciation of low suction pressure while running and in the capacity control logic.
2. **Discharge pressure transducer (-15.0 - 300 PSIG)** measures the discharge pressure of the process gas in the separator, which provides annunciation for high discharge pressure, and may also be used for capacity control logic.
3. **Oil Filter Inlet pressure transducer (-15.0 - 300 PSIG)** measures the oil pressure as it enters the oil filter canisters and is used to calculate oil filter differential pressure to provide annunciation of high filter differential pressure
4. **Oil Manifold pressure transducer (-15.0 - 300 PSIG)** measures the oil pressure downstream of the oil filter as the oil is injected into the compressor, and provides annunciation protection for low prelube oil pressure, and low running oil injection pressure.

Additional pressure transducers may be required and installed by the customer for pressure readings at customer specified points such as process gas discharge pressure from the package boundary, cooling water pressure to and/or from the oil cooler, etc.

Temperature

There are four temperature readings required for processor control, as listed below.

1. **Suction temperature RTD** measures the temperature of the incoming suction gas, and is used to provide annunciation for low suction temperature when the unit is running.
2. **Discharge temperature RTD** measures the temperature of the gas/oil mixture as it is discharged from the compressor housing, and provides annunciation for high running discharge temperature.
3. **Oil Separator temperature RTD** measures the temperature of the oil in the separator sump, and gives the oil temperature start permissive and low running separator temperature annunciation.
4. **Oil Injection temperature RTD** measures the temperature of the oil as it is injected into the compressor, which provides annunciation for either high or low running oil injection temperature.

** Additional RTD's may be required and installed by the customer for temperature readings at customer specified points such as discharge gas temperature from the package boundary, cooling water temperature to and/or from the oil cooler, gas aftercooler temperature, etc.*

Miscellaneous

Additional instrumentation devices required are a current transformer mounted around one phase of the drive motor leads to measure main motor amperage, and two rotary potentiometers to read the position of the slides. The amperage signal provides annunciation for high motor amperage, and is used in the capacity control logic. The rotary potentiometers indicate the position of the slides, which is used as a starting permissive and in the capacity control logic. Also, additional input points may be required for customer connection of remote signals such as Start and Stop commands, and capacity setpoint control.

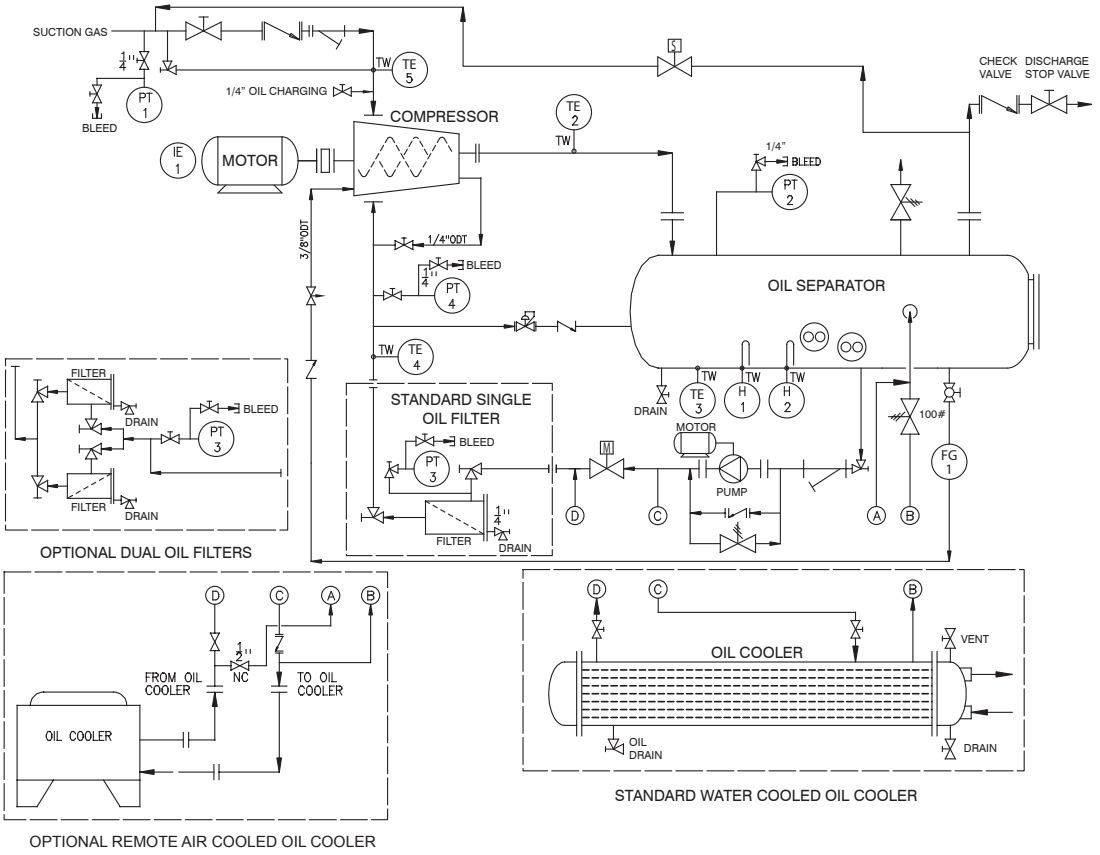


Figure 3-1. Additional Instruments

Piping

Before installing piping, the compressor inlet and outlet x Piping should be supported so that no piping loads are transmitted to the compressor casings.

All piping should be inspected for cleanliness before installation. As each pipe is connected to the compressor, the coupling alignment should be checked to ensure that no alteration has taken place.

If alignment has altered, the compressor is being strained and the piping supports must be adjusted.

It is not sufficient merely to re-align the drive coupling, as this will not correct the cause of the strain.

Compressors must have an inlet strainer permanently fitted to the compressor inlet.

Care must be taken to avoid trapping the lines except for specific purposes. When traps are used, the horizontal dimensions should be as short as possible to avoid excessive oil trapping.

Steel pipe is generally used in large installations when joints are welded.

In making up joints for steel pipe, the following procedures should be followed:

For threaded connections, all threads on the pipe and fitting should be carefully cleaned to remove all traces of grease or oil. Threads should then be wiped dry with a lintless cloth. Only thread filling compounds suitable for service should be used for making steel pipe joints. These compounds should be used sparingly, and on the pipe only. Do not put any on the first two threads to prevent any of the thread sealing compound from entering the piping system. Acetylene or arc welding is frequently used in making steel pipe joints, however, only a skilled welder should attempt this kind of work. Take care to see no foreign materials are left in the pipes and remove all burrs formed when cutting pipe.

For halocarbon piping, only wrought copper fittings should be used. Cast fittings as used for water service are porous and will allow the refrigerant to escape. Note this exception: In larger pipe sizes, wrought fittings are not available. However, specially tested cast fittings are available and these may be used with complete safety.

It is important to avoid short, rigid pipe lines that do not allow any degree of flexibility. This must be done to prevent vibration being transmitted through the pipe lines to the buildings. One method of providing the needed flexibility to absorb the vibration is to provide long lines that are broken by 90° Ells in three directions.

A second method would be to install flexible pipe couplings as close to the compressor unit as possible with connections run in two different directions, 90° apart. These flexible connections should be installed on both the high and low side lines of the compressor unit.

Hangers and supports for coils and pipe lines should receive careful attention. During prolonged operation of the coils, they may become coated with ice and frost, adding extra weight to the coil. The hangers must have ample strength and be securely anchored to withstand the vibration from the compressor and adequately support the pipe lines.

This information is taken from and ANSI B31.3. The installing contractor should be thoroughly familiar with these codes, as well as any local codes.

Recommended Header Piping

The following would be the recommended configurations for the compressor's piping.

Compressor Suction Piping

Whenever possible, follow these guidelines:

- 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.
- Were possible use several 90-degree 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.
- Avoid excessive piping loads when piping to equipment, see Table 3-1.

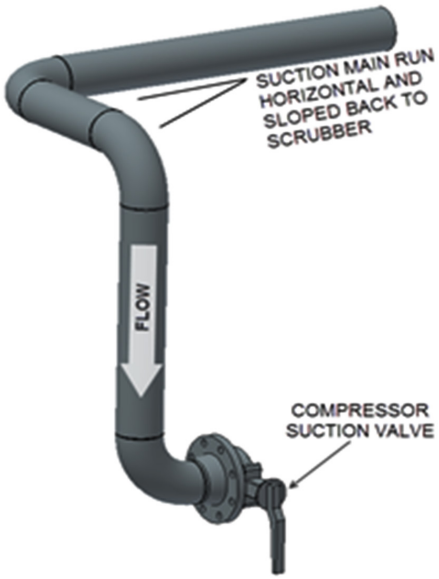


Figure 3-2. Single Compressor Suction Piping

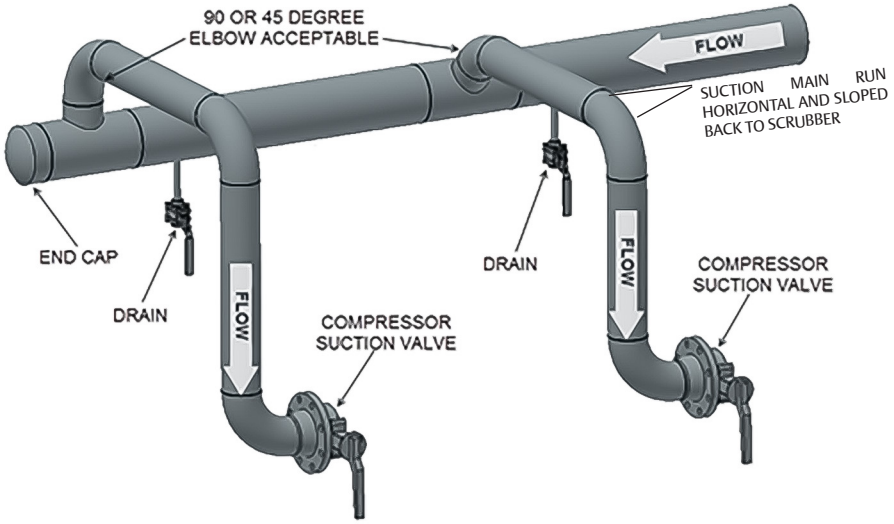


Figure 3-3. Multiple Compressor Suction Piping

Compressor Discharge Piping

Whenever possible, follow these guidelines:

- 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. If your local codes prohibit laterals, tees or saddled connections are acceptable entrances.
- 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.
- Avoid excessive piping loads when piping to equipment, see Table 3-1.

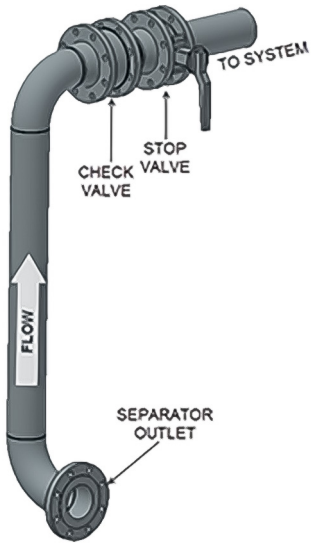


Figure 3-5. Single Compressor Discharge Piping

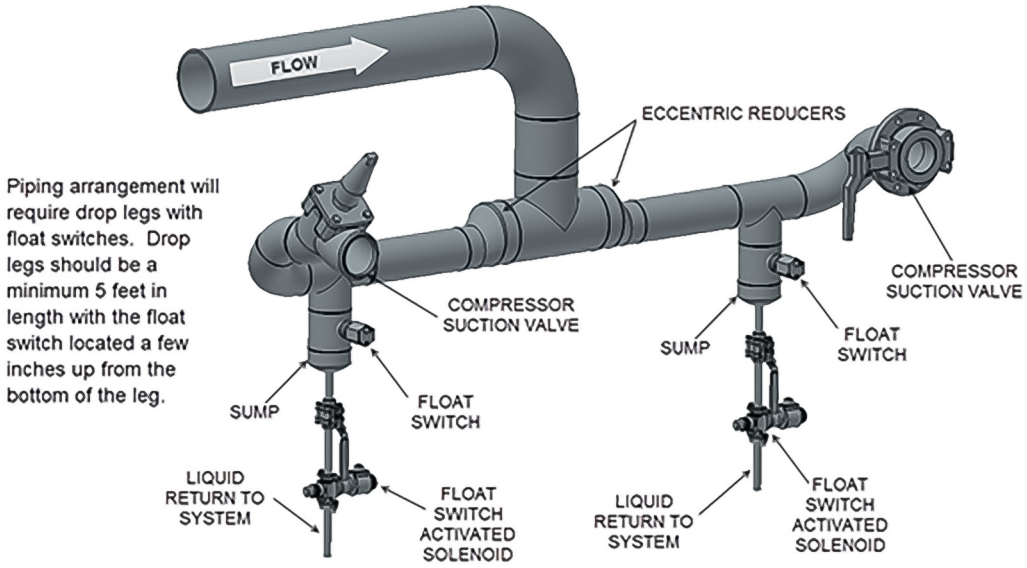


Figure 3-4. Multiple Compressor Suction Piping (Where Drain Back to Accumulator Is Not Possible)

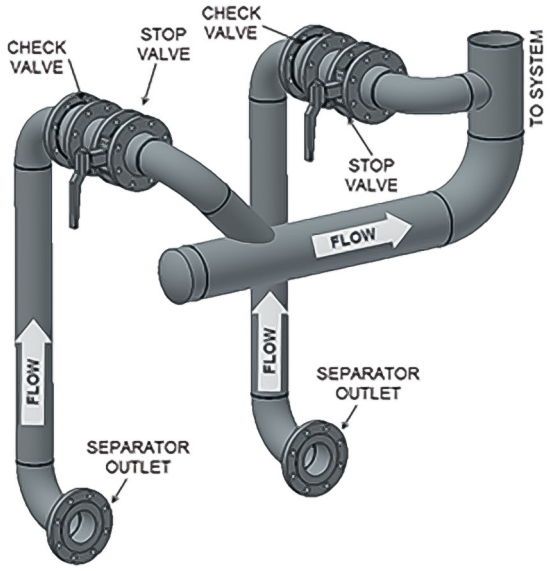


Figure 3-6. Multiple Compressor Discharge Piping, Vertical To System

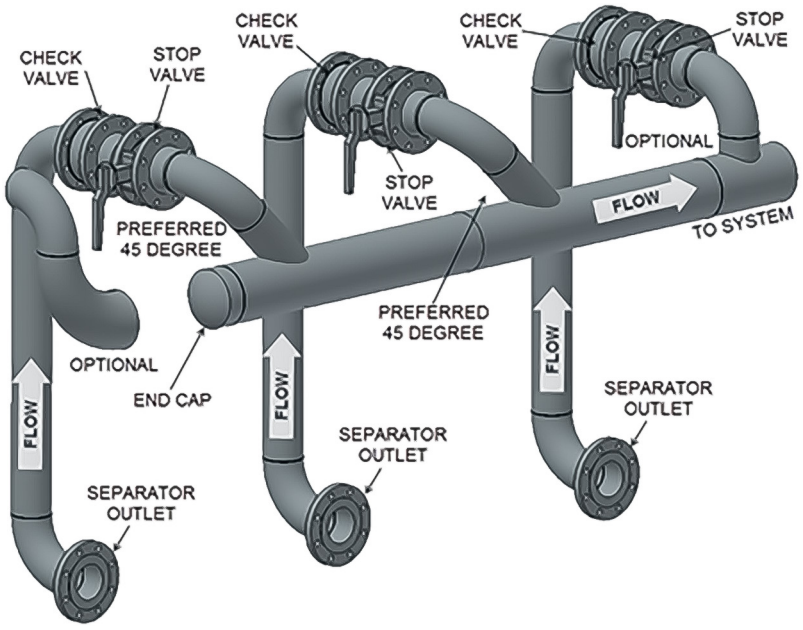


Figure 3-7. Multiple Compressor Discharge Piping, Horizontal to System With Options

Oil Line and Aftercooler Piping

Whenever possible, follow these guidelines:

- Vertical drops should be no higher than 8 to 10 feet.
- In the event that 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 the equipment service valves.
- With ambient temperatures below 50°F, heat trace and insulation on oil lines and air cooler heads must be installed.
- The maximum pressure drop on oil lines to and from the air cooler and compressor must not exceed 5 to 10 psi. (Check drawing note).
- Avoid excessive piping loads when piping to equipment, see Table 3-1.

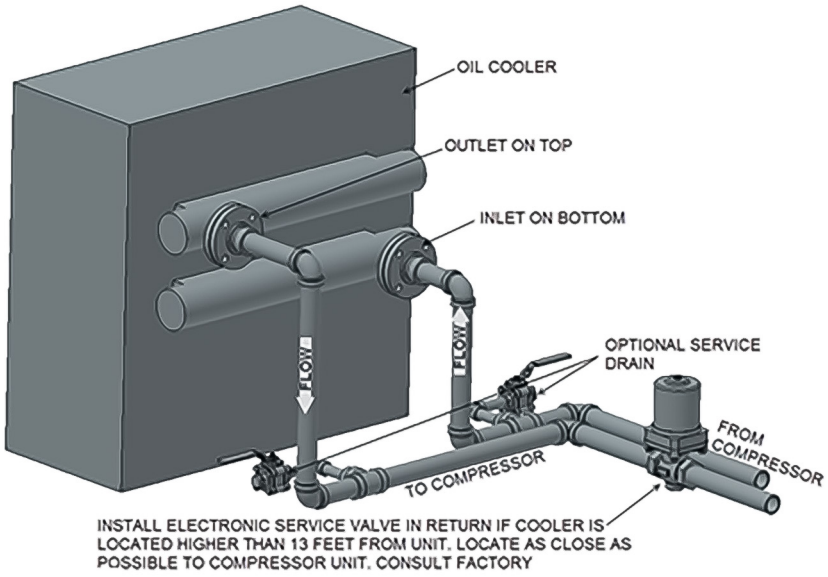


Figure 3-8. Compressor Oil Line piping to Air-Cooled Oil Cooler

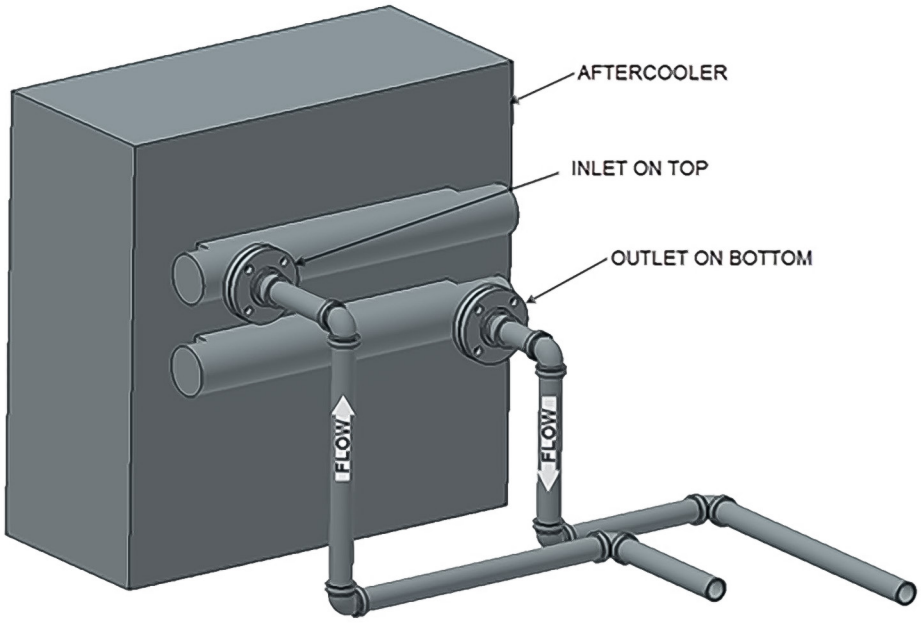


Figure 3-9. Aftercooler Piping

Air Cooled Condenser Piping

- Minimum slope for horizontal refrigerant condenser liquid gravity drain lines (Open Channel Flow).

Nominal pipe size (Inches)	Minimum Slope (Inches/Feet)
1 through 1-1/2	1/2
2 through 4	3/8
Larger than 4	1/4

- Contact the factory if equipment room layout does not allow the recommended heights.
- Avoid excessive piping loads when piping to equipment.

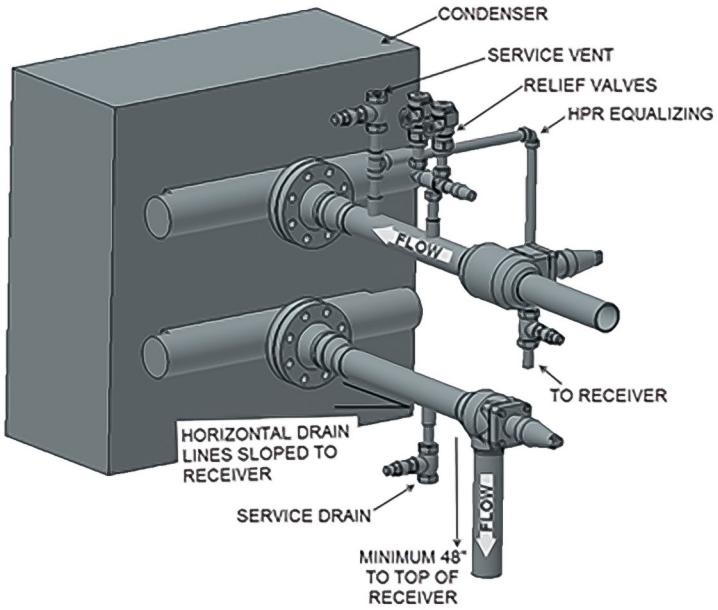


Figure 3-10. Single Refrigeration Air-Cooled Condenser Piping

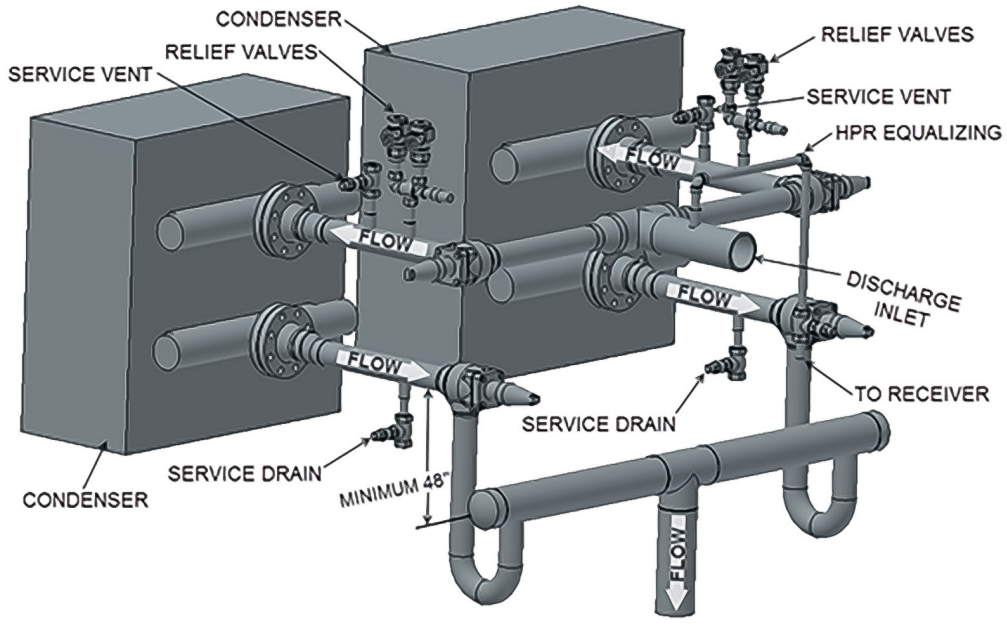


Figure 3-11. Refrigeration Multiple Air Cooled Condenser Piping

Allowable Flange Loads

While ideally the flanges of a Vilter compressor should not be strained with any loads, thermal, dead, live, wind & seismic loads applied to unit connections must be considered & even tolerated on the field. Even well supported external piping connected to the compressor will result in some loads applying forces and moments to flanges in three axes.

The most important issue is the motor/compressor misalignment caused by external forces and moments imposed by plant piping. Table 3-1 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 B31.5 / 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 (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

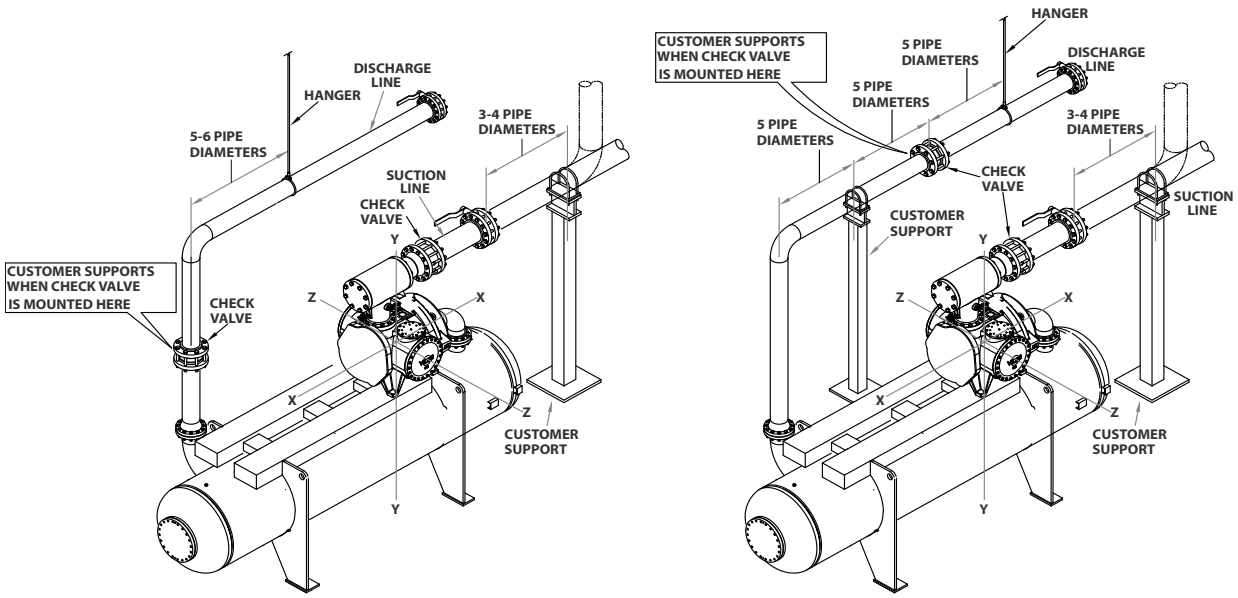


Figure 3-12. Piping Elements Support

Testing System For Leaks

Vilter™ equipment is tested for leaks at the factory. One the most important steps in putting the system into operation is field testing for leaks. This must be done to assure a tight system that will operate without any appreciable loss of gas.

First, if test pressures exceed the settings of the system, relief valves or safety devices, they must be removed and the connection plugged during the test. Secondly, all valves should be opened except those leading to the atmosphere. Then, open all solenoids and pressure regulators by the manual lifting stems. All bypass arrangements must also be opened.

Hydrocarbons Systems

"Oil pumped" dry nitrogen, or anhydrous CO_2 in this order of preference may be used to raise the pressure to the proper level for testing.

When the proper pressure is attained, test for leaks with the soap mixture previously described. After all leaks are found and marked, relieve the system pressure and repair the leaks. Never attempt to repair soldered or welded joints while the system is under pressure. Soldered joints should be opened and re soldered.

Do not simply add more solder to the leaking joint. After all the joints have been repaired and the system is considered "tight".

Remove the drum and bring the pressure to the recommended test level with oil pumped dry nitrogen or CO_2. Then check the entire system again for leaks, using a halide torch or electronic leak detector. Be sure to check all flanged, welded, screwed and soldered joints, all gasketed joints, and all parting lines on castings. If any leaks are found, they must be repaired and rechecked before the system can be considered tight again, remembering that no repair should be made to welded or soldered joins while the system is under pressure.

Notice on Using Non-Vilter Oils

Oil and its additives are crucial in system performance. Vilter™ Manufacturing will **NOT APPROVE** non-Vilter™ oils for use with Vilter™ compressors. Due to the innumerable choices available it is not possible for us to test all oils offered in the market place, and their effects on our equipment.

We realize that customers may choose lubricants other than Vilter™ branded oil. This is certainly within the customers' right as owners of the equipment. When this choice is made, however, Vilter™ is unable to accept responsibility for any detrimental affects those lubricants may have on the equipment or system performance and durability.

Should a lubrication related system issue occur with the use of non-Vilter™ oils, Vilter™ may deny warranty upon evaluation of the issue. This includes any parts' failure caused by inadequate lubrication.

Certainly, there are many good lubricants in the market place. The choice of a lubricant for a particular application involves consideration of many aspects of the lubricant and how it and its additive package will react in the various parts of the entire system. It is a complex choice that depends on a combination of field experience, lab and field-testing, and knowledge of lubricant chosen. Vilter™ will not accept those risks other than for our own lubricants.

Oil for Single Screw Compressors

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

Installation and Calibration of Slide Valve Actuators

Slide Valve Actuator Installation Instructions

CAUTION

When installing the optical slide motor, loosen locking collar before sliding the collar down on the shaft. Do not use a screwdriver to pry locking collar into position.

Calibration of an optical slide valve actuator is a two step process that must be done for each actuator installed of the compressor. Briefly, the steps are as follows.

1. The actuator motor control module, located inside the actuator housing, is calibrated so that it knows the minimum and maximum rotational positions of the slide valve it controls. The calibrated actuator will output 0 VDC at the minimum position and 5 VDC at the maximum position.
2. After the actuator motor control module has been calibrated for 0-5Volts, the controlling channel corresponding to the actuator motor (either the capacity or volume) has to be calibrated. This instructs the control panel to learn the rotational 0% position & rotational 100% position of the slide valve travel.

NOTE

Because there is an optical sensor on this motor, do not attempt calibration in direct sunlight.

Actuator Motor Control Module Calibration Procedure

1. Disable the Slide Non-Movement Alarm by going to the "Setup" menu on the control panel and choosing "Alarm Disable" for the Slide Non-Movement Option. (If applicable).
2. Completely shut off the power to the control panel completely.
3. If not already done, mount the slide valve actuator per ("Vilter™ Actuator set up for Capacity and Volume Slide Motors). Next, wire the actuator per the attached wiring diagrams, using the already installed electrical conduit to run the cables. The old wiring can be used to pull the new cables through the conduit to the control panel. The cables may also be externally tie-wrapped to the conduit. **Run the yellow AC power cable(s) and the gray DC position transmitter cable(s) in different conduit.** This prevents the DC position transmitter cable from picking up electrical noise from the AC power cable. **Do not connect either of the cables to the actuators yet.**

In addition, if the actuators are replacing old gearmotors on early units, **you must remove the capacitors and associated wiring from inside the control panel.** This is necessary to prevent electrical damage to the new actuator motor.

4. When completing the calibration of the new actuators, the motors are signaled to move to below 5%. This may not completely occur when exiting the calibration screen due to a "program timer". HOWEVER, when the compressor actually starts, the motors will travel below 5% and function correctly. The user may see that the actuators are not below 5% after calibration and try to find the reason. If the calibration screen is re-entered right away and then exited, the timer will allow the actuator to go below the 5% on the screen. This may be perceived as a problem; in reality, it is not.

NOTE

The 0 to 5V-position transmitter output of the actuator will fluctuate wildly during the calibration process. To prevent damage to the actuators, do not connect the yellow power cable or the gray position transmitter cable until instructed to do so later on.

5. Open the plastic cover of the capacity motor by removing the four #10 screws.

CAUTION

There are wires attached to the connector on the plastic cover. Handling the cover too aggressively could break the wires.

6. Gently lift the cover and tilt it toward the Turck connectors. Raise the cover enough to be able to press the blue calibrate button and be able to see the red LED on the top of assembly.
7. Press "Menu" on the main screen and then press the "Slide Calibration" button, to enter the slide calibration screen.

NOTE

You must be in this slide calibration screen before attaching the yellow power cable or gray position transmitter cable.

8. Now connect the yellow power cable and the gray position transmitter cable to the actuator.
9. Press INC and DEC to move the slide valve and check for the correct rotation. See Table 4-1 on page for Actuator/command shaft rotation specifications.

NOTE

If the increase and decrease buttons do not correspond to increase or decrease shaft rotation, swap the blue and brown wires of the "yellow power cable". This will reverse the rotation of the actuator/ command shaft.

10. 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.

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.

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.

11. Use the DEC button on the control panel to drive the slide valve to its minimum "mechanical stop" position. **Do not continue to run the actuator in this direction after the slide valve has reached the stop. Doing so may cause damage to the actuator or the slide valve.** When the slide has reached the mechanical stop position, use the INC button 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, indication that the minimum slide valve position (0V position) has been set.
13. Use the INC button on the control panel to drive the slide to its maximum "mechanical stop" position. **Do not continue to run the actuator in this direction after the slide valve has reached the stop. Doing so may cause damage to the actuator or the slide valve.** When the slide valve has reached the mechanical stop position, use the DEC button to pulse the actuator to where the slide is just off of its mechanical stop and there is no tension on the motor shaft.
14. 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. Now the capacity or volume channel of the control panel can be calibrated.
15. Use the Dec button to move the actuator towards its minimum position while watching the millivolt readout on the control panel screen. Discontinue pressing the DEC button when the millivolt reading in the "Current" window above the "Set Min" button is approximately 500 millivolts.
16. Now use the DEC and INC buttons to position the slide valve until a value close to 300 millivolts is on the screen. Then, press the "Set Min" button for the capacity or volume slide valve window to tell the controller that this is the minimum millivolt position. Note: The value in the "Current Cap" or "Current Vol" window has no meaning right now.
17. Use the INC button to rotate the actuator towards its maximum position while watching the millivolt readout on the controller screen. Discontinue pressing the INC button when the millivolt reading in the "Current" window is approximately 4200 millivolts (2900 millivolts for the 2783J qualified analog boards). You are nearing the mechanical stop position.
18. Pulse the INC button to carefully move the slide valve until the millivolt readout "saturates", or stops increasing. This is around 4500 millivolts (2400 millivolts for 2783 qualified analog boards).
19. Pulse the DEC button until the millivolts just start to decrease. (This is the point where the channel drops out of saturation). Adjust millivolt value to 300 millivolts below recorded maximum millivolts in step #22.
20. Press the "Set Max" button.
21. Press the "Main" button to complete calibration and exit the "Slide Calibration" screen. 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.

22. Gently lower the plastic cover over the top of the actuator to where it contacts the base and O-ring seal. After making sure the cover is seated properly, gently tighten the four #10 screws.

CAUTION

The plastic cover will crack if the screws are over tightened.

23. Enable the “Slide Non-Movement Alarm” by going to the “Setup” menu and choosing “Alarm Enable” for the “Slide Non-Movement Option”.
24. This completes the calibration for this channel either capacity or volume. Repeat the same procedure to the other channel.

Slide Valve Operation

The slide valve actuator is a gear-motor with a position sensor. The motor is powered in the forward and reverse directions from the main computer in the control panel. The position sensor tells the main computer the position of the slide valve. The main computer uses the position and process information to decide where to move the slide valve next.

The position sensors works by optically counting motor turns. On the shaft of the motor is a small aluminum “photochopper”. It has a 180 degree fence that passes through the slots of two slotted optocouplers. The optocouplers have an infrared light emitting diode (LED) on one side of the slot and a phototransistor on the other. The phototransistor behaves as a light controlled switch. When the photochopper fence is blocking the slot, light from the LED is prevented from reaching the phototransistor and the switch is open. When photochopper fence is not blocking the slot, the switch is closed.

As the motor turns, the photochopper fence alternately blocks and opens the optocoupler slots, generating a sequence that the position sensor microcontroller can use to determine motor position by counting. Because the motor is connected to the slide valve by gears, knowing the motor position means knowing the slide valve position.

During calibration, the position sensor records the high and low count of motor turns. The operator tells the position sensor when the actuator is at the high or low position with the push button. Refer to the calibration instructions for the detailed calibration procedure.

The position sensor can get “lost” if the motor is moved while the position sensor is not powered. To prevent this, the motor can only be moved electrically while the position sensor is powered. When the position sensor loses power, power is cut to the motor. A capacitor stores enough energy to keep the position sensor circuitry alive long enough for the motor to come to a complete stop and then save the motor position to non-volatile EEPROM memory. When power is restored, the saved motor position is read from EEPROM memory and the actuators resumes normal function.

This scheme is not foolproof. If the motor is moved manually while the power is off or the motor brake has failed, allowing the motor to free wheel for too long after the position sensor looses power, the actuator will become lost.

A brake failure can sometimes be detected by the position sensor. If the motor never stops turning after a power loss, the position sensor detects this, knows it will be lost, and goes immediately into calibrate mode when power is restored.

Notice on Using Non-Vilter Oils

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Should a lubrication related system issue occur with the use of non-Vilter™ oils, Vilter™ may deny warranty upon evaluation of the issue. This includes any parts' failure caused by inadequate lubrication.

Certainly, there are many good lubricants in the market place. The choice of a lubricant for a particular application involves consideration of many aspects of the lubricant and how it and its additive package will react in the various parts of the entire system. It is a complex choice that depends on a combination of field experience, lab and field-testing, and knowledge of lubricant chosen. Vilter™ will not accept those risks other than for our own lubricants.

Safety Setpoints

A detailed explanation of all safety setpoints can be found in the Compact Logix PLC manual, p/n 35391CL.

1. Oil Pressure

Low oil pressure differential stops the compressor unit when there is an insufficient difference in pressure between the oil manifold and suction.

2. Discharge Pressure

High discharge pressure cutout stops the compressor unit, when the discharge pressure in the oil separator exceeds the setpoint.

3. Suction Pressure

Low suction pressure cutout stops the compressor unit when the suction pressure drops below the setpoint.

4. Oil Filter Differential

High oil filter differential cutout stops the compressor unit when the difference between the outlet and inlet of the filter exceeds the setpoint.

5. Oil Temperature

The oil temperature cutout stops the compressor unit when the oil temperature is too high or too low.

6. Discharge Temperature

The high discharge temperature cutout stops the compressor unit when the discharge temperature exceeds the setpoint.

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 transducers. To use the block and bleed valves to recalibrate the pressure transducers, 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 transducer enclosure. The transducer 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 transducer cannot be isolated from its pressure source, so it is equipped with only a valve to allow an accurate pressure gauge to be attached and the pressure transducer calibrated at unit pressure.

Recheck the transducers periodically for any drift of calibration, refer to maintenance/service interval table 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 accomplish. 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 prelubre pressure above setpoint set in the HMI. For additional information on Low Oil Pressure at Start, see Troubleshooting Guide - General Problems and Solutions 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 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 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 take 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 push.

Slide Valve Actuator Calibration (25972XP)

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

Slide Calibration Screen Overview

- Must be logged in as "MGR" to calibrate slides.
- Press "Enter Slide Calibration" To Activate Slide Calibration Mode, see Figure 4-1 and Figure 4-2. (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 in VSG/VSSG Compressor Unit manual (35391STG). 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.

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. As a reference see Figure 4-3.
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". Figure 4-2.
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.

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 4-1.

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

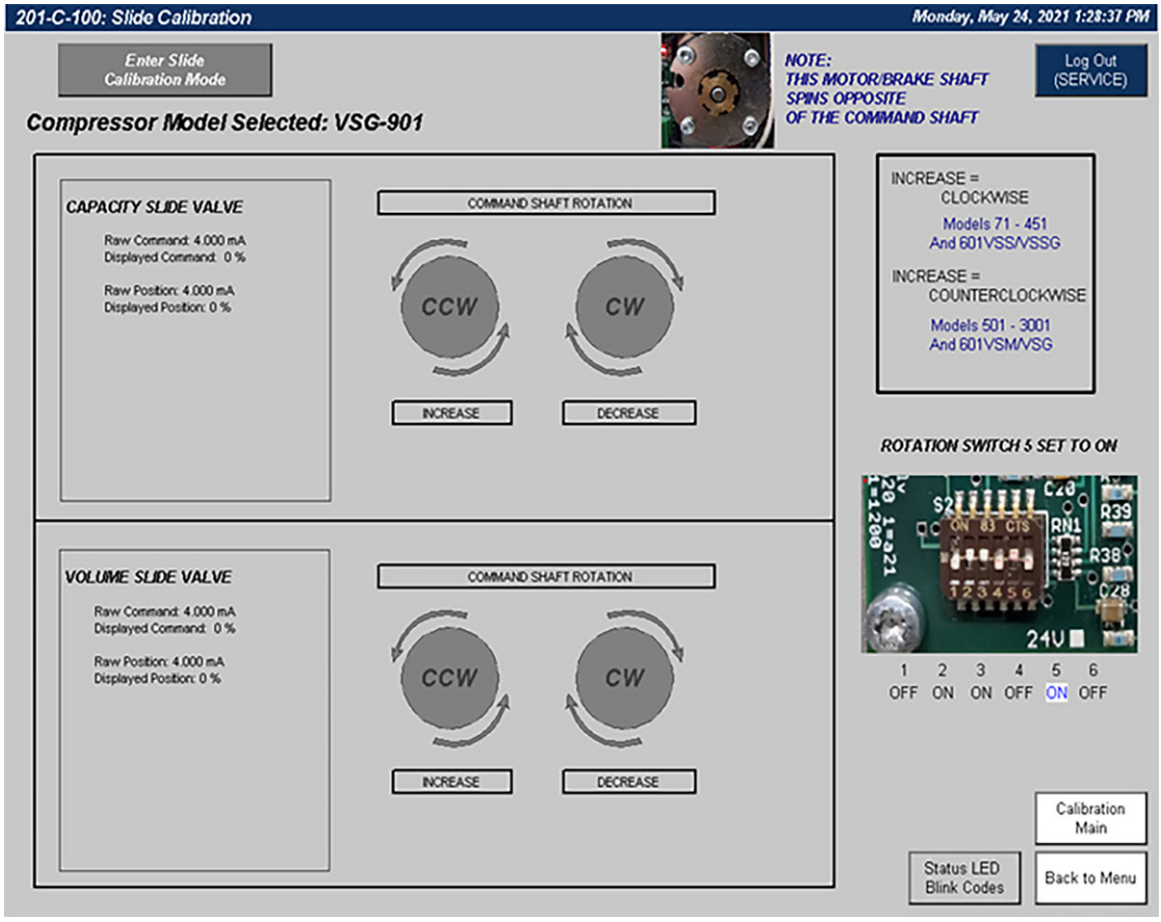


Figure 4-1. Slide Calibration Screen (Not in Calibration Mode)

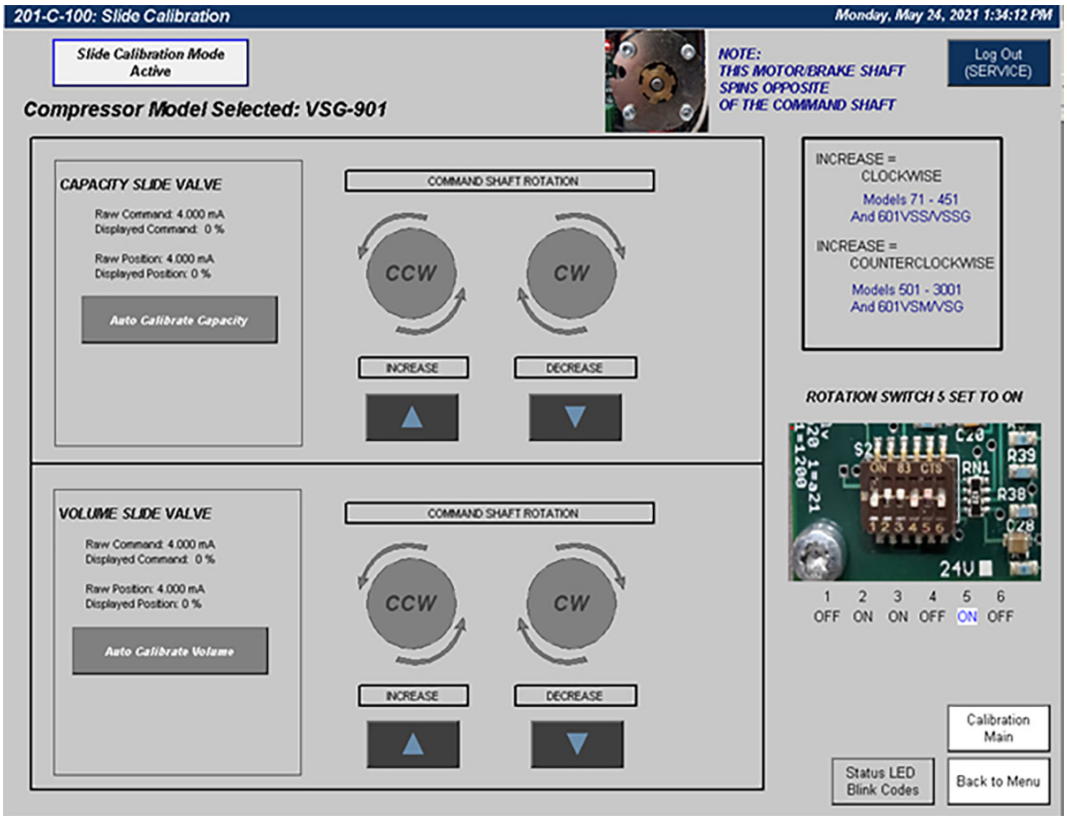


Figure 4-2. Slide Calibration Screen (In Calibration Mode)

Figure 4-3. Actuator Inside

Figure 4-4. 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. As a reference see Figure 4-5.

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.

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 4-6.
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 4-7.

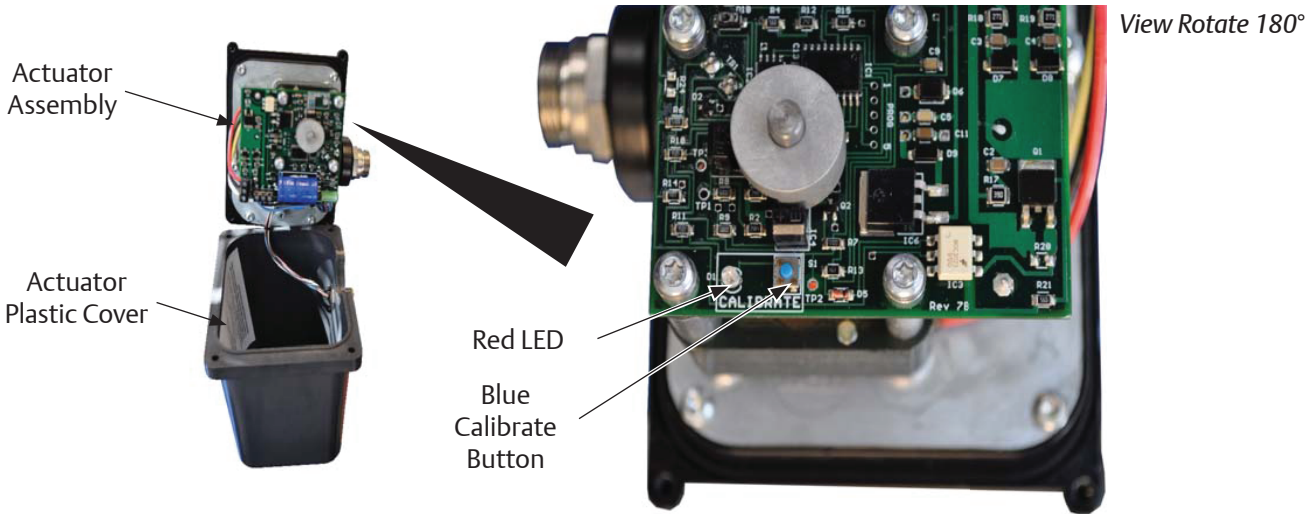


Figure 4-5. Actuator Assembly

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 4-8. 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, indication 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 4-7.

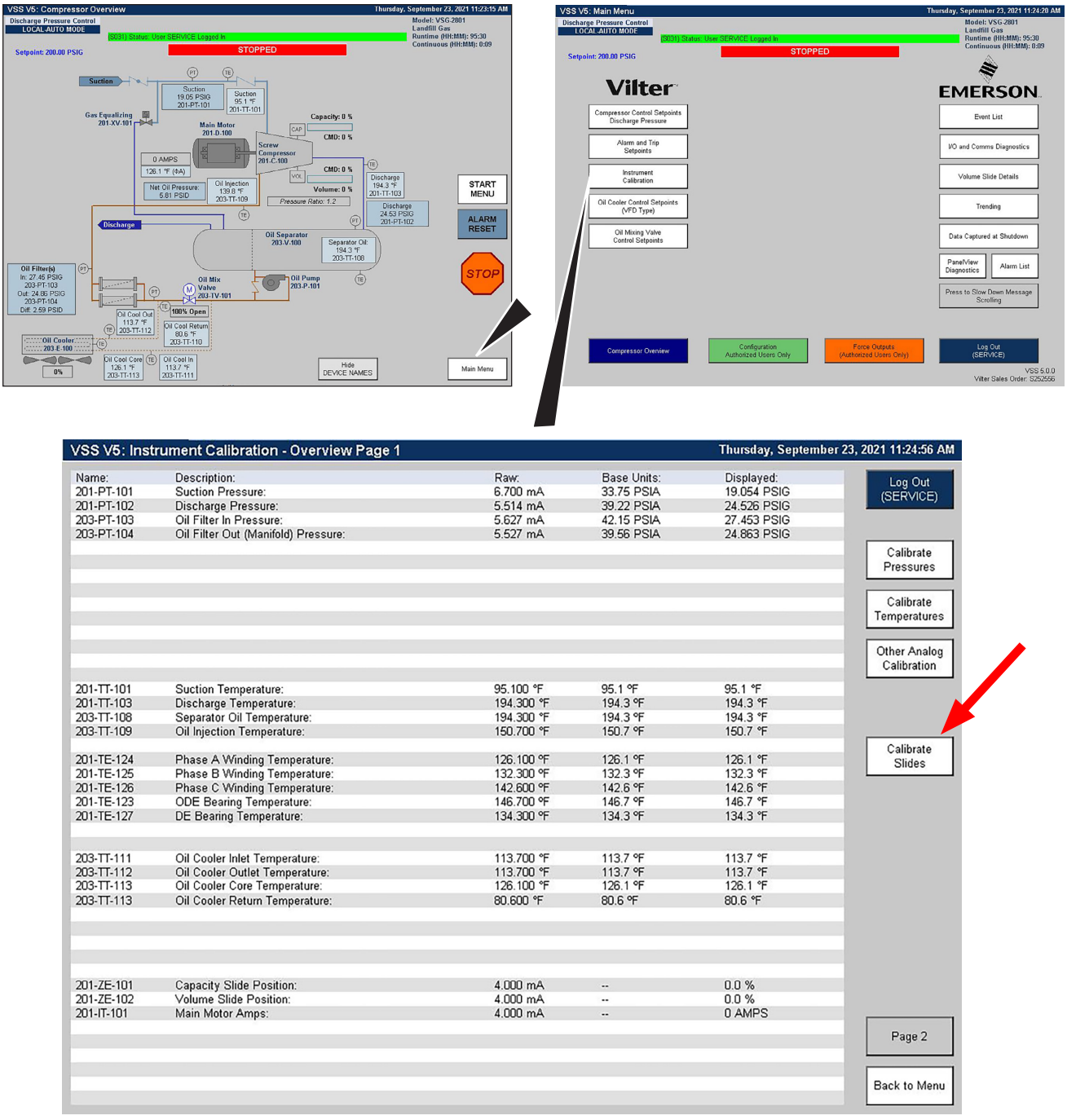
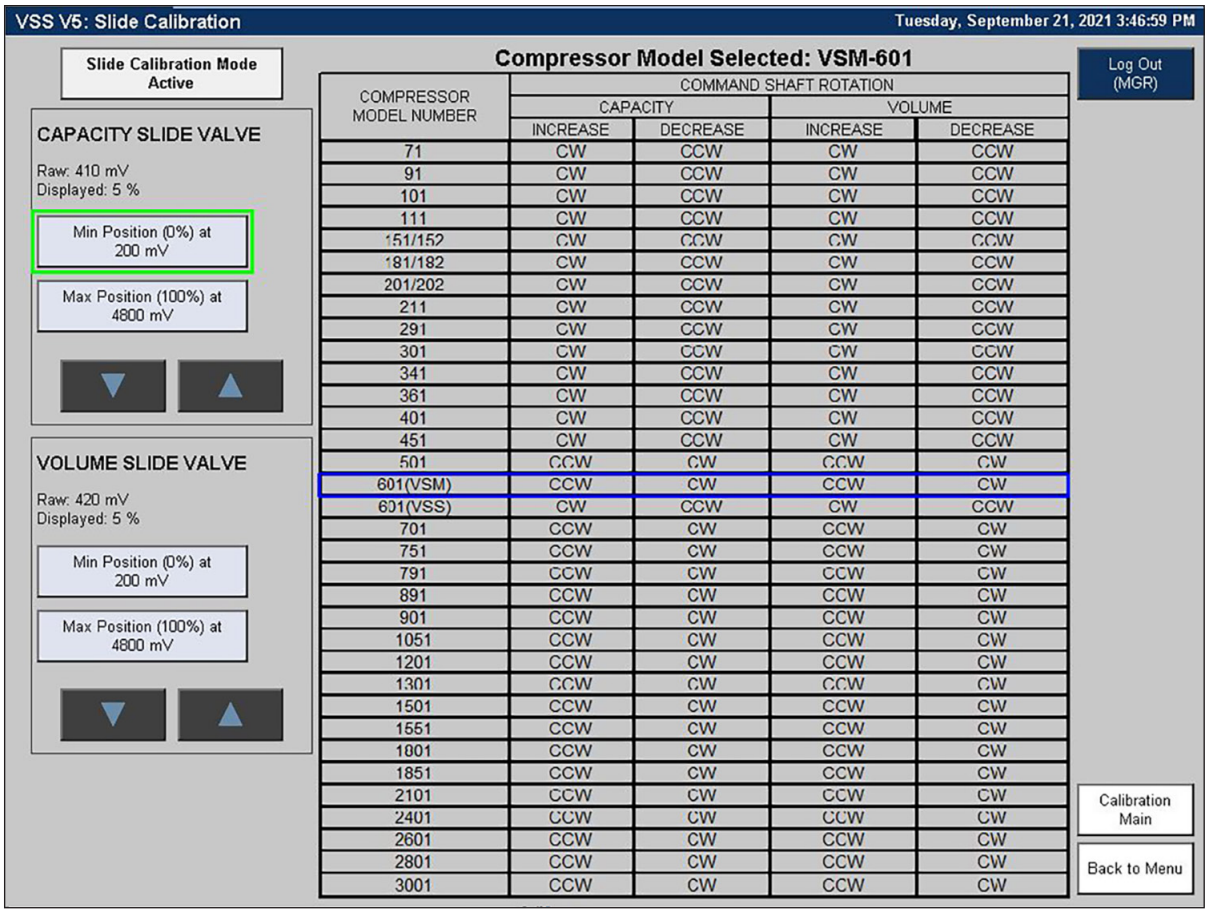


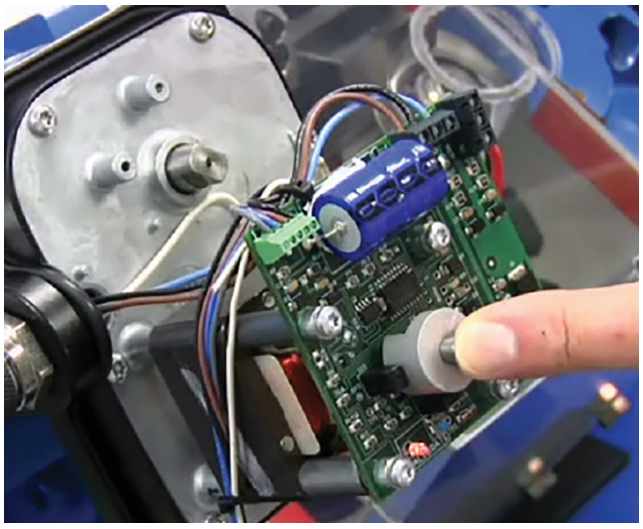
Figure 4-6. Overview, Main Menu and Instrument Calibration Screens (Compact Logix PLC)



COMPRESSOR MODEL NUMBER	COMMAND SHAFT ROTATION			
	CAPACITY		VOLUME	
	INCREASE	DECREASE	INCREASE	DECREASE
71	CW	CCW	CW	CCW
91	CW	CCW	CW	CCW
101	CW	CCW	CW	CCW
111	CW	CCW	CW	CCW
151/152	CW	CCW	CW	CCW
181/182	CW	CCW	CW	CCW
201/202	CW	CCW	CW	CCW
211	CW	CCW	CW	CCW
291	CW	CCW	CW	CCW
301	CW	CCW	CW	CCW
341	CW	CCW	CW	CCW
361	CW	CCW	CW	CCW
401	CW	CCW	CW	CCW
451	CW	CCW	CW	CCW
501	CCW	CW	CCW	CW
601(VSM)	CCW	CW	CCW	CW
601(VSS)	CW	CCW	CW	CCW
701	CCW	CW	CCW	CW
751	CCW	CW	CCW	CW
791	CCW	CW	CCW	CW
891	CCW	CW	CCW	CW
901	CCW	CW	CCW	CW
1051	CCW	CW	CCW	CW
1201	CCW	CW	CCW	CW
1301	CCW	CW	CCW	CW
1501	CCW	CW	CCW	CW
1551	CCW	CW	CCW	CW
1801	CCW	CW	CCW	CW
1851	CCW	CW	CCW	CW
2101	CCW	CW	CCW	CW
2401	CCW	CW	CCW	CW
2601	CCW	CW	CCW	CW
2801	CCW	CW	CCW	CW
3001	CCW	CW	CCW	CW

Screen colors inverted for ease of reading.

Figure 4-7. Slide Calibration Screen (Compact Logix PLC)



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

Figure 4-8. 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 291 VSSG 341 VSSG 451 VSSG 601	CW	CCW	CW	CCW	0.91	328	3.568”	0.52	187	2.045”
VSG 301 VSG361 VSG 401	CW	CCW	CW	CCW	0.80	288	3.141”	0.45	162	1.767”
VSG 501 VSG 601 VSG 701	CCW	CW	CCW	CW	0.91	328	3.568”	0.52	187	2.045”
VSG 751 VSG 901	CCW	CW	CCW	CW	1.09	392	4.283”	0.63	227	2.473”
VSG 791 VSG 891 VSG 1051 VSG 1201 VSG 1301	CCW	CW	CCW	CW	1.22	439	4.777”	0.74	266	2.889”
VSG 1551 VSG 1851 VSG 2101	CCW	CW	CCW	CW	1.48	533	5.823”	0.87	313	3.433”
VSG 2401 VSG 2601 VSG 2801 VSG 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.

Maintenance and Service Schedule

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

Table 5-1. Maintenance/Service Schedule

Group	Inspection/ Maintenance	Service Interval (Hours) Based on **WET SATURATED GAS**										Service Interval (Hours) Based on **DRY CLEAN GAS**													
		200	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	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
Package [6]	Coalescing Elements	-	I	I	-	-	-	I	-	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
	Liquid Line Strainers	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
Control Calibration	Transducers	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
	Slide Valve Motors [3]***	I	-	I	-	I	-	I	-	I		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][5]	Main Motors	See Motor Manual for proper lubrication procedures and service intervals.																							
	Inspect for Back Spin[4]	I	I	I	I	I	I	I	I	I		Inspect Every 5,000 Hours or As Needed													
	Inspect Compressor**	-	-	-	-	-	-	-	-	I		-	I	-	I	-	I	-	I	-	I	-	I	-	I
	Inspect for Leaks	I	-	I	-	I	-	I	-	I	*	Check Monthly													
	Bearings (Except for VSG 128-243)	-	-	-	-	-	-	-	-	I		-	I	-	I	-	I	-	I	-	I	-	I	-	I
	Bearings (VSG 128-243)	-	-	-	-	-	-	-	-	I		-	-	I	I	R	I	I	R	I	I	R	-	-	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: gate rotor inspection (backlash measurement, shelf clearance and gate rotor float), end play measurement (main rotor & gate rotor), slide valve inspection (if applicable).
***: All the VSGC/VSSGC units will have the self-calibrated slide valve actuators. If that's the case, disregard this inspecting schedule.

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 over time) 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 compressor suction. The discharge temperature must be kept a minimum of 30F 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 cal/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 build up.

Recommendations When Servicing

When working on the compressor, care must be taken to ensure that contaminants (i.e. water from melting ice, dirt and dust) do not enter the compressor while it is being serviced. It is essential that all dust, oil or ice that has accumulated on the outside of the compressor be removed before servicing the compressor.

When servicing the compressor, all gaskets, O-rings, roll pins and lock washers must be replaced when reassembling the compressor.

Preparation of Unit For Servicing

1. Shut down the unit, open the electrical disconnect switch and pull the fuses for the compressor motor to prevent the unit from starting. Put a lock on the disconnect switch and tag the switch to indicate that maintenance is being performed.

2. Isolate the unit by manually closing the discharge Stop valve. Allow the unit to equalize to suction pressure before closing the Suction Bypass. After the unit has equalized to suction pressure and suction valve closed, use an acceptable means to depressurize the unit that complies with all Local, State and Federal Ordinances.

3. Remove drain plugs from the bottom of compressor housing and the discharge manifold. Drain the oil into appropriate containers.

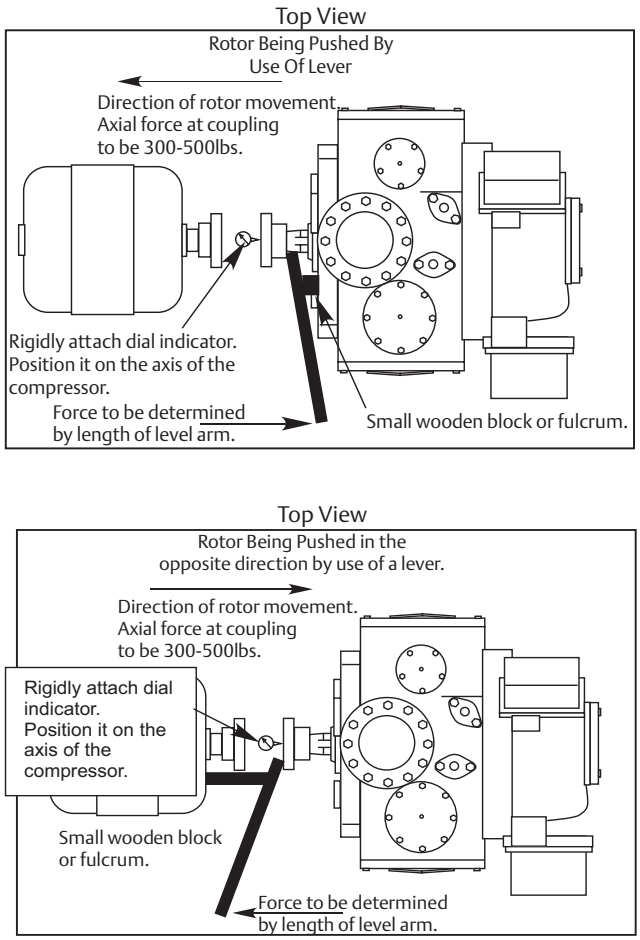


Figure 5-1. Bearing Axial Clearance Inspection

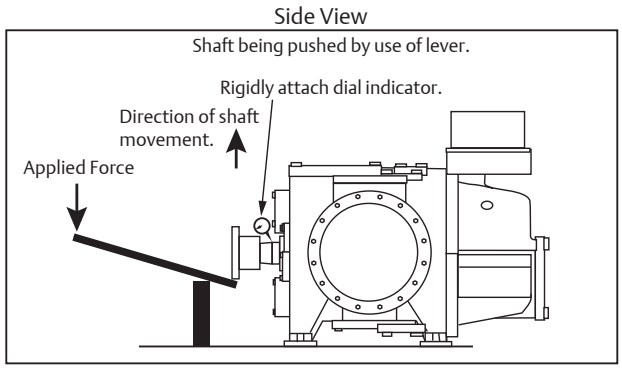


Figure 5-2. Bearing Radial Clearance Inspection

Compressor Inspection

The Vilter™ Single Screw Compressor is 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 float is measured for the main rotor and gate rotors.

The following are the procedures used in measuring the main rotor and gate rotor bearing float.

Bearing Check

CAUTION

When taking the measurements, do not exceed 300 to 500 Lbs. of force at point of contact or damage may result to the bearings.

A. Shut down and de-pressurize the unit.

B. Main rotor bearing float.

1. Remove the coupling guard, then remove the center member from the coupling.
2. Attach a dial indicator to the compressor frame as shown and zero indicator. Place a lever arm and fulcrum behind the compressor coupling half and push the coupling towards the motor (note measurement).

Table 5-2. Maximum Bearing Float

	Main Rotor	Gate Rotor
Bearing Float	0.003”	0.002”
Maximum Force	300 to 500 Lbs.	200 to 300 Lbs.

3. Re-Zero indicator, now position the fulcrum on the motor and use the lever arm to push the input shaft towards the compressor (note measurement).
4. Add both readings, the total indicator movement is the bearing float and this should not exceed 0.003”.

C. Gate rotor bearing float

1. Remove the side covers and position a dial indicator on the gate rotor.
2. Use a lever arm pivoting on a bolt with a small block of wood against the gate rotor blade to protect the blade.
3. The maximum amount of bearing float should not exceed 0.002”.

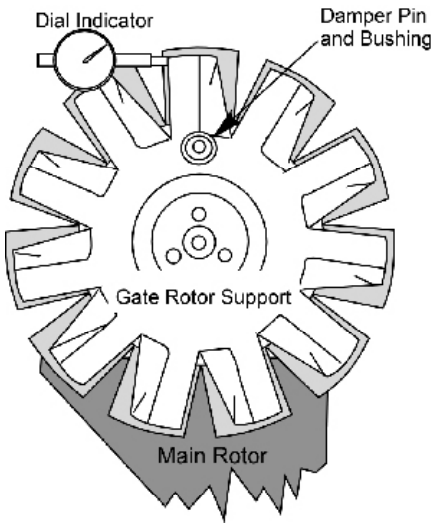


Figure 5-3. Gaterotor Float Dial Location

D. Measure the gate rotor to blade float. Some movement between blade and support is necessary to prevent damage to the compressor blade, however at no time should the blade uncover the support.

1. Position the blade with the gate rotor damper pin and 90º to the main rotor.
2. Position a dial indicator at the tip of the support. The total movement of the damper pin in the bushing is the gate rotor float. Refer to Table 5-3 to find the maximum blade to support float (on new compressor parts only).

Table 5-3. Gate Rotor Float

Model	Max. Float in. (mm)
VSSG 291 - 601	0.045 (1.143)
VSG 97 - 127	0.045 (1.143)
VSG 128 - 243	0.065 (1.651)
VSG 301 - 401	0.045 (1.143)
VSG 501 - 701	0.045 (1.143)
VSG 751 - 901	0.055 (1.397)
VSG 791-1301	0.060 (1.524)
VSG 1551-2101	0.060 (1.524)
VSG 2401-3001	0.060 (1.524)

E. Readings could be higher than 0.020. If readings is greater than 0.030 over table tolerance contact Vilter's home office.

F. Inspect the main and gate rotors for signs of abnormal wear due to dirt or other contaminants.

G. After the inspection is complete, the covers, coupling center member and guard can be reinstalled and the unit can then be evacuated and leak checked before starting.

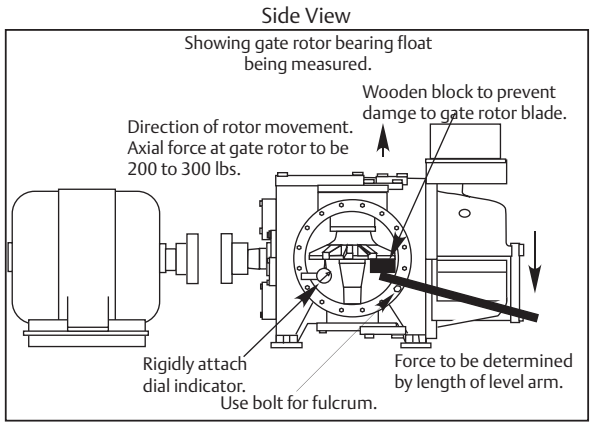
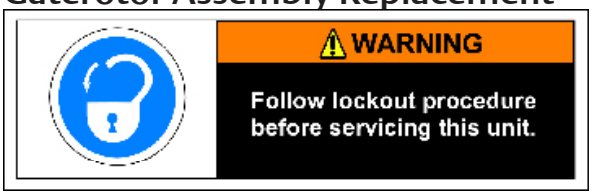


Figure 5-4. Gaterotor Bearing Clearance

Gaterotor Assembly Replacement



CAUTION

Gate rotor removal and assembly is divided into distinct instructions, instructions for all VSG and VSSG models and different instructions for all VSM models. Please follow the appropriate set of instructions.

Removal (All VSG Models)

1. Prepare the compressor for servicing.

NOTE

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

2. Remove two upper bolts from the side cover, and install guide studs in the holes. Remove the remaining bolts and side cover. There will be some oil drainage when the cover is removed.
3. Turn the main rotor so a driving edge of any one of the main rotor grooves is even with the back of the gate rotor support.
4. Insert the gate rotor stabilizer. The side rails are not required on VSSG 291 thru 601. For the VSG 751 thru 901 and VSG 1051 thru 1201 compressors, use the side rails and assemble to the gate rotor stabilizer as stamped. For the VSG 1551 thru 2101, use the side rails and assemble to the gate rotor stabilizer. The gate rotor stabilizer is designed to hold the gate rotor support in place and prevent damage to the gate rotor blade as the thrust bearings and housing is being removed.
5. Remove the hex head and socket head bolts from the thrust bearing cover. Insert two of the bolts into the threaded jacking holes to assist in removing the cover. Retain the shim pack and keep it with the bearing housing cover.
6. Hold the gate rotor support with a suitable wrench on the flats provided near the roller bearing housing. Remove the inner retainer bolts and the retainer. To remove the thrust bearing housing, install the thrust bearing removal and installation tool with the 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.

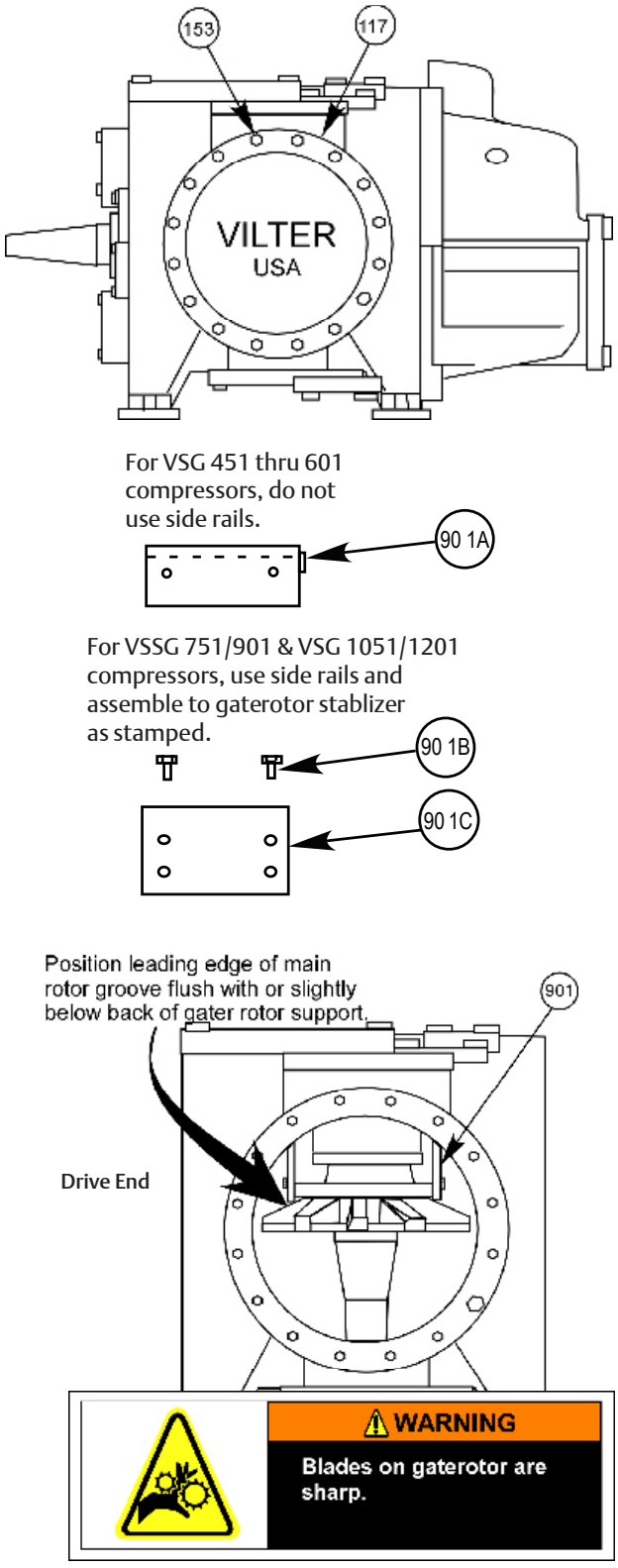


Figure 5-5. Gaterotor Assembly Removal and Tools

7. Remove the bolts on the roller bearing housing. Thread two bolts into the jack screw holes provided in the housing to assist in removing it.
8. To remove the gate rotor 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 gate rotor support. On dual gate compressor units, repeat the procedure for the remaining gate rotor support assembly.

Removal (All VSG 301-701 Models)

The removal of the gate rotor 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 per paragraph B.
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 gate rotor support. At this point install the gate rotor 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 gate rotor blades. These must be kept with their respective parts for that side of the compressor.
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 gate rotor 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 gate rotor support. On dual gate versions, repeat the procedure for the remaining gate rotor support assembly.

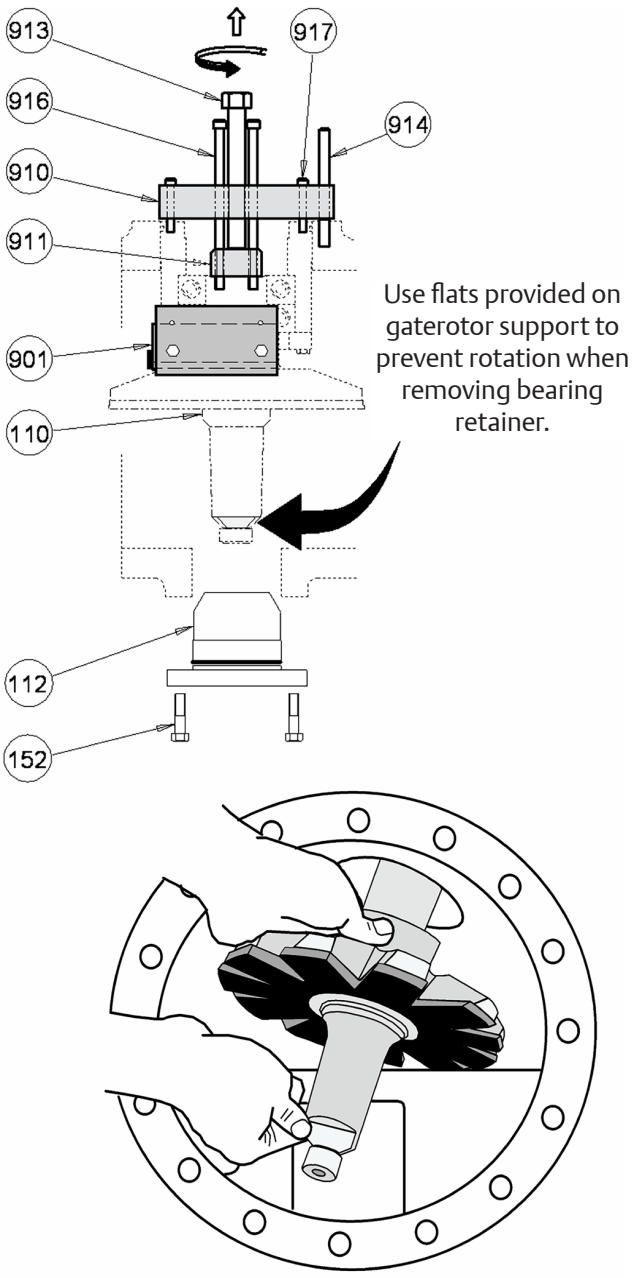


Figure 5-6. Gaterotor Assembly Removal

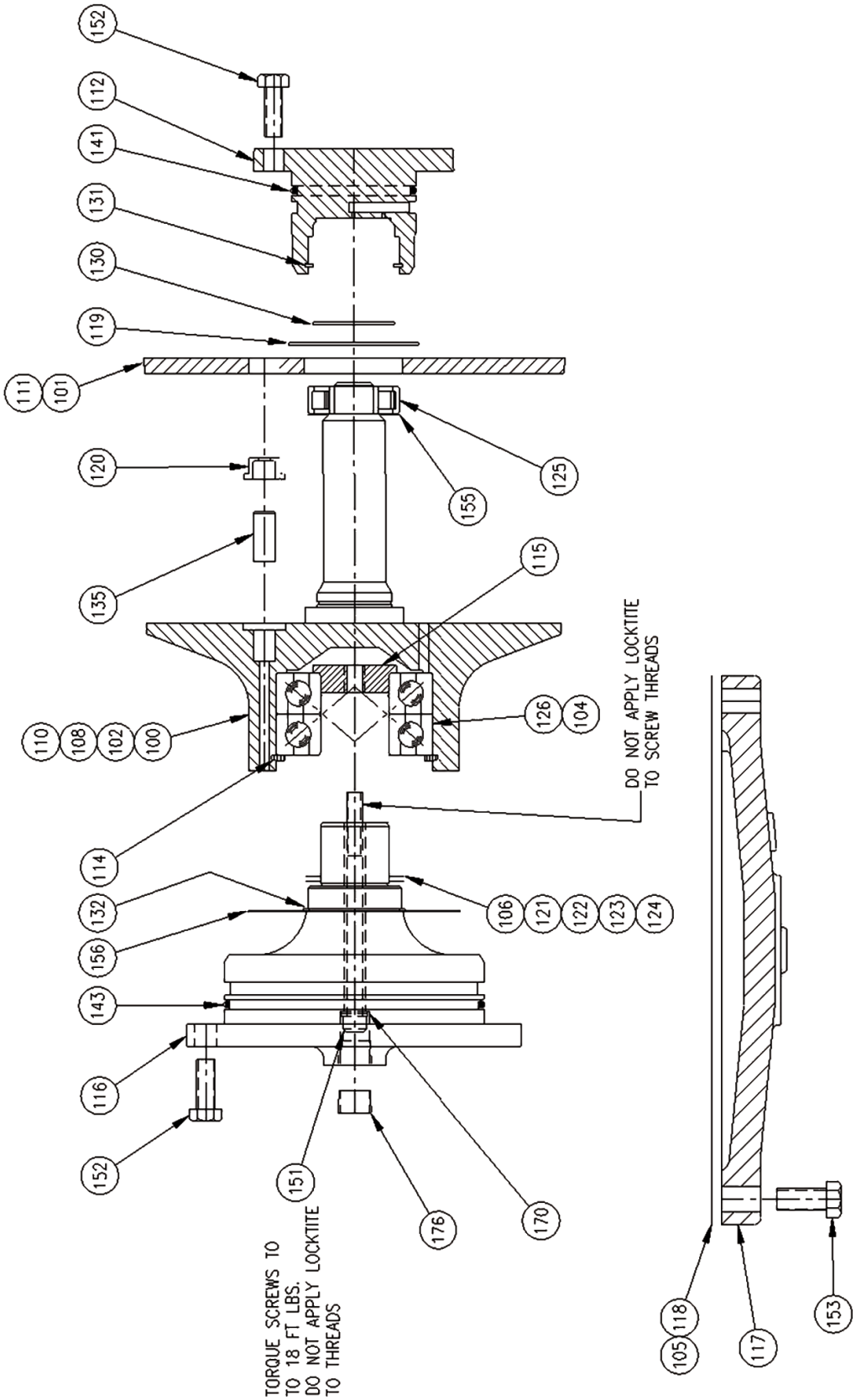


Figure 5-7. Gaterotor Assembly Breakdown

Installation (All VSG Models)

1. Install the gate rotor support by carefully tilting the roller bearing end of the gate rotor support towards the suction end of the compressor. The compressor input shaft may have to be rotated to facilitate the installation of the gate rotor support. Install gate rotor stabilizer. The gate rotor stabilizer (901) will hold the gate rotor support in place as the thrust bearing housing is being installed. If the gate rotor support is not restricted from moving, the gate rotor blade may be damaged.
2. Install the roller bearing housing (112) with a new O-ring (141).
3. Tighten the bolts (152) to the recommended torque value.
4. When installing the thrust bearing housing (113), a new O-ring (142) must be used when the housing is installed. 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 gate rotor 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 the bolts to the recommended torque value.
5. Set the clearance between the gate rotor blade and the shelf.
6. Place a piece of 0.003”-0.004” shim stock between the gate rotor blade and the shelf.
7. Measure the depth from the top of the compressor case to the top of the thrust bearing housing. This determines the amount of shims needed for the correct clearance.
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 gate rotor blade and the shelf, rotate the gate rotor to find the tightest spot. It should be between 0.003”-0.004”. Make adjustments, if necessary. It is preferable to shim the gate rotor blade looser rather than tighter against the shelf.
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.
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 as outlined in section 3.

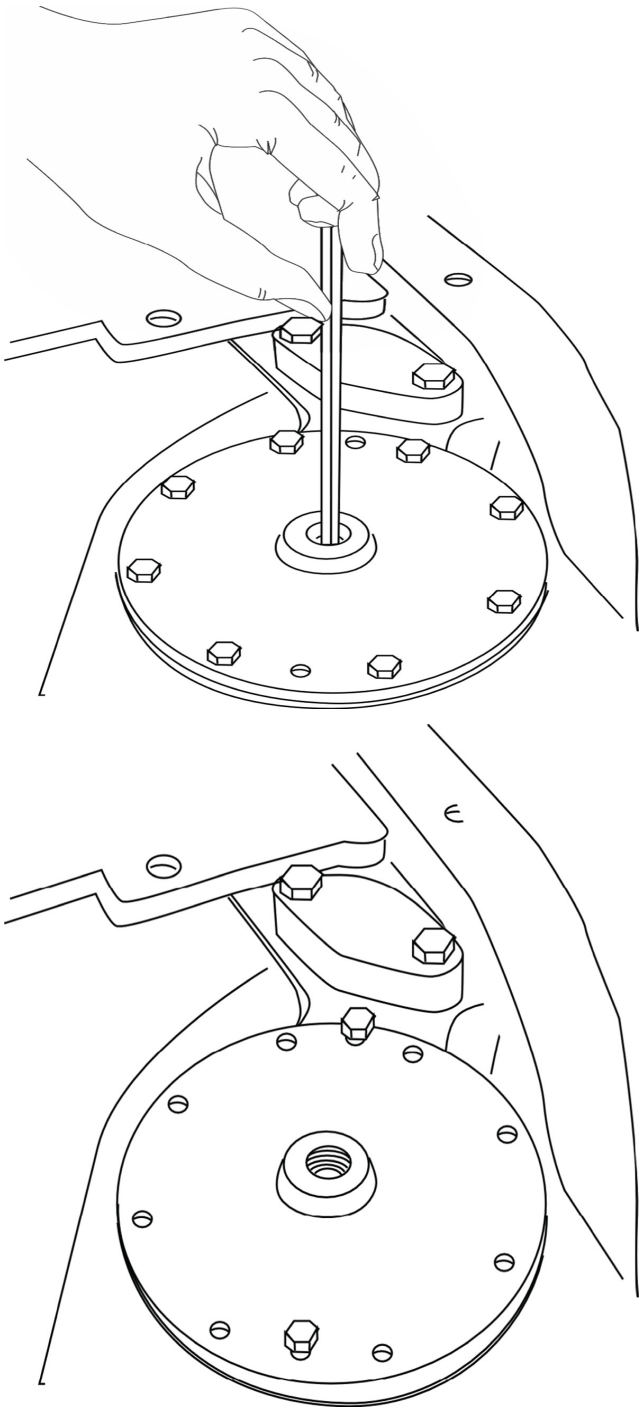
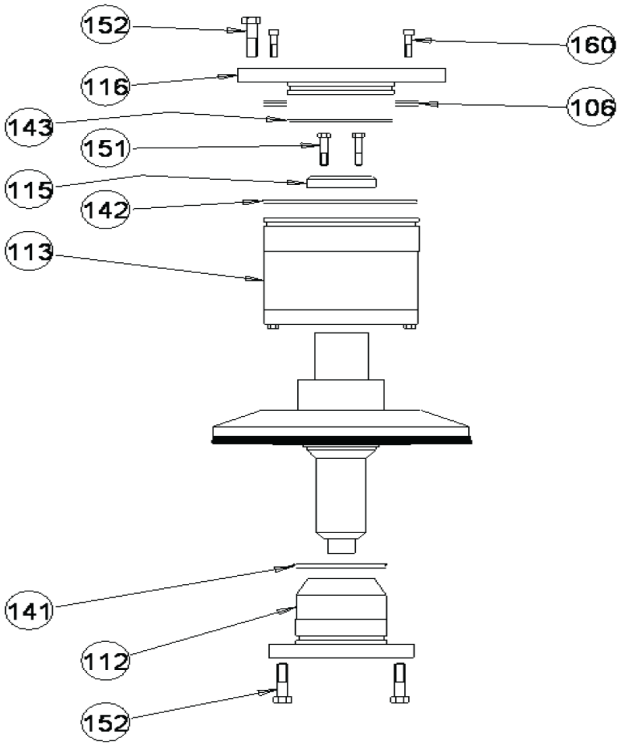


Figure 5-8. Gaterotor Thrust Bearing



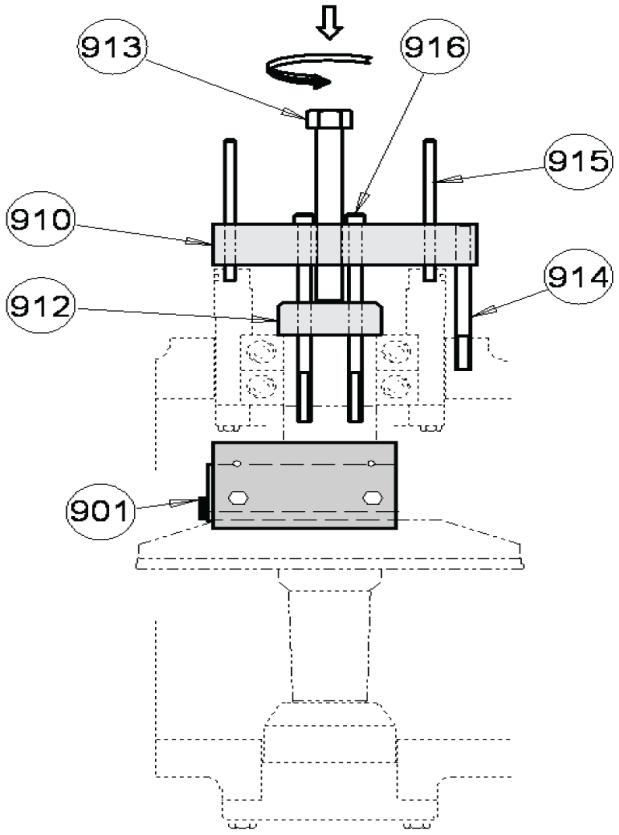


Figure 5-9. Gaterotor Assembly and Tools

Check for 0.003" to 0.004 Clearance Between Gaterotor Blade and Partition.

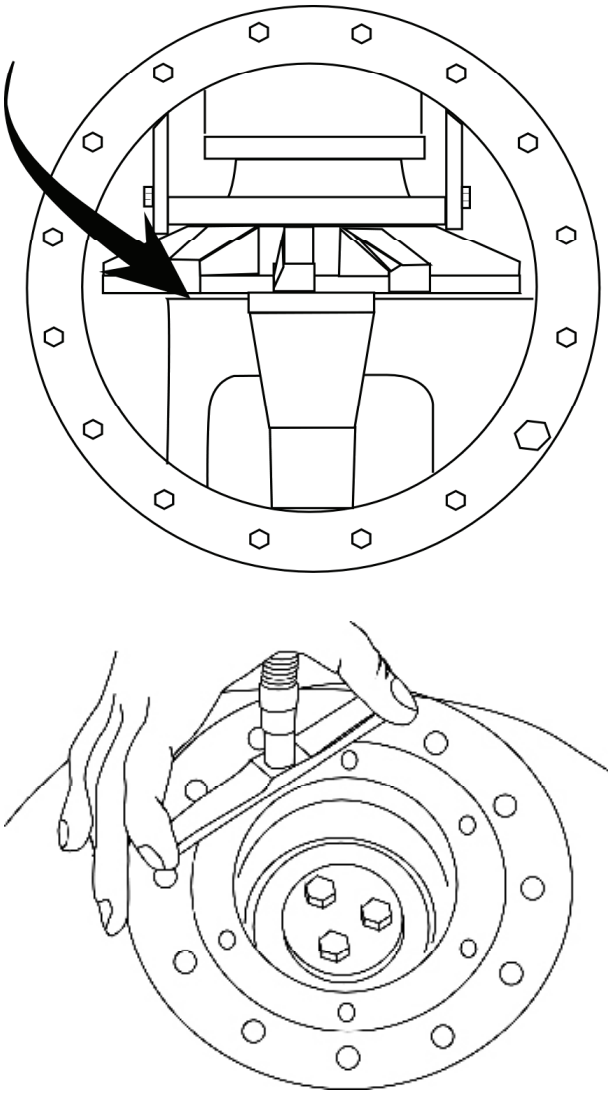


Figure 5-10. Gaterotor and Shelf Clearance

Installation (All VSG 301-701 Models)

1. Install the gate rotor support. Carefully tilt the roller bearing end of the gate rotor support towards the suction end of the compressor. The compressor input shaft may have to be rotated to facilitate the installation of the gate rotor 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 the bolts to the recommended torque value, measure the clearance between the shelf and blade.
4. Check the clearance between the entire gate rotor blade and the shelf, rotate the gate rotor to find the tightest spot. It should be between 0.003”-0.004”. Make adjustments, if necessary. It is preferable to shim the gate rotor 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 to the recommended torque values.
6. Install side covers with new gaskets. Tighten bolts to the recommended torque value. The unit can now be evacuated and leak checked as outlined in section 3.

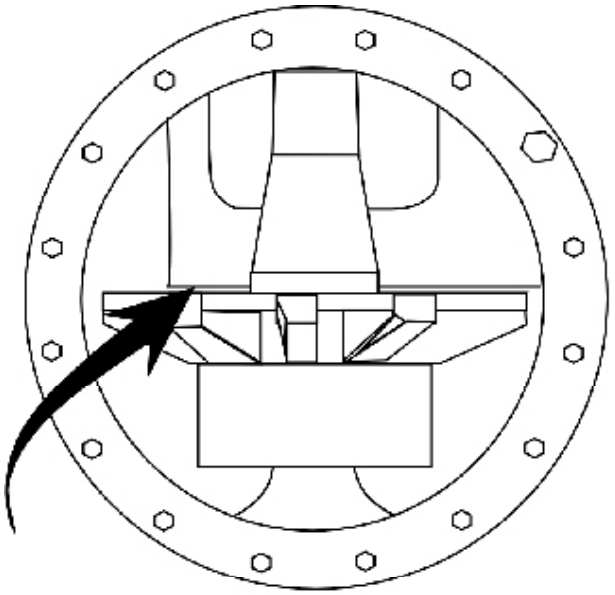
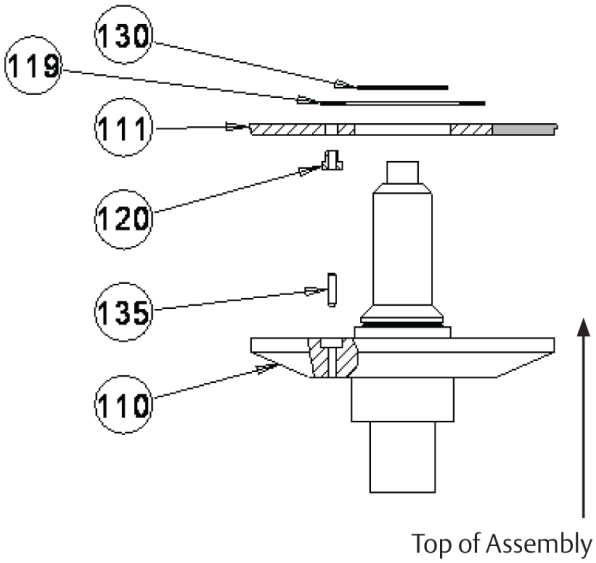


Figure 5-11. Gaterotor and Shelf Clearance Gaterotor for C-flange Models



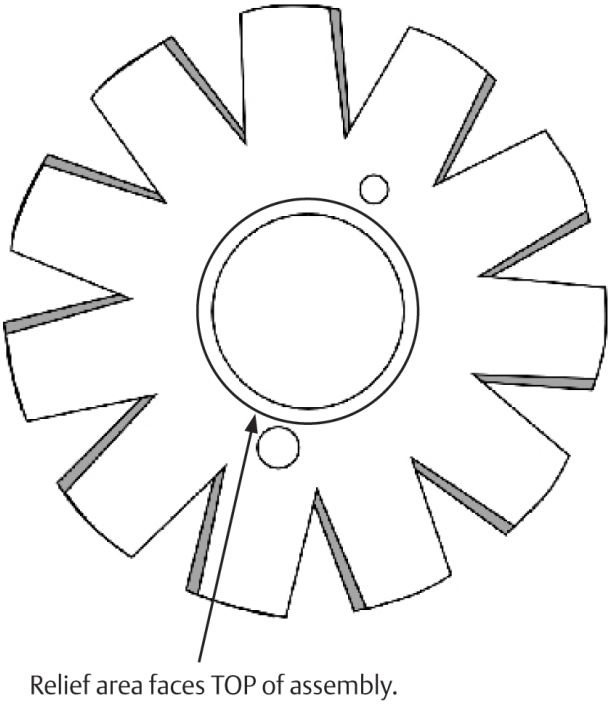


Figure 5-12. Gaterotor Blade Assembly

Gate Rotor Blade Removal

1. Remove the gate rotor assembly.
2. Remove the snap ring and washer from the gate rotor assembly. Lift gate rotor blade assembly off the gate rotor support.
3. Check damper pin and bushing for excessive wear. Replace if necessary.

Gate Rotor Blade Installation

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

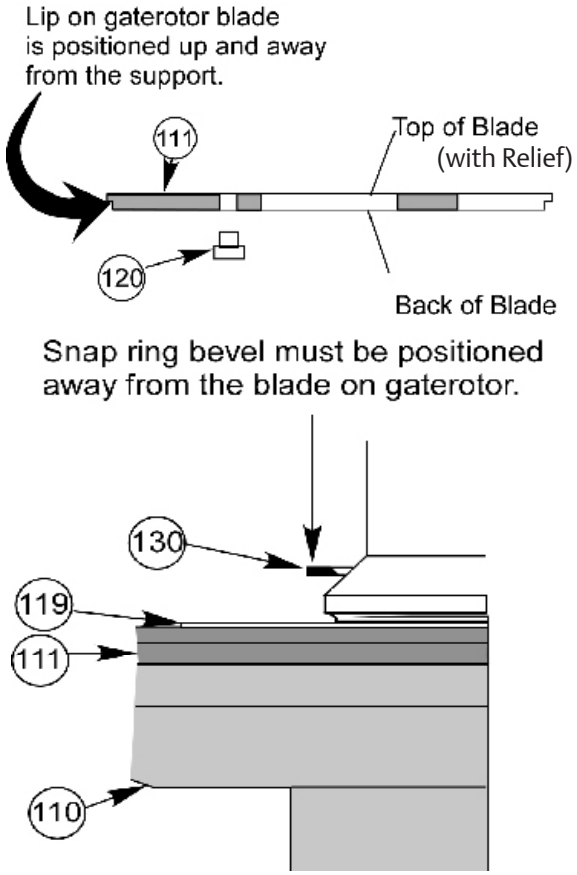


Figure 5-13. Gaterotor Blade Installation

4. For installation of the gate rotor assembly and setting of gate rotor clearance, refer to section INSTALLATION (All VSG 301-701 Models).

Gate Rotor Thrust Bearing Removal

Refer to section **INSTALLATION (All VSG Models)** for removal of the gate rotor bearing housings and gate rotor supports.

For removal of thrust bearings on VSG units:

1. Remove bolts (150) from the clamping ring (114).
2. Remove thrust bearing clamping ring.
3. Remove thrust bearings (126) from housing (113).

For removal of thrust bearings on VSSG units:

1. Remove retaining ring from gate rotor support.
2. Remove bearings from support.
3. Remove bearing retainer from inner race.

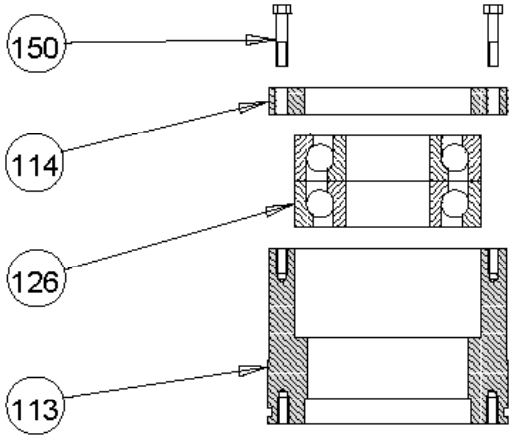


Figure 5-14. Gaterotor Thrust Bearing

Gate Rotor Thrust Bearing Installation

For installation of thrust bearings on VSG and VSSG units:

1. Install 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.
3. For installation of the bearing housing and the setting of the gate rotor blade clearance, refer to section **INSTALLATION (All VSG Models).**

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 gate rotor support.
3. Install the bearing retaining snap ring.
4. For installation of the bearing housing and the setting of the gate rotor blade clearance, refer to section **INSTALLATION (All VSG Models).**

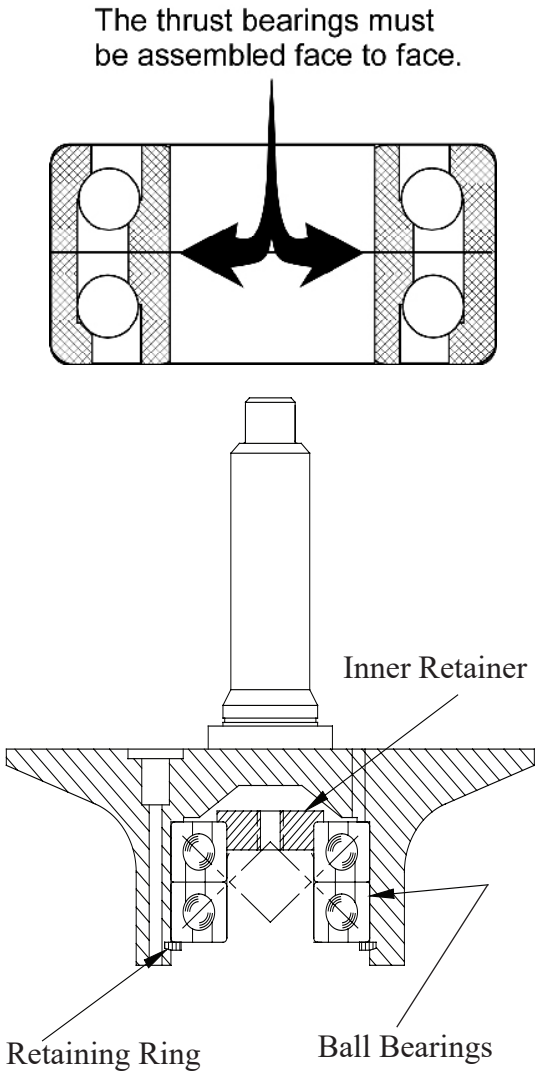


Figure 5-15. Thrust Bearing Installation

Gate Rotor Roller Bearing Removal

1. Refer to section **REMOVAL (All VSG)** for removal of the gate rotor bearing housings and gate rotor supports.
2. Remove the snap ring (131), which retains the roller bearing in the bearing housing.
3. Remove the roller bearing (125) from the bearing housing (112).
4. Use a bearing puller to remove the roller bearing race (125) from the gate rotor support (110).

Gate Rotor Roller Bearing Installation

1. Match up the part numbers on the inner race to the part numbers outer race. Press the bearing race (numbers visible) onto the gate rotor 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.
3. For installation of the bearing housing, refer to section **INSTALLATION (All VSG Models).**

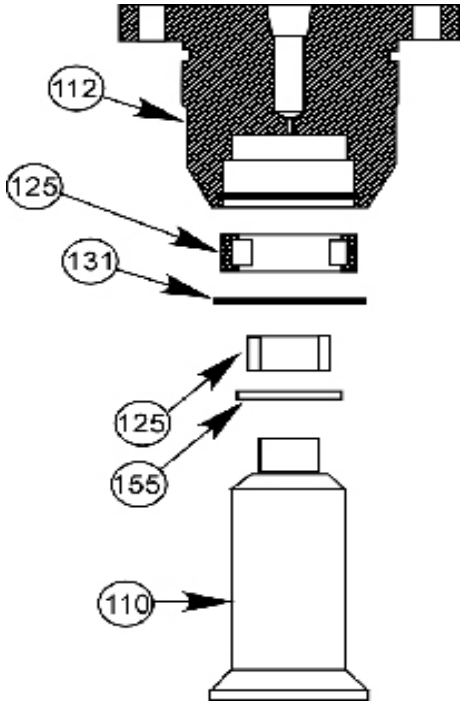


Figure 5-16. Roller Bearing Assembly

Compressor Shaft Seal Replacement

Compressor Shaft Seal Removal

1. Prepare the compressor for servicing as outlined in section **REMOVAL (All VSG) .**
2. Remove bolts (281) holding the shaft seal cover (218). Insert two of the bolts into the threaded jacking holes to assist in removing the cover. There will be a small amount of oil drainage as the cover is removed.
3. Remove the rotating portion of the shaft seal (219C).
4. Remove oil seal (230) from cover.
5. Remove the stationary portion of the shaft seal (219B) from the seal cover using a brass drift and hammer to tap it out from the back side of the seal cover.

Compressor Shaft Seal Installation

Seal with stationary mirror face (219B) and rotating carbon face (219C).

Seal with stationary carbon face (219B) and rotating mirror face (219C).

Current Shaft Seal and for all Replacement.

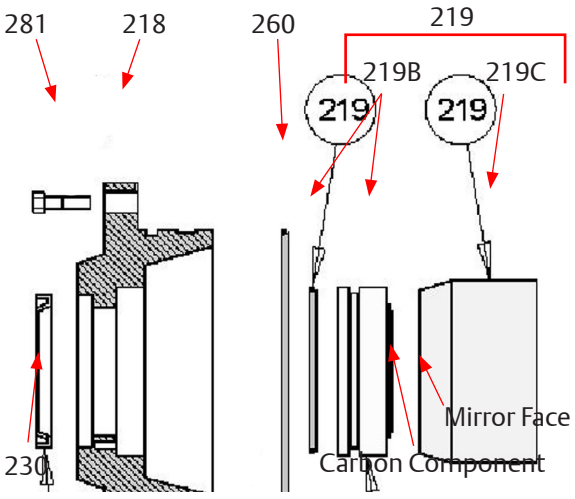


Figure 5-17. Compressor Shaft Seal

NOTE

When replacing the stationary members of the seal on the VSSG 291 thru VSSG 601 the roll pin in the cover is used only with the seal assembly having a stationary mirror face. If a seal assembly with a stationary carbon face is installed, the roll pin must be removed.

1. Install new oil seal in cover.

CAUTION

Care must be taken when handling the shaft seal and mirror face so it is not damaged. Do not touch the carbon or mirror face as body oil and sweat will cause the mirror face to corrode.

2. To install the carbon cartridge part of the seal in the seal cover; clean the seal cover, remove protective plastic from the carbon cartridge, do not wipe or touch the carbon face. Lubricate the sealing O-ring with clean compressor lubricating oil. If applicable, align the hole on the back of the carbon cartridge with the dowel pin in the seal cover. Install cartridge using seal installation tool or similar (see tool lists).
3. Wipe clean, the compressor input shaft and the shaft seal cavity in the compressor housing. Apply clean compressor oil to the shaft seal seating area on input shaft.
4. Lubricate the inside area of the rotating seal with clean compressor lubricating oil, do not wipe or touch the face of the rotating portion of the seal. Align the slot in the rotating seal with the drive pin on the compressor input shaft. Carefully push the seal on, holding onto the outside area of the seal until the seal seats against the shoulder on the input shaft. Make sure the seal is seated against the shoulder. If the seal is not fully seated against the shoulder, the shaft seal carbon will be damaged when the seal cover is installed.

Maintenance Suggestion:

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

5. Install a new O-ring on the seal cover, 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.
6. Carefully install the seal cover on the compressor shaft, evenly tightening the bolts to the recommended torque values.
7. Install the coupling and coupling guard. The unit can then be evacuated and leak checked.

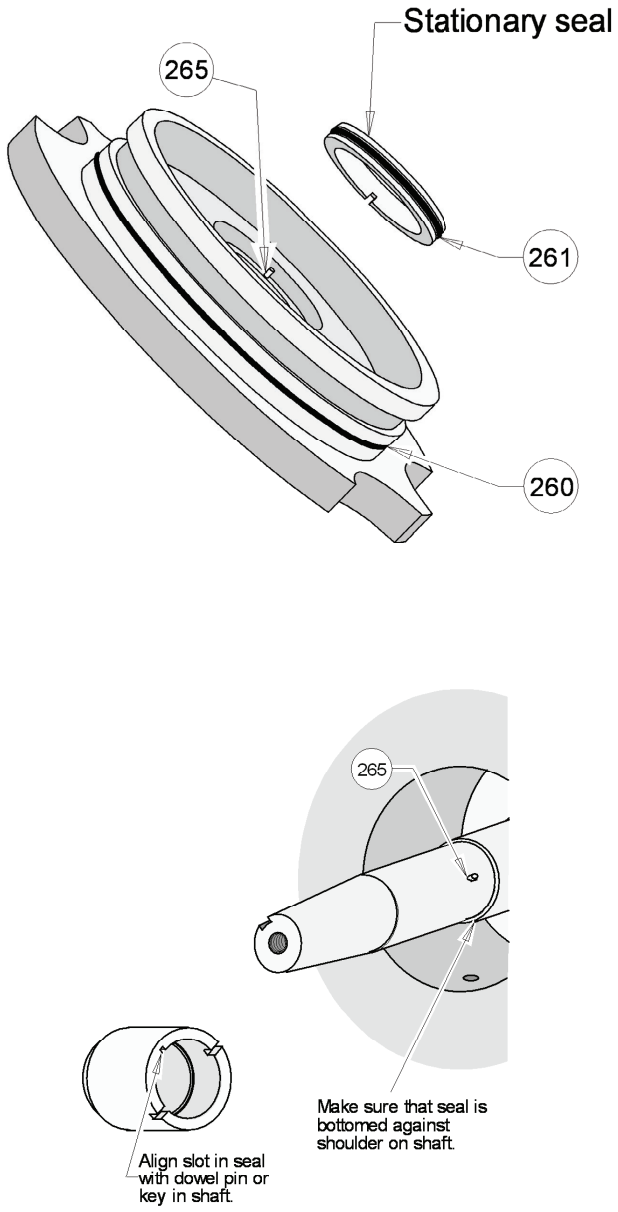
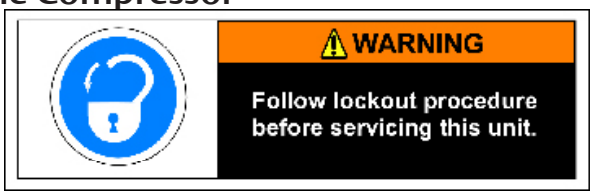


Figure 5-18. Compressor Shaft Seal Installation

Inspection of Slide Valve Assemblies In The Compressor



Prepare The Compressor For Servicing

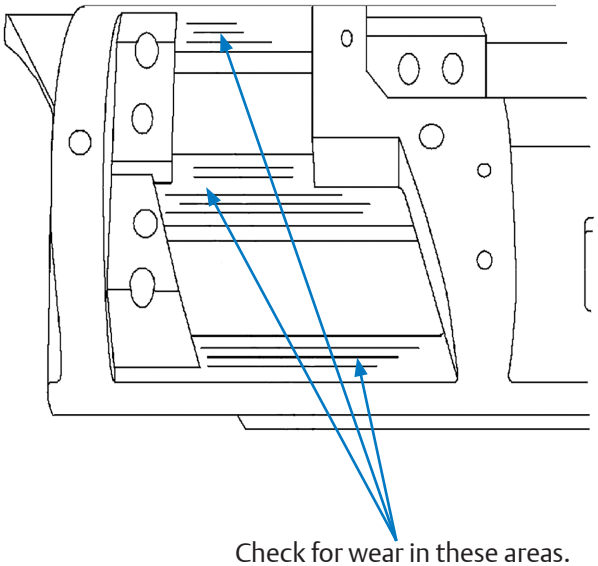
1. Remove the gate rotor access covers. Using a mirror and flashlight, visually inspect the slide valve carriage through the gas bypass opening. Look for any significant signs of wear on the slide valve carriage.
2. To check the clearance of the slide valve clamps, the gate rotor support must be removed. Refer to removal of the gate rotor 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.

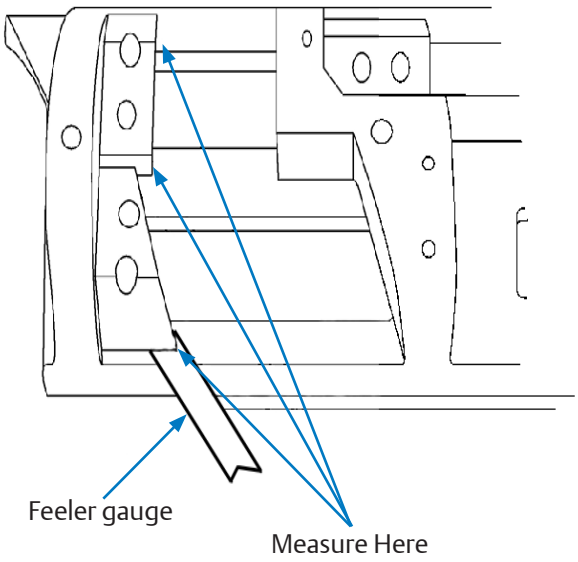
Removal of Slide Valve Carriage Assemblies

1. Prepare the compressor for servicing.
2. If only one of the slide valve carriages is removed only the corresponding gate rotor support needs to be removed. If both carriages are removed both gate rotors must be removed. Remove the gate rotor 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

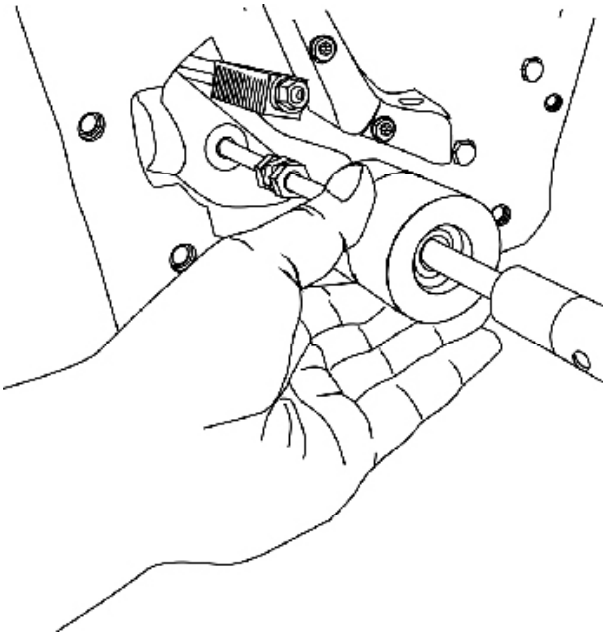
Slide Valves may be re-positioned to aid in removal of assembly.

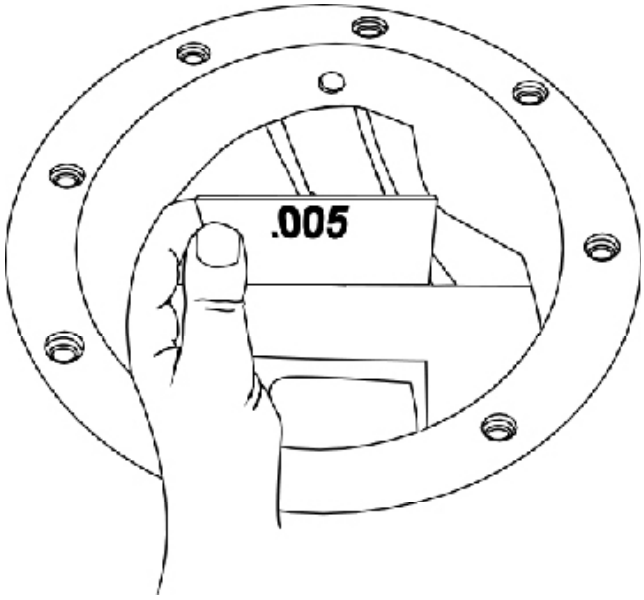




Installation of Slide Valve Carriage Assemblies

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.
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 gate rotor assemblies.





Slide Valve Actuator Assembly Replacement

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

Removal

WARNING

At shutdown, open any other valves that may trap liquids to prevent 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

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 Washes that securing actuator assembly to actuator mount. See Figure 5-19 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.

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

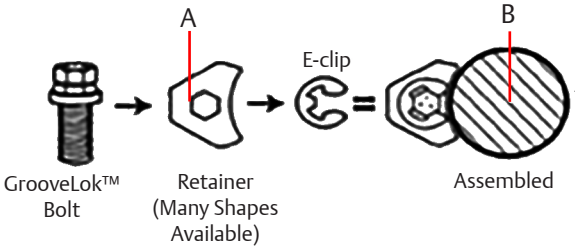
Tools Needed: A 7/16” open wrench or torque wrench with 7/16” crowfoot wrench adapter.

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 5-19 (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.

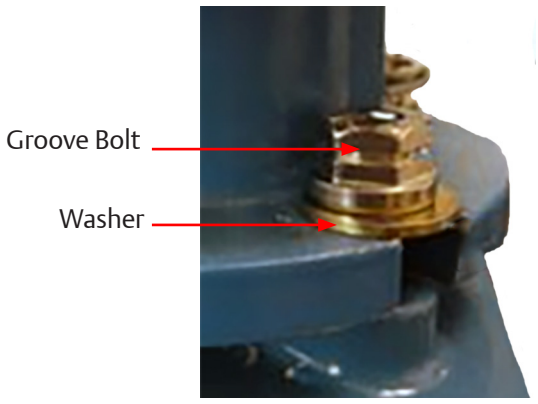


2. Position Locking Retainer over Grooved Bolt, with the shallow curved edge toward the center of the command shaft housing. See figure 5-19 (b).

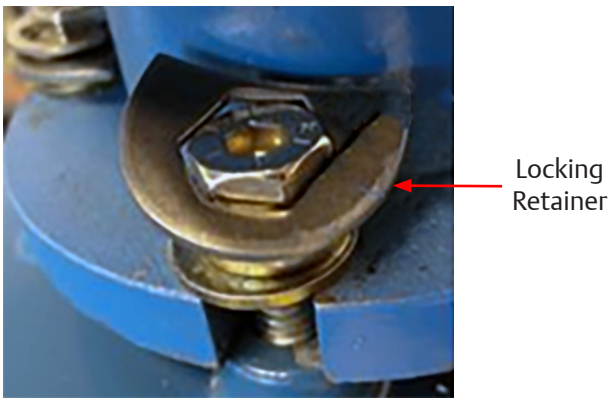
NOTE

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 5-19 (c).



(a) Groove bolt and washer



(b) Locking Retainer

(C) E-clip

Figure 5-19. Actuator Installation Using Anti-Rotation Bolts

Slide Valve Command Shaft Assembly Replacement

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.

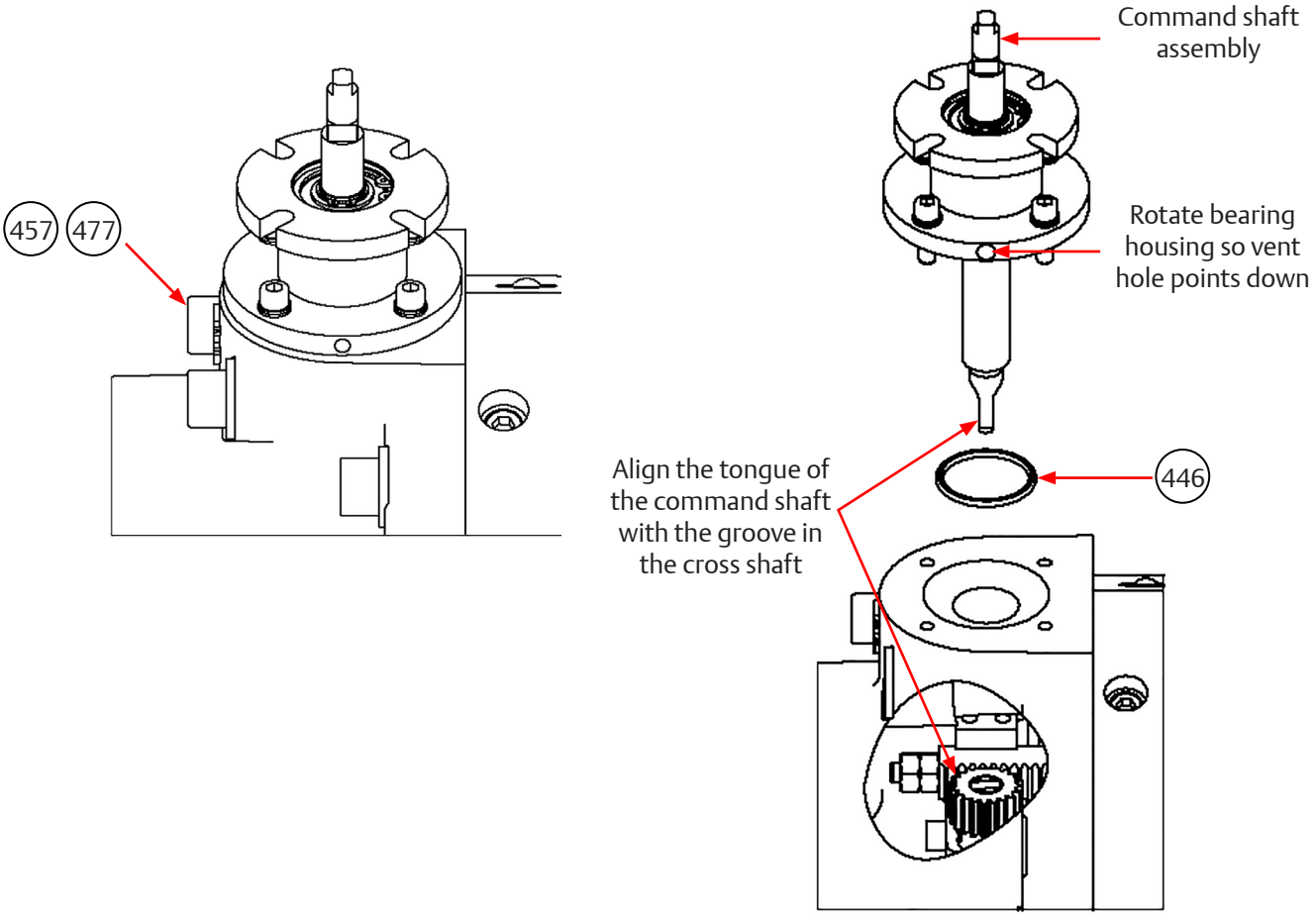


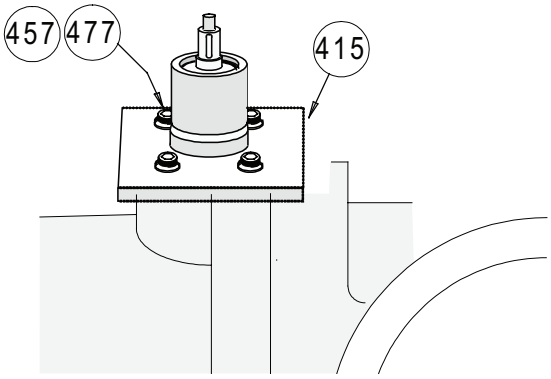
Figure 5-20. Command Shaft Assembly Replacement

Slide Valve Command Shaft Assembly Replacement (For the Design Before June 2006)

Removal

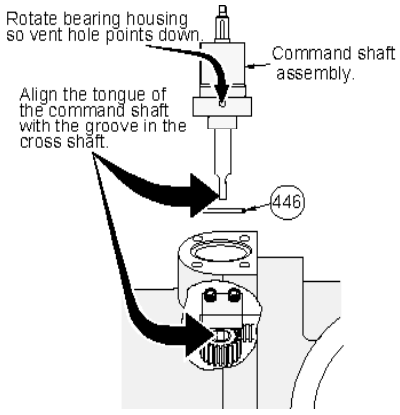
The following steps can be used to remove or install either the capacity or volume command shaft assemblies.

1. Prepare the compressor for servicing.
2. Follow the appropriate instructions to remove control actuator.
3. Remove four socket head cap screws (457) and Nord-Lock washers (477) securing mounting plate (415) to manifold.
4. The command shaft and mounting plate may now be removed from the compressor.



Installation

5. Install the command shaft assembly with a new O-ring (446) on the manifold. Make sure that the command shaft tongue is engaged in the cross shaft slot. Rotate the bearing housing so the vent holes point down, this will prevent water and dust from entering the vents.

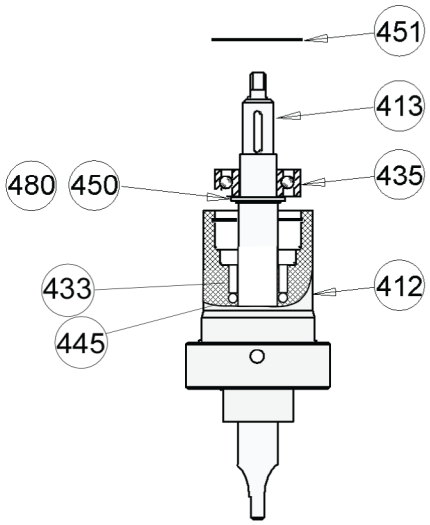


6. Install the actuator mounting plate with the four socket head cap screws and Nord-Lock washers securing it with proper torque.
7. The unit can now be leak checked.

Slide Valve Command Shaft Bearing and O-Ring Seal Replacement (For the Design Before June 2006)

Removal

1. Remove command shaft assembly, as shown before.
2. Remove snap ring retainer (451) from command shaft housing (412). Push the command shaft assembly out of the housing.



3. The command shaft bearing (435) is a press fit on the command shaft (413). Remove the command shaft bearing with a suitable press.
4. Remove the O-ring seal (445) from the command shaft housing. The command shaft bushing (433 and 436) might have to be removed to gain access to O-rings. Replace bushing if the bore is deeply scored or excessively worn.

Reassembly

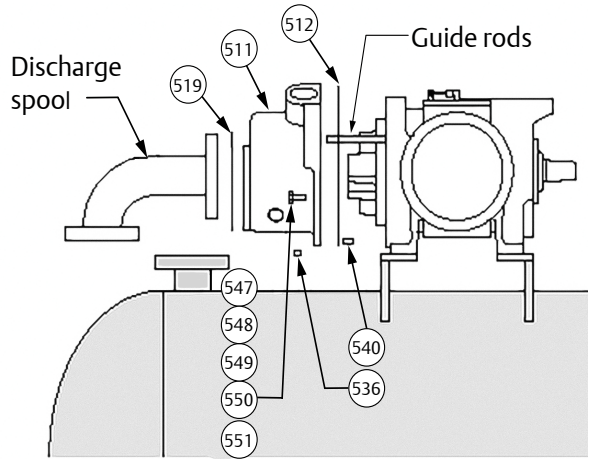
1. Install new O-ring seal in housing and lubricate the O-ring with clean compressor oil. A vent hole is provided in the command shaft bearing housing to allow any gas and oil that may leak past the O-ring seal to vent to atmosphere and not into the slide valve motor housing. Install snap ring retainer and washer on the command shaft.
2. Remove any burrs from the command shaft to prevent damage to the O-ring when assembling. Press the command shaft bearing onto the command shaft. Insert the command shaft into the housing applying pressure on outer race of bearing. Make sure the bearing is fully seated in the command shaft housing. Install the snap ring retainer in the command shaft housing.
3. Install command shaft assembly, as shown before.

Discharge Manifold Removal

1. Remove both control actuators and command shaft assemblies.
2. On VSG 751-2101 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

1. 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.
2. On VSG 751-2101 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.
3. On VSG 301-701 compressors install the bolts in the discharge flange. Install the drain plug in the bottom of the discharge manifold.
4. Install both command shaft assemblies and control actuators.

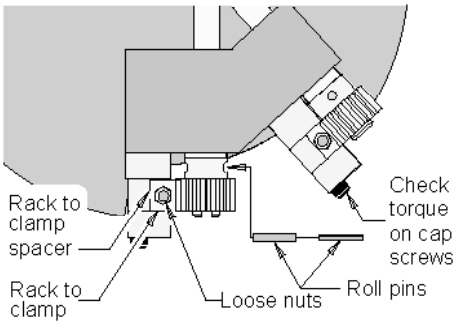
Slide Valve Gear and Rack Inspection

1. Remove the discharge manifold.
2. Check rack to rack clamp and rack clamp spacer clearance on all four slide valves.

Table 5-4. Rack Clearance Values

Measurement	Clearance
Rack to clamp	0.005 to 0.010”
Rack to clamp spacer	0.003 to 0.005”

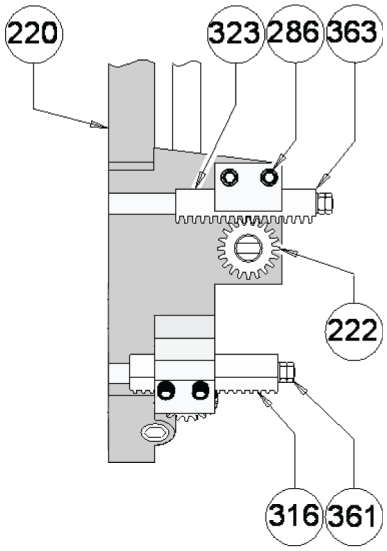
3. Check torque of socket heat cap screws.
4. Check for excessive movement between the slide valve rack shafts and the rack. The jam nuts on the end of the slide valve rack shaft should be tight.
5. Check for loose or broken roll pins in gears.



6. Look for any excessive wear on all moving parts and replace the worn parts.
7. Reassemble the manifold and discharge elbow.

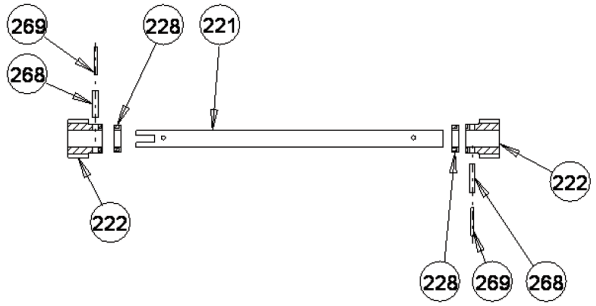
Removal of Capacity or Volume Cross Shafts

1. Remove the discharge manifold.
2. To remove the capacity or volume ratio slide valve racks, remove the two jam nuts and lock washers (361) securing the rack (316) to the slide valve shafts. The racks can now be pulled off the slide valve shafts. Repeat the procedure for the remaining pair of slide valve racks.

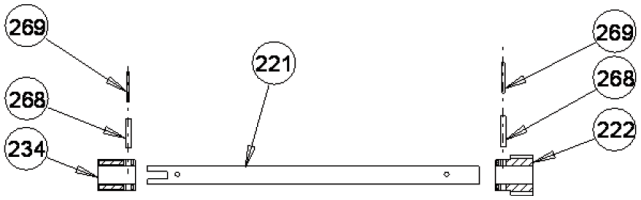


3. To remove the cross shafts, remove socket head bolts, clamp and spacers from both sides.

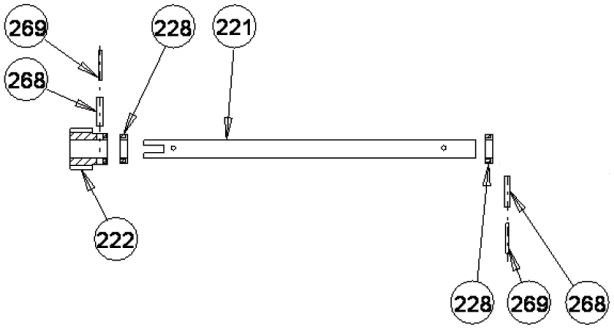
VSG 751-2101 compressors cross shafts.



VSSG 291-601 compressors cross shafts
Volume control cross shaft.



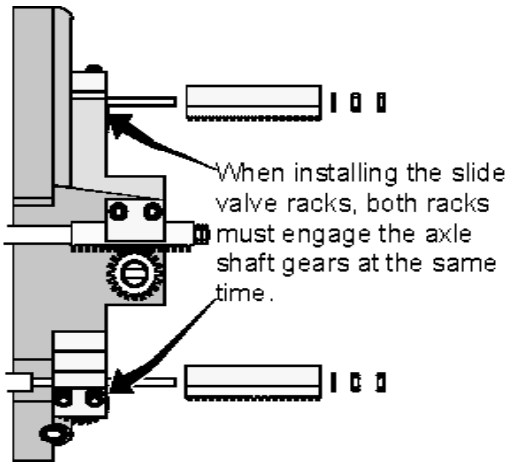
Capacity control cross shaft.



4. Drive the roll pins from pinion gear from one side. Remove pinion gear. Slide the cross shaft with the remaining pinion gear or spacers out of the opposite side. Repeat the procedure for the remaining cross shaft.

Installation of Capacity or Volume Cross Shafts

1. To reassemble either set of capacity or volume ratio slide valve racks, install the cross shaft with the pinion gear onto the back plate, place the remaining pinion gear on the shaft and drive in the roll pins. Install clamps, spacers and bolts on both sides. Tighten the bolts to the recommended torque values.
2. The slide valve sets must be synchronized on VSG 751-2101 and dual gate VSG 301-701 units. Both slide valve racks for either the volume ratio or capacity slide valves must engage the cross shaft gears at the same time. Push the racks all the way towards the suction end of the compressor until they stop. Install washers and jam nuts on the slide valve shafts. Repeat the procedure for the remaining set of slide valve racks.



3. 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.
4. On VSG 751-2101 and VSSG 291-601 and VSG 301-701 compressors install the discharge.

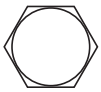
Main Rotor Assembly

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 5-5. Torque Specifications (All units, Ft.-Lbs)

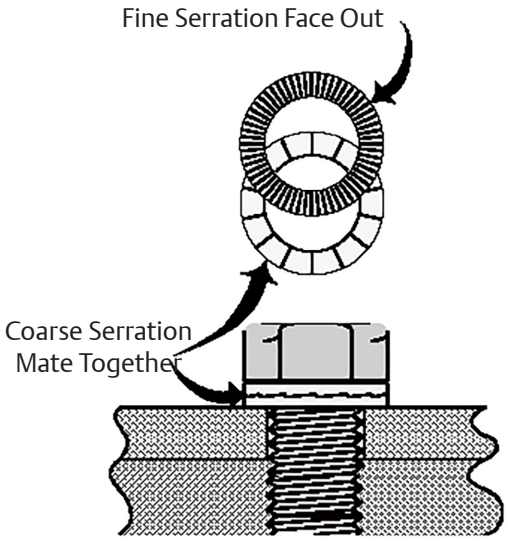
TYPE BOLT	HEAD MARKINGS	NOMINAL SIZE NUMBERS OR INCHES									
		#10	1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4	7/8
SAE GRADE 2 COARSE (UNC)			5	10	18	29	44	63	87	155	150*
SAE GRADE 5 COARSE (UNC)			8	16	28	44	68	98	135	240	387
SAE GRADE 5 FINE (UNF)				16							
SAE GRADE 8 COARSE (UNC)			11	22	39	63	96	138	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.										

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 Troubleshooting Guide

Refer to the following tables for Slide Valve Actuator Troubleshooting Guide.

Table 6-1. Slide Valve Actuator 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.
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 recalibrate.
	The position sensor's EEPROM memory has failed	Replace the actuator.

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

Problem	Reason	Solution
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 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 6-2. Slide Valve Actuator 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 6-2. Slide Valve Actuator 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: 1. The EEPROM memory in the micro-controller is bad. 2. 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.

Troubleshooting Guide - General Problems and Solutions

Refer to the following tables for Troubleshooting Guide - General Problems and Solutions.

Table 6-3. Troubleshooting Guide - General Problems and 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 transducer, discharge pressure transducer, and suction transducer. • Check for correct oil pump motor rotation and operation. • Ensure transducer isolation valves are open. • Verify that the correct transducer 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.
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 and transducers.

Table 6-3. Troubleshooting Guide - General Problems and Solutions (2 of 3)

Problem	Solution
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.
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.

Table 6-3. Troubleshooting Guide - General Problems and Solutions (3 of 3)

Problem	Solution
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 Service and Warranty (S&W) department representative. *Ensure to have the original Vilter sales order number for the equipment available to better assist you.*
2. Our Vilter S&W 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, 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@Emerson.com

If the defective part or product is a motor or starter, please complete the form on the next page and return it to:

Service.Vilter@Emerson.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.

EMERSON

VILTER™

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@Emerson.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 S&W 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 i.

- 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 frame with cast ductile iron discharge manifold and gate rotor covers with discharge connection horizontal.
- Standard drive shaft is tapered.
- Standard slide assembly.
- Viton shaft seal O-rings.
- 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@Emerson.com

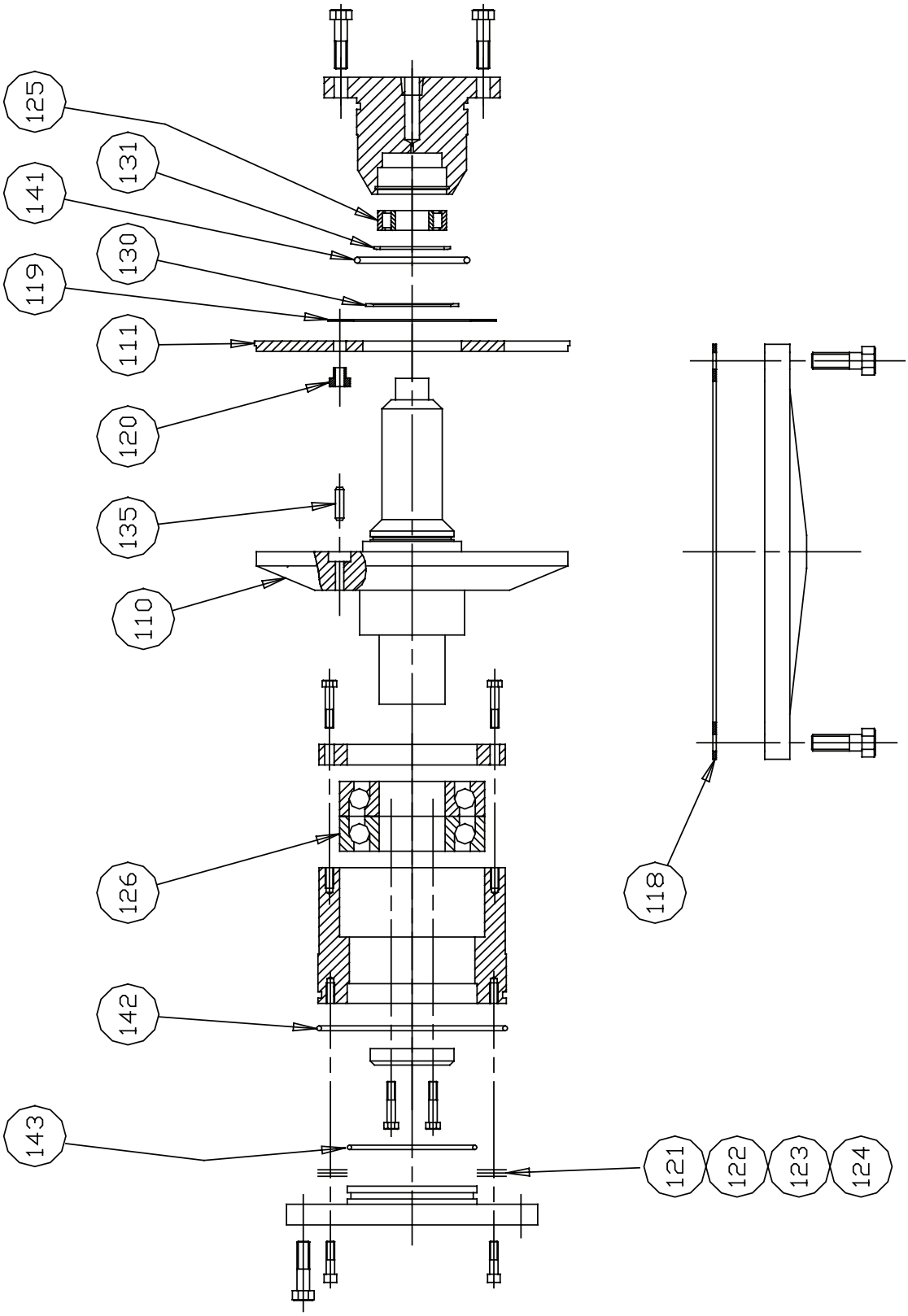
Website: Emerson.com/Vilter

Recommended Spare Parts List

Refer to the Custom Manual
Spare Parts Section for Specific Applications

NOTE
Please have your Model # and Sales Order # available when ordering.
These are found on the compressor's Name Plate.

Gate Rotor


125
131
141
130
119
111
120
135
110
126
142
143
118
121
122
123
124

Gate Rotor

ITEM	DESCRIPTION	MODEL NUMBER			
		VSSG 451		VSSG 601	
		QTY	VPN	QTY	VPN
-	GATE ROTOR BLADE AND BEARING REPLACEMENT KIT (111, 118, 120A, 120B, 121, 122, 123, 124, 125, 126, 130, 131, 141, 142, 143)	2	KT712AV	2	KT712B
-	GATE ROTOR BLADE REPLACEMENT KIT (111, 118, 120A, 120B, 121, 122, 123, 124, 130, 141, 142 AND 143)	2	KT713A	2	KT713B
102	GATE ROTOR SUPPORT ASSEMBLY (100, 111, 119,120B AND 130)	2	A25161BB	2	A25161BA
105	GATE ROTOR GASKET SET (118, 141, 142 AND 143)	2	A25164B	2	A25164B
106	SHIM PACK SET ((2) 121, (2) 122, (1) 123 AND (1) 124)	2	A25165B	2	A25165B
110	SUPPORT	2	25606A	2	25520A
111	GATE ROTOR	2	25557A	2	25534A
112	SMALL BEARING HOUSING	2	25518D	2	25518D
113	LARGE BEARING HOUSING	2	25517A	2	25517A
114	RETAINER	2	25008A	2	25008A
115	RETAINER	2	25009A	2	25009A
116	BALL BEARING COVER	2	25258A	2	25258A
117	GATE ROTOR COVER	2	25519A	2	25519A
118	GATE ROTOR COVER GASKET	2	25259A	2	25259A
119	WASHER	2	25007A	2	25007A
120A	BUSHING, SMALL DOWEL PIN	2	25006A	2	25006A
120B	BUSHING, LARGE DOWEL PIN	2	25760A	2	25760A
121	SHIM 0.002”	AR	25010AA	AR	25010AA
122	SHIM 0.003”	AR	25010AB	AR	25010AB
123	SHIM 0.005”	AR	25010AC	AR	25010AC
124	SHIM 0.010”	AR	25010AD	AR	25010AD
125	ROLLER BEARING	2	2864B	2	2864B
126	BALL BEARING	4	2865BP	4	2865BP
130	RETAINING RING	2	2866A	2	2866A
131	RETAINING RING	2	2867A	2	2867A
135A	DOWEL PIN, SM, 0.250” O.D.	2	2868B	2	2868B
135B	DOWEL PIN, LG, 0.4375” O.D.	2	25910A	2	25910A
141	O-RING ROLLER BRG HSG	2	2825D	2	2825D
142	O-RING BALL BRG HSG	2	2825G	2	2825G
143	O-RING BRG HSG COVER	2	2825E	2	2825E
150	HEX HEAD CAP SCREW	12	2796AJ	12	2796AJ
151	HEX HEAD CAP SCREW	6	2796B	6	2796B
152	HEX HEAD CAP SCREW	40	2796CJ	40	2796CJ
153	HEX HEAD CAP SCREW	32	2796E	32	2796E
160	SOCKET HEAD CAP SCREW	12	2795E	12	2795E

Note- AR - As Required.

Gate Rotor

ITEM	DESCRIPTION	MODEL NUMBER							
		VSG 751		VSG 901		VSG 1051		VSG 1201	
		QTY	VPN	QTY	VPN	QTY	VPN	QTY	VPN
-	GATE ROTOR BLADE AND BEARING REPLACEMENT KIT (111, 118, 120A, 120B, 121, 122, 123, 124, 125, 126, 130, 131, 141, 142 143)	2	KT712C	2	KT712DV	2	KT712E	2	KT712FV
-	GATE ROTOR BLADE REPLACEMENT KIT (111, 118, 120A, 120B, 121, 122, 123, 124, 130, 141, 142, 143)	2	KT713C	2	KT713D	2	KT713E	2	KT713F
102	GATE ROTOR SUPPORT ASSEMBLY (100, 111, 119, 120B, 130)	2	A25161CB	2	A25161CA	2	A25161DB	2	A25161DA
105	GATE ROTOR GASKET SET (118, 141, 142, 143)	2	A25164C	2	A25164C	2	A25164D	2	A25164D
-	SHIM PACK SET ((2) 121, (2) 122, (1) 123, (1) 124)	2	A25165C	2	A25165C	2	A25165C	2	A25165C
110	SUPPORT	2	25612A	2	25553A	2	25614A	2	25587A
111	GATE ROTOR	2	25608A	2	25554A	2	25610A	2	25588A
118	GATE ROTOR COVER GASKET	2	25088A	2	25088A	2	25132A	2	25132A
119	WASHER	2	25086A	2	25086A	2	25086A	2	25086A
120A	BUSHING, SMALL DOWEL PIN	2	25087A	2	25087A	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	2864C	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	2867E	2	2867L	2	2867L
135A	DOWEL PIN, SMALL, 0.3125” O.D.	2	2868F	2	2868F	2	2868H	2	2868H
135B	DOWEL PIN, LARGE, 0.4375” O.D.	2	25910B	2	25910B	2	25910B	2	25910B
141	O-RING ROLLER BRG HSG	2	2825G	2	2825G	2	2825AB	2	2825AB
142	O-RING BALL BRG HSG	2	2825X	2	2825X	2	2825AC	2	2825AC
143	O-RING BRG HSG COVER	2	2825T	2	2825T	2	2825T	2	2825T

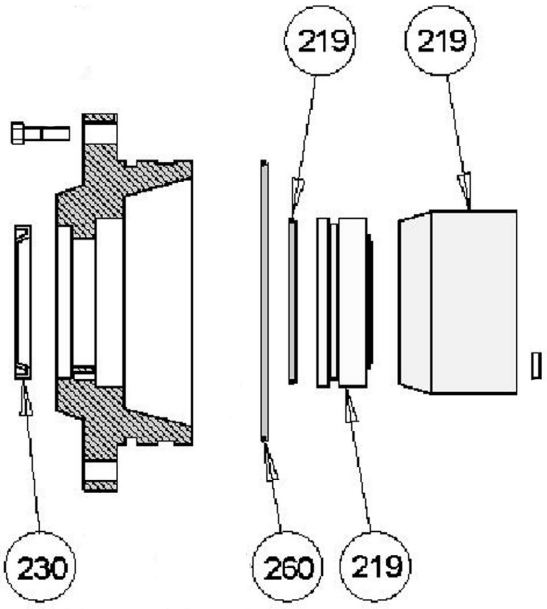
Note- AR - As Required.

Gate Rotor

ITEM	DESCRIPTION	QTY	MODEL NUMBER		
			VSG 1551	VSG 1851	VSG 2101
			VPN	VPN	VPN
-	GATE ROTOR BLADE AND BEARING REPLACEMENT KIT (111, 118, 120A, 120B, 121, 122, 123, 124, 125, 126, 130, 131, 141, 142, 143)	2	KT712L	KT712M* KT712MN** KT712MNAF**	KT712K* KT712KN** KT712KNAF**
-	GATE ROTOR BLADE REPLACEMENT KIT (111, 118, 120A, 120B, 121, 122, 123, 124, 130, 141, 142, 143)	2	KT713G	KT713H* KT713HN**	KT713L
101	GATE ROTOR ASSEMBLY (111, 120)	2	A25160EB	A25160EA	A25160EA
102	GATE ROTOR SUPPORT ASSEMBLY (100, 111, 119, 120B, 130)	2	A25161EB	A25161EA	A25161EC
104	SHIM 350 MM GATEROTOR BALL BRG VSS	2	25977U	25977U	25977U
105	GATE ROTOR GASKET SET (118, 141, 142, 143)	2	A25164E	A25164E	A25164E
-	SHIM PACK SET ((2) 121, (2) 122, (1) 123, (1) 124)	2	A25165E	A25165E	A25165E
110	SUPPORT	2	25665C	25665E	25665D
111	GATE ROTOR	2	25647A	25645A	25744D
112	SMALL BEARING HOUSING	2	26507A	26507A	26507A
113	LARGE BEARING HOUSING	2	26506A	26506A	26506A
114	RETAINER	2	25141A	25141A	25141A
115	RETAINER	2	25789A	25789A	25789A
116	BALL BEARING COVER	2	25351A	25351A	25351A
117	GATE ROTOR COVER	2	26508B	26508B	26508B
118	GATE ROTOR COVER GASKET	2	26509A	26509A	26509A
119	WASHER	2	25788A	25788A	25788A
120B	BUSHING, LARGE DOWEL PIN	2	25760C	25760C	25760C
121	SHIM 0.002”	AR	25791AA	25791AA	25791AA
122	SHIM 0.003”	AR	25791AB	25791AB	25791AB
123	SHIM 0.005”	AR	25791AC	25791AC	25791AC
124	SHIM 0.010”	AR	25791AD	25791AD	25791AD
125	ROLLER BEARING	2	2864K	2864K	2864K
126	BALL BEARING	4	2865K	2865K	2865K
130	RETAINING RING	2	2866G	2866G	2866G
131	RETAINING RING	2	2867R	2867R	2867R
135B	DOWEL PIN, LARGE, 0.500” O.D.	2	25910C	25910C	25910C
141	O-RING ROLLER BRG HSG	2	2825T	2825T	2825T
142	O-RING BALL BRG HSG	2	2825V	2825V	2825V
143	O-RING BRG HSG COVER	2	2825S	2825S	2825S
150	HEX HEAD CAP SCREW	12	2796CJ	2796CJ	2796CJ
151	HEX HEAD CAP SCREW	8	2796N	2796N	2796N
152	HEX HEAD CAP SCREW	32	2796CJ	2796CJ	2796CJ
153	HEX HEAD CAP SCREW	44	2796R	2796R	2796R
160	SOCKET HEAD CAP SCREW	16	2795G	2795G	2795G

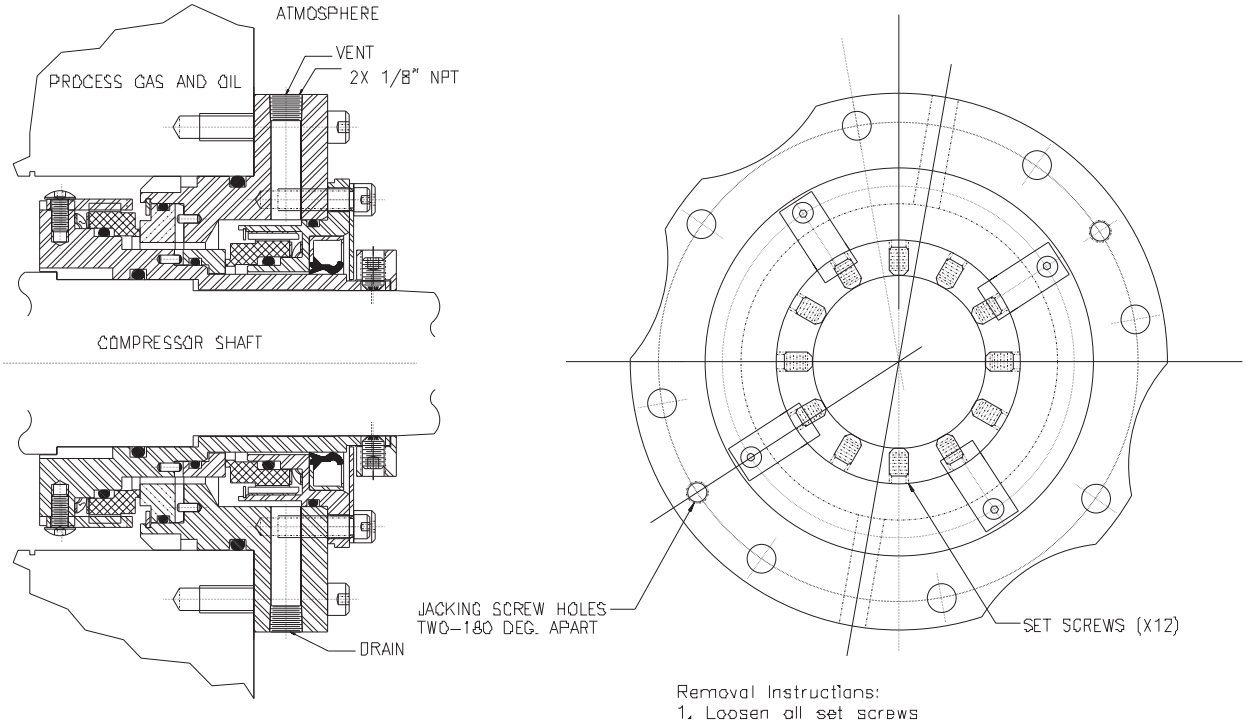
Notes- AR - As Required. * - For Serial Numbers Before 5580. ** - For Serial Numbers After 5580.

Shaft Seal



ITEM	DESCRIPTION	MODEL NUMBER					
		VSSG 291 - 601		VSG 751 - 1201		VSG 1551 - 2101	
		QTY	VPN	QTY	VPN	QTY	VPN
-	SHAFT SEAL VITON KIT (219, 260, 230)	1	KT709AG	1	KT709BG	1	KT709CG
230	OIL SEAL	1	25040A	1	2930F	1	2930B
260	O-RING	1	2825F	1	2825AR	1	2825W

Tandem Shaft Seal



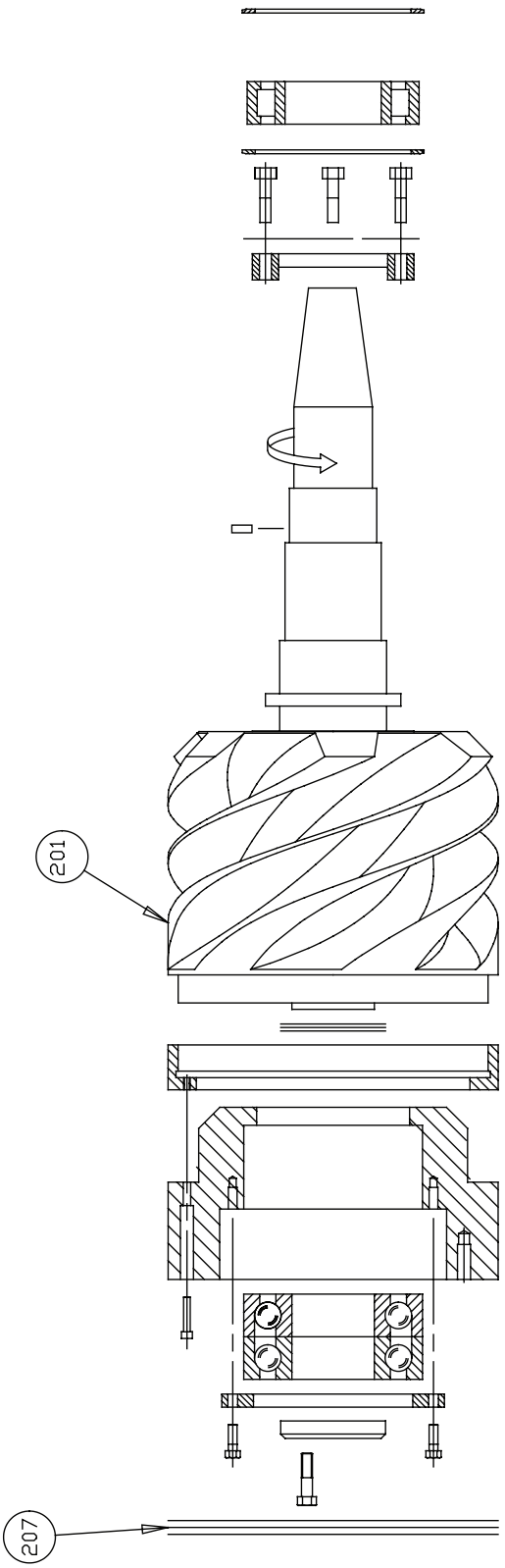
Removal Instructions:
1. Loosen all set screws
2. Remove bolts
3. Remove seal from compressor.(jacking locations are provided to help remove the seal)

PIPE VENT & DRAIN SEPARATELY USING MIN. 1/4" OD TUBING TO LOW PRESSURE COLLECTION POINTS

ITEM	DESCRIPTION	SHAFT DIAMETER			
		2.25"		2.875"	
		QTY	VPN	QTY	VPN
-	TANDEM SHAFT SEAL	1	25713A*	1	26380A***
		1	25713B**		

Notes- * - W/ Neoprene O-Rings. ** - W/ Viton O-Rings. *** - FEPM O-Rings.

Main Rotor

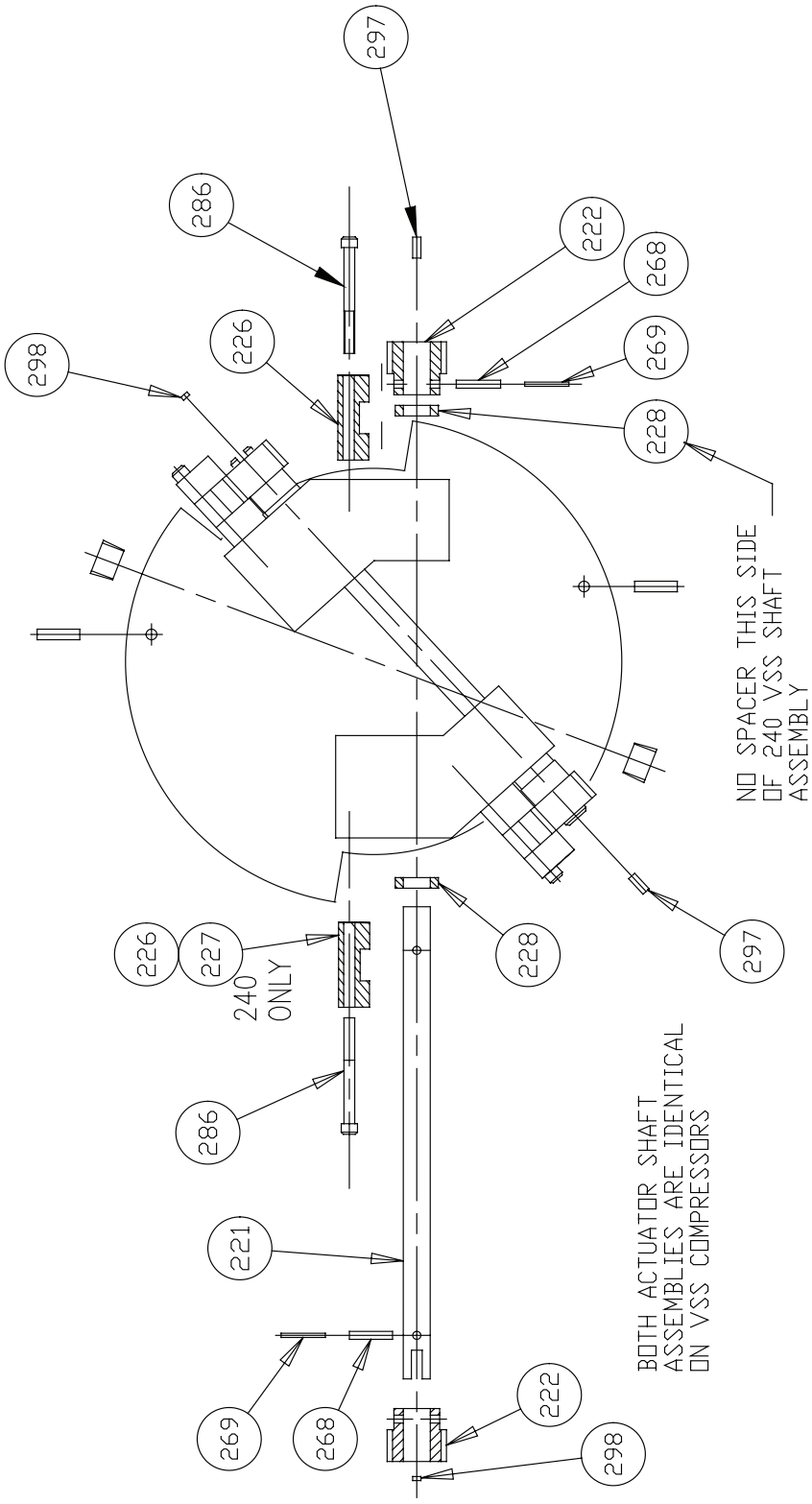


Note: Endplate to frame O–Rings
See item 530

Main Rotor

ITEM	207		201	
MODEL NUMBER	DESCRIPTION			
	SHIM PACK		ROTOR ASSEMBLY (DOES NOT INCLUDE SHIM PACK #207)	
	QTY	VPN	QTY	VPN
VSSG 451	1	A25177B	1	A25168BB
VSSG 601	1	A25177B	1	A25168BA
VSG 751	1	A25177C	1	A25168CB
VSG 901	1	A25177C	1	A25168CA
VSG 1051	1	A25177D	1	A25168DB
VSG 1201	1	A25177D	1	A25168DA
VSG 1551	1	A25177E	1	A25168EB
VSG 1851	1	A25177E	1	A25168ED
VSG 2101	1	A25177E	1	A25168EE

Slide Valve Cross Shafts and End Plate

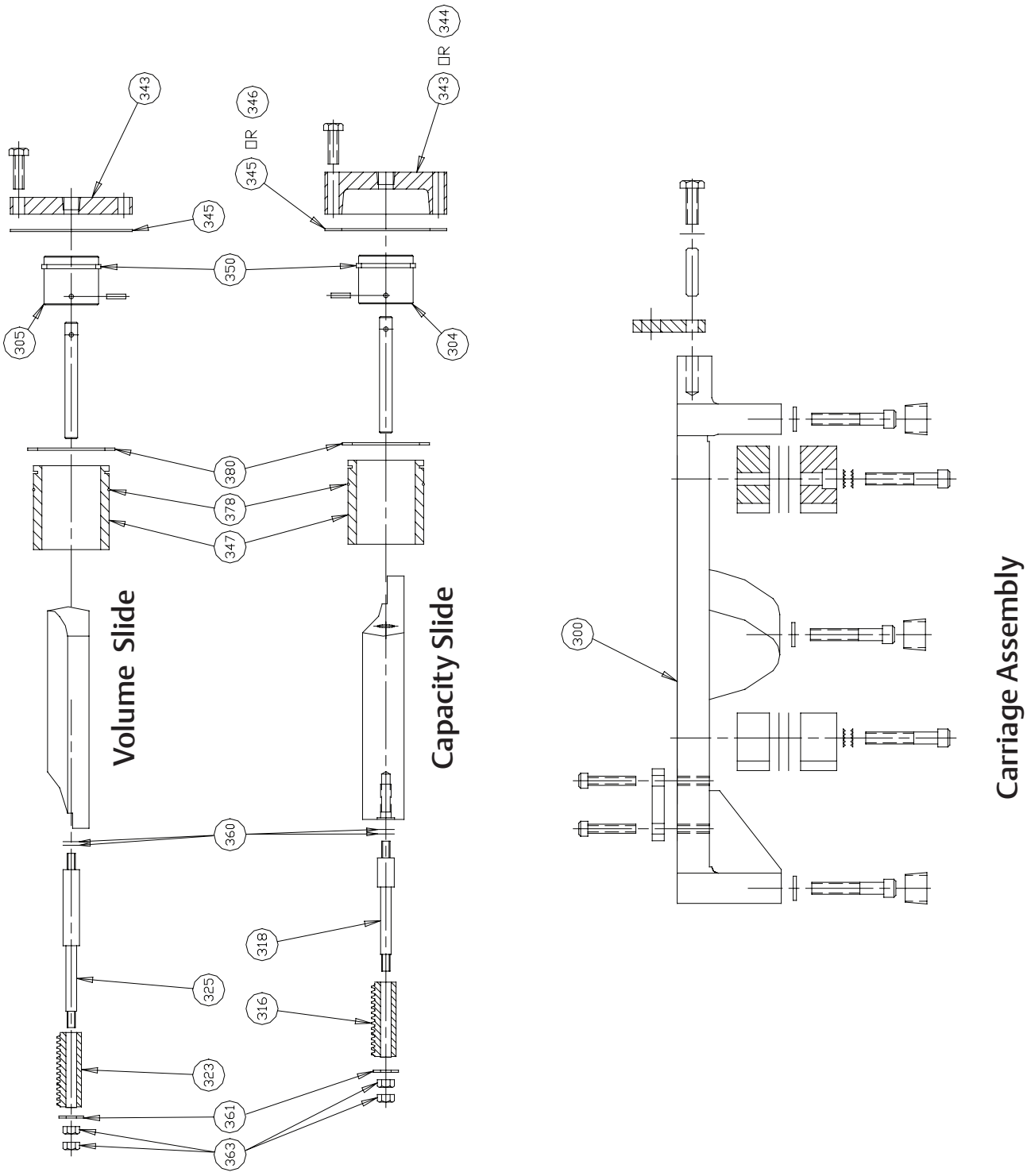


Slide Valve Cross Shafts and End Plate

ITEM	DESCRIPTION	MODEL NUMBER							
		VSSG 291 - 601		VSG 751 VSG 901		VSG 1051 VSG 1201		VSG 1551 - 2101	
		QTY	VPN	QTY	VPN	QTY	VPN	QTY	VPN
220	END PLATE	-	N/A	1	25543A	1	25593A	1	25661A
221	SHAFT	2	25843A	2	25844A	2	25845A	2	25793A
222	GEAR	4	25027A	4	25027A	4	25027A	4	25027A
226	RACK CLAMP	2	25913A	4	25913C	4	25913C	4	25913C
227	RACK CLAMP	2	25913B	-	N/A	-	N/A	-	N/A
228	SPACER	2	25847A	4	25033C	4	25033C	4	25033C
267	DOWEL PIN	-	N/A	2	2868B	2	2868B	2	2868B
268	EXPANSION PIN	4	1193D	4	1193D	4	1193D	4	1193D
269	EXPANSION PIN	4	2981AA	4	2981AA	4	2981AA	4	2981AA
270	PIPE PLUG	-	N/A	2	2606E	2	2606E	2	2606A
286	SOCKET HEAD CAP SCREW	8	2795F	8	2795F	8	2795F	8	2795F
297	SET SCREW	2	2060J	2	2060J	2	2060J	2	2060J
298	SET SCREW	2	2060H	2	2060H	2	2060H	2	2060H

Note - N/A - Not Available.

Slide Valve Carriage Assembly



Slide Valve Carriage Assembly

ITEM	DESCRIPTION	MODEL NUMBER VSSG 291 - 601	
		QTY	VPN
300	CARRIAGE ASSEMBLY	2	A25179B
304	CAPACITY PISTON (340, 341, 350, 355)	2	A25183B
305	VOLUME PISTON (340, 342, 350, 355)	2	A25184B
307	GASKET (345B)	2	A25200B
316	RACK	2	25024AH
323	RACK	2	25023AH
343A	COVER, SEPARATE VOL. & CAP.	4	25022A
343B	COVER, ONE PIECE CAST	2	25399D
345A	GASKET, SEPARATE VOL. & n/a CAP COVERS	4	25021A
345B	GASKET, ONE PIECE CAST COVER	2	25900A
350	PISTON RING SET	4	2953AA
355	EXPANSION PIN	4	1193PP
359	PIPE PLUG	6	2606D
360	LOCK WASHER (PAIR)	4	3004C
361	WASHER	4	13265B
363	NUT	8	2797A
366A	HEX HEAD CAP SCREW, SEPARATE VOL. & CAP COVERS	24	2796N
366B	HEX HEAD CAP SCREW, ONE PIECE CAST COVER	24	2796B

Slide Valve Carriage Assembly

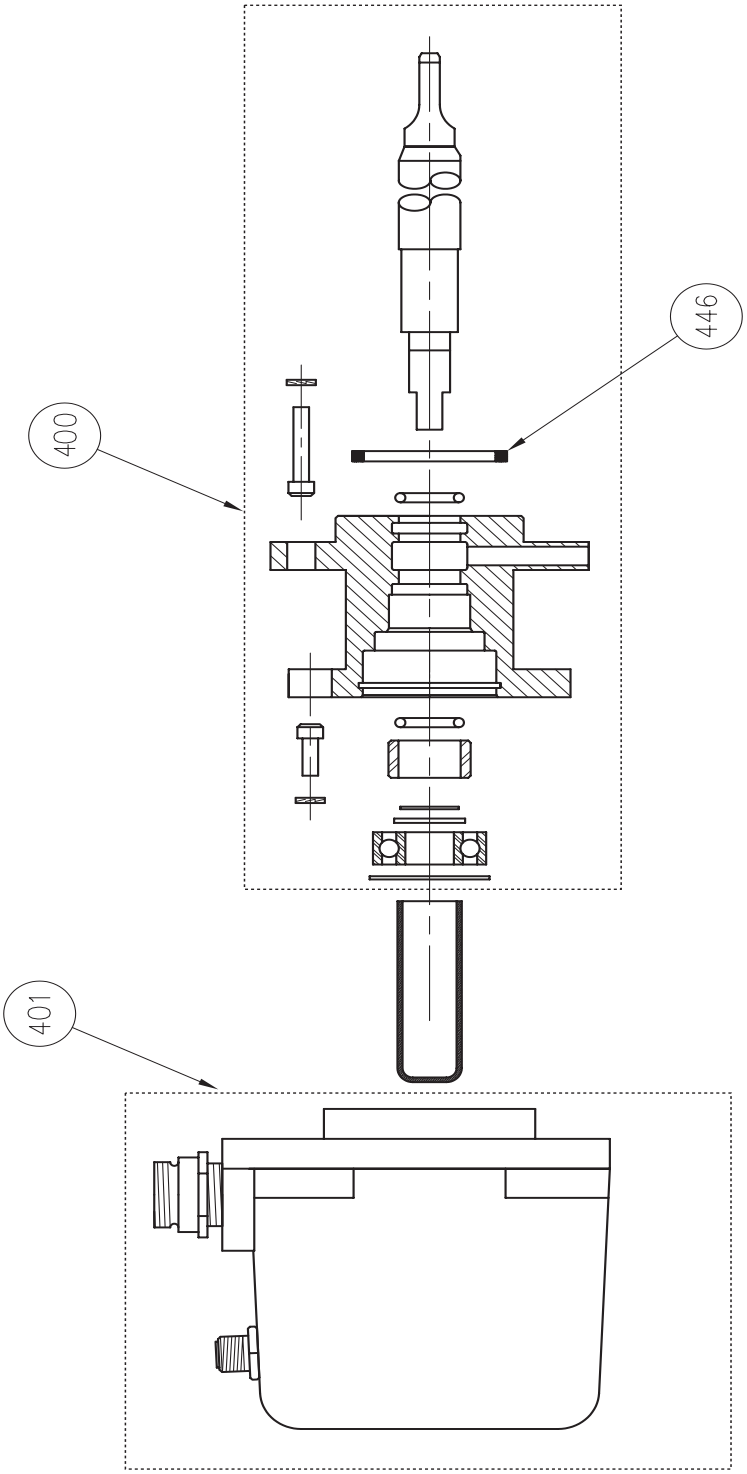
ITEM	DESCRIPTION	MODEL NUMBER			
		VSG 751 VSG 901		VSG 1051 VSG 1201	
		QTY	VPN	QTY	VPN
300	CARRIAGE ASSEMBLY	2	A25179C	2	A25179D
304	CAPACITY PISTON (340, 341, 350, 355)	2	A25183C	2	A25183D
305	VOLUME PISTON (340, 342, 350, 355)	2	A25184C	2	A25184D
307	GASKET (345B, 378**)	2	A25200C	2	A25200D
316	RACK	2	25080AH	2	25080CH
323	RACK	2	25080BH	2	25080DH
340	PISTON	4	25076A	4	25138A
341	CAPACITY PISTON SHAFT	2	25078A	2	25078E
342	VOLUME PISTON SHAFT	2	25078B	2	25078F
343A	COVER, SEPARATE VOL. & CAP.	2	25123B	4	25123D
343B	COVER, ONE PIECE CAST	2	25279A	2	25401A
344	COVER, SEPARATE VOL. & CAP.	2	25123A	-	N/A
345A	GASKET, SEPARATE VOL. & n/a CAP COVERS	2	25124B	4	25124C
345B	GASKET, ONE PIECE CAST COVER	2	25902A	2	25901A
346	GASKET, SEPARTAE VOL. & CAP. COVERS	2	25124A	-	N/A
347	PISTON SLEEVE	2	25079A	-	N/A
350	PISTON RING SET	4	2953AB	4	2953AC
355	EXPANSION PIN	4	1193PP	4	1193PP
359	PIPE PLUG	6	2606D	6	2606E
360	LOCK WASHER (PAIR)	4	3004C	4	3004C
361	WASHER	4	13265B	4	13265B
363	NUT	8	2797A	8	2797A
366A	HEX HEAD CAP SCREW	12	2796B	24	2796B
366B	HEX HEAD CAP SCREW	12	2796P	24	2796P
367	HEX HEAD CAP SCREW	12	2796BN	-	N/A
373	SOCKET HEAD CAP SCREW	6	2795N	6	2795P
374	LOCK WASHER (PAIR)	6	3004C	6	3004D
378	O-RING	2	2825G	-	N/A
380	RETAINER RING	2	2866C	-	N/A

Note - N/A - Not Available.

Slide Valve Carriage Assembly

ITEM	DESCRIPTION	MODEL NUMBER VSG 1551 - 2101	
		QTY	VPN
300	CARRIAGE ASSEMBLY	2	A25179E
304	CAPACITY PISTON (340, 341, 350, 355)	2	A25183E
305	VOLUME PISTON (340, 342, 350, 355)	2	A25184E
307	GASKET (345, 378)	2	A25200E
316	RACK	2	25779AH
323	RACK	2	25780AH
325	SHAFT	2	25778A
340	PISTON	4	25782A
341	CAPACITY PISTON SHAFT	2	25784A
342	VOLUME PISTON SHAFT	2	25783A
343B	COVER	2	25690A
345B	GASKET	2	25384A
347	PISTON SLEEVE	4	25786A
350	PISTON RING SET	4	2953AD
355	EXPANSION PIN	4	1193PP
359	PIPE PLUG	6	2606E
360	LOCK WASHER (PAIR)	4	3004C
361	WASHER	4	13265B
363	NUT	8	2797A
366B	HEX HEAD CAP SCREW	28	2796BL
373	SOCKET HEAD CAP SCREW	6	2795AG
374	LOCK WASHER (PAIR)	6	3004D
378	O-RING	4	2825U
380	RETAINER RING	4	2866G

Actuator and Command Shaft

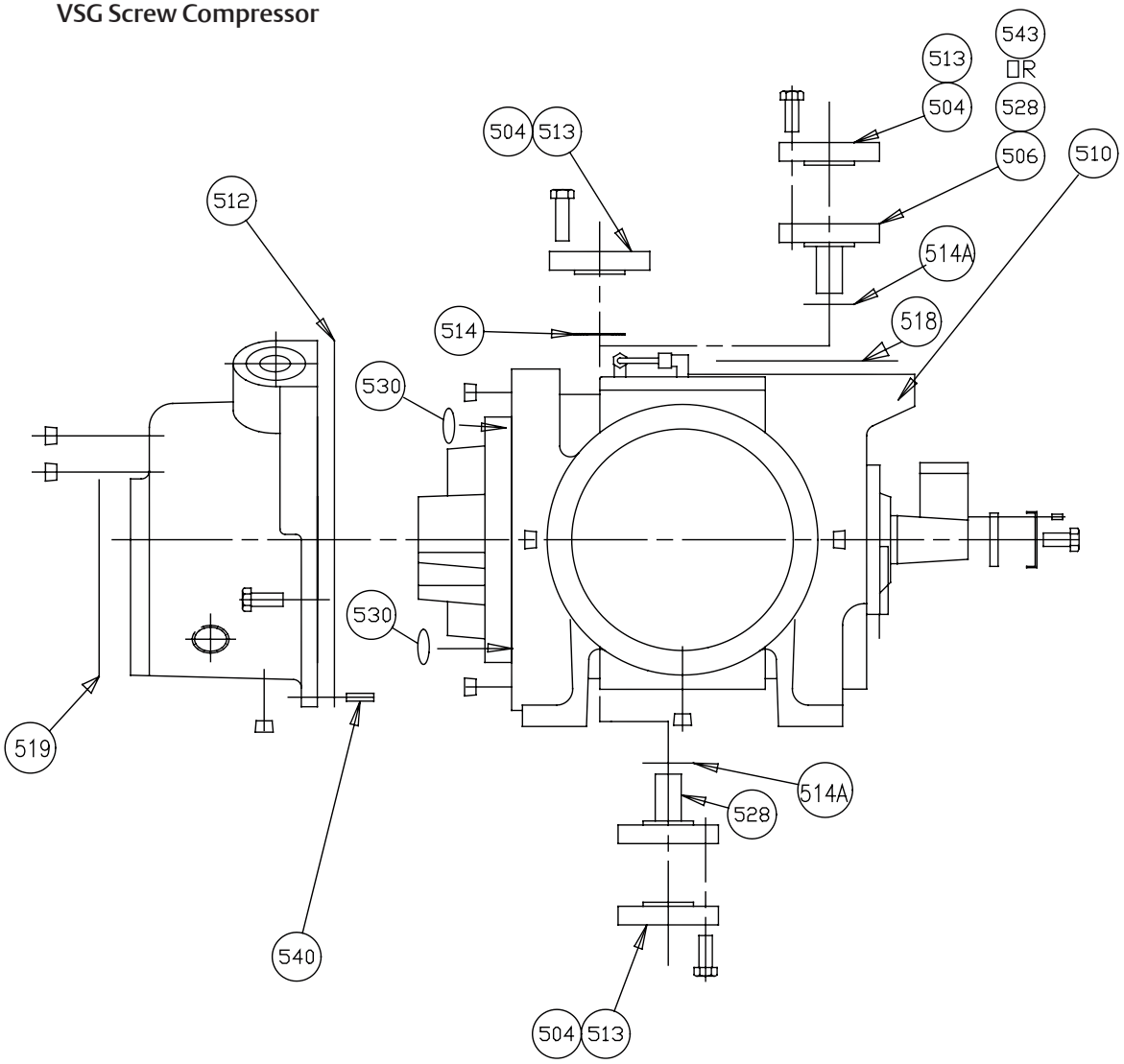


Actuator and Command Shaft

ITEM	DESCRIPTION	MODEL NUMBER							
		VSSG 291- 601		VSG 751- 901		VSG 1051-1201		VSG 1551 - 2101	
		QTY	VPN	QTY	VPN	QTY	VPN	QTY	VPN
400	COMMAND SHAFT ASSEMBLY	2	A25994B	2	A25994C	2	A25994D	2	A25994E
401	SLIDE VALVE ACTUATOR	2	25972D	2	25972D	2	25972D	2	25972D
446	O-RING	2	2825C	2	2825C	2	2825C	2	2825C

Miscellaneous Frame Components

VSG Screw Compressor



Miscellaneous Frame Components

ITEM	DESCRIPTION	MODEL NUMBER VSSG 291 - 601	
		QTY	VPN
-	GASKET AND O-RING KIT	1	KT710AN
504	FLANGE SET (513, 514, 547A)	1	A25190A
506	ECON-O-MIZER PORT	2	A25190B
512	MANIFOLD GASKET	1	25503A
513	FLANGE OIL	1	25058A
513	FLANGE ECON-O-MIZER	2	25058A
514	FLANGE GASKET OIL	1	11323D
514A	FLANGE GASKET ECON-O-MIZER	2	11323D
518	SUCTION FLANGE GASKET	1	25199C
519	DISCHARGE FLANGE GASKET	1	25199B
530	O-RING	2	2825B
540	DOWEL PIN	2	2868B
545	HEX HEAD CAP SCREW FOR OIL SUPPLY FLANGE	2	2796C
545	HEX HEAD CAP SCREW FOR ECON-O-MIZER FLANGE	4	2796C
547	HEX HEAD CAP SCREW	8	2796C

Miscellaneous Frame Components

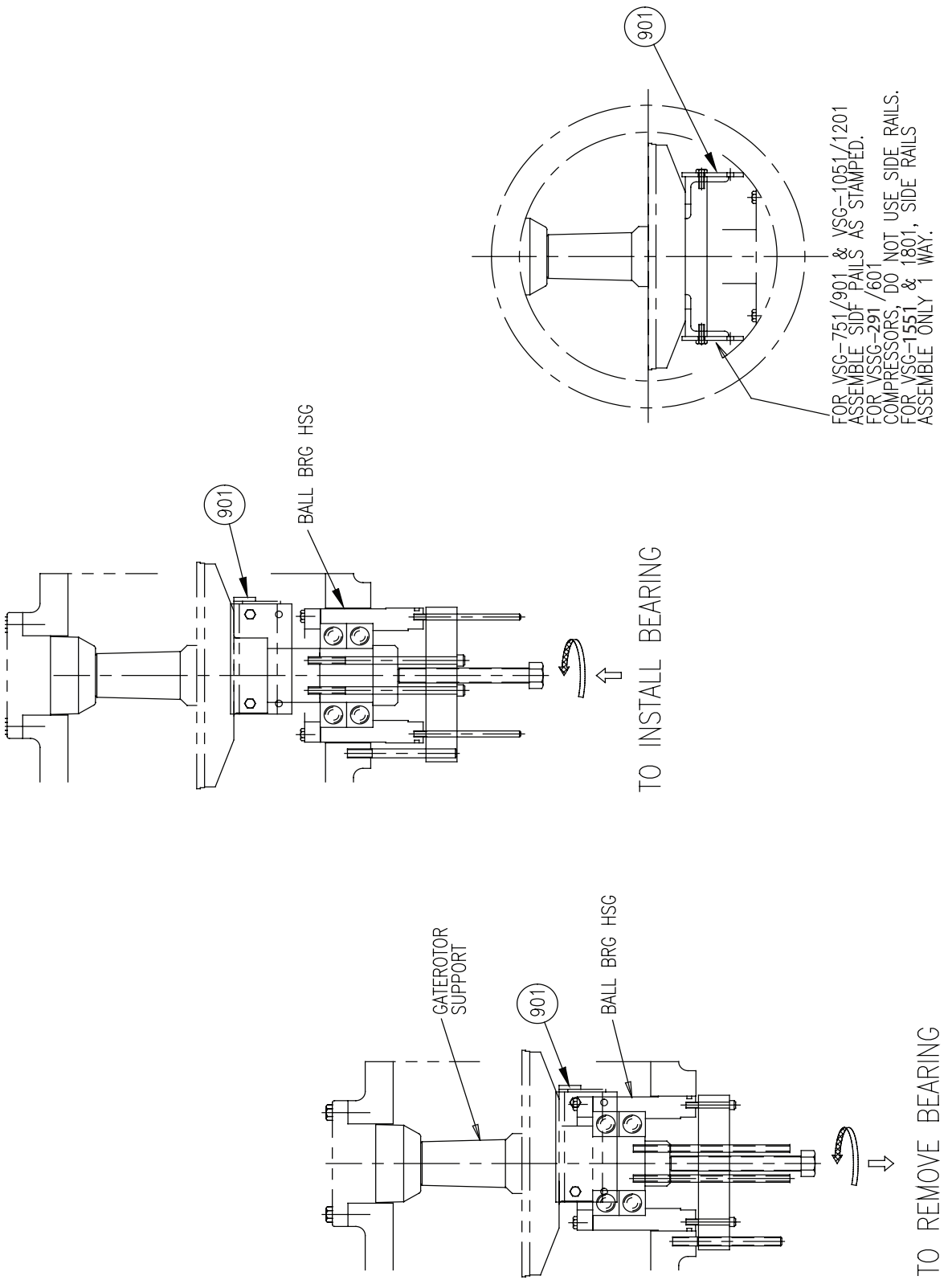
ITEM	DESCRIPTION	MODEL NUMBER					
		VSG 751		VSG 901		VSG1051 VSG1201	
		QTY	VPN	QTY	VPN	QTY	VPN
-	GASKET AND O-RING KIT	1	KT710B	1	KT710B	1	KT710C
504	FLANGE SET (513, 514, 547)	1	A25190A	1	A25190A	1	A25190B
512	MANIFOLD GASKET	1	25541A	1	25541A	1	25324A
513	FLANGE OIL	1	25058A	1	25058A	1	25058B
514	FLANGE GASKET OIL	1	11323D	1	11323D	1	11323E
518	SUCTION FLANGE GASKET	1	25199C	1	25199C	1	25199D
519	DISCHARGE FLANGE GASKET	1	25199B	1	25199B	1	25199C
526	ORIFICE PLATE	1	25223CB	1	25223CA	1	25223DB
529	WAVE SPRING	1	2912E	1	2912E	1	2912E
530	O-RING	2	2825R	2	2825R	2	2825R
538	PIPE PLUG 3/4” MPT	-	N/A	-	N/A	6	2606A
540	DOWEL PIN	2	2868B	2	2868B	2	2868B
547	HEX HEAD CAP SCREW	21	2796GP	21	2796GP	24	2796GP
554	HEX HEAD CAP SCREW	1	2796U	1	2796U	1	2796U

Note - N/A - Not Available.

Miscellaneous Frame Components

ITEM	DESCRIPTION	MODEL NUMBER	
		VSG 1551 - VSG 2101	
		QTY	VPN
-	GASKET AND O-RING KIT	1	KT710D
504	FLANGE SET (513, 514, 547)	1	A25190C
504	FLANGE SET 513A, 514A & 547 ECON-O-MIZER PORT	2	A25190D
512	MANIFOLD GASKET	1	25676A
513	FLANGE OIL	1	12477C
513A	FLANGE ECON-O-MIZER	-	-
514	FLANGE GASKET OIL.	1	11323F
514A	FLANGE GASKET ECON-O-MIZER	-	-
518	SUCTION FLANGE GASKET	1	25199D
519	DISCHARGE FLANGE GASKET	1	25199C
530	O-RING	2	2825R
538	PIPE PLUG 3/4” MPT.	3	2606A
540	DOWEL PIN	2	2868K
542	PIPE PLUG 3/4” MPT.	1	13163F
545	HEX HEAD CAP SCREW FOR OIL SUPPLY FLANGE	4	11397E

Replacement Tools



Replacement Tools

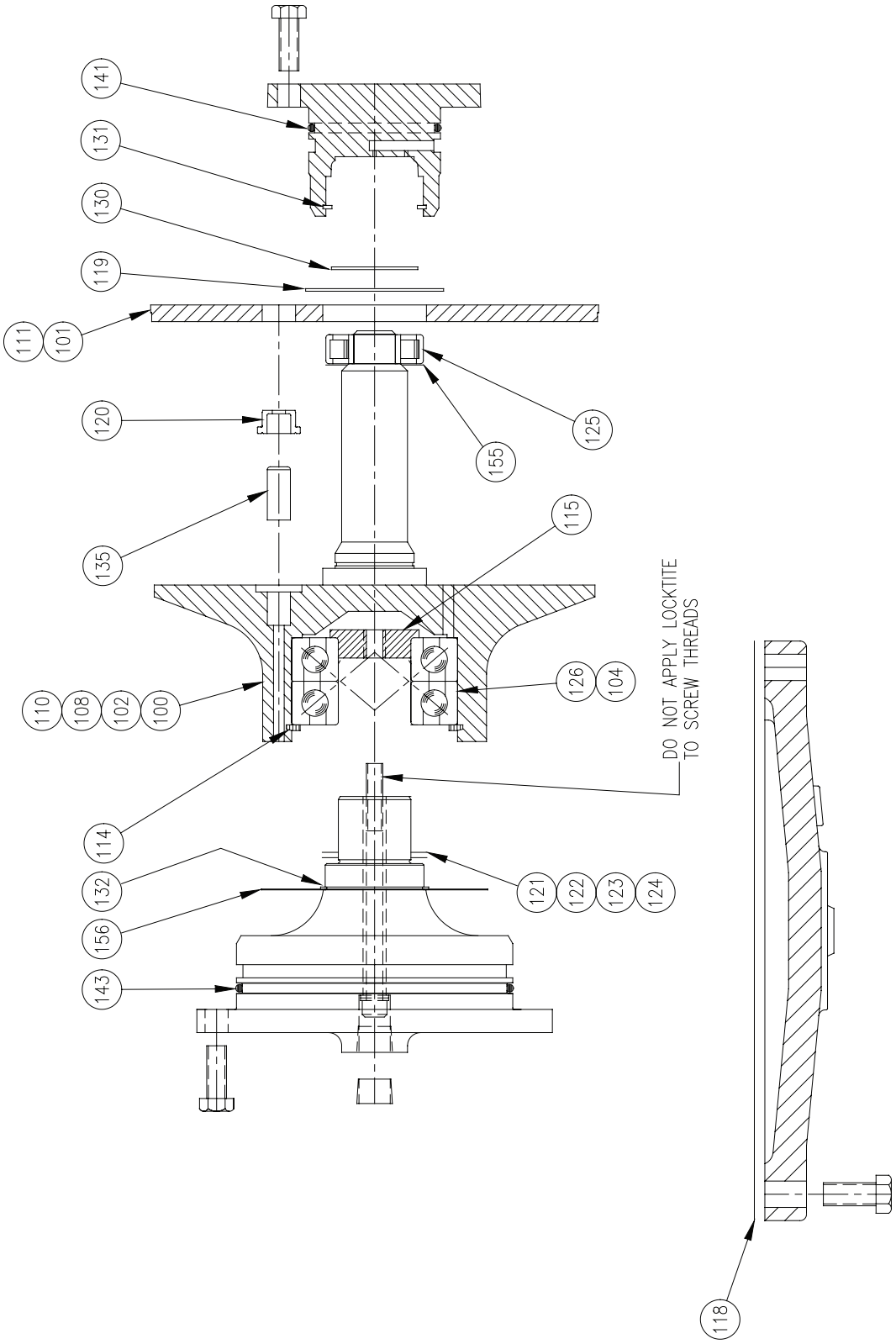
ITEM	DESCRIPTION	MODEL NUMBER							
		VSSG 291 - 601		VSG 751 VSG 901		VSG 1051 VSG 1201		VSG 1551 - 2101	
		QTY	VPN	QTY	VPN	QTY	VPN	QTY	VPN
900	GATE ROTOR TOOLS (901, 910, 911, 912, 913, 914, 915, 916, 917)	1	A25205B	1	A25205C	1	A25205C	1	A25205E
901	GATE ROTOR STABILIZER SET (901A, 901B, 901C)	1	A25698A	1	A25698A	1	A25698A	1	A25699A

VSG 301-701 Replacement Parts Section

Refer to the Custom Manual
Spare Parts Section for Specific Applications

NOTE
Please have your Model # and Sales Order # available when ordering.
These are found on the compressor's Name Plate.

Gaterotor Assembly



Gaterotor Assembly

Part totals indicated are for one gate rotor assembly, machines with two gate rotors will require double the components listed below.

ITEM	DESCRIPTION	MODEL NUMBER					
		VSG 301		VSG 361		VSG 401	
		QTY	VPN	QTY	VPN	QTY	VPN
100	SUPPORT ASSEMBLY (110 AND 135B)	1	A25222AB	1	A25222AA	1	A25222AC
101	GATE ROTOR AND DAMPER ASSEMBLY (111 AND 120)	1	A25160AB	1	A25160AA	1	A25160AC
102	GATE ROTOR SUPPORT ASSEMBLY (100, 101, 119 AND 130)	1	A25161AB	1	A25161AA	1	A25161AC
-	SHIM PACK SET ((2) 121, (2) 122, (1) 123, (1) 124)	1	A25165A	1	A25165A	1	A25165A
110	SUPPORT	1	25723D	1	25723C	1	25723B
111	GATE ROTOR	1	25718B	1	25718C	1	25718D
114	SNAP RING	1	2867L	1	2867L	1	2867L
115	RETAINER BALL BEARING	1	25935A	1	25935A	1	25935A
118	GATE ROTOR COVER GASKET	1	25259B	1	25259B	1	25259B
119	WASHER WAVE SPRING	1	3203A	1	3203A	1	3203A
120	DAMPER	1	25760A	1	25760A	1	25760A
121	SHIM 0.002”	AR	25921AA	AR	25921AA	AR	25921AA
122	SHIM 0.003”	AR	25921AB	AR	25921AB	AR	25921AB
123	SHIM 0.005”	AR	25921AC	AR	25921AC	AR	25921AC
124	SHIM 0.010”	AR	25921AD	AR	25921AD	AR	25921AD
125	ROLLER BEARING	1	2864F	1	2864F	1	2864F
126	BALL BEARING	2	2865L	2	2865L	2	2865L
130	RETAINING RING	1	2866H	1	2866H	1	2866H
131	RETAINING RING	1	2867S	1	2867S	1	2867S
132	RETAINING RING	1	2866J	1	2866J	1	2866J
135	DOWEL PIN	1	25910A	1	25910A	1	25910A
141	O-RING ROLLER BRG HSG	1	2825AL	1	2825AL	1	2825AL
143	O-RING BALL BRG SUPPORT	1	2825F	1	2825F	1	2825F
155	SHIM	AR	25977D	AR	25977D	AR	25977D
156	SHIM	AR	25977C	AR	25977C	AR	25977C

Note - AR - As Required.

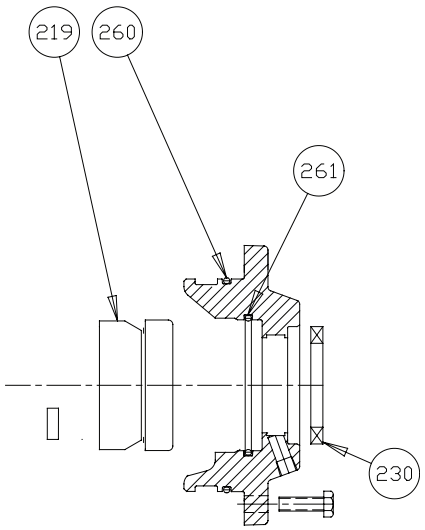
Gaterotor Assembly

Part totals indicated are for one gate rotor assembly, dual gate machines will require double the components.

ITEM	DESCRIPTION	MODEL NUMBER					
		VSG 501		VSG 601		VSG 701	
		QTY	VPN	QTY	VPN	QTY	VPN
100	SUPPORT ASSEMBLY (110 AND 135B)	1	A26001BB	1	A26001BA	1	A26001BA
101	GATE ROTOR AND DAMPER ASSEMBLY (111 AND 120)	1	A26002BB	1	A26002BA	1	A26002BC
102	GATE ROTOR SUPPORT ASSEMBLY 100, 101, 119 & 130	1	A26003BB	1	A26003BA	1	A26003BC
-	SHIM PACK SET ((2) 121, (2) 122, (1) 123, (1) 124)	1	A26035B	1	A26035B	1	A26035B
110	SUPPORT	1	26030BB	1	26030BA	1	26030BA
111	GATE ROTOR	1	26032A	1	26031A	1	26033A
114	SNAP RING	1	2867U	1	2867U	1	2867U
115	RETAINER BALL BEARING	1	25935B	1	25935B	1	25935B
118	GATE ROTOR COVER GASKET	1	25259C	1	25259C	1	25259C
119	WASHER	1	25007A	1	25007A	1	25007A
120	DAMPER	1	25760A	1	25760A	1	25760A
121	SHIM 0.002”	AR	26027BA	AR	26027BA	AR	26027BA
122	SHIM 0.003”	AR	26027BB	AR	26027BB	AR	26027BB
123	SHIM 0.005”	AR	26027BC	AR	26027BC	AR	26027BC
124	SHIM 0.010”	AR	26027BD	AR	26027BD	AR	26027BD
125	ROLLER BEARING	1	2864B	1	2864B	1	2864B
126	BALL BEARING	1	2865BP	1	2865BP	1	2865BP
130	RETAINING RING	1	2866A	1	2866A	1	2866A
131	RETAINING RING	1	2867A	1	2867A	1	2867A
132	RETAINING RING	1	2866K	1	2866K	1	2866K
135	DOWEL PIN	1	25910A	1	25910A	1	25910A
141	O-RING ROLLER BEARING HOUSING	1	2825D	1	2825D	1	2825D
143	O-RING BALL BEARING SUPPORT	1	2825G	1	2825G	1	2825G
155	SHIM	AR	25977G	AR	25977G	AR	25977G
156	SHIM	AR	25977H	AR	25977H	AR	25977H

Note - AR - As Required.

Shaft Seal



ITEM	DESCRIPTION	MODEL NUMBER			
		VSG 301-401		VSG 501-701	
		QTY	VPN	QTY	VPN
*	SHAFT SEAL KIT VITON KIT (219, 230, 260)	1	KT709DG	1	KT709AG
219	SHAFT SEAL.	1	A	1	A
230	OIL SEAL.	1	2930C	1	25040A
244**	TEFLON SEAL	1	25939A	1	25939A
252**	RETAINER RING	1	2928M	1	2928M
260	O-RING	1	2825T	1	2825F
261	O-RING.(205 Only)	1	2825AX	-	N/A

Notes - * - Not Pictured.

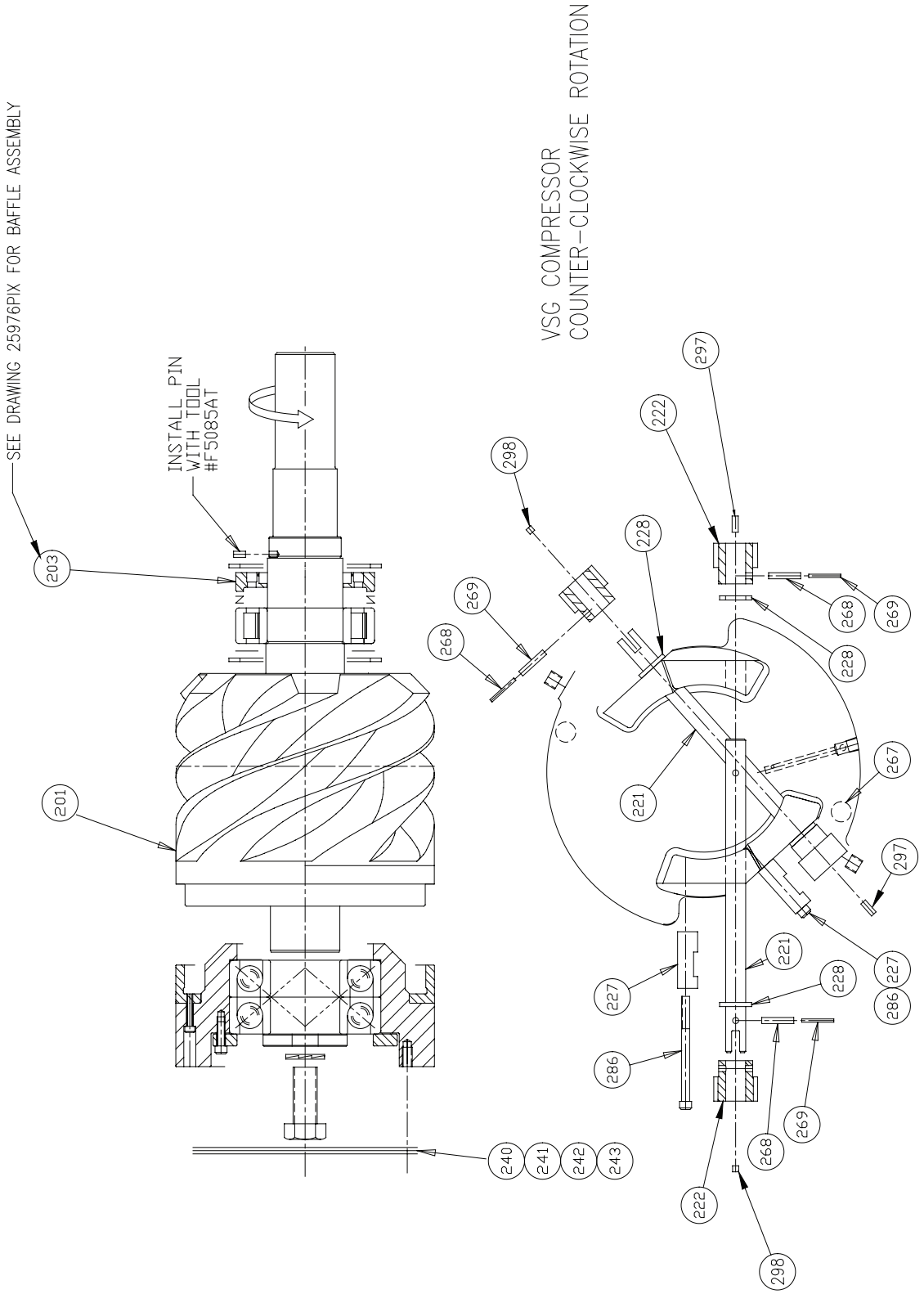
A - Sold Only As Kit.

** - See recommended spare parts lists for complete assembly.

N/A - Not Available.

Main Rotor, Slide Valve Cross Shafts and End Plate

Models VSG301-401 Counter Clockwise ONLY



Main Rotor, Slide Valve Cross Shafts and End Plate

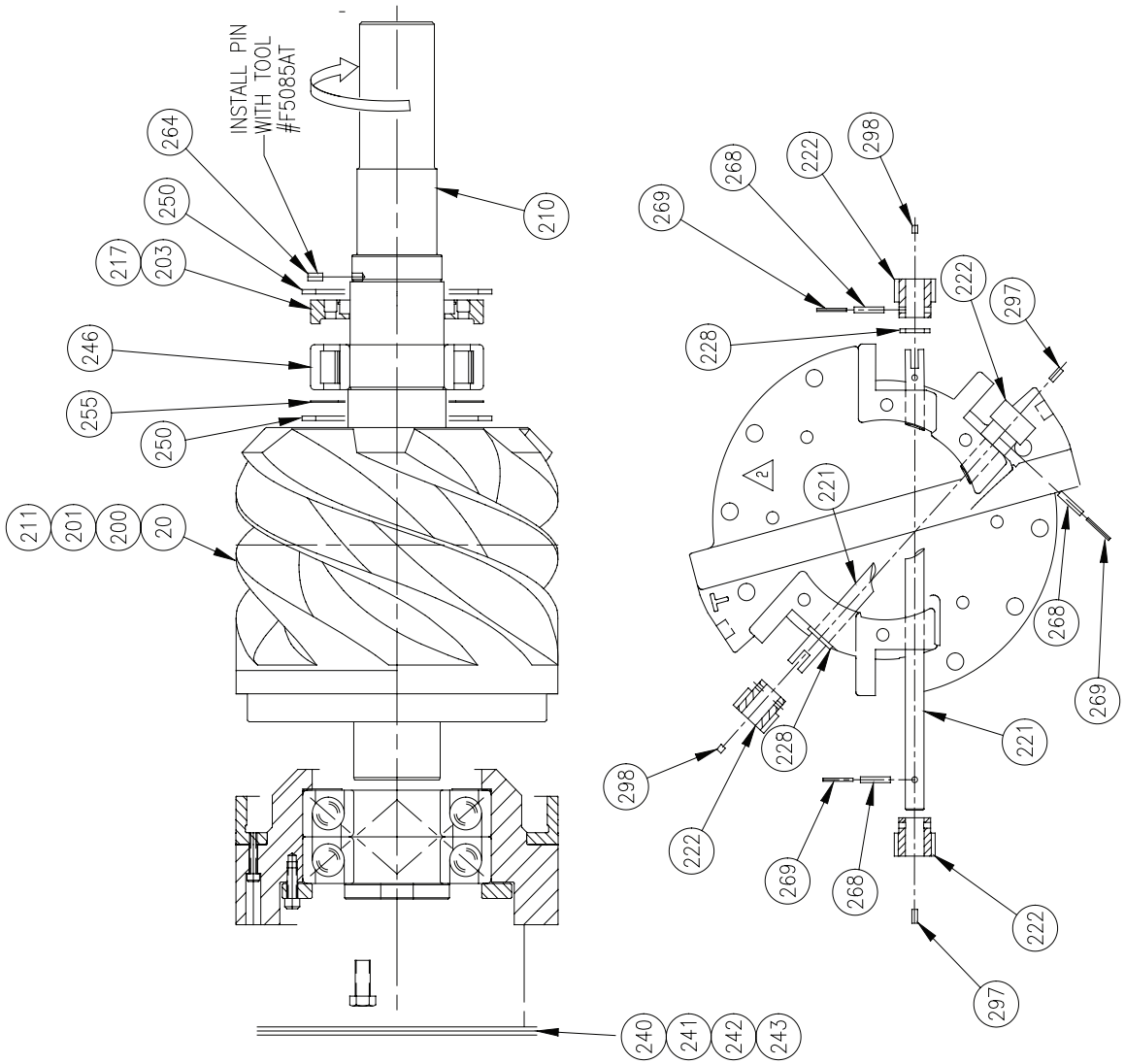
Models VSG301-401 Counter Clockwise ONLY

ITEM	DESCRIPTION	MODEL NUMBER					
		VSG 301		VSG 361		VSG 401	
		QTY	VPN	QTY	VPN	QTY	VPN
201	MAIN ROTOR ASSEMBLY	1	A25226AB	1	A25226AA	1	A25226AC
203	OIL BAFFLE ASSEMBLY ((1) 217, (1) 244, (1) 248, (1) 249, (1) 252)	1	A25942AA	1	A25942AA	1	A25942AA
-	SHIM ASSORTMENT ((2) 240, (2) 241, (1) 242, (1) 243)	1	A25177A	1	A25177A	1	A25177A
217	OIL BAFFLE PLATE	1	25938A	1	25938A	1	25938A
220	END PLATE	1	25719D	1	25719D	1	25719D
221	SHAFT	2	25941A	2	25941A	2	25941A
222	GEAR	4	25027A	4	25027A	4	25027A
227	CLAMP	4	25913A	4	25913A	4	25913A
228	SPACER	4	25847A	4	25847A	4	25847A
240	SHIM 0.002”	AR	25409AA	AR	25409AA	AR	25409AA
241	SHIM 0.003”	AR	25409AB	AR	25409AB	AR	25409AB
242	SHIM 0.005”	AR	25409AC	AR	25409AC	AR	25409AC
243	SHIM 0.010”	AR	25409AD	AR	25409AD	AR	25409AD
244	TEFLON RING	1	25939A	1	25939A	1	25939A
248	CHECK VALVE	1	3120A	1	3120A	1	3120A
249	CHECK VALVE	1	3120B	1	3120B	1	3120B
252	RETAINING RING	1	2829M	1	2829M	1	2829M
268	EXPANSION PIN	4	1193D	4	1193D	4	1193D
269	EXPANSION PIN	4	2981AA	4	2981AA	4	2981AA
271**	PLUG SOLID	1	25422A	1	25422A	1	25422A
281	HEX HEAD CAP SCREW	6	2796N	6	2796N	6	2796N
286	SOCKET HEAD CAP SCREW	8	2795F	8	2795F	8	2795F
297	SET SCREW	2	2060J	2	2060J	2	2060J
298	SET SCREW	2	2060H	2	2060H	2	2060H

Notes- ** - Required At Top Locate Single Gaterotor Only.
AR - As Required.

Main Rotor, Slide Valve Cross Shafts and End Plate

Models VSG501-701 Clockwise ONLY



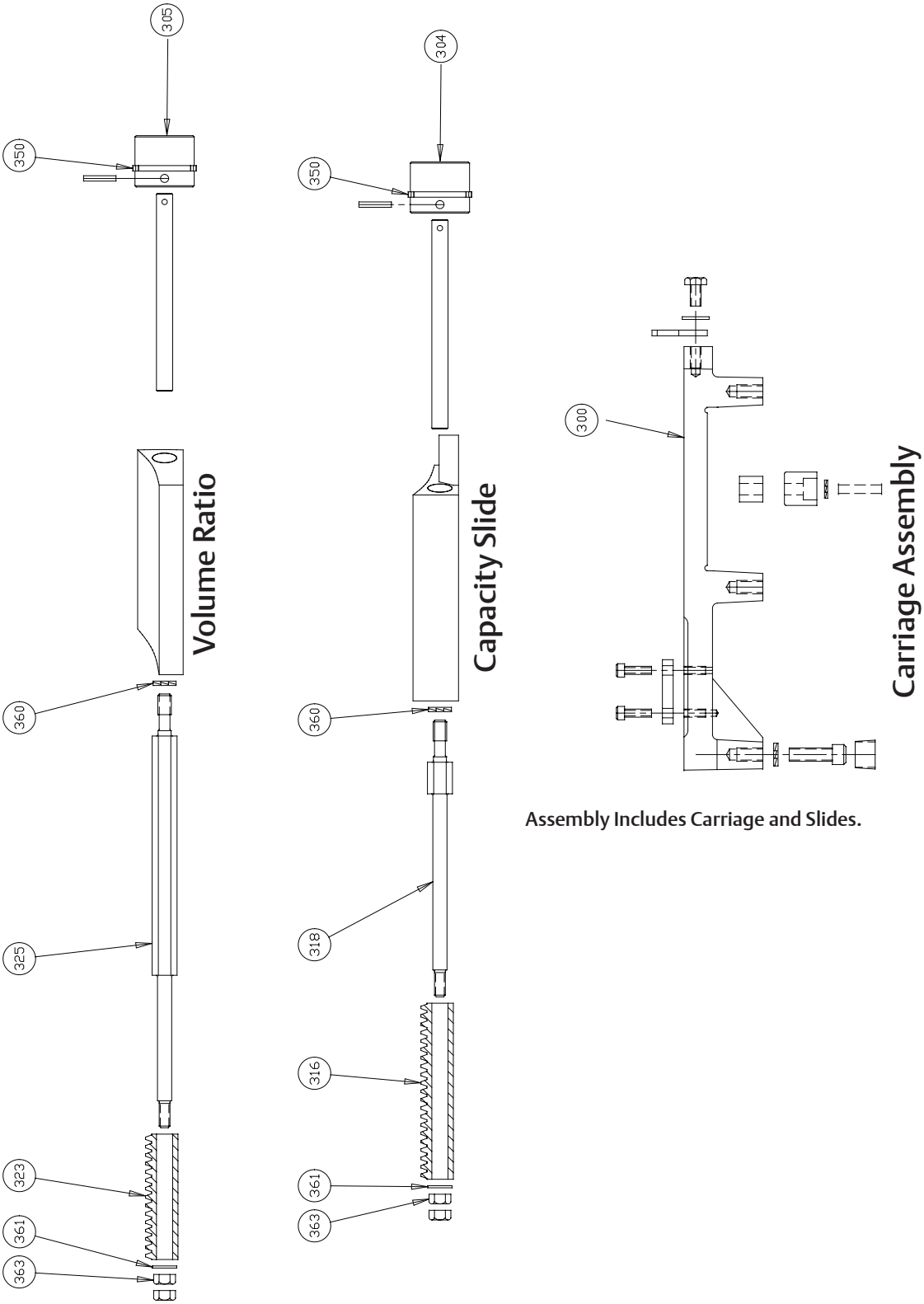
Main Rotor, Slide Valve Cross Shafts and End Plate

Models VSG501-701 Clockwise ONLY

ITEM	DESCRIPTION	MODEL NUMBER					
		VSG 501		VSG 601		VSG 701	
		QTY	VPN	QTY	VPN	QTY	VPN
201	MAIN ROTOR ASSEMBLY	1	A26010BB	1	A26010BA	1	A26010BC
203	OIL BAFFLE ASSEMBLY ((1) 217, (1) 244, (1) 248, (1) 249, (1) 252)	1	A26034B	1	A26034B	1	A26034B
-	SHIM ASSORTMENT ((2) 240, (2) 241, (1) 242, (1) 243)	1	A25177B	1	A25177B	1	A25177B
220	END PLATE	1	26025B	1	26025B	1	26025B
221	SHAFT	2	25843A	2	25843A	2	25843A
222	GEAR	4	25027A	4	25027A	4	25027A
228	SPACER	4	25847A	4	25847A	4	25847A
240	SHIM 0.002”	AR	25255AA	AR	25255AA	AR	25255AA
241	SHIM 0.003”	AR	25255AB	AR	25255AB	AR	25255AB
242	SHIM 0.005”	AR	25255AC	AR	25255AC	AR	25255AC
243	SHIM 0.010”	AR	25255AD	AR	25255AD	AR	25255AD
244	TEFLON RING	1	25929B	1	25929B	1	25929B
248	CHECK VALVE	1	3120A	1	3120A	1	3120A
249	CHECK VALVE	1	3120B	1	3120B	1	3120B
252	RETAINING RING	1	2928N	1	2928N	1	2928N
255	WASHER	2	25977E	2	25977E	2	25977E
256	WASHER	2	25977F	2	25977F	2	25977F
268	EXPANSION PIN	4	1193D	4	1193D	4	1193D
269	EXPANSION PIN	4	2981AA	4	2981AA	4	2981AA
281	HEX HEAD CAP SCREW	8	2796B	8	2796B	8	2796B
282	SOCKET HEAD CAP SCREW	2	2795D	2	2795D	2	2795D
297	SET SCREW	2	2060J	2	2060J	2	2060J
298	SET SCREW	2	2060H	2	2060H	2	2060H

Notes - * - Not Pictured.
AR - As Required.

Slide Valve Carriage Assembly



Assembly Includes Carriage and Slides.

Slide Valve Carriage Assembly

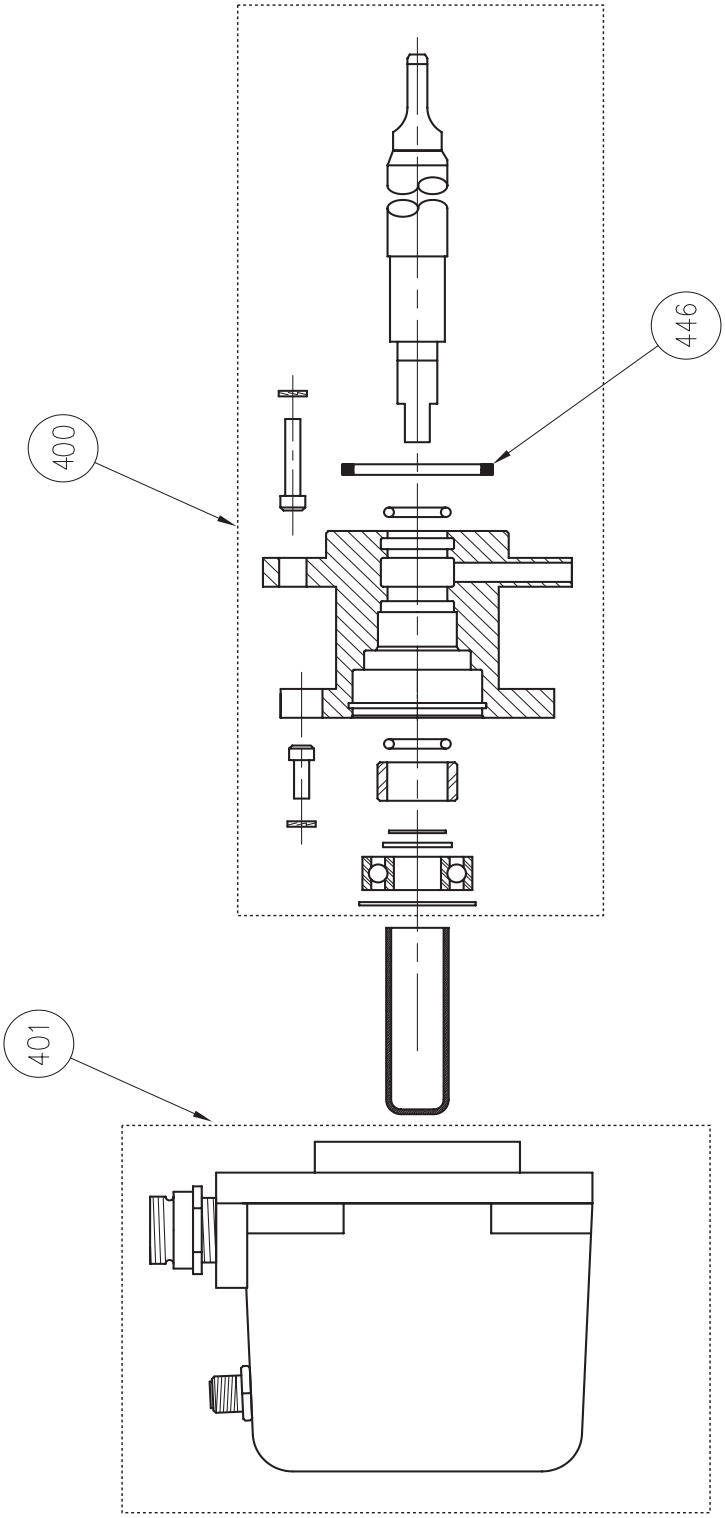
ITEM	DESCRIPTION	MODEL NUMBER			
		VSG 301 - 401		VSG 501 - 701	
		QTY	VPN	QTY	VPN
300	CARRIAGE ASSEMBLY	1	A25179A	1	A26012B
304	CAPACITY PISTON (340, 341, 350, 355)	1	A25183A	1	A25183B
305	VOLUME PISTON (340, 342, 350, 355)	1	A25184A	1	A25184B
316	CAPACITY RACK	1	25023B	1	25024AH
318	CAPACITY RACK SHAFT	1	25772C	1	25772A
323	VOLUME RATIO RACK	1	25023CH	1	25023AH
325	VOLUME RATIO RACK SHAFT	1	25772D	1	25772B
350	PISTON RING SET	2	2953AE	2	2953AA
360	LOCK WASHER (PAIR)	2	3004C	2	3004C
361	WASHER	2	13265B	2	13265B
363	NUT	4	2797A	4	2797A
372*	SOCKET HEAD CAP SCREW	-	NA	1	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.

Actuator and Command Shaft

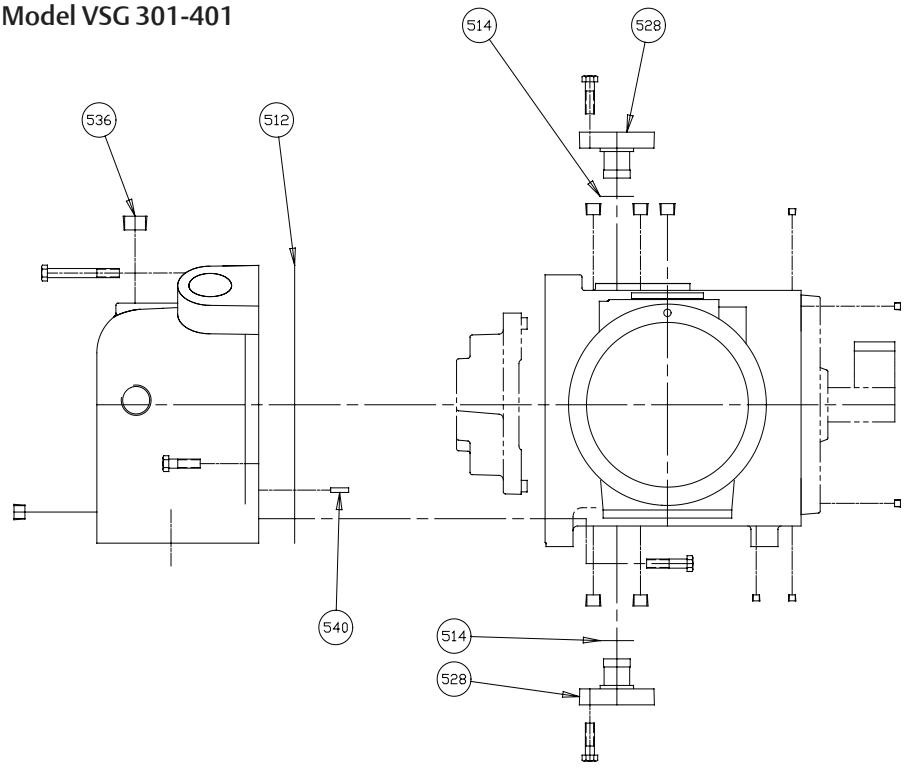


Actuator and Command Shaft

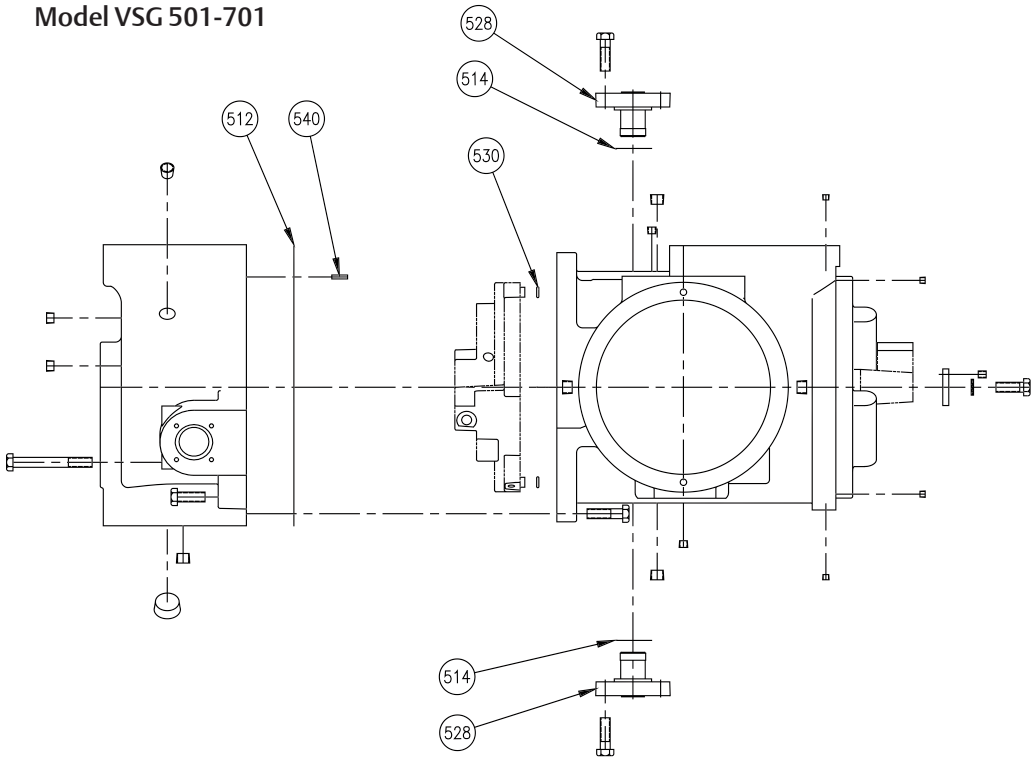
ITEM	DESCRIPTION	MODEL NUMBER							
		VSSG 291 - 601		VSG 751 - VSG 901		VSG 1051 - 1201		VSG 1551 - 2101	
		QTY	VPN	QTY	VPN	QTY	VPN	QTY	VPN
400	COMMAND SHAFT ASSEMBLY	2	A25994B	2	A25994C	2	A25994D	2	A25994E
401	SLIDE VALVE ACTUATOR	2	25972D	2	25972D	2	25972D	2	25972D
446	O-RING	2	2825C	2	2825C	2	2825C	2	2825C

Miscellaneous Frame Components

Model VSG 301-401



Model VSG 501-701

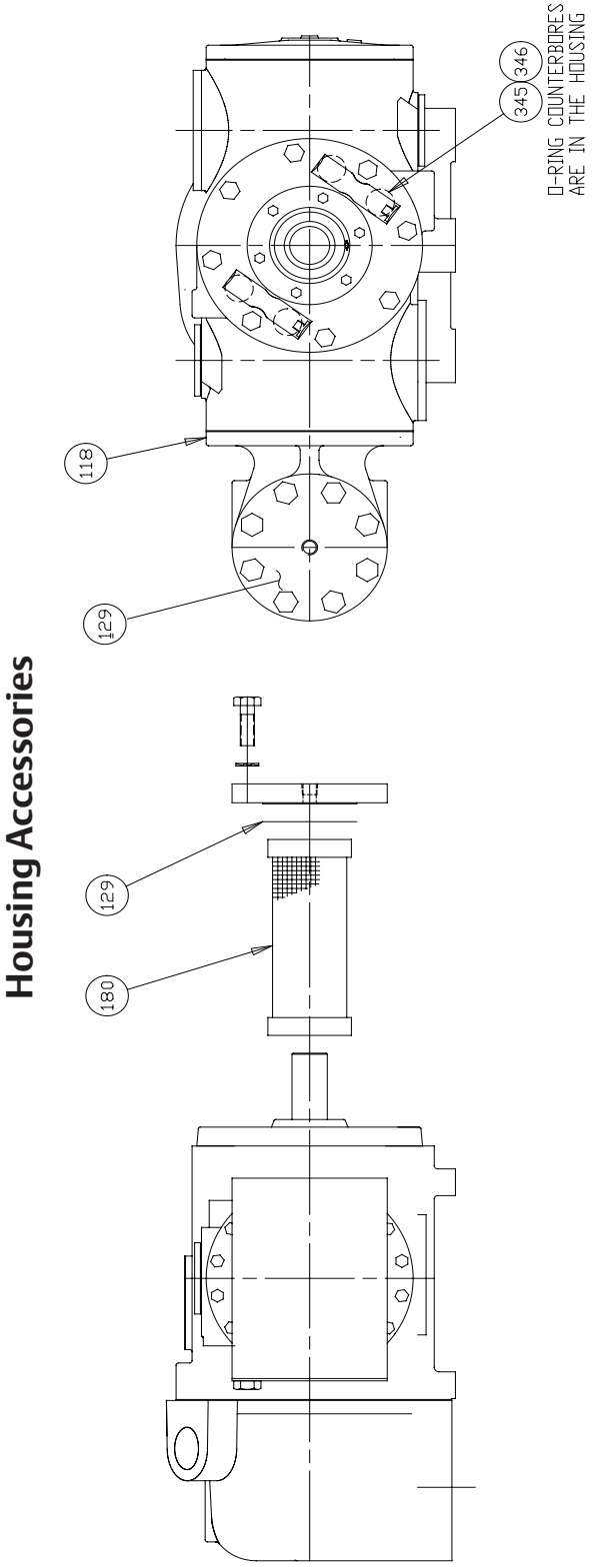


Miscellaneous Frame Components

ITEM	DESCRIPTION	MODEL NUMBER			
		VSG 301 - 401		VSG 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	-	NA	1	25004D
523	LOCK WASHER	-	NA	1	3004H
528	ECON-O-MIZER PLUG	2	25419A	2	25397K
530	O-RING	-	NA	2	3547AW
540	DOWEL PIN	2	2868B	2	2868B
542	PIPE PLUG	3	2606C	10	2606B
551	HEX HEAD CAP SCREW	-	NA	2	2796C
570	BEARING OIL PLUG	1	25978A	-	NA
571	PLUG	1	25979A	-	NA
572	SPRING	1	3148A	-	NA

Note - * - Not Pictured.

Miscellaneous Frame Components



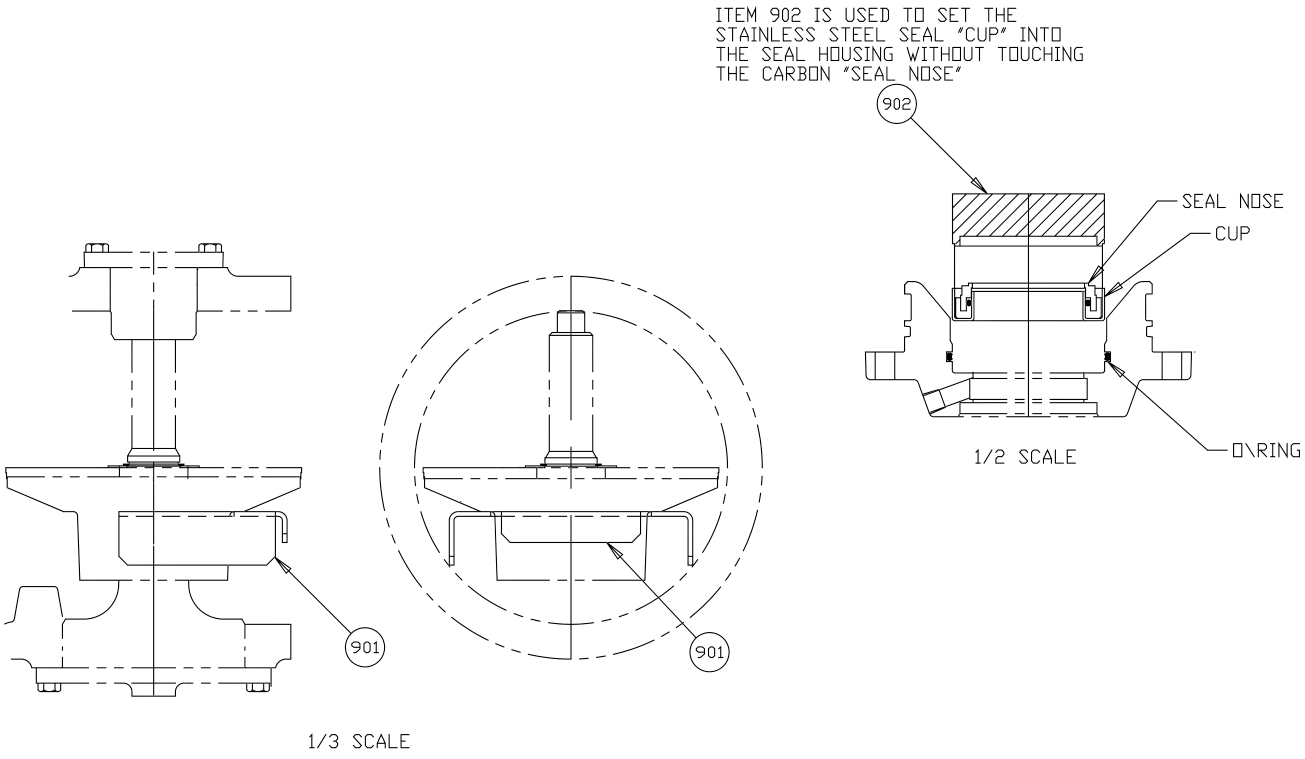
Miscellaneous Frame Components

Housing Accessories

ITEM	DESCRIPTION	MODEL NUMBER			
		VSG 301 - 401		VSG 501 - 701	
		QTY	VPN	QTY	VPN
117	GATE ROTOR COVER	1	25416B	1	25416B
118	COVER GASKET	2	25259B	2	25259B
129	GASKET	1	11323T	1	11323T
180	INLET SCREEN	1	25920A	1	25920A
343*	PISTON COVER	1	25724B	1	25724B
345	O-RING	4	2825AY	4	3547AX
346	O-RING	2	2825AD	2	2825AD

Note - * - Not Pictured.

Replacement Tools



ITEM	DESCRIPTION	MODEL NUMBER			
		ALL VSG 301 - 401		ALL VSG 501 - 701	
		QTY	VPN	QTY	VPN
901	GATEROTOR STABILIZER	1	25742A	1	25742B
902	SEAL INSTALLATION TOOL	1	25455A	1	25455B

Torque Specifications

Refer to the following tables for torque specifications.

Table A-1. Torque Specifications (ft-lbs)

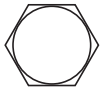
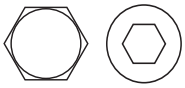
TYPE BOLT	HEAD MARKINGS	NOMINAL SIZE NUMBERS OR INCHES									
		#10	1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4	7/8
SAE GRADE 2 COARSE (UNC)			5	10	18	29	44	63	87	155	150*
SAE GRADE 5 COARSE (UNC)			8	16	28	44	68	98	135	240	387
SAE GRADE 5 FINE (UNF)				16							
SAE GRADE 8 COARSE (UNC)			11	22	39	63	96	138	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)

Type Bolt/Nut	Head Markings	Nominal Size Numbers or Inches								
		#10	¼"	5/16"	3/8"	7/16"	½"	9/16"	5/8"	¾"
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.

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-717
Serial Number	****-***
Model Number	VSM-601
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 B & Fl Type Lubricants

Vilter Type B and FL lubricants are ester-based fluids and are hygroscopic by nature. This means that they absorb water moisture from the surrounding environment. Compared to mineral based lubricants which are typically saturated with water at less than 100 PPM, ester based lubricants become saturated with water at approximately 2,500 PPM.

High water moisture levels cannot be tolerated in the refrigeration systems where ester based lubricants are utilized and require specific handling and storage guidelines, in addition to the normal precautions for system dehydration prior to system start-up.

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

- Use a suitable dehydration process for the complete refrigeration system to ensure that the system as a whole is completely dry and water free. This can be accomplished by the use of vacuum pumps and checked by a vacuum gauge to ensure that a suitable micron value has been reached, and maintained.
- 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 B Type lubricant is available in 5 and 55 gallon containers.
- Refrigeration systems using ester based lubricants will require suitable high capacity moisture filter/driers to maintain low total moisture content in the refrigerant and lubricant.

Compatibility & Misc.

- Vilter Type B lubricant has been extensively tested with many of the components in a refrigeration system. Elastomers, driers, etc. for use with HFCs have demonstrated no adverse effects when tested for hardness, swelling and brittleness.
- Vilter Type B lubricant cannot be used in conjunction with a mineral based oils are not miscible with HFCs. The performance of a refrigeration system is optimized when the lubricant is allowed to be miscible with the refrigerant to aid in the oil return to the compressor. If the oil used in an HFC refrigeration system does not provide oil return capability, the oil will tend to accumulate in the evaporator reducing the overall system capacity.
- CFC and HCFC refrigerants should not be used with Vilter Type B lubricant since these types of refrigerants greatly reduce the viscosity of ester based lubricants, resulting in inadequate compressor lubrication.

Table B-1 Oil Recommendations for Standard Warranty Coverage Single Screw Compressors Only

Vilter Oil Type	717	HCL-68	F-68	FL-100	B-68	HC-68
ISO Grade	68	68	68	100	68	68
@ 100°F (cSt)	77	75.7	65.67	76.4	71	67.2
Viscosity Index	100	132	79	115	108	168
Spec. Gravity	0.867	0.835	0.876	0.96	0.957	0.989
Density lbm/gal, 60°F	7.4	6.95	7.3	8.26	7.96	8.25
Flash Point - °F	440	525	295	558	505	425
Fire Point - °F	475	570	315	633	560	465
Pour Point - °F	-38.2	-67	-31	Pending	-45	-55
Floc Point - °F	-25	NA	-75	NA	NA	NA
Refrigerant Type	R-717	R-717, R-22, R-1270	R-22	R-22	R-134a, R-507, R-404A, R-407C, R-410A	R-290

Table B-2 Cross Reference Index

Vilter Part No.	Oil Type	Vilter Lube Type	Container Size	Applications
2939A	HMO	R717	5 gallon pail	R-717 (Ammonia)
2939AFG	HMO	717FG	55 gallon drum	R-717 (Ammonia)
2939B	HMO	R717	5 gallon pail	R-717 (Ammonia)
2939BFG	HMO	717FG	55 gallon drum	R-717 (Ammonia)
3098A	PAG	HC-68	5 gallon pail	R-290
3098B	PAG	HC-68	55 gallon drum	R-290
3099A	PAG	HC-100	5 gallon pail	Hydrocarbon
3100A	Naphthenic	VILTER D	5 gallon pail	R-22, R-123 & R-414A
3100B	Naphthenic	VILTER D	55 gallon drum	R-22, R-123 & R-414A
3101A	POE	FL-100	5 gallon pail	R-22
3101B	POE	FL-100	55 gallon drum	R-22
3103A	PAO	HCL-68	5 gallon pail	Ammonia
3103B	PAO	HCL-68	55 gallon drum	Ammonia
3103C	PAO	HCL-15	5 gallon pail	R-717
3105A	BLEND	F-68	5 gallon pail	R-22, R-123 & R-502
3105B	BLEND	F-68	55 gallon drum	R-22, R-123 & R-502
3106A	POE	B-68	5 gallon pail	All HFC applications (including R-134a, R-404A, R-407C, R-410A, R-507)
3106B	POE	B-68	55 gallon drum	All HFC applications (including R-134a, R-404A, R-407C, R-410A, R-507)
3107A	POE	B-120	5 gallon pail	R-134A, R-404A, R-407C, R-410A
3107B	POE	B-120	55 gallon drum	R-134A, R-404A, R-407C, R-410A
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

Vilter Part No.	Oil Type	Vilter Lube Type	Container Size	Applications
3339A	PAO	CO_2 GAS	5 gallon pail	CO_2, CO
3339B	PAO	CO_2 GAS	55 gallon drum	CO_2, CO
3456A	POE	B-32	5 gallon pail	All HFC applications (including R-134a, R-404A, R-407C, R-410A)
3456B	POE	B-32	55 gallon drum	All HFC applications (including R-134a, R-404A, R-407C, R-410A)
3595A	HMO	NH3-100-CI	5 gallon pail	Ammonia
3595B	HMO	NH3-100-CI	55 gallon drum	Ammonia
3603B	POE	B-68AWAF	55 gallon drum	All HFC applications (including R-134a, R-404A, R-407C, R-410A, R-507)
3603C	POE	B-68AWAF	5 gallon pail	All HFC applications (including R-134a, R-404A, R-407C, R-410A, R-507)
3603D	POE	B-100AWAF	55 gallon drum	All HFC applications (including R-134a, R-404A, R-407C, R-410A, R-507)
3603E	POE	B-100AWAF	5 gallon pail	All HFC applications (including R-134a, R-404A, R-407C, R-410A, R-507)
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

Vibration Measurements - Single Screw Compressor

Scope

The vibration criteria provided applies to broad-band vibration measurements taken on the bearings and housing of the Single Screw compressors under steady-state operating conditions within the nominal operating speed range in addition to the piping and tubing on the compressor unit. They relate to both acceptance testing and operational monitoring. The evaluation criteria is intended to apply to both continuous and non-continuous monitoring situations. The scope does not address the diagnostic evaluation of the condition of the roller element bearings. The criteria are applicable only for the vibration produced by the machine itself and not for vibration which is transmitted to the machine set from external sources. Information used in this chapter was taken from ISO Standard 10816-3, Mechanical Vibration – Evaluation of Machine Vibration by Measurements on Non-Rotating Parts – Part 3, First Edition, 1998.

Measurement Procedures and Operational Conditions

Measurement Equipment

The measurement equipment shall be capable of measuring broad-band rms vibration with flat response over a frequency range of at least 10 Hz to 1000 Hz. Depending on the vibration criteria, this may require measurements of displacement or velocity or combinations thereof.

Care should be taken to ensure that the measuring system is not influenced by environmental factors such as: temperature variations;

- Magnetic fields;
- Sound fields;
- Power source variations;
- Transducer cable length;
- Transducer orientation.

Particular attention should be given to ensure that the vibration transducers are correctly mounted and that such mountings do not degrade the accuracy of the measurements.

Compressor Measurement locations

Measurements taken on the compressor will usually be taken on exposed parts that are normally accessible. Care shall be taken to ensure that measurements reasonably represent the vibration of the bearing housing and do not include any local resonances or amplification. The locations and directions of vibration measurements shall be such that they provide adequate sensitivity to the machine dynamic forces. Typically, this will require two radial measurement locations on each bearing cover on the gate rotor housing support and back plate (near the compressor shaft). Vertical and horizontal directions are preferred for Single Screw compressors. The specific locations and directions shall be recorded with the measurement.

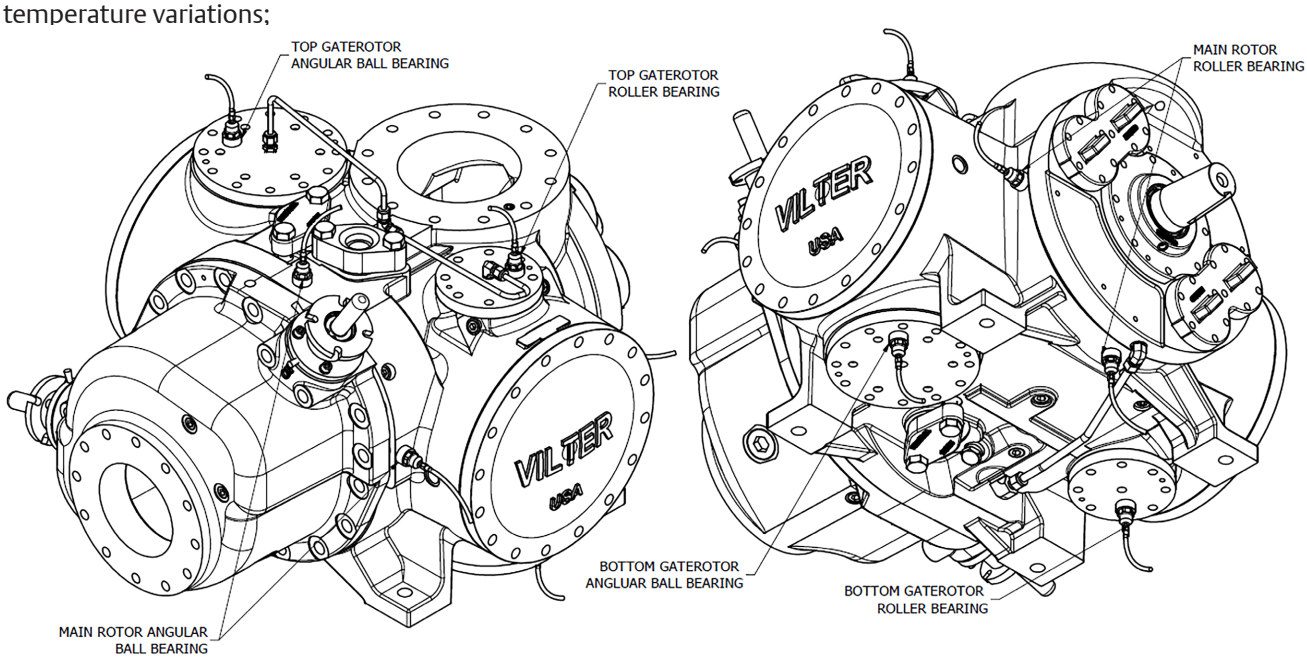


Figure C-1. Compressor Bearing Vibration Measurement Location

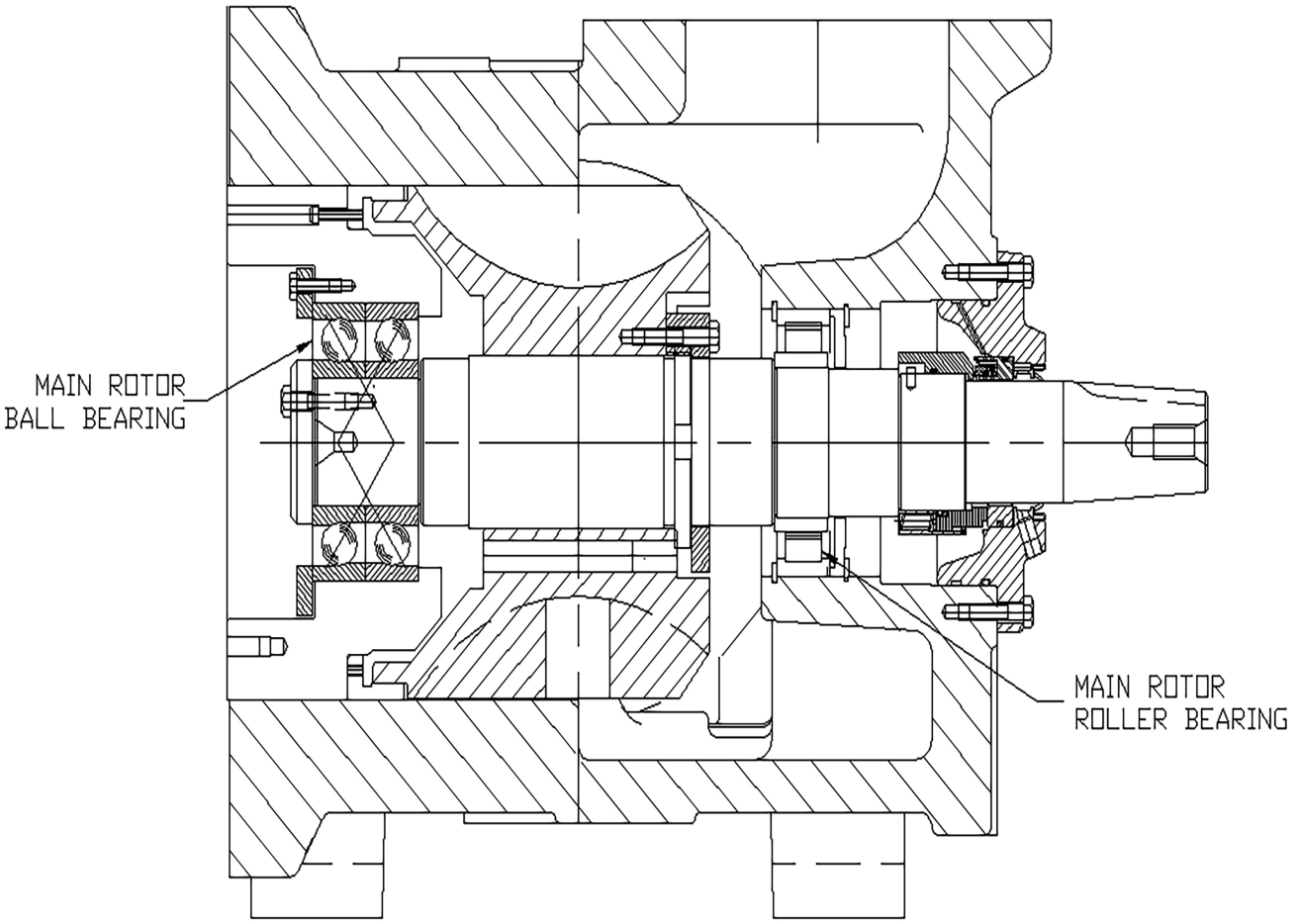


Figure C-2. Main Rotor Cross-Section VSS/VSMC Compressors

Continuous and Non-continuous Monitoring

While it is common practice on large or critical machinery to have installed instrumentation for continuous online monitoring of vibration values at key measurement points, this is not necessarily carried out in industrial applications.

Changes in unbalance, bearing performance, alignment, etc. can be detected with sufficient reliability from periodic measurements with permanently installed or handheld instruments. The use of computers for trend analysis and warning against malfunctions is also becoming more common.

Operational Conditions

Measurements shall be carried out when the compressor has reached normal steady-state operating temperatures and with the machine running under specified conditions. If the measured vibration is greater than the acceptance criteria allowed and an excessive background vibration is suspected, measurements should be made with the machine shut down to determine the degree of external influence. If the vibration with the machine stationary exceeds 25% of the value measured when the machine is running, corrective action may be necessary to reduce the effect of the background vibration.

Evaluation

There are two evaluation criteria used to assess vibration severity on various classes of machines. One criteria considers the magnitude of observed broad-band vibration; the second considers changes in magnitude, irrespective of whether they are increases or decreases.

Criterion 1: Vibration Magnitude

This criterion is concerned with defining limits for vibration magnitude consistent with acceptable dynamic loads on the bearings and acceptable vibration transmission into the environment through the support structure and foundation. The maximum vibration magnitude observed at each bearing or pedestal is assessed against the evaluation zones for the support class. The evaluation zones have been established from international experience.

The following evaluation zones are defined to permit a qualitative assessment of the vibration of a given machine and provide guidelines on possible actions.

- Zone A: The vibration of newly commissioned machines would normally fall within this zone.
- Zone B: Machines with vibration within this zone are normally considered acceptable for unrestricted long-term operation.
- Zone C: machines with vibration within this zone are normally considered unsatisfactory for long term continuous operation. Generally, the machine may be operated for a limited period in this condition until a suitable opportunity arises for remedial action.
- Zone D: Vibration values within this zone are normally considered to be of sufficient severity to cause damage to the machine.

Numerical values assigned to the zone boundaries are not intended to serve as acceptance specifications, which shall be subject to agreement between Vilter™ manufacturing and the customer. However, these values provide guidelines for ensuring that gross deficiencies or unrealistic requirements are avoided. In certain cases, there may be specific features associated with a particular machine which would require different zone boundary values (higher or lower) to be used.

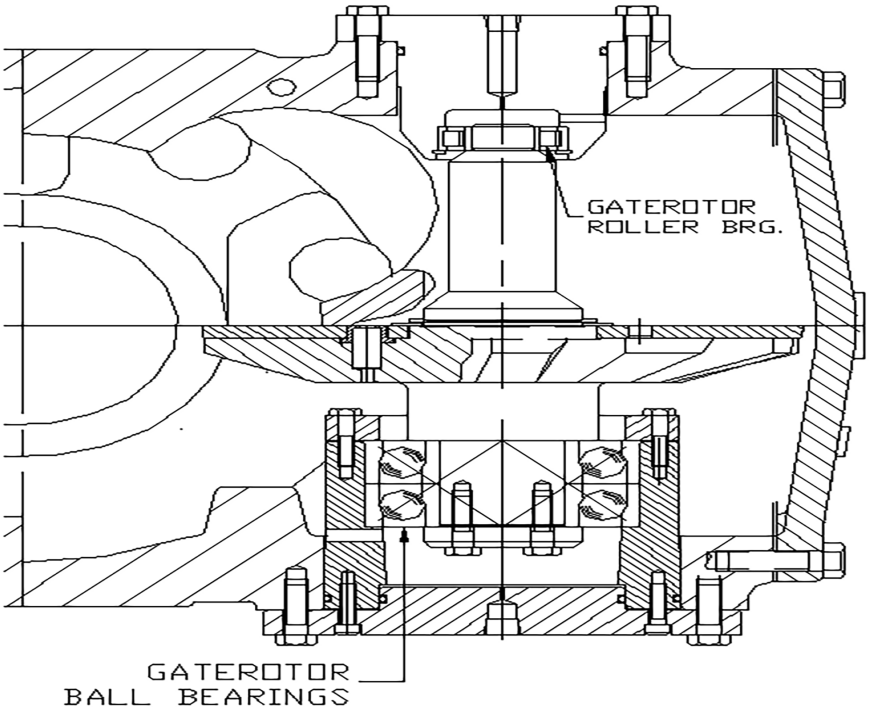


Figure C-3. Gaterotor Cross-Section VSS/VSR/VSMC Compressors

Evaluation Zone limits

The values for the zone boundaries given below are based on the maximum broad-band values of velocity and displacement when measurements are taken from two orthogonally oriented radial transducers. Therefore when using these tables, the higher of each of the values measured from the two transducers in each measurement plane should be used. When the maximum measured values of velocity and displacement are compared to the corresponding values in the table, the severity zone which is most restrictive shall apply.

Operational limits

For long-term operation, it is common practice to establish operational vibration limits. These limits take the form of ALARM and TRIP set points.

ALARM: To provide a warning that a defined value of vibration has been reached or a significant change has occurred, at which remedial action may be necessary. In general, if an ALARM situation occurs, operation can continue for a period while investigations are carried out to identify the reason for the change in vibration and define any remedial action.

TRIP: To specify the magnitude of vibration beyond which further operation of the machine may cause damage. If the TRIP value is exceeded, immediate action should be taken to reduce the vibration or the machine should be shut down.

Different operational limits, reflecting differences in dynamic loading and support stiffness, may be specified for different measurement positions and directions.

Setting of ALARMS

The ALARM values may vary considerably, up or down, for different machines. The values chosen will normally be set relative to a baseline value determined from experience for the measurement position or direction for that particular machine.

It is recommended that the ALARM value should be set higher than the baseline by an amount equal to 25% of the upper limit for zone B. If the baseline is low, the ALARM may be below zone C.

Where there is no established baseline (for example with a new machine) the initial ALARM setting should be based either on experience with other similar machines or relative to agreed acceptance values. After a period of time, the steady-state baseline value will be established and the ALARM setting should be adjusted accordingly.

It is recommended that the ALARM value should not normally exceed 1.25 times the upper limit of zone B.

If the steady-state baseline changes (for example after a machine overhaul), the ALARM setting should be revised accordingly.

Setting of TRIPS

The TRIP values will generally relate to the mechanical integrity of the machine and be dependent on any specific design features which have been introduced to enable the machine to withstand abnormal dynamic forces. The values used will, therefore, generally be the same for all machines of similar design and would not normally be related to the steady-state baseline value used for setting ALARMS.

There may, however, be differences for machines of different designs and it is not possible to have clear guidelines for absolute TRIP values. In general, the TRIP value will be within zone C or D, but it is recommended that the TRIP value should not exceed 1.25 times the upper limit of zone C.

Table C-1. Vibration Zone Values

VIBRATION MEASUREMENTS – SINGLE SCREW COMPRESSOR*					
Support Class	ZONE	RMS Displacement		RMS Velocity	
		μmm	mils	mm/s	In/sec
	A	0-30	0-1.15	0-2.3	0-0.09
	B	30-57	1.15-2.25	2.3-4.5	0.09-0.18
	C	57-90	2.25-3.55	4.5-7.1	0.18-0.28
	D	Above 90	Above 3.55	Above 7.1	Above .28

*RMS= 0.707 X peak (sine wave only)

Vibration limits For Piping and Tubing

The piping and tubing on the compressor units must be supported with the appropriate brackets and supports to minimize the vibration levels. These brackets and supports should also be strategically placed to prevent the natural frequency from matching the normal operating speed. The typical goal is to have the natural frequency of an assembly to be at least 10% above or below the operating speed. In the case when a compressor is operated by a VFD (Variable Frequency Drive), there is a high probability that there will be an opportunity to match either the natural frequency of the assembly or it's 2nd or 3rd order since the compressor's speed will vary within a large range of RPM's.

The compressor unit should first be operated at either the normal operating speed or if it utilizes a VFD, through the operating range of speed. Visual observations of the vibration levels of all the piping and tubing should first be observed. After this initial survey, the vibration measurement equipment should be individually mounted or attached to each specific piece of piping or tubing as required in the location of what is perceived as the maximum amplitude or worse vibration.

While there are references which specifically allow higher levels of vibration for piping, the goals for the vibration levels of the piping and tubing on the compressor unit should still utilize the same criteria outlined in this standard. If possible, the vibration levels should be within the zone boundaries of Zone B or better. These values will ensure that the stress levels in the piping and tubing are acceptable for continuous operation. These values provide guidelines for ensuring that gross deficiencies or unrealistic requirements are avoided. In certain cases, there may be specific features associated with a particular compressor unit which would require different zone boundary values.

For compressors that are operated at a fixed speed, brackets and supports may be added or moved to reduce the vibration levels of the specific component. If the compressor is operated utilizing a VFD, a skip frequency should be inputted into the controls to ensure the compressor passes through the harmonic and that it operates either below or above the operating speed that matches the natural frequency of the specific component. It is not unusual to have three or four skip frequencies within the normal operating ranges of a compressor utilizing a VFD.

Bearing Vibration Data

The following pages contain tables of bearing vibration data collected for different models of VSMC and VSS single screw compressors. Please use your model number to find your compressor-specific information.

Table C-2. VSG 71/91/101/151/152/181/182/201/202/301/361/401 (Ø1.875” Compressor Drive Shaft)

Bearing	Number of Balls/ Rollers Per Row Nb	Ball/ Roller Diameter (MM) Bd	Pitch Diameter (MM) Pd	Contact Angle (DEG.) ø	Fundamental Train Frequency FTF (Hz)	Ball Spin Frequency BSF (Hz)	Ball Pass Frequency of Inner Race BPFI (Hz)	Ball Pass Frequency Of Outer Race BPFO (Hz)
G.RTR.RLR BRG 2864F	11	7.500	34.000	0	6.495	35.940	111.887	71.446
G.RTR.BALL BRG 2865L	11	14.290	57.500	40	9.715	32.610	76.473	106.860
M.RTR.BALL BRG 2865M	12	21.430	87.600	40	9.693	33.158	83.684	116.316
MN.RTR.RLR BRG 2864N	16	14.000	86.000	0	6.977	49.834	155.039	111.628

Table C-3. VSSG 291/341/451/601 (Ø2.250” / Ø2.500” Compressor Drive Shaft) and VSG 501/601/701 (Clockwise) (Ø2.250” Compressor Drive Shaft)

Bearing	Number of Balls/ Rollers Per Row Nb	Ball/ Roller Diameter (MM) Bd	Pitch Diameter (MM) Pd	Contact Angle (DEG.) ø	Fundamental Train Frequency FTF (Hz)	Ball Spin Frequency BSF (Hz)	Ball Pass Frequency of Inner Race BPFI (Hz)	Ball Pass Frequency Of Outer Race BPFO (Hz)
G.RTR.RLR BRG 2864B	13	7.500	39.000	0	6.731	41.731	129.167	87.500
G.RTR.BALL BRG 2865B	12	19.840	80.500	40	9.703	32.899	83.563	116.437
M.RTR.BALL BRG 2865A	12	26.190	110.000	40	9.657	34.118	84.121	115.879
MN.RTR.RLR BRG 2864A	17	18.000	118.500	0	7.068	53.595	163.186	120.148

Note: Defect frequencies calculated at 1000 rpm inner ring speed.

To calculate actual frequencies for your application, use the following formula: freq. Actual (hz.) = .001*(Rpm)*(precalc. Freq.)

Table C-4. VSSG 451/601 (Ø2.875" Compressor Drive Shaft)

Bearing	Number of Balls/ Rollers Per Row Nb	Ball/ Roller Diameter (MM) Bd	Pitch Diameter (MM) Pd	Contact Angle (DEG.) ø	Fundamental Train Frequency FTF (Hz)	Ball Spin Frequency BSF (Hz)	Ball Pass Frequency of Inner Race BPFI (Hz)	Ball Pass Frequency Of Outer Race BPFO (Hz)
G.RTR.RLR BRG 2864T	13	9.000	46.500	0	6.720	41.443	129.301	87.366
G.RTR.BALL BRG 2865B	12	19.840	80.500	40	9.703	32.899	83.563	116.437
M.RTR.BALL BRG 2865E	12	26.190	110.000	40	9.657	34.118	84.121	115.879
MN.RTR.RLR BRG 2864J	17	18.000	118.500	0	7.068	53.595	163.186	120.148

Table C-5. VSSG 341/451/601 (Ø2.500" Compressor Drive Shaft W/ Large Bearing)

Bearing	Number of Balls/ Rollers Per Row Nb	Ball/ Roller Diameter (MM) Bd	Pitch Diameter (MM) Pd	Contact Angle (DEG.) ø	Fundamental Train Frequency FTF (Hz)	Ball Spin Frequency BSF (Hz)	Ball Pass Frequency of Inner Race BPFI (Hz)	Ball Pass Frequency Of Outer Race BPFO (Hz)
G.RTR.RLR BRG 2864T	13	9.000	46.500	0	6.720	41.443	129.301	87.366
G.RTR.BALL BRG 2865B	12	19.840	80.500	40	9.703	32.899	83.563	116.437
M.RTR.BALL BRG 2865E	12	26.190	110.000	40	9.657	34.118	84.121	115.879
MN.RTR.RLR BRG 2864A	17	18.000	118.500	0	7.068	53.595	163.186	120.148

Note: Defect frequencies calculated at 1000 rpm inner ring speed.

To calculate actual frequencies for your application, use the following formula: freq. Actual (hz.) = .001*(Rpm)*(precalc. Freq.)

Table C-6. VSG 791/891/1051/1201/1301 (Ø2.500" Compressor Drive Shaft)

Bearing	Number of Balls/ Rollers Per Row Nb	Ball/ Roller Diameter (MM) Bd	Pitch Diameter (MM) Pd	Contact Angle (DEG.) ø	Fundamental Train Frequency FTF (Hz)	Ball Spin Frequency BSF (Hz)	Ball Pass Frequency of Inner Race BPFI (Hz)	Ball Pass Frequency Of Outer Race BPFO (Hz)
G.RTR.RLR BRG 2864G	14	11.000	60.500	0	6.818	44.318	137.879	95.455
G.RTR.BALL BRG 2865A	12	23.010	95.100	40	9.678	33.545	83.863	116.137
M.RTR.BALL BRG 2865G	12	26.980	117.500	40	9.610	35.441	84.686	115.314
MN.RTR.RLR BRG 2864D	18	15.000	103.500	0	7.126	56.292	171.739	128.261

Table C-7. VSG 1551/1851/2101 (Ø3.250" Compressor Drive Shaft

Bearing	Number of Balls/ Rollers Per Row Nb	Ball/ Roller Diameter (MM) Bd	Pitch Diameter (MM) Pd	Contact Angle (DEG.) ø	Fundamental Train Frequency FTF (Hz)	Ball Spin Frequency BSF (Hz)	Ball Pass Frequency of Inner Race BPFI (Hz)	Ball Pass Frequency Of Outer Race BPFO (Hz)
G.RTR.RLR BRG 2864K	15	11.000	65.500	0	6.934	48.222	145.992	104.008
G.RTR.BALL BRG 2865K	13	26.980	117.500	40	9.610	35.441	91.743	124.924
M.RTR.BALL BRG 2865J	12	30.160	132.500	40	9.598	35.767	84.819	115.181
MN.RTR.RLR BRG 2864J	17	21.000	133.500	0	7.022	51.665	163.951	119.382

Note: Defect frequencies calculated at 1000 rpm inner ring speed.

To calculate actual frequencies for your application, use the following formula: freq. Actual (hz.) = .001*(Rpm)*(precalc. Freq.)

Table C-8. VSG 2401/2601/2801/3001 (Ø3.250” Compressor Drive Shaft)

Bearing	Number of Balls/ Rollers Per Row Nb	Ball/ Roller Diameter (MM) Bd	Pitch Diameter (MM) Pd	Contact Angle (DEG.) ø	Fundamental Train Frequency FTF (Hz)	Ball Spin Frequency BSF (Hz)	Ball Pass Frequency of Inner Race BPFI (Hz)	Ball Pass Frequency Of Outer Race BPFO (Hz)
G.RTR.RLR BRG 2864K	15	11.000	65.500	0	6.934	48.222	145.992	104.008
G.RTR.BALL BRG 2865J	12	30.160	132.500	40	9.598	35.767	84.819	115.181
M.RTR.BALL BRG 2865T	12	31.750	140.000	40	9.594	35.905	84.875	115.125
MN.RTR.RLR BRG 2864R	17	21.000	133.500	0	7.022	51.665	163.951	119.382

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 Emerson

Vilter Manufacturing LLC is a business segment of Emerson, a global leader in bringing technology and engineering together to provide innovative solutions for customers in industrial, commercial and consumer markets around the world. Our Emerson Automation Solutions business helps process, hybrid, and discrete manufacturers maximize production, protect personnel and the environment while optimizing their energy and operating costs. Our Emerson Commercial and Residential Solutions business helps ensure human comfort and health, protect food quality and safety, advance energy efficiency, and create sustainable infrastructure. For more information please visit

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