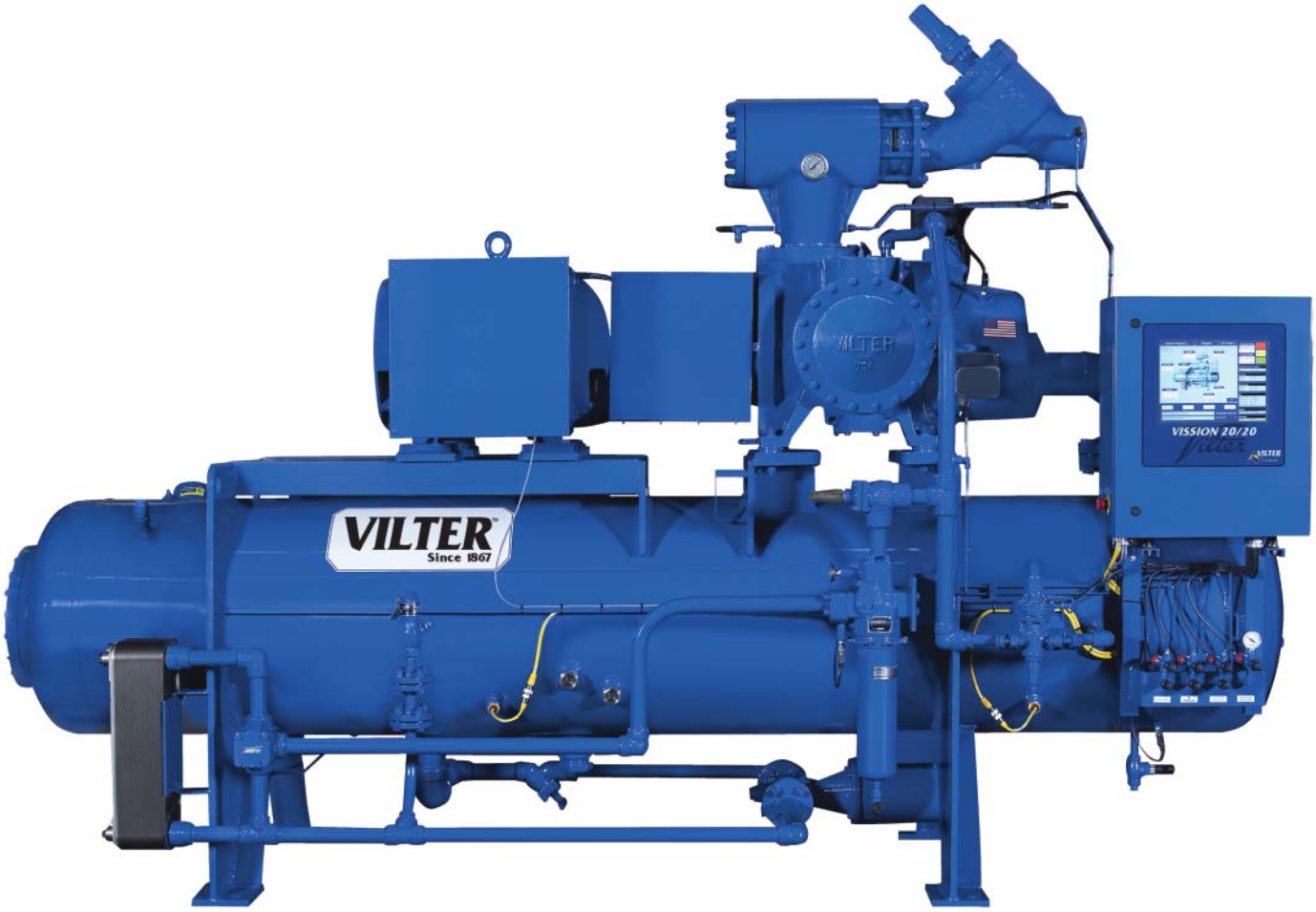
VSS/VSR/VSM single screw compressor

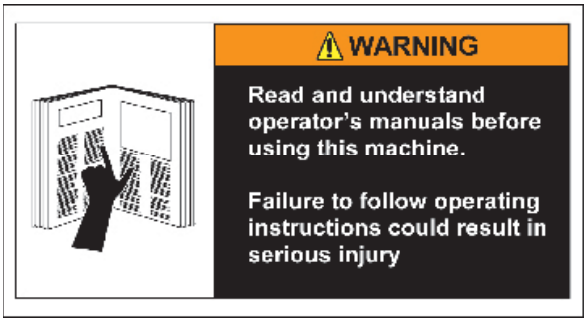
Operation and service manual



VILTER™
Since 1867

EMERSON™
Climate Technologies

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.

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
P.O. Box 8904
5555 South Packard Ave
Cudahy, WI 53110-8904 USA
Telephone: 1-414-744-0111
Fax:1-414-744-3483
e-mail: info.vilter@emerson.com

Equipment Identification Numbers:

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

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Standard VILTER Warranty Statement

Seller warrants the products it manufactures to be free from defects in material and workmanship for a period of eighteen (18) months from the date of shipment from Seller's manufacturing plant or twelve (12) months from date of installation at the initial end users location, whichever occurs first. In addition, Seller provides the following extended warranties: (a) three (3) years from the date of shipment on single screw compressor internal rotating parts, (b) two (2) years from the date of shipment on reciprocating compressors and single screw and reciprocating compressor parts, and (c) two (2) years on all other parts on a single screw compressor unit. Such warranties do not apply to ordinary wear and tear. Seller does not warrant that the product complies with any particular law or regulation not explicitly set forth in the specifications, and Buyer is responsible for ensuring that the product contains all features necessary to safely perform in Buyer's and its customer's plants and operations. Buyer must notify Seller of any warranty claim within ten (10) days after such claim arises, otherwise Buyer waives all rights to such claim. Products supplied by Seller, which are manufactured by others, are not warranted by Seller, but rather Seller merely passes through the manufacturer's warranty to Buyer.

SELLER EXPRESSLY DISCLAIMS ALL OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Unless otherwise agreed in writing, Buyer's sole remedy for breach of warranty is, at Seller's option, the repair of the defect, the correction of the service, or the providing a replacement part FOB Seller's office. Seller will not be responsible for costs of dismantling, lost refrigerant, reassembling, or transporting the product. Further, Seller will not be liable for any other direct, indirect, consequential, incidental, or special damages arising out of a breach of warranty. **THESE WARRANTY REMEDIES ARE EXCLUSIVE AND ALL OTHER WARRANTY REMEDIES ARE EXCLUDED.** Products or parts for which a warranty claim is made are to be returned transportation prepaid to Seller's factory. Any improper use, corrosion, neglect, accident, operation beyond rated capacity, substitution of parts not approved by Seller, or any alteration or repair by others which, in Seller's judgement, adversely affects the Product, shall void all warranties and warranty obligations. Further, Seller shall not be liable under the above warranties should Buyer be in default of its payment obligations to Seller under this Agreement or any credit agreement.

Standard VILTER 5/15 Warranty Statement

The seller extends warranty, from date of shipment, to a period of fifteen (15) years on all compressor bearings, five (5) years on all internal compressor parts and two (2) years on the remainder of the parts on single screw compressor units. 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 Seller's receiving written notice of any alleged defect within ten (10) days after its discovery and, at Seller's option, return of such parts to Seller, F.O.B., freight prepaid to Seller's factory. Expenses incurred by Buyer in repairing or replacing any defective product or any lost refrigerant will not be allowed except by written permission of Seller. This warranty is only applicable to products properly maintained and used according to Seller's instructions, the use of genuine Vilter replacement parts and recommended oil in all repairs and replacements has demonstrated adherence to a scheduled maintenance program as detailed in the Single Screw Compressor operating manual. This warranty does not apply to normal wear and tear, or damage caused by corrosion, misuse, overloading, neglect, improper operation, accident or alteration, as determined by Seller. 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 the Seller may have from the original manufacturer. Labor and expenses for repair are not covered by warranty.

THE WARRANTY CONTAINED IN THIS SECTION IS EXCLUSIVE AND IN LIEU OF ALL OTHER REPRESENTATIONS AND WARRANTIES (EXCEPT OF TITLE), EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

Any description of the product, 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. The 5/15 Extended Warranty shall be applicable only if the specific maintenance guidelines as outlined in the technical manual are followed. This includes the compressor inspections, completing periodic oil analysis and the change out of the oil and oil filters, and related components as required with only genuine Vilter parts. The customer is required to keep a maintenance log and receipts demonstrating the use of Genuine Vilter parts for validation of a warranty claim, if requested.

Note: The 5/15 warranty applies to NEW compressors only, and does NOT include used or remanufactured compressors.

Long Term Storage Requirements

The procedure described is a general recommendation for long term storage (over one month of no operation) of Vilter Manufacturing packages and compressors. While this procedure is intended to cover most of the commonly encountered situations, it is the responsibility of the installation firm and end user to address any unusual conditions. We suggest using the accompanying Long Term Storage Log sheet for recording purposes to validate the appropriate procedures.

Prior to start-up, Vilter recommends that a complete system pressure check be performed. Upon verification of the system integrity, a comprehensive evacuation procedure should be completed to ensure a dry system before gas is introduced. The oil circuit of any compressor is to be primed at initial start-up through the pre-lube oil pump on screw compressors.

Warranty of the system remains in effect as described in Section 5, Product Warranty and Procedures.

* If the unit is designed for indoor duty, it must be stored in a heated building.

  If the unit is designed for outdoor duty, and is to be stored outdoors, a canvas tarp is recommended for protection until installation is imminent. Adequate drainage should be provided, by placing wood blocks under the base skid, so that water does not collect inside the base perimeter or low spots in the tarp.

* All compressor stop valves are to be closed to isolate the compressor from the remainder of the system. All other valves, except those venting to atmosphere, are to be open. It is essential that the nitrogen holding charge integrity be maintained.

* Cover all bare metal surfaces (coupling, flange faces, etc.) with rust inhibitor.

* Desiccant is to be installed in the control panel. If the panel is equipped with a space heater, it is to be energized. If the panel does not have a space heater, use a thermostatically controlled 50-watt light bulb. Use an approved electrical spray-on corrosion inhibitor for panel components (relays, switches, etc.)

* All pneumatic controllers and valves (Fisher, Taylor, etc.) are to be covered with plastic bags and sealed with desiccant bags inside.

* System and compressor pressures (unit is shipped with dry nitrogen holding charge approximately 5 psi above atmospheric pressure) are to be monitored, on a regular basis, for leakage. It will be necessary to add a gauge to monitor the system holding charge pressure. If a drop in pressure occurs, the source of leakage must be found and corrected. The system must be evacuated and recharged with dry nitrogen to maintain the package integrity.

* Motors – (**NOTE:** The following are general recommendations. Consult the manufacturer of your motor for specific recommendations.)

1) Remove the condensation drain plugs from those units equipped with them and insert silica-gel into the openings. Insert one-half pound bags of silica-gel (or other desiccant material) into the air inlets and outlets of drip-proof type motors.

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

2) Cover the unit completely to exclude dirt, dust, moisture, and other foreign materials.

3) If the motor can be moved, it is suggested that the entire motor be encased in a strong, transparent plastic bag. Before sealing this bag, a moisture indicator should be attached to the side of the motor and several bags of silica-gel desiccant put inside the bag, around the motor. When the moisture indicator shows that the desiccant has lost its effectiveness, as by a change in color, the bag should be opened and fresh replacement desiccants installed.

   Whenever the motor cannot be sealed, space heaters must be installed to keep the motor at least 10°F above the ambient temperature.

   NOTE: There is a potential for damage by small rodents and other animals that will inhabit motors in search of warm surroundings or food. Due to this, a possibility of motor winding destruction exists. Sealing motor openings should restrict access to the motor.

4) Rotate motor and compressor shafts several revolutions (approximately 6) per month to eliminate flat spots on the bearing surfaces. If the compressor unit is installed, wired and charged with oil, open all oil line valves and run the oil pump for 10 seconds prior to rotating the compressor shaft. Continue running the oil pump while the compressor shaft is being turned to help lubricate the surfaces of the shaft seal.

Description

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 fingers 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 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

Description

The Vilter 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.

Foundation

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

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

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

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

Safety:

NOTE
Always check with a safety engineer before proceeding.

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

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

Foundation

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

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

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

For examples of foundation diagrams, refer to Figure 1 - Concrete Pad with Compressor Unit Dimensions - Side View and Figure 2 - Concrete Pad with Compressor Unit Dimensions - Front View

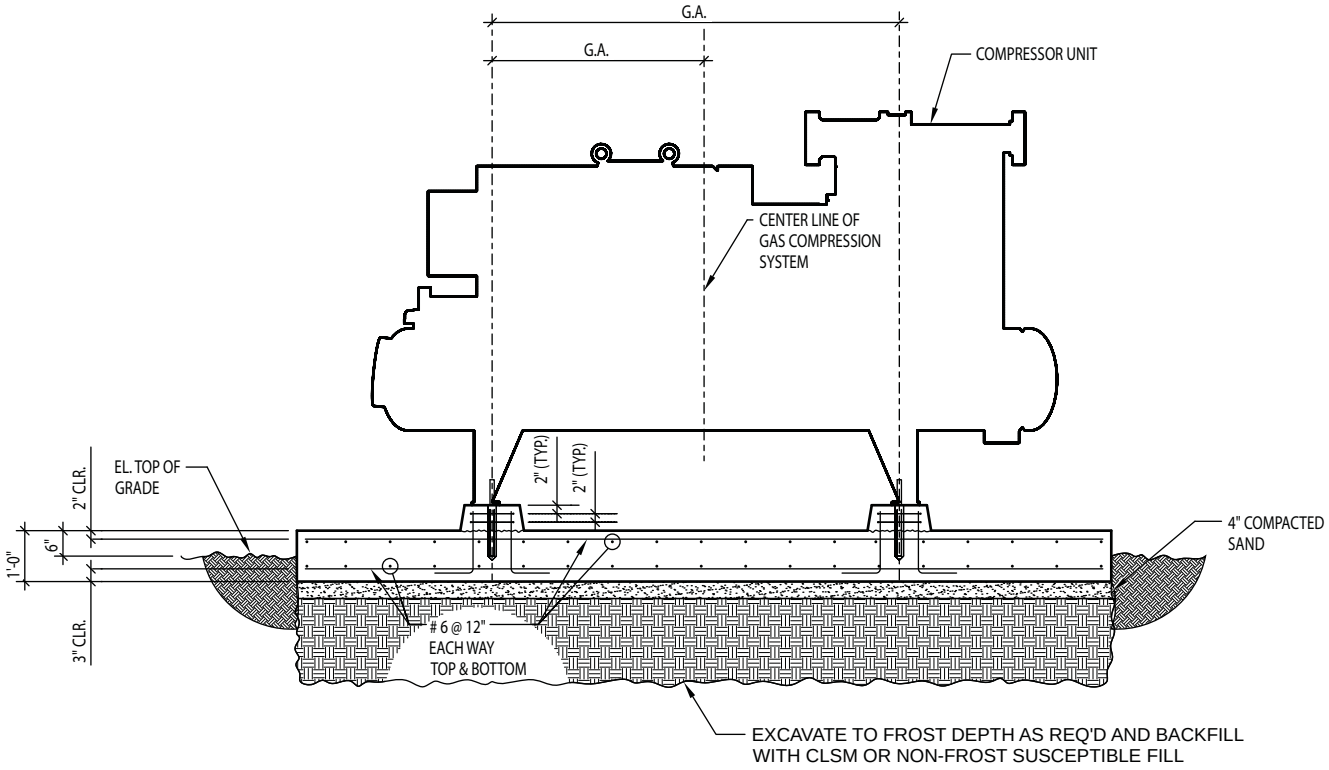


Figure 1. Concrete Pad with Compressor Unit Dimensions - Side View

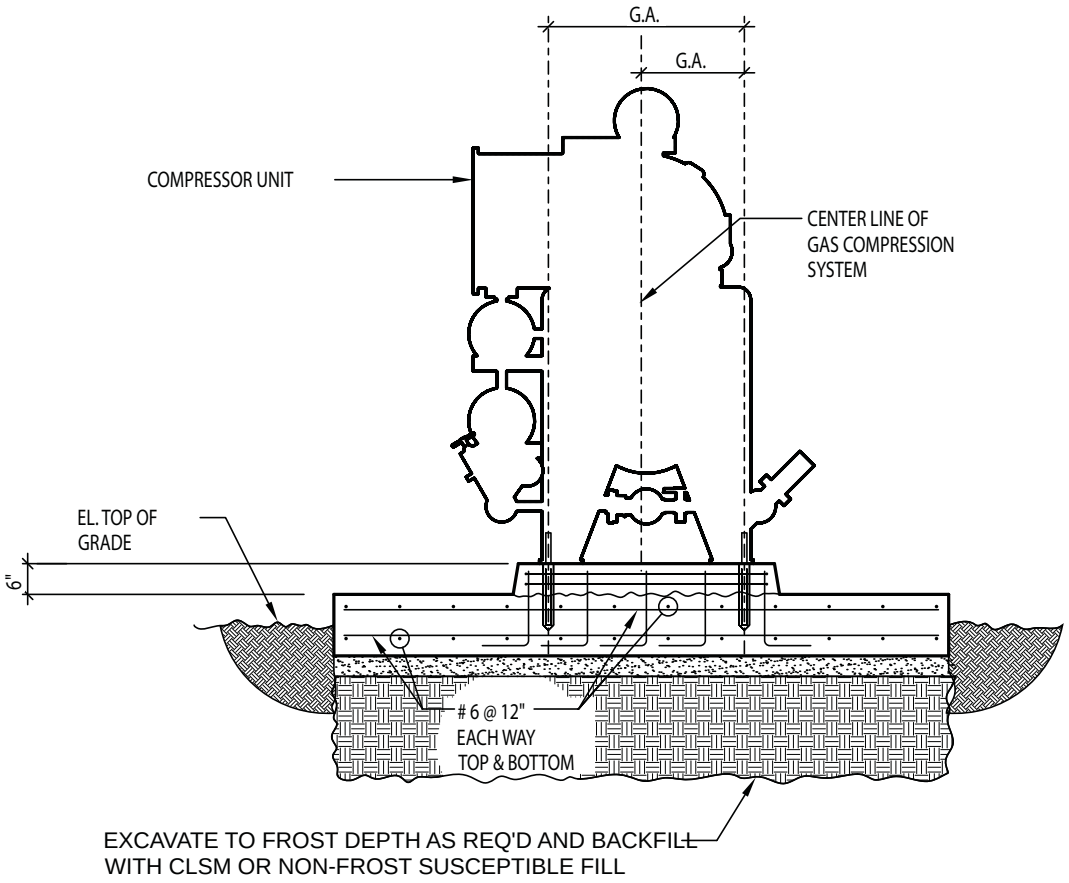


Figure 2. Concrete Pad with Compressor Unit Dimensions - Front View

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

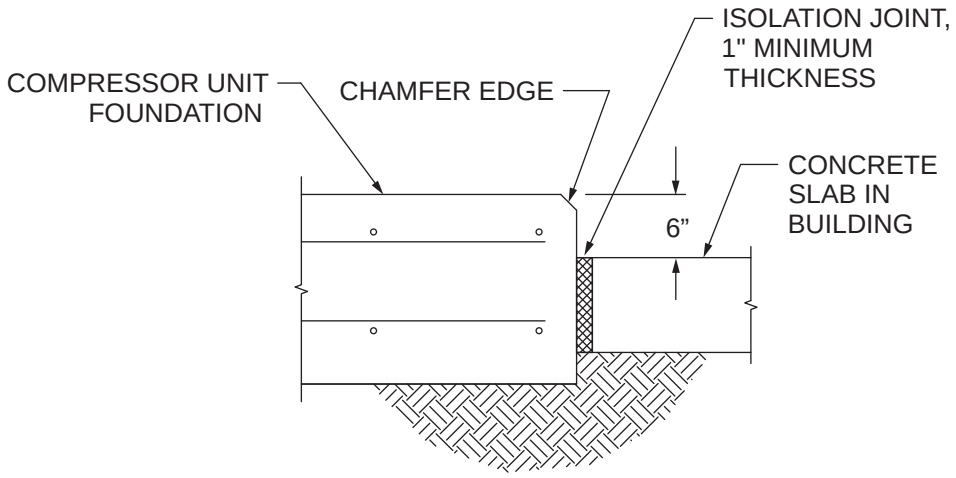


Figure 3. Interior Foundation Isolation

Foundation

Compressor Unit Installation

Once the foundation has cured, the compressor unit can be placed on the foundation, see Figure 4. Foundation with Housekeeping Pads Dimensions - Top View and Figure 5. Housekeeping Pad Dimension Detail - Top View. With the appropriate material handling equipment, lift the compressor unit by locations shown on the Vilter GA drawing and slowly place it on the foundation housekeeping piers. As per the Vilter GA drawing, ensure the compressor unit is correctly placed on the foundation. Once placed, use the spherical washers directly under the compressor as the surface to level the compressor unit, see Figure 6 - Compressor with Spherical Washers. Place shims under the feet of the compressor unit, as needed, until it is leveled, see Figure 7 - Concrete Pad Housekeeping Detail. Select the correct drill bit and drill thru the anchor bolt hole in the mounting feet of the compressor unit to the depth called for on the Vilter foundation drawing. Finally using the HILTI instructions, put your anchor bolts in place and wait for them to cure. Then place the nuts on the anchor bolts to finger tight and prepare to grout.

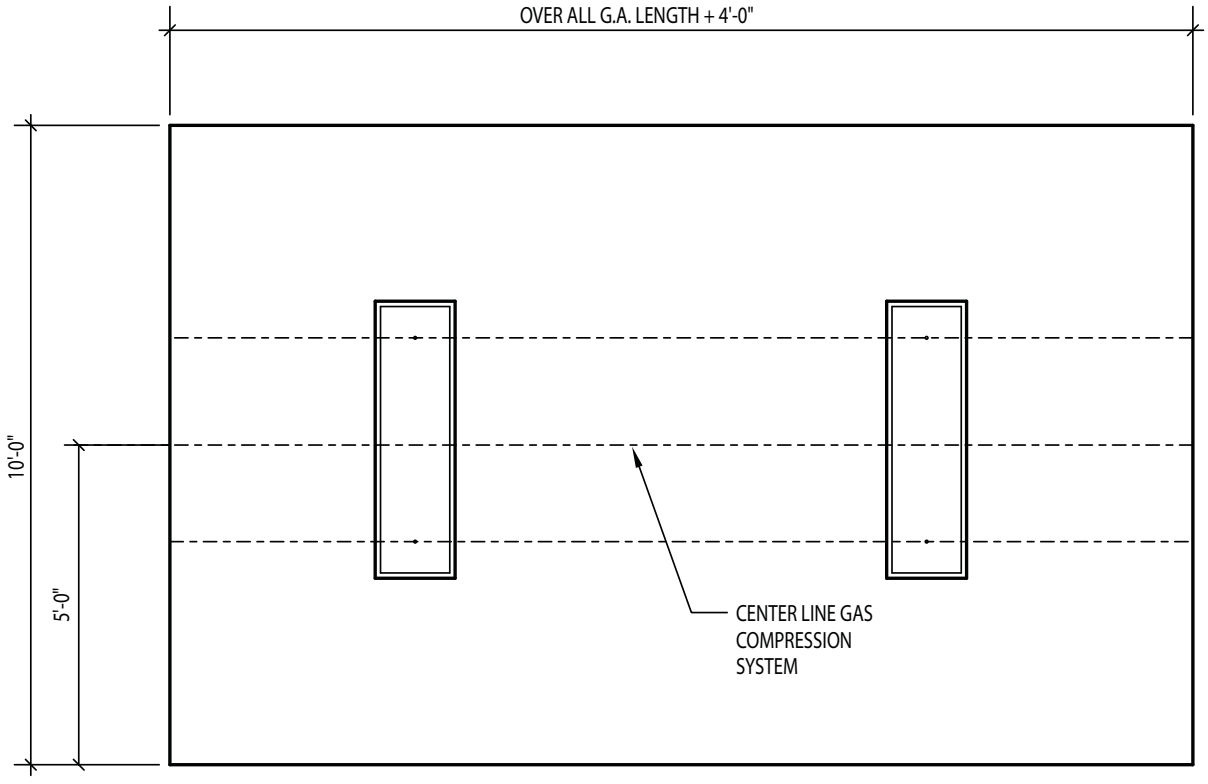


Figure 4. Foundation with Housekeeping Pads Dimensions - Top View

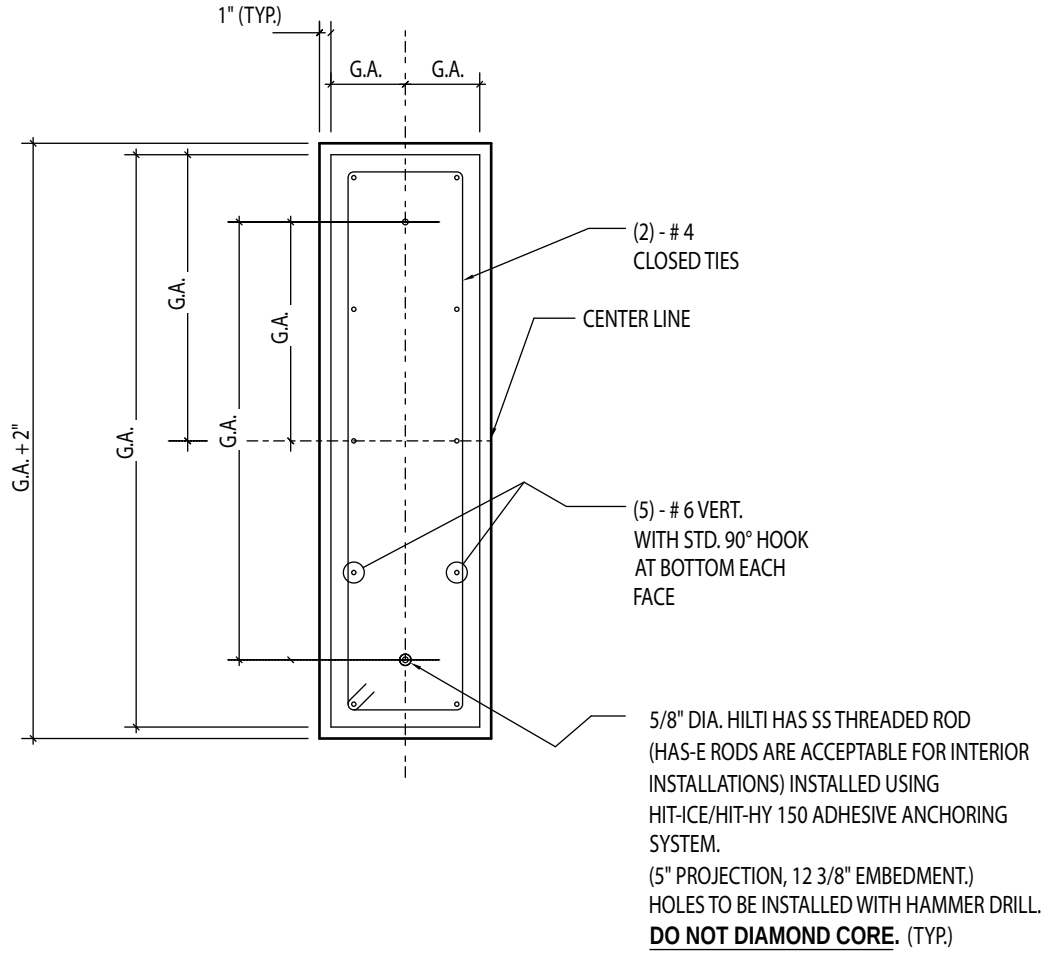


Figure 5. Housekeeping Pad Dimension Detail - Top View

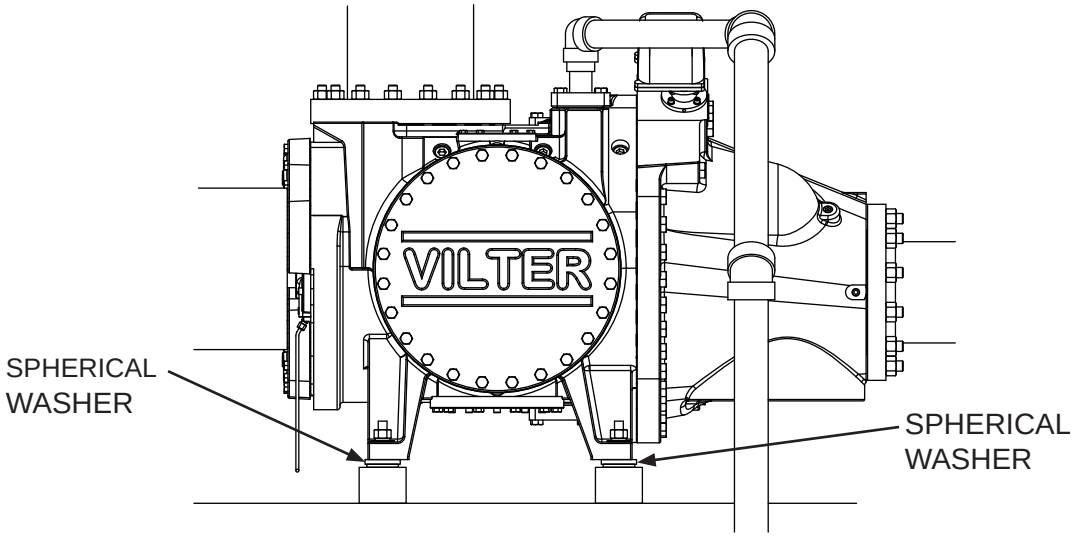


Figure 6. Compressor with Spherical Washers

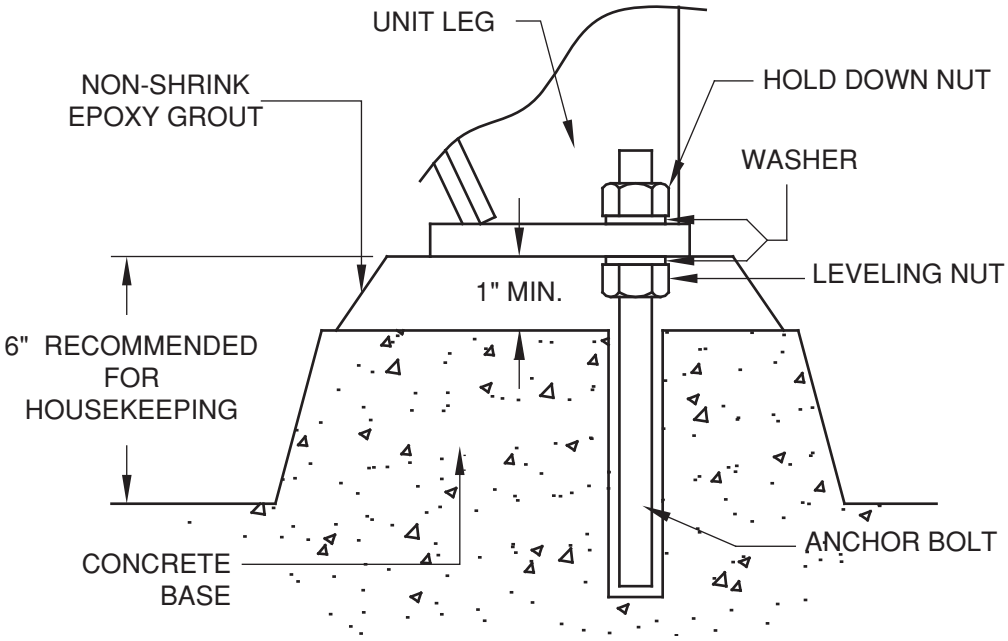


Figure 7. Concrete Pad Housekeeping Detail

Leveling and Grouting

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

Piping Connections

Piping Stress

Once the screw compressor package has been installed, properly grouted and anchored, it is imperative that the piping bolted to the screw compressor not impose excessive forces on the compressor. Suction and discharge lines should be supported so the lines will not move if disconnected from the compressor.

Additional Information

Codes and Standards

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

- ACI
- ASTM
- ASCE 7
- IBC 2006

Foundation

Operation and Performance
The foundation was designed for:

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

General Design Requirements
The compressor foundation is designed to:

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

Rigging and Lifting

Thank you for purchasing a gas compressor (the "Compressor") from Vilter Manufacturing LLC ("Vilter"). Rigging and Lifting a large piece of equipment like the Compressor is extremely dangerous.

DISCLAIMER

Notice

This rigging and lifting manual (this "Manual") is provided to you as a courtesy by Vilter and is not intended to be a comprehensive guide to rigging and lifting the Compressor. Vilter shall not be liable for errors contained herein or for incidental or consequential damages (including any injury to persons performing the rigging or lifting) in connection with the furnishing, performance, or use of this Manual. This Manual is only a set of suggestions and you may not rely solely on the information contained in this Manual to conduct the lift. In addition, information in this Manual is subject to change without notice.

Limited Warranty

The information is this Manual does not constitute any warranty as to the Compressor. The warranty provision contained in the terms and conditions pursuant to which the Compressor was sold serves as the sole and exclusive warranty.

Safety

To correctly and safely operate the Compressor, you must consult all of the documentation that was provided to you with the purchase of the Compressor (including all information sheets, warning notices and any other documents). This Manual is not intended to summarize or supplant any directions regarding how to safely operate or move the Compressor.

BEFORE LIFTING AND RIGGING THE COMPRESSOR

In order to minimize the inherent risk involved in rigging and lifting a large piece of equipment, before attempting to lift the Compressor, the actions of all parties involved in the lift must be carefully planned.

The following is provided merely to encourage purchasers to think about all of the steps necessary to rig and lift the Compressor. Vilter can neither anticipate all of the dangers involved in a particular lift, nor evaluate the particular capabilities of each of person who will participate in the lift.

Educate and Select Lift Participants

To rig and lift the Compressor in a safe manner, you will need to select experienced, trained people ("Participants") to take on (and successfully perform) at a minimum the tasks associated with each of the following positions:

- Crane Operator;
- Crane Owner;
- Lift Coordinator;
- Lift Engineer;
- Rigging Specialist;
- Riggers; and
- Safety Signaler.

Training curriculum for Participants, at a minimum, should include:

- A review of safe operating practices;
- A review of who each person is and their specific role in the lift;
- A tutorial on how to read lift charts;
- A demonstration on how to use and inspect rigging hardware;
- A review of the company's general lift plans and procedures;
- A tutorial on hand signals normally used to communicate with crane operators (a copy of such hand signals may be obtained from machine safety vendors); and
- A review of the Compressor's specific rig and lift plan (the "Plan") (developed by the Lift Coordinator and Lift Engineer); please see the section immediately below entitled "Create and Communicate the Plan."

Individuals participating in the lift should fully understand the scientific principles pursuant to which a successful lift is dependent—for example, center of gravity, equilibrium, and mechanics of load stabilization, critical angle considerations and force.

All Participants should undergo a fitness-for-duty program, including drug testing and medical examinations.

Create and Communicate the Plan

Well in advance of the planned lift date, lift planning meetings and hazard assessment meetings should be held with all Participants in attendance. In addition, the Plan should be finalized and distributed for review and comment.

The Plan should clearly define requirements, expectations and specifications for lifting the Compressor. At a minimum, the Plan should include:

- Standard lifting and rigging procedures in place at the lift site (including proper classification of the lift as a "critical lift" a "serious lift" or a "standard lift");
- Drawings of the Compressor;
- A description of the lifting task;
- An evaluation of the hazards;
- The rigging plan and sketches of rigging to be attached to the Compressor;
- The roles and responsibilities of all Participants;
- An emergency plan; and
- The contact information of the Plan preparer

It is important to confirm that each Participant understands both the broader Plan and their specific responsibilities during the lift. Participants should be encouraged to contact the Plan preparer at any time if they have questions. In addition, the Plan preparer should be on-site during the lift to ensure that the lift is being executed in accordance with the Plan. Finally, well in advance of the lift date, it should be confirmed that all necessary permits have been obtained.

Inspect and Use the Appropriate Lifting Equipment

Verify Crane Operator and Crane Owner Credentials

Prior to rigging and lifting the Compressor, certain precautions should be taken with regards to the crane, the crane operator and the crane owner.

- The lift capacity of the crane must exceed the Compressor's weight;
- Confirm that the crane operator is qualified to work on the site;

- Get third-party confirmation that the crane owner and the crane operator are in compliance with applicable laws, regulations and internal safety standards;
- Consult with the crane owner to determine if any site preparation is required for outriggers—improper use of outriggers is a significant cause of crane failure;
- Determine the level of supervision to be supplied by the crane owner; and
- Review all crane maintenance and inspection records, including without limitation, the crane log book, maintenance records, inspection reports and the physical condition of the crane.

Take all Appropriate Measurements
- Understand and interpret the load charts;
- Review all Compressor drawings for unit size, weight, center of gravity and other specifications;
- Communicate incident response procedures in writing prior to the lift and verbally immediately before the lift;
- Determine the initial position, final position, orientation and elevation of the Compressor;
- Ensure that adequate space is provided to safely assemble, erect, and operate the crane and materials (such as timber mats, cribbing and blocks);
- Identify and communicate to all Participants the access points, lift radius, swing radius, clearances, and obstructions;
- Eliminate hazards and obstructions that may interfere with moving the Compressor; and
- Inform all Participants of water lines, sewer lines, power lines and other obstructions.

Use Proper Rigging Methods
- Determine diameter, length and quantity of necessary rigging hardware (design and detail the rigging hardware to suit lifting the Compressor at the supplied pad eyes);
- Review and inspect all hoisting, lifting and rigging equipment;
- Select shackle size and prepare sketches or drawings for rigging;
- Use proper, conservative rigging techniques—including spreader beams—needed to lift the Compressor;
- Pad sharp corners, check the orientation of chocker hitches and the orientation of hooks;
- Prevent the binding of hoist rings; and
- Verify pad eye information.

TEST AND BALANCE THE COMPRESSOR

It is essential to test and balance the compressor before executing the actual lift in order to identify potential causes of injury to Participants and the Compressor.

Secure Rigging and the Lift Site
- Reiterate that no one should walk under the raised load;
- Secure and restrict access to the lift area (consider vacating all non-essential personnel from the area);
- Provide qualified supervision for the duration of the lift;
- If applicable, assess the weather conditions and decide if it is safe to proceed;
- Stop the lift when any potentially unsafe conditions are recognized; and
- Ensure there are open channels for communications during the pre-lift, lift and post-lift phases (radio communications should be used if a direct line of sight is not possible).

Test and Balance the Compressor before the Lift
- Slowly raise the crane to take slack out of the rigging without actually lifting the load;
- Allow the rigging gear to settle into place;
- Check for twists and binds;
- Verify that all padding has remained in place and that all slings are protected from sharp edges;
- Begin to raise the load to verify balance and check the braking system; and
- If the Compressor is not balanced, lower and adjust as necessary.

CONTACT VILTER

While Vilter will not offer any specific feedback on the Plan or provide a specific Plan for rigging and lifting the Compressor, Vilter may be able to answer questions about the Compressor that are important in developing your Plan.

Please contact Vilter at:

P.O. Box 8904
5555 S Packard Ave
Cudahy, WI 53110-8904

Telephone: 1-414-744-0111
Fax: 1-414-744-3483

email: info.vilter@emerson.com

www.vilter.com

Installation

I. DELIVERY INSPECTION

Vilter screw compressor components are thoroughly inspected at the factory, assuring the shipment of a mechanically perfect piece of equipment. Damage can occur in shipment, however. For this reason, the units 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.

TABLE 1. UNIT WEIGHTS (LBS)*

MODEL	STANDARD	ECON-O-MIZER
VSM 71	2,750	2,750
VSM 91	2,750	2,750
VSM 101	2,750	2,750
VSM 151	2,750	2,750
VSM 181	2,750	2,750
VSM 201	2,750	2,750
VSM 301	2,850	2,850
VSM 361	2,850	2,850
VSM 401	2,850	2,850
VSM 501	4,000	4,000
VSM 601	4,500	4,500
VSM 701	5,000	5,000
VSS 451	4,000	4,000
VSS 601	4,500	4,500
VSS 751	5,300	5,300
VSS 901	5,300	5,300
VSS 1051	6,600	6,600
VSS 1201	6,700	6,700
VSS 1301	6,750	6,750
VSS 1501	10,010	10,010
VSS 1801	10,010	10,010
VSS 1551	11,000	11,000
VSS 1851	11,000	11,000
VSS 2101	11,000	11,000

* Does not include motor.

II. FOUNDATIONS

Vilter single screw compressor units are basically vibration free machines, therefore, no elaborate foundations are necessary. The floor or foundation upon which the unit will be placed should be designed to support the entire operating weight of the unit. See Table 1 for unit weights. See Foundation, page 12, for additional foundation instructions.

III. LOCATING UNIT - DRIVE COUPLING ALIGNMENT

The single screw compressor units are shipped with all major components mounted on structural steel. Place the entire unit on the floor on a concrete pad and securely bolt in place. Review local codes and ASHRAE Safety Code for Mechanical Refrigeration. Bolt holes are located in the unit's mounting feet. When locating the unit, provide adequate space for service work. When the compressor unit is in place on the concrete pad, check both lengthwise and crosswise to assure it is level. Use shims and wedges as needed under the mounting feet to adjust the level of the unit.

On single screw units, the motor and compressor have been roughly aligned at the factory. The coupling center section was shipped loose to allow a check of proper electrical phasing, direction of rotation of the motor and final coupling alignment. The dial indicator alignment method is recommended. Final alignment should be within 0.004 inches total indicator reading in all direction for the VSS models and 0.010 inches for the VSM models.

III. SYSTEM PIPING

Refer to the ANSI/ASME B31.5 Code for Refrigeration Piping. All compressor oil supply and oil return piping has been completed at the factory. The necessary connections to be made to the screw compressor unit will vary depending on the type of oil cooling method purchased. Main line refrigerant suction and discharge connections are always necessary.

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.

Lines for ammonia systems must be of steel pipe with specially designed ammonia service fittings. Common pipe fittings must NEVER be used as they will not provide the same service. 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 refrigeration 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 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.

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.

Smaller Halocarbon and Hydroflourocarbon installations use copper pipes with solder type fittings where possible. The use of screw type fittings in Halocarbon systems should be held to an absolute minimum, as these refrigerants, due to their physical properties, will leak through screw type joints.

When drawn copper tubing is used for Halocarbon lines, type “K” or “L” conforming to ASTM B88 should be used. Soft annealed copper tubing conforming to ASTM B280 can also be used for tube sizes not larger than 1-3/8” in outside diameter. These requirements are in accordance with the mechanical code for refrigeration ANSI B9.1-1971. The type of copper tubing to be used for a given pressure is dependent on the strength of the copper at the design temperature. Some local codes forbid the use of Type “L”. Therefore, before installation, be sure to check local requirements. Never use type “M” as it does not have adequate wall thickness to withstand the operating pressures. In selecting fittings 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.

In larger pipe sizes, wrought fittings are not available. However, specially tested cast fittings are available and these may be used with complete safety.

When soldering copper tubing joints, only silver solder should be used for Refrigerant-22 service. Soft solder such as “50-50” should never be used, as its melting point is too low, lacks mechanical strength, and tends to break down chemically in the presence of moisture.

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.

Water supply and drain connections, and equipment using water, should be installed so all the water may be drained from the system after the plant has been shut down in cold weather.

These precautions will avoid costly damage to the equipment due to freezing.

This information is taken from ASHRAE 15-89 and ANSI B31.5. The installing contractor should be thoroughly familiar with these codes, as well as any local codes.

IV. ELECTRICAL CONNECTIONS

The single screw compressor units are shipped with all package mounted controls wired. The standard control power is 115 volts 60 Hertz, single phase. If a 115 volt supply is not available, a control transformer may be required. The power source must be connected to the control panel according to the electrical diagrams.

The units are shipped without the compressor motor starter. Field wiring is required between the field mounted starters and package mounted motors.

Additional control wiring in the field is also required. Dry contacts are provided in the control panel for starting the screw compressor motor. These contacts are to be wired in series with the starter coils. A current transformer is supplied along with the compressor unit, and is located in the motor junction box. This transformer is to be installed around one phase of the compressor motor starter. A normally open auxiliary contact from the compressor motor starter is also required.

Terminal locations for this wiring can be found on the wiring diagram supplied with this unit. Additional aspects of the electrical operation of the single screw units are covered in the start up and operation section of this manual.

V. TESTING REFRIGERATION SYSTEM FOR LEAKS

Vilter equipment is tested for leaks at the factory. One the most important steps in putting a refrigeration 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 refrigerant. To test for leaks, the system pressure must be built up. Test pressures for various refrigerants are listed in ANSI B9.1-1971 code brochure entitle “Safety Code for Mechanical Refrigeration”. These pressures will usually suffice, however, it is advisable to check local codes as they may differ. Before testing may proceed, several things must be done.

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. Because of differences in characteristics of the various refrigerants, two different testing methods are necessary.

A. Ammonia Systems

Dry nitrogen may be used to raise the pressure in an ammonia system to the proper level for the test. The gas may be put into the system through the charging valve or any other suitable opening. Adjust the pressure regulator on the bottle to prevent over-pressurization. Do not exceed the pressure rating on the vessel with the lowest pressure rating.

Carbon Dioxide should NOT be used as a testing gas in a system where ammonia is already dissolved in any moisture remaining. This will cause ammonium carbonate to precipitate when the CO_2 is added. If heavy enough, this precipitate may cause the machine to freeze and clog the strainer.

A mixture of four parts water to one part liquid soap, with a few drops of glycerin added, makes a good solution. Apply this mixture with a one inch round brush at all flanges, threaded joints, and welds. Repair all visible leaks. If possible, leave the pressure on over night. A small pressure drop of 5 lbs. Over this period indicates a very tight system.
Remember to note the ambient temperature, as a change in temperature will cause a change in pressure.

After the system is thoroughly tested, open all

valves on the lowest part of the system so the gas will float away from the compressor. This prevents any dirt or foreign particles from entering the compressor and contaminating the working parts. The oil should then be charged into the compressor.

Charge a small amount of ammonia into the system and pressurize the system to its respective design pressure. Pass a lit sulfur stick around all joints and connections. Any leaks will be indicated by a heavy cloud of smoke. If any leaks are observed during this test, they must be repaired and rechecked before the system can be considered tight and ready for evacuation.

B. Halocarbon Refrigerant 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" the system may be tested with refrigerant.

Attach a drum of the refrigerant to be used in the system and allow the gas to enter until a pressure of 5 psig is reached.

Remove the refrigerant 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.

C. Evacuating The System

A refrigeration system operates best when only refrigerant is present. Steps must be taken to remove all air, water, vapor, and all other non-condensables from the system before charging it with refrigerant. A combination of moisture and refrigerant, along with any oxygen in the system, can form acids or other corrosive compounds that corrode internal parts of the system.

To properly evacuate the system, and to remove all non-condensables, air and water vapor, use a high vacuum pump capable of attaining a blanked off pressure of 50 microns or less. Attach this pump to the system and allow it to operate until system pressure is reduced somewhere below 1000 microns. Evacuation should not be done unless the room temperature is 60F or higher.

Attach vacuum gauge(s), reading in the 20 to 20,000 micron gauge range, to the refrigerant system. These gauge(s) should be used in conjunction with the high vacuum pump. The reading from the gauge(s) indicates when the system has reached the low absolute pressure required for complete system evacuation.

Connect the high vacuum pump into the refrigeration system by using the manufacturer's instructions. Connect the pump both to the high side and low side of the system, to insure system evacuation. Attach the vacuum gauge to the system in accordance with the manufacturer's instructions.

A single evacuation of the system does not satisfactorily remove all of the non-condensable, air and water vapor. To do a complete job, a triple evacuation is recommended.

When the pump is first turned on, bring system pressure to as low a vacuum level as possible, and continue operation for 5 to 6 hours.

Stop the pump and isolate the system. Allow the unit to stand at this vacuum for another 5 to 6 hours. After this time, break, the vacuum and bring the system pressure up to 0 psig with dry nitrogen.

To begin the second evacuation, allow the pump to operate and reduce the pressure again to within 50 to 1000 microns. After this reading is reached, allow the pump to operate 2 or 3 hours. Stop the pump and let the system stand with this vacuum. Again using dry nitrogen, raise the system pressure to zero.

For the third evacuation, follow the previous procedure with the pump operating until system pressure is reduced below the 1000 micron level. Run the pump an additional 6 hours and hold the system for approximately 12 hours at low pressure. After this, again break the vacuum with dry nitrogen and allow the pressure in the system to rise slightly above zero pounds (psig). Install new drier cartridges and moisture indicators. Charge the system once more below the 1000 micron level and use the refrigerant designed for the system.

When properly evacuating the system as outlined above, the system is dry, oxygen-free and free of non-condensables. The piping should not be insulated before the evacuation process is started. If moisture is in the system before evacuating, it condenses in low places and freezes. If this happens, it can be removed by gently heating the trap farthest away from the vacuum pump. This causes the ice to melt and water to boil. Water vapor collects in the next trap towards the vacuum pump. This process should be repeated until all pockets of water have been boiled off, and the vacuum pump has had a chance to remove all the water vapor from the system.

VI. UNIT OIL CHARGING

The compressor unit is shipped from Vilter with no oil charge. The initial oil charge can be made through the drain valve at the oil receiver/separator. Vilter motor driven and manually operated oil chargers are available for this purpose. Once the unit has been started and is operating above 50% capacity, oil may have to be added to bring the oil level to the normal operating point. With the unit operating, oil should be added through the charging connection at the suction strainer. The normal operating level is between the (2) sight glasses on the oil separator. See Table 2 for approximate oil charge requirements.

TABLE 2. OIL CHARGE

Oil Separator Size	Approximate Oil Charge (Gallons)
VSR 16”	20 to 27
VSR 20”	22 to 31
VSM 20”	20 to 25
VSM 30”	30 to 35
20”	30 to 40
24”	40 to 50
30”	60 to 75
36”	95 to 105
42”	145 to 165

The oil level may be above the top sight glass at this time. Later, when the unit is placed in operation, there will be some drop in the oil level as the various oil lines, oil filter and other piping becomes charged with the normal amount of oil that will be in circulation. This drop in oil level should bring the level in the oil receiver/separator into the normal operating range. Do not mix oils.

A. 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 refrigerant specific lubricating oils. Use of oil not specified or supplied by Vilter will void the compressor warranty.

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

VII. SYSTEM REFRIGERANT CHARGING

CAUTION

When charging the system, make sure the compressor unit is pressurized from the discharge side of the compressor. Pressurizing the compressor from the suction side may cause rotation of the compressor, without oil supply, which could lead to internal damage.

After the system is leak-free and evacuation has been completed, it is ready for charging. Before actual charging, however, the entire operation of the refrigeration system should be inspected as outlined below:

A. Low Side Equipment

1. Fans on air handling equipment running.
2. Pumps on water cooling equipment running.
3. Proper location and attachment of thermostatic expansion valve bulb to suction line.
4. Correct fan and pump rotation.
5. Evaporator pressure regulators and solenoid valves open.
6. Water pumps and motors correctly aligned.
7. Belt drives correctly aligned and tensioned.
8. Proper voltage to motors.

B. Compressors

1. Proper oil level.
2. Voltage agrees with motor characteristics.
3. Properly sized motor fuses and heaters.
4. Direct drivers aligned and couplings tight.
5. All suction and discharge valves open.
6. All transducers and RTD's calibrated and reading correctly.

C. Condensers

1. Water available at water cooled condensers and supply line valve open.
2. Water in receiver of evaporative condenser and makeup water available.
3. Correct rotation of pump and fan motors.
4. Belt drives aligned and tensioned correctly.
5. Pump, fans and motors lubricated.

D. Controls

Controls should be at the initial set points. See microprocessor manual for further information.

E. Initial Charging – High Side Charging

There are two methods of charging refrigerant into the system, through the "high side" or through the "low side". High side charging is usually used for initial charging as filling of the system is much faster. Low side charging is usually reserved for adding only small amounts of refrigerant after the system is in operation.

High side charging of refrigerant into the system is accomplished as follows:

1. Connect a full drum of refrigerant to the liquid charging valve. This valve is generally located in the liquid line immediately after the king or liquid line valve. Purge the air from the charging line.

2. Invert the refrigerant drum if the drum is not equipped with "Liquid" and "Vapor" valves, and place in such a position so the liquid refrigerant only can enter the system. Close the liquid line or king valve, if it is not already closed. Open the "Liquid" charging valve slowly to allow refrigerant to enter the system. The vacuum in the system will draw in the refrigerant.

   It is important that, during this operation, air handling units be running and water is circulating through the chillers. The low pressures on the system can cause the refrigerant to boil at low temperature and possibly freeze the water if it is not kept circulating.

   Water freezing in a chiller can rupture the tubes and cause extensive damage to the system. It would be desirable to charge the initial amount of refrigerant without water in the shell and tube equipment to eliminate the possibility of freeze up.

3. After some refrigerant has entered the system, the compressor unit starting procedure may be followed. See Start-Up and Operation Section of this manual.

4. Continue charging refrigerant into the system until the proper operating requirements are satisfied. Then, close the liquid charging connection and open the liquid line valve allowing the system to operate normally. To check that enough refrigerant has been added, the liquid sight glass

should show no bubbles, and there will be a liquid seal in the receiver. If these two conditions are not satisfied, additional refrigerant must be added.

5. When sufficient refrigerant has been charged into the system, close the charging and drum valves. Then remove the drum from the system.

6. During the charging period, observe the gauge carefully to insure no operating difficulties. Watch head pressures closely to make sure the condensers are functioning properly.

Since it is usually necessary to use several drums when charging a system, follow the procedures in paragraphs E1 and E2 of the above description when attaching a new drum. After charging, the refrigerant drums should be kept nearby for several days as it is sometimes necessary to add more refrigerant as the system "settles down".

VIII. MAINTENANCE SUGGESTIONS

Careful checking of a refrigeration system for leaks and proper operation of all components upon installation will start the system on its way to a long life of satisfactory service. To ensure the desired trouble-free operation, however, a systematic maintenance program is a prerequisite. The following maintenance schedule is suggested.

A. Daily

1. Check oil levels.

2. Check all pressure and temperature readings.

3. Check micronic oil filter inlet and outlet pressures for excessive pressure drop. Change filter when pressure drop exceeds 45 psi or every six months, whichever occurs first. For proper procedure for changing micronic oil filter and for charging oil into the system, see Operation Section.

4. Clean strainers each time filter cartridge if replaced.

5. Check compressor sound for abnormal noises.

6. Check shaft seals for excessive oil leakage. A small amount of oil leakage (approximately 10 drops/min) is normal. This allows lubrication of the seal faces.

B. Weekly
(Items 1 thru 6 above plus 7 thru 9)

7. Check the refrigeration system for leaks with a suitable leak detector.

8. Check oil pressures and review microprocessor log and log sheets.

9. Check refrigerant levels in vessels.

C. Monthly
(Items 1 thru 8 above plus 9 thru 13)

10. Oil all motors and bearings. Follow manufacturer's instructions on lubrication.

11. Check calibration and operation of all controls, particularly safety controls.

12. Check oil cooler for any evidence of corrosion, scaling or other fouling.

13. Operate compressor capacity and volume ratio controls through their range both automatically and manually.

D. Trimonthly
(About 2000 operating hours)

Check movement of compressor rotor at drive coupling end to determine bearing float. (Refer to Service Section.)

E. Yearly
(Items 1 thru 13 and "D" above plus 14 thru 28)

14. Check entire system thoroughly for leaks.

15. Remove all rust from equipment, clean and paint.

16. Flush out sediment, etc. from water circuits.

17. Clean all oil strainers.

18. Clean suction strainer – compressors.

19. Check motors and fans for shaft wear and end play.

20. Check operation and general condition of microprocessor and other electrical controls.

21. Clean all water strainers.

22. Check drains to make sure water will flow away from equipment.

23. Drain and clean entire oil system at receiver drain. Recharge with new clean moisture free oil. For proper procedure for changing micronic oil filter and charging oil into the system, see Start-Up and Operation section.

24. Check compressor coupling. For integrity and alignment.

25. Check oil pump for wear.

26. Check the calibration of the microprocessor pressure transducers and RTD's for accuracy.

27. Check mounting bolts for compressor and motor.

F. System Leaks

There are any number of reasons why leaks develop in a refrigeration system (i.e. such as drying out of valve packing, yielding of gaskets, improper replacement of valve caps and loosening of joints due to vibration). For these reasons, the need for periodic leak testing cannot be overemphasized. Similarly, when any service operations are performed on the system, care should be exercised to insure all opened flanges are tightened, all plugs that were removed are replaced with a suitable thread filling compound, all packing glands on valve stems are tightened, and all valve caps are replaced. When operation is restored, all joints opened or any valves moved during the servicing should be checked for leaks.

G. Year Round Operation

On a continual basis:

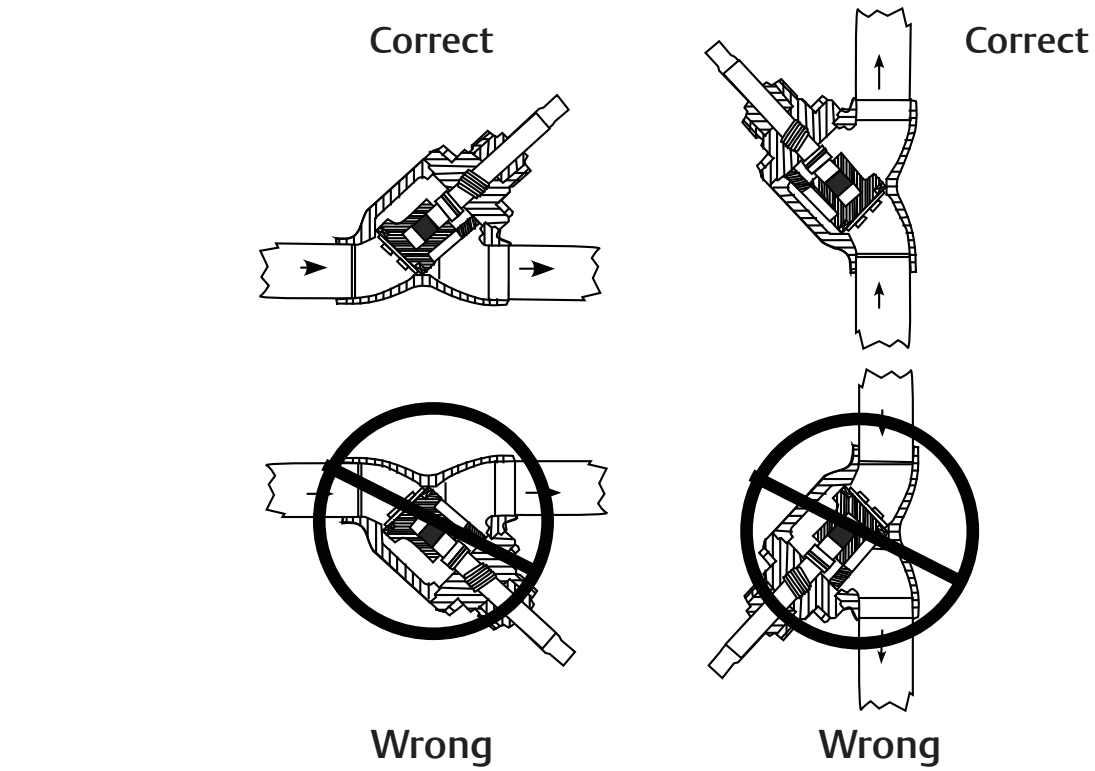
1. Guard against liquid slugging of compressor.

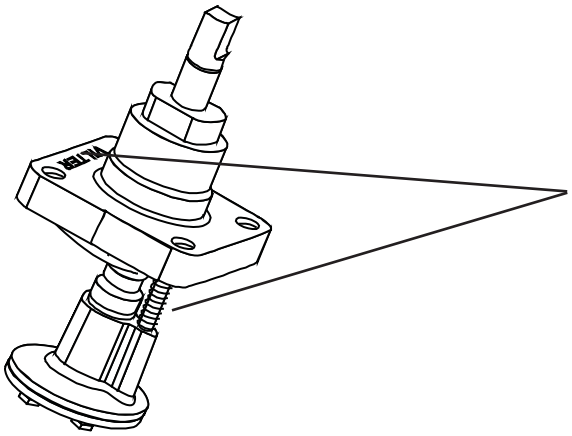
2. Maintain unit in clean condition and paint as necessary.

3. Grease valve stems and threads for the valve caps.

When refrigeration equipment is operated 24 hours a day year round, it is highly recommended that a yearly check of all internal parts be made (see Service Section). While the highest material standards are maintained throughout all Vilter compressors, continuous operation and any presence of dirt may prove injurious to the machine. To forestall needless shutdowns or prevent possible machine breakdowns, the side covers should be removed yearly, and a visual inspection be made of the internal parts. In this way, a small amount of time spent checking machine conditions once a year may prevent extensive shutdowns later with subsequent product loss and expensive repairs.

Stop Check Valve Installation





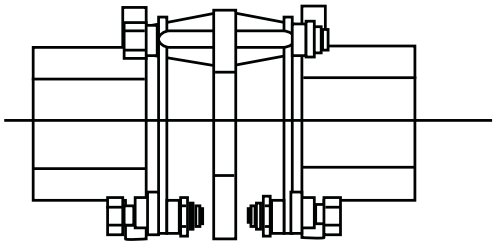
Verify the location of the Spring and note the Vilter name.

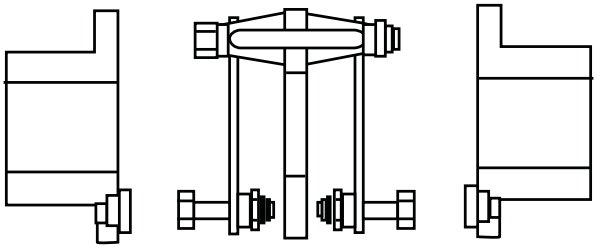
Installation:

The new design will apply only to the 2" thru 4" stop valves. Retrofitting a field installation will require replacing the bonnet assembly.

The bonnet must be installed with the spring towards the bottom (see illustrations above). The drill fixture is designed so that the hole for the spring will always be drilled on the opposite side from the cast-in Vilter name on the bonnet. From the outside of the valve, the casting numbers must always be towards the top of the valve.

See Operation Section on Stop Check Operation.





COUPLING INFORMATION

COUPLINGS INSTALLATION AND ALIGNMENT

These instructions are intended to help you to install and align the coupling. Covered here will be general information, hub mounting, alignment, assembly, locknut torquing, discpack replacement, and part numbers. The coupling as received, may or may not be assembled.

*If assembled, the locknuts are not torqued.

*If coupling is assembled, remove the bolts that attach the hubs to the disc packs. Remove both hubs. Leave the disc packs attached to the center member.

A. Hub Mounting:

1. Clean hub bores and shafts. Remove any nicks or burrs. If bore is tapered, check for good contact pattern. If the bore is straight, measure the bore and shaft diameters to assure proper fit. The key(s) should have a snug side-to-side fit with a small clearance over the top.

NOTE: If the hub position on the shaft does not allow enough room to install the short bolts in the hub after hub mounting, install the bolts and disc pack before mounting hub on shaft.

B. Straight Bore:

1. Install key(s) in the shaft. If the hub is an interference fit, heat the hub in an oil bath or oven until bore is sufficiently larger than the shaft. 350º F. is usually sufficient. An open flame is not recommended. However, if flame heating is necessary, use a very large rose bud tip to give even heat distribution. A thermal heat stick will help determine hub temperature. **DO NOT SPOT HEAT THE HUB OR DISTORTION MAY OCCUR.** With the hubs expanded, slide it up the shaft to the desired axial position. A pre-set axial stop device can be helpful.

C. Taper Bore:

1. Put the hub on the shaft without key(s) in place. Lightly tap hub up the shaft with a soft hammer. This will assure a metal-to-metal fit between shaft and hub. This is the starting point for the axial draw. Record this position between shaft and hub face with a depth micrometer. Mount a dial indicator to read axial hub movement. Set the indicator to "0". Remove hub and install key(s). Remount hub, drawing it up the shaft to the "0" set point. Continue to advance hub up the taper to the desired axial position. Use the indicator as a guide only. A pre-set axial stop device can be helpful. Check the final results with a depth micrometer. The hub may have to be heated in order to reach the desired position on the shaft. **DO NOT SPOT HEAT THE HUB OR DISTORTION MAY OCCUR.** Install shaft locknut to hold hub in place.

D. Shaft Alignment.

Move equipment into place.

1. *Soft Foot*. The equipment must sit flat on its base (+/- 0.002 inches). Any soft foot must be corrected now.

2. *Axial Spacing.* The axial spacing of the shafts should be positioned so that the disc packs (flexing elements) are flat when the equipment is running under normal operating conditions. This means there is a minimal amount of waviness in the disc pack when viewed from the side. This

will result in a flexing element that is centered and parallel to its mating flange faces. Move the connected equipment to accomplish the above.

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

See documentation that came with the coupling for complete specifications.

3. *Angular Alignment*. Rigidly mount a dial indicator on one hub or shaft, reading the face of the other hub flange, as shown on next page. Rotate both shafts together, making sure the shaft axial spacing remains constant. Adjust the equipment by shimming and/or moving so that the indicator reading is within .002 inch per inch of coupling flange.

4. *Parallel Offse*t. Rigidly mount a dial indicator on one hub or shaft, reading the other hub flange outside diameter, as shown in Figure 3. Indicator set-up sag must be compensated for. Rotate both shafts together. Adjust the equipment by shimming and/or moving so that the indicator reading is within .002 inch per inch of the axial length between flex elements. See drawing below.

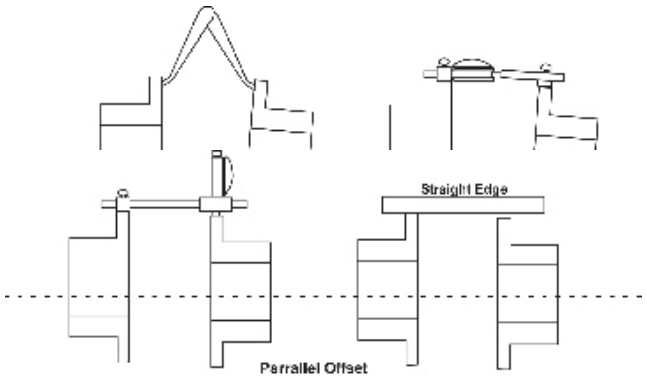
Note: If the driver or driven equipment alignment specification is tighter than these recommendations, the specification should be used. Also, be sure to compensate for thermal movement in the equipment. The coupling is capable of approximately four time the above shaft alignment tolerances. However,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

E. Final assembly

With the coupling in good alignment the bolts will fit through the holes in the flanges and the disc packs more easily.

1. If the coupling arrived assembled, the disc packs are still attached to the center ring. Before taking the discs packs off, first install one hub bolt through each disc pack and secure with lock out. This will help when the pack is reinstalled late. If the coupling was shipped disassembled, the bolt through the pack is not required as the discs in the pack are factory taped together.

Note: Alignment of C-Flange Units should be checked when compressor or motor are replaced.



2. Remove the long bolts. Mount the disc packs on the hubs with one bolt through the disc pack aligned with a clearance hole in the hub. Install the short bolts through the hub, disc pack, bevel washer or link, and secure with a lockout.

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

3. Position one set of short bolts in each hub on top. Now slide the center ring down into place straddling the short bolts with the center ring bushings. If coupling is dynamically balanced, the center ring match marks must lineup with both hub match marks. When one bushing is in-line with the hole in the disc pack, slide one long bolt through washer or link, disc pack, center ring, disc pack, washer or link, and then secure with a locknut. On size 226 and larger a link must be put on the bolt first. Now install the rest of the long bolts in the same manner.

4. Torque the long bolt locknuts at this time.

NOTE: With the coupling in good alignment, the bolts will fit through the holes in the flanges and the disc pack more easily. It is recommended that all locknuts be retightened after several hours of initial operation.

5. For further help with the installation or alignment, consult Rexnord.

F. Disc Pack Replacement.

If it becomes necessary to replace the disc pack, it can be done as follows:

1. Remove all the long bolts and lower the center ring by sliding it our from between the two disc packs.

2. Remove one short bolt from the disc pack/hub connection and reinstall it through a hub clearance hole and into the hole in the disc pack. Put the nut on. This will keep the discs together and maintains the disc orientation for later reinstallation. Remove the rest of the short bolts and takeoff the disc pack. Repeat for the second disc pack.

3. Replace the pack(s) if required. Recheck alignment per Section D. Reassemble per Section E.

Slide Valve Actuator Installations 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.

OVERVIEW

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.

PLEASE 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.

5. 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.

6. 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.

7. 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.

8. 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.)

9. Now connect the yellow power cable and the gray position transmitter cable to the actuator.

10. Press INC and DEC to move the slide valve and check for the correct rotation. See Table 1 on page 48 for Actuator/command shaft rotation specifications.

11. 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.

12. 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.

13. 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.

14. 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.

15. 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.

16. 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.

17. 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.

18. 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.

19. 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.

20. 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.

21. 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 9200 millivolts (7900 millivolts for the 2783J qualified analog boards). You are nearing the mechanical stop position.

22. Pulse the INC button to carefully move the slide valve until the millivolt readout "saturates", or stops increasing. This is around 9500 millivolts (8400 millivolts for 2783 qualified analog boards).

23. 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.

24. Press the "Set Max" button.

25. 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.

26. 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.

27. 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.**

28. Enable the "Slide Non-Movement Alarm" by going to the "Setup" menu and choosing "Alarm Enable" for the "Slide Non-Movement Option".

29. This completes the calibration for this channel either capacity or volume. Repeat the same procedure to the other channel.

Slide Valve Actuator 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.

Slide Valve Actuator Trouble Shooting Guide

Problem	Reason	Solution
The actuator cannot be calibrated	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. 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. Replace the actuator.

Slide Valve Actuator Trouble Shooting Guide

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

Slide Valve Actuator Trouble Shooting Guide

Problem	Reason	Solution
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 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.

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 (see Note 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.

Slide Valve Actuator Trouble Shooting Guide

*_____	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.
*__*__*_____	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 (see Note 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.

Note 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.

Note 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.

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 SYSTEM

A. Oil Charge

Charge the oil separator with the proper quantity of lubricating oil (see Table 2 in the Installation Section).

CAUTION

It is imperative you charge the oil into the receiver/separator prior to energizing the control panel to prevent burning out the immersion heater in the separator/receiver.

During operation, maintain the separator oil level in the normal operating range between the two bullseye sight glasses. If the oil level is visible only in the lowest sight glass, add oil to the operating compressor through the connection located at the compressor suction inlet. Pump oil into the compressor until the oil level in the separator is between the two bullseye sight glasses. Watch this level carefully to maintain proper operation. Never allow the oil to reach a level higher than indicated on the highest sight glass, since this may impair the operation and efficiency of the oil separator portion of this combination vessel.

B. Oil Separator

The refrigerant-oil mixture is led into the first part of oil separator. There, the first step of oil separation is performed by a combined agglomerator/demister. At the same time, these part of the oil separator serves as oil collector.

In the second part of the oil separator, the fine separation of the aerosol oil portion from the refrigerant is performed by means of replaceable fine oil separation cartridges. The oil separated in the fine section of the oil separator is returned to the compressor via an additional injection orifice.

C. Oil Filter

Change the oil filter after the first 200 hours of operation, as noted on the hour meter. Thereafter, replace the filter every six months, or when the oil pressure drop through the filter reaches 45 psi, whichever occurs first. The pressure drop across the filter is read on the microprocessor panel. Check the pressure drop and record it daily.

To prepare for the removal of the filter, shut down the compressor. Isolate the filter housing appropriately. If unit is equipped with duplex filter housings the unit does not have to be shut down, however the filter to be serviced must be isolated before the tank can be opened.

1. Filter Removal, VSS Units using Vilter Part Number 1833C oil filter elements.

   Release the pressure in the oil filter housing by opening the bleed valves at the stop valve in the block and bleed assembly, or at the bleed valve for the oil filter housing. Be sure to follow all Local, State, and Federal ordinances regarding the recovery of refrigerants.

   Drain the filter housing in to an appropriate container and dispose of the oil in a appropriate manner following all Local, State and Federal ordinances regarding the disposal of used oil.

   Unscrew the bolts holding the cover flange to the tank. Remove the cover flange and spring plate. Pull out the filter element(s). Before reassembling, thoroughly clean the tank and spring plate to lengthen the life span of the filter element(s).

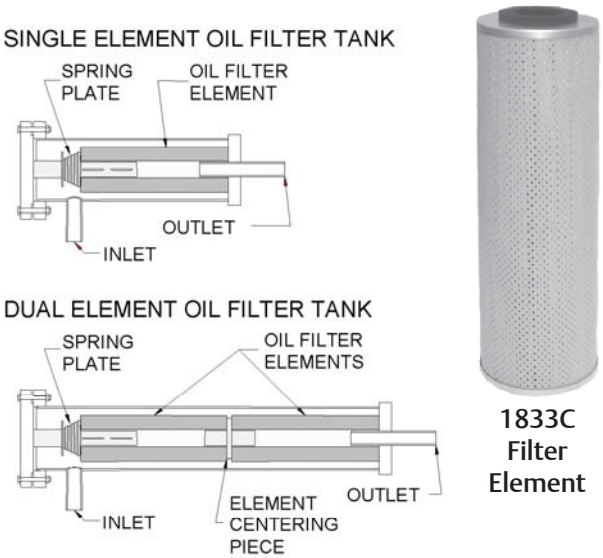


FIGURE 1.
1833C FILTER ELEMENT TANKS

To replace the filter element(s), on single element tanks, insert the element and make sure it fits onto the outlet connection. Install spring plate, and bolt the cover assembly in place. On units equipped with dual element tanks, insert inner element and make sure it fits onto the outlet connection. Put the centering piece on the outer element and slide into tank making sure the center piece fits into the inner element. Put spring plate on outer element and bolt the cover assembly in place.

2. Filter Removal and installation, all VSR Units.

Release the pressure in the oil filter housing by opening the bleed valves at the stop valve in the block and bleed assembly, or at the bleed valve for the oil filter housing. Be sure to follow all Local, State and Federal ordinances regarding the recovery of refrigerants.

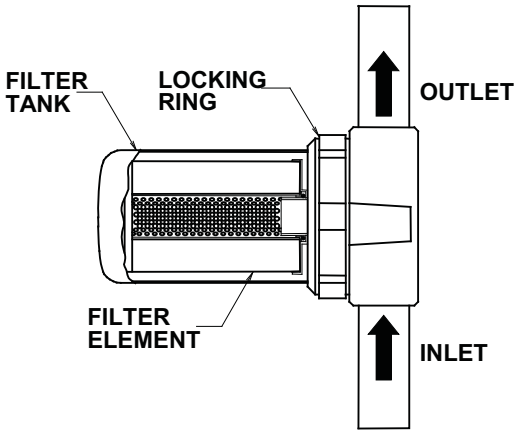


FIGURE 2.
TYPICAL CANISTER TYPE FILTER CROSS SECTION

Drain the filter bowl or housing in to an appropriate container and dispose of the oil in a appropriate manner following all Local, State and Federal ordinances regarding the disposal of used refrigeration oil.

Loosen and remove the locking ring on filter tank by turning in a counter clockwise direction. Remove filter tank with the used element.

Remove the filter element from the tank. Before reassembling, thoroughly clean the tank to lengthen the life span of the filter element.

Wet the threads and O-ring on the head and the O-ring in the new element with clean refrigeration oil.

CAUTION

Do not use a pipe wrench, hammer or any other tool to tighten the locking ring.

nsert new element into the filter tank with the open end visible. Attach tank to head and **HAND TIGHTEN** the locking ring.

The filter housing can be evacuated and then slowly pressurized to check for leaks before returning to service.

3. Filter Removal, VSS and VSM Units (after 5/1/00) when using Vilter Part Numbers 3111A (16" Simplex), or 3112A (39" Simplex) oil filter housings.

Release the pressure in the oil filter housing by opening the bleed valves at the stop valve in the block and bleed assembly, or at the bleed valve for the oil filter housing. Be sure to follow all Local, State and Federal ordinances regarding the recovery of refrigerants.

Drain the filter bowl or housing in to an appropriate container and dispose of the oil in a appropriate manner following all Local, State and Federal ordinances regarding the disposal of used refrigeration oil.

Loosen and remove the cover on the bowl of the filter tank by turning it in a counter clockwise direction. Remove the used element.

Wet the O-ring in the new element with clean refrigeration oil. Insert the new element into the filter tank with the closed end visible and attach the cover to the bowl. **HAND TIGHTEN** the cover.

The filter housing can be evacuated and then slowly pressurized to check for leaks before returning to service.

4. Filter Removal, VSS and VSM Units (after 5/1/00) when using Vilter Part Numbers 3109A (16" Duplex), or 3110A (39" Du plex) oil filter housings.

Isolate the bowl to be worked on by turning handle. The handle will cover the drain valve of active element. Close commuter valve in center of handle. Release the pressure in the isolated bowl by bleeding through the stop valve on the oil filter cover for Duplex (Vilter Part #3109A or 3110A), or through the stop valve for the oil filter housing. Be sure to follow all Local, State and Federal ordinances regarding the recovery of refrigerants.

Drain the filter bowl or housing in to an appropriate container and dispose of the oil in a appropriate manner following all Local, State and Federal ordinances regarding the disposal of used refrigeration oil.

Loosen and remove the cover on the bowl of the filter tank by turning it in a counter clockwise direction. Remove the used element.

Wet the O-ring in the new element with clean refrigeration oil. Insert the new element into the filter tank with the close end visible and attach the cover to the bowl. **HAND TIGHTEN** the cover.

The filter housing can be evacuated and then slowly pressurized by opening the commuter valve on handle. This will pressurize the housing. Check for leaks. The filter can now be returned to service. Repeat for other filter bowl if needed.

CAUTION

When changing filter, discard clogged filter only. Save and reuse spring plate and centering piece. This filter* MUST *be installed with the spring plate. A compressor that is allowed to operate without the spring plate is running with unfiltered oil.

The filter housing can be evacuated and then slowly pressurized to check for leaks before returning to service.

D. Oil Pressure Regulating

On units with a full time oil pump, the back pressure regulator, in the oil supply line from the separator, controls upstream pressure to the compressor bearings and should be adjusted to hold the oil pressure at 50 psig above suction pressure. Excess oil not required for bearing lubrication is passed through the regulator and flows into the separator.

E. Oil Cooling

1. Water Cooled Oil Cooler

In lieu of the three way oil temperature valve to control the temperature of the oil used for lubrication and cooling of the compressor, it is required to install a water regulating valve and solenoid valve combination to control the water supply to the oil cooler. The water inlet connection should be made on the bottom and the outlet connection on the top. The water supply is controlled by the water regulating valve to maintain the oil temperature at approximately 120°F.

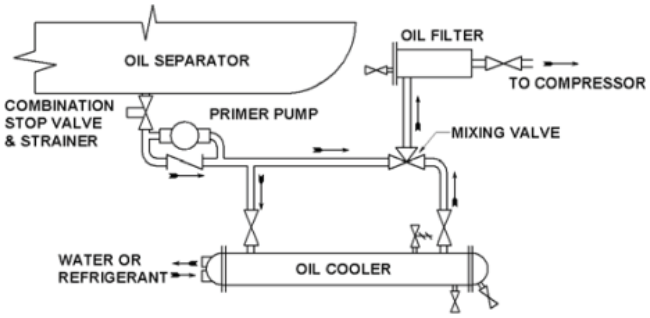


FIGURE 3.
TYPICAL WATER COOLED OIL COOLER
DIAGRAM

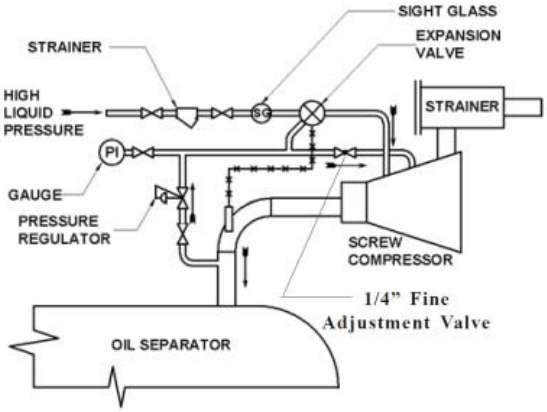


FIGURE 4.
TYPICAL LIQUID INJECTION OIL COOLING
SCHEMATIC DIAGRAM

The solenoid valve provides positive water shut-off when the compressor is not in operation. A temperature of 150°F is considered high in most circumstances and the compressor is protected by a safety control to prevent operation of the compressor above this temperature. Unless otherwise specified, the oil cooler is sized for an 85°F water inlet temperature and 10°F temperature rise.

2. Liquid Injection Oil Cooling.

The components are furnished with liquid injection for a typical system. The liquid solenoid valve opens whenever the compressor is in operation. The thermostatic expansion valve controls the flow of liquid refrigerant to the compressor injection port in response to the discharge temperature. The discharge temperature is maintained at a minimum of 120°F with a maximum of 140°F. The discharge temperature can be adjusted either of two ways. First, the small outlet pressure regulator can be used to adjust superheat. Normally, this regulator should be adjusted to maintain 70 psig pressure at the external equalizing port of the expansion valve. Raising the pressure beyond 70 psig tends to raise the discharge temperature, while lowering the pressure lowers the discharge temperature. Secondly, the standard superheat adjusting screw on the thermostatic expansion valve can be used to adjust the discharge temperature.

Liquid injection cooling on booster compressors is handled in the following manner. Using high pressure liquid, the point of injection can be the discharge line and no horsepower penalty is paid by injecting liquid into the compressor discharge line. The high pressure gas source normally used for the pressure regulator would be compressor discharge pressure. Since, on a booster unit, this intermediate pressure is very rarely as high as the nominal setting of 70 psig, high stage discharge gas is used. On high stage compressors, the liquid is injected directly into the compressor. However, there is a horsepower penalty when the liquid is injected into the compressor. This will vary with refrigerant and operating condition. The liquid is injected into the compressor at a point in the compressor cycle that minimizes the brake horsepower penalty.

3. V-PLUS Oil Cooling System

This system consists of a liquid pump, shut-off valves, motor, solid state variable speed controller and solid state temperature controller. This method of oil cooling is not available on the VSM or VSR compressor units. The pump and solenoid valve cycle on and off in parallel with the compressor drive motor. The temperature controller receives a temperature signal from the sensor located in the discharge and oil lines and in turn, sends a signal to the motor speed controller.

As the oil and desupserheating load varies, the temperature controller adjusts the speed of the pump/motor combination to maintain a constant oil temperature.

NOTE:
See separate V-PLUS® instruction manual for detailed start-up and operation.

4. Thermosyphon Oil Cooling

Using a brazed plate or an one pass shell and tube type vessel, similar to the water cooled oil cooler, oil is circulated on the shell side and liquid refrigerant from the receiver is circulated through the tubes. Thermosyphon systems use a 3-way temperature sensing control valve to regulate oil at 120°F. Oil is bypassed around the thermosyphon oil cooler. When oil is higher than 120°F, the oil is passed through the thermosyphon oil cooler. A 1/4" tubing line w/valve adds high pressure gas to the oil to quiet the sound of injection. Open this valve in small amounts, until noise subsides. The closed type cooling circuit is free from the fouling problems associated with open circuit water cooling. Since the oil cooling load is rejected in the condenser, this type of cooling is practical. The temperature limits here are the same as those regarding the water cooled oil coolers.

5. Oil Pump

This system is designed to provide adequate compressor lubrication when there is low differential oil pressure across the compressor suction and discharge for some high stage applications and booster applications as required.

On start-up, the control system will calculate the pressure differential between the compressor oil manifold & suction pressure. If this differential pressure ratio is less than 2.8:1, then the oil pump will turn on and will continue to run until the pressure ratio is 3.0:1.

CONTROL SYSTEM

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 with a remote pressure source, 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.

A. Screw Compressor Control And Operation

1. Starting, Stopping and Restarting the Compressor.

Before the screw compressor unit is started, certain conditions must be met. All of the safety setpoints must be in a normal condition, and the suction pressure must be above the low suction pressure setpoint to assure that a load is present. When the "On-Off" switch or

"Manual-Auto" button is pressed, the oil pump will start. When sufficient oil pressure is built up and the compressor capacity control and volume ratio slide valves are at or below 10%, the compressor unit will start.

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

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 "On-Off" or stop button will turn the compressor unit off as will the low pressure setpoint. If any of these conditions turns the compressor unit off, the slide valve motors will immediately energize to drive the slide valves back to 5% limit. The control motors will be de-energized when the respective slide valve moves back below 5%. If there is a power failure, the compressor unit will stop. If the manual start on power failure option is selected (see appropriate Microprocessor Instruction Manual), restarting from this condition is accomplished by pushing the reset button to insure positive operator control. If the auto start on power failure option is selected (see appropriate Microprocessor Instruction 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.

2. Slide Valve Control Actuators

Capacity and volume ratio control of the screw compressor is achieved by movement of the respective slide valves, actuated by electric motors.

Note:
Optical Actuators CAN NOT be manually rotated.

(The VSM 501-701 models will have motor locations opposite of figure #6)

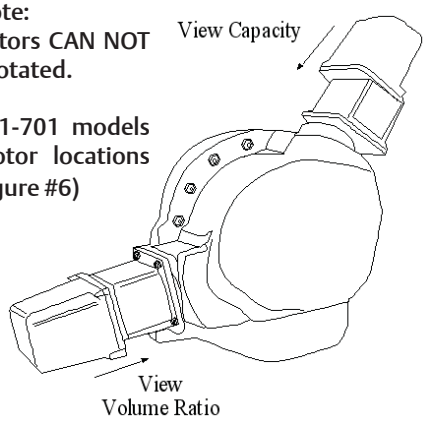


FIGURE 5.
SLIDE VALVE MOTOR LOCATION

When viewing the compressor from the discharge end (opposite the drive end), the upper motor is for capacity control. The command shaft turns (see Table 1) to decrease the capacity to 10% and reverses to increase the capacity to 100%. The lower motor is for volume ratio control. The command shaft turns to reduce the volume ratio to 2.0, and reverses to increase the volume ratio to 5.0.

Actuation of the electric motors can be done manually or automatically. To actuate the motors manually, place the desired mode selector in the manual position and push the manual Increase or Decrease buttons. In the automatic mode, the microprocessor determines the direction to actuate the electric motors. However, in the automatic mode, there is an "On" and "Off" time for the capacity control motor. The "On" time is the time in which the slide valve moves, and the "Off" time is the time in which the system is allowed to stabilize before another change in slide valve position.

The Motor Amps Load Limit protects the compressor from overloading by decreasing the compressor capacity if the motor amperage is at the Maximum Amps setpoint, or preventing an increase in capacity if the motor amperage is above the Full Load Amps setpoint. (See manual for the appropriate microprocessor.)

3. Oil Separator Heater

The oil separator heater keeps the oil in the separator from becoming too viscous and helps keep gas from condensing in the receiver section of the separator.

The heater is turned on only when the compressor is off. The separator heater is supplied with an integral temperature control.

B. 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.

TABLE 1. VSS / VSR / VSM COMMAND SHAFT ROTATION AND TRAVEL

	COMMAND SHAFT ROTATION				NO. OF TURNS / ROTATION ANGLE / SLIDE TRAVEL	
COMP.	CAPACITY		VOLUME		CAPACITY	VOLUME
MODEL	INC	DEC	INC	DEC	TURNS/ANGLE/TRAVEL	TURNS/ANGLE/TRAVEL
VSS 291	CW	CCW	CW	CCW	0.91 / 328 / 3.568”	0.52 / 187 / 2.045”
VSS 341	CW	CCW	CW	CCW	0.91 / 328 / 3.568”	0.52 / 187 / 2.045”
VSS 451	CW	CCW	CW	CCW	0.91 / 328 / 3.568”	0.52 / 187 / 2.045”
VSS 601	CW	CCW	CW	CCW	0.91 / 328 / 3.568”	0.52 / 187 / 2.045”
VSS 751	CCW	CW	CCW	CW	1.09 / 392 / 4.283”	0.63 / 227 / 2.473”
VSS 901	CCW	CW	CCW	CW	1.09 / 392 / 4.283”	0.63 / 227 / 2.473”
VSS 791	CCW	CW	CCW	CW	1.22 / 439 / 4.777”	0.74 / 266 / 2.889”
VSS 891	CCW	CW	CCW	CW	1.22 / 439 / 4.777”	0.74 / 266 / 2.889”
VSS 1051	CCW	CW	CCW	CW	1.22 / 439 / 4.777”	0.74 / 266 / 2.889”
VSS 1201	CCW	CW	CCW	CW	1.22 / 439 / 4.777”	0.74 / 266 / 2.889”
VSS 1301	CCW	CW	CCW	CW	1.22 / 439 / 4.777”	0.74 / 266 / 2.889”
VSS 1501	CCW	CW	CCW	CW	1.36 / 490 / 5.325”	0.82 / 295 / 3.200”
VSS 1801	CCW	CW	CCW	CW	1.36 / 490 / 5.325”	0.82 / 295 / 3.200”
VSM 71	CW	CCW	CW	CCW	0.80 / 288 / 3.141”	0.45 / 162 / 1.767”
VSM 91	CW	CCW	CW	CCW	0.80 / 288 / 3.141”	0.45 / 162 / 1.767”
VSM 101	CW	CCW	CW	CCW	0.80 / 288 / 3.141”	0.45 / 162 / 1.767”
VSM 151	CW	CCW	CW	CCW	0.80 / 288 / 3.141”	0.45 / 162 / 1.767”
VSM 181	CW	CCW	CW	CCW	0.80 / 288 / 3.141”	0.45 / 162 / 1.767”
VSM 201	CW	CCW	CW	CCW	0.80 / 288 / 3.141”	0.45 / 162 / 1.767”
VSM 301	CW	CCW	CW	CCW	0.80 / 288 / 3.141”	0.45 / 162 / 1.767”
VSM 361	CW	CCW	CW	CCW	0.80 / 288 / 3.141”	0.45 / 162 / 1.767”
VSM 401	CW	CCW	CW	CCW	0.80 / 288 / 3.141”	0.45 / 162 / 1.767”
VSM 501	CCW	CW	CCW	CW	0.91 / 328 / 3.568”	0.52 / 187 / 2.045”
VSM 601	CCW	CW	CCW	CW	0.91 / 328 / 3.568”	0.52 / 187 / 2.045”
VSM 701	CCW	CW	CCW	CW	0.91 / 328 / 3.568”	0.52 / 187 / 2.045”

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.

INITIAL START-UP

A. Setting of Controls

(Refer to the appropriate microprocessor manual for a list of initial settings.)

B. Valve Settings

1. The suction line uses separate stop and check valves. Ensure the suction stop valve is open prior to starting.

2. The ¼" suction equalization valve should be closed during operation. The valve enables the unit to slowly equalize to low side pressure during off periods. This valve must be adjusted to minimize oil loss when compressor stops.

3. The discharge line uses separate stop and check valves. Ensure the discharge valve is open prior to starting.

4. Manually open the oil isolating valve at the oil separator outlet connection.

5. Open the isolating valve(s) before and after the oil filter housings.

6. Manually open the stop valve on the oil bleed return line from the element section and open the expansion valve 1/2 of a turn.

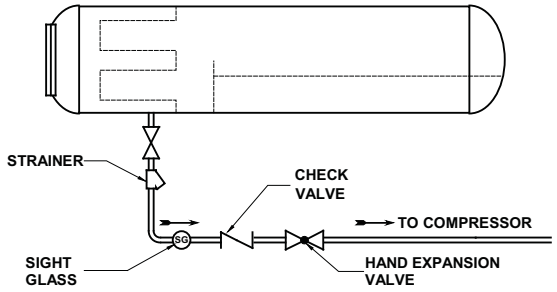


FIGURE 6.
OIL SEPARATOR BLEED LINE

NOTE:
The purpose of the oil bleed return assembly is to collect any oil that passes through the oil separating element and returns that oil to the compressor. The hand expansion valve should be adjusted to prevent an oil level from forming in the sight glass when the compressor is at 100% capacity. Generally 1/2 to 1 turn open is satisfactory.

7. Open 1/4" high pressure gas line valve piped to oil injection line just enough to quiet compressor at 100% capacity.

C. Compressor Pre Start-Up Check List

Before proceeding with actual starting of the compressor, the items listed on the "Pre Start-Up Check List" must be verified. Time and money will be saved before the Vilter start-up technician arrives. (See next page.)

Pre Start-Up Checklists

The following checklists are to help prepare the equipment before the Vilter Technician arrives at the jobsite. Vilter recommends that a Trained Technician go through the following tasks. The operating Manuals provided by Vilter, can be referenced for any type of questions or special instructions.

Every Refrigeration unit includes a Vilter Start-Up (Confirm on PO). The following tasks are not included in the Vilter Start-up provided in your equipment purchase. Any tasks below that are done by the Vilter Technician will take away from the pre-determined time that was provided with the equipment purchase. Vilter suggests that the Vilter Technician's time be used during the start-up of the System and not for the below System Preparation.

Note: Each item below MUST be "Checked-Off", Signed and Returned to the Vilter Service Department. Failure to do so will "Null & Void" future Warranty considerations.

Field Piping and Mechanical Requirements

NOTE: If start-up service has been purchased, the following items should be completed before the start-up technician arrives. This will help save time and money.

☐ 1. The unit should be leveled and secured to the mounting pad or floor.

☐ 2. The suction and Discharge line must be piped and properly supported, independent of the unit

☐ 3. The Discharge Stop/Check Valve is shipped loose and must be installed in a vertical up flow direction or in a horizontal line with the valve stem pointing upward at a 45° angle. During off periods, refrigerant can condense in the line downstream of the Discharge Stop/Check Valve. It is recommended the Stop/Check Valve be located to minimize the quantity of liquid that can accumulate downstream of the valve.

☐ 4. A Dual Safety Relief Valve is shipped loose for field installation. A connection is provided on the oil separator for the relief valve. Refer to ASHRAE/ANSI Standard 15 (Safety Code for Refrigeration) for proper sizing and installation of Relief Valves and Vent Lines.

☐ 5. Piping For Oil Cooling

☐ a) Liquid Injection
An adequate, or dedicated, liquid line is required for the Liquid Injection System. A high pressure liquid source must be piped to the stop valve at the inlet of the Thermostatic Expansion Valve. On booster units, an additional $^{3}/_{8}$" line must be piped to the regulator from high stage discharge gas flow or the Thermostatic Expansion Valve.

☐ b) V-PLUS
A high pressure liquid source must be run to the V-PLUS® inlet. Some subcooling is desirable. A high pressure float must be installed at the inlet of the pump and a $^{3}/_{8}$" vent line must be returned to a suction trap. Refer to the V-PLUS manual for additional information.

☐ c) External Oil Cooler
On thermosyphon oil coolers, the refrigerant lines must be connected to the front head of the oil cooler. On water cooled oil coolers, the water lines must be connected to the front head of the oil cooler. Installation of water regulating and solenoid valves are recommended.

☐ 6. The oil separator should be provided with oil until the oil level is between the (2) sight glasses. An oil charging connection is provided on the bottom of the oil separator.

☐ 7. The center member of the compressor coupling is shipped loose to help facilitate final field alignment and allow for motor rotation check. The motor alignment should be within 0.004" total indicator reading in all directions.

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

☐ b) The motor should be checked and shimmed for soft foot prior to attempting final alignment.

☐ c) The center section of the coupling should be left out to allow the start-up technician to verify the final alignment and motor rotations.

☐ 8. The unit should be pressure tested, evacuated and a system load should be available at the time of start-up.

Order #_____Compressor Serial #_____

Field Wiring Requirements

VRS SCREW COMPRESSOR, VSS/VSM SINGLE SCREW COMPRESSOR UNITS
PRESTART-UP CHECKLIST

FIELD WIRING REQUIREMENTS FOR UNITS WITH FACTORY WIRED **VISSION®** MICROPROCESSORS

NOTE: If startup service has been purchased, to save time and money, the following items should be completed *before* the startup technician arrives.

The unit is pre-wired at the factory. The necessary field wiring connections are described below.

☐ 1. Control power of 115 VAC 50/60 HZ must be wired to the left side terminals of the digital I/O board inside the ViSSion® cabinet. Line power (L1) is brought in to a 10-amp fuse via the terminal marked "L1" on the appropriate connector. The neutral (L1A) is brought in and connected to any of the "N" terminals located on left connectors. Two separate line power feeds for the oil heaters are brought to two additional 10 amp fuses via the terminals marked "L2" and "L3" on the same connector just below the "L1" terminal. The neutrals for these circuits (L2A and L3A) are also connected to any of the "N" terminals. For units with V-PLUS® oil cooling, L1 must also be brought to the fuse in the V-PLUS® panel, and L1A must also be brought to the terminal #2B in the V-PLUS® panel.

☐ 2. An auxiliary contact from the compressor motor starter is required. This isolated contact is connected to the K-1 input relay using any of the "L" terminals on the strip of connectors, and returned to the terminal marked "Motor Starter Aux. Safety" at the very top connector.

☐ 3. A dry contact from control relay K-22 must be wired to the compressor motor starter coil. This dry contact is wired to terminals marked "Compressor Start – N.O. #1A" and "Compressor Start – N.O. #1B". Control power for this coil should come from a source, which will be de-energized with the compressor disconnect.

☐ 4. A dry contact from control relay K-19 must be wired to the oil pump motor starter coil. This dry contact is wired to the two terminals marked "Oil Pump Starter". Control power for this coil should come from a source, which will be de-energized with the compressor disconnect.

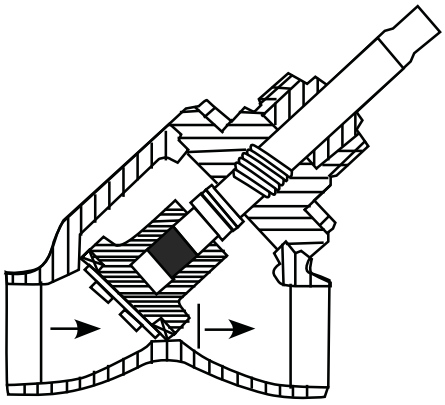
☐ 5. An auxiliary safety cutout is available to shut down the compressor package using the K-2 input relay. A dry contact must be supplied and wired to one of the "L" terminals on any of the connectors, and returned to the terminal marked "Auxiliary #1 Safety" at the top connector. The jumper to the "Auxiliary #1 Safety" terminal must be removed to use this cutout. The contact, if closed, will allow the compressor to run. If this contact opens at any time, the compressor will shut down.

☐ 6. Indication of the compressor alarm or shutdown status is also available via two control relays. Relay K-20 is provided for remote trip indication and relay K-21 is provided for remote alarm indication. Each relay has three terminals available: a common input, a normally open contact, and a normally closed contact. For both relays, the energized state represents a "trip" or "alarm" condition. Loss of voltage to the relay coil and the resultant return to normal state indicates "safe" condition.

☐ 7. The current transformer supplied in the compressor motor conduit box should be checked to insure that the motor leads of one leg are pulled through the transformer. Note that there is a dot on one side of the current transformer. This dot must face away from the motor. Typically, a wye delta started motor should have leads 1 and 6 pulled through this transformer for a 6 lead motor. However, this should always be checked as different motors and starting methods will require different leads to be used.

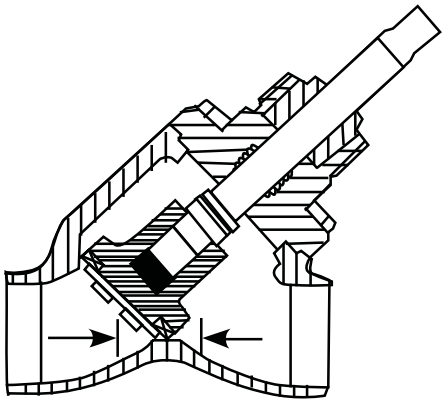
Order #_____Compressor Serial #_____

Stop Check Valve Operation



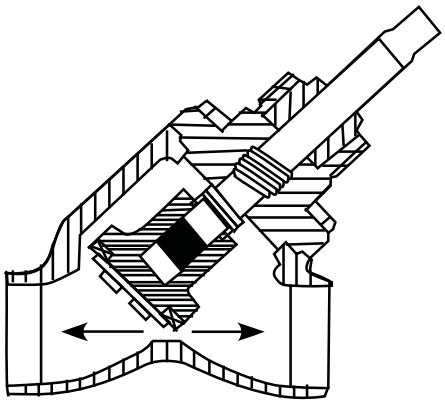
AUTO
In the “Auto Position”, the stop valve is operating as a check valve, allowing flow in the directions of the arrows.

To set the valve to the automatic position, fully close the valve, and turn the stem out as indicated by the chart below.



CLOSED

In the manually “Closed Postion”, the stop check is operating as a conventional stop valve, not allowing flow in either direction.



OPEN

In the manually ” Open Position”, with the valve stem fully back seated, the valve disc is lifted slightly, allowing flow in either direction.

Valve Size	1.5”	2”	2.5”	3”	4”	5”	6”	8”
Number of Turns Open (from closed position)	2	2.25	2.75	3.25	4.5	3.75	5.75	7.75

GENERAL COMMENTS

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

A) 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.

B) 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.

C) Remove drain plugs from the bottom of compressor housing and the discharge manifold On units equipped with Suction Oil Injection (SOI) manually open the SOI solenoid valve below the compressor. Drain the oil into appropriate containers.

REMOVAL OF COMPRESSOR FROM THE UNIT

After preparing the unit for service, the following steps should be followed when removing the compressor from the unit:

A) Disconnect the motor drive coupling from the compressor input shaft.

B) Disconnect all gas and oil piping which is attached to the compressor. When removing the suction strainer on gas compression units, the suction line should be supported to prevent it from sagging.

C) Replace oil drain in compressor housing and discharge manifold after oil has stopped draining.

D) Remove all electrical connections to the compressor.

E) On compressors with mounting feet, loosen and remove bolts holding the compressor to the base.

Keep compressor alignment shims together and mark the locations with a permanent marker.

F) On compressors with C-flange the motor/C-flange/compressor assembly must be supported with a chain fall or other lifting device before the bolts holding the compressor to the C-flange adapter can be removed.

G) Install appropriate lifting eye into the threaded hole on the top of the compressor.

Verify unit is properly secured to avoid compressor from falling. Re-verify all piping and electrical are properly disconnected prior to lifting unit.

H) Lift compressor from the base, verify the amount of room needed for clearance and weight of the bare compressor when the compressor is removed from the unit.

INSTALLATION OF THE COMPRESSOR

A) After the work has been completed, reinstall the compressor on the base or C-flange adapter (dependent upon compressor model).

B) On the units, replace the shims under the compressor feet. Check for a soft foot. This is accomplished by tightening down three of the hold down bolts and checking the clearance under the fourth compressor foot. If there is clearance, add the appropriate amount of shims. Tighten down the fourth bolt and loosen either adjacent bolt and check again for clearance, adding shims accordingly. Align the compressor and motor.

   On compressors the discharge elbow should be tightened on the separator first, before the compressor manifold flange is tightened. This should be done to prevent compressor to motor misalignment.

   Replace all electrical, gas and oil connections removed when servicing the compressor.

LEAK CHECKING UNIT

Note: Unit can be leak checked before evacuation.

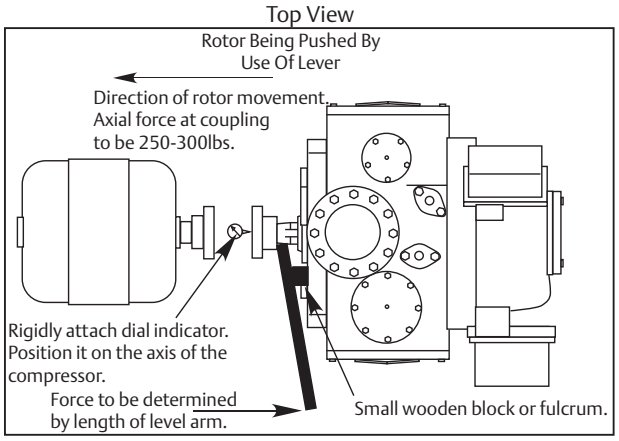
CAUTION

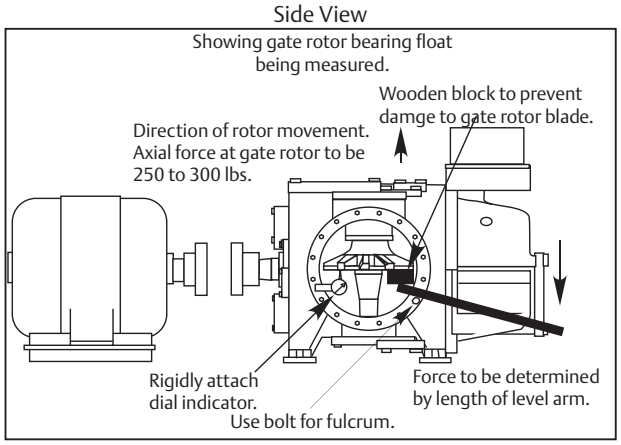
Slowly pressurize the unit from the discharge side of the compressor. Pressurizing the compressor from the suction side may cause rotation of the compressor without oil supply, which could lead to internal damage.

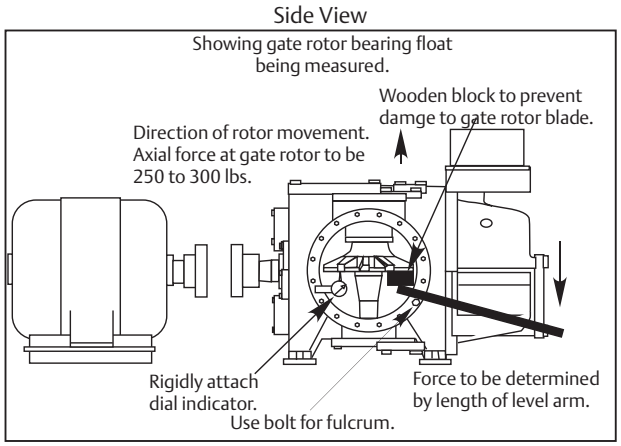
A) Use a vacuum pump to evacuate the unit.

B) Break the vacuum on the unit using dry nitrogen and check for leaks. Concentrate on areas where work was done.

C) If no leaks are found, the unit can be returned to service.







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 250 to 300 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.1 MAXIMUM BEARING FLOAT

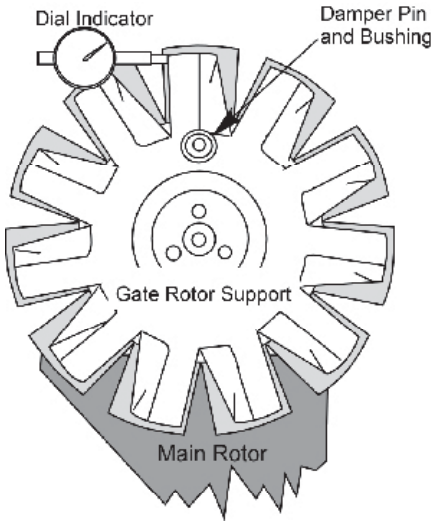
	MAIN	GATE
Bearing Float	0.003”	0.002”
Maximum Force	250 to 300 Lbs.	50 to 100 Lbs.

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".



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 0.2 to find the maximum blade to support float (on new compressor parts only).

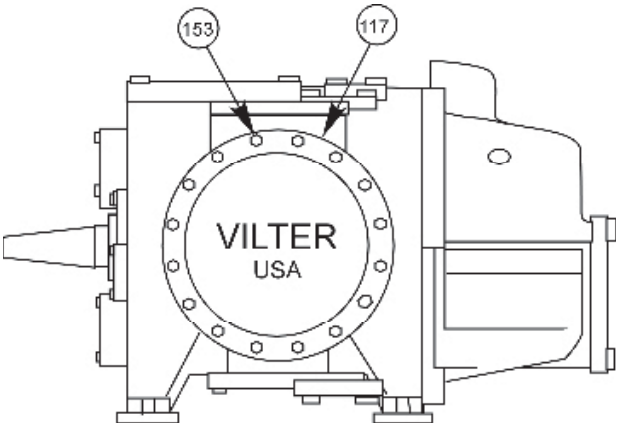
TABLE 2. GATE ROTOR FLOAT

MODEL	FLOAT
VSM 301 THRU 401	0.045"
VSM 501 THRU 701	0.045"
VSS 291 THRU VSS 601	0.045"
VSS 751 & VSS 901	0.055"
VSS 1051 THRU VSS 1301	0.060"
VSS 1551 & VSS 2101	0.060"

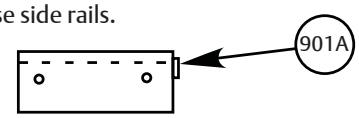
E) **NOTE: Readings could be higher than 0.020. If readings are greater than 0.030 over table tolerance contact Vilter's home office.**

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

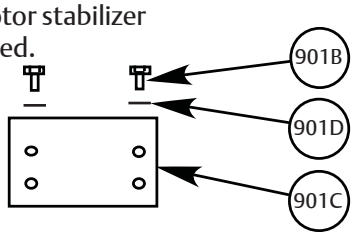
G) After the inspection is complete, the covers, coupling center member and guard can be reinstalled and the unit can then be evacuated and leak checked before starting.

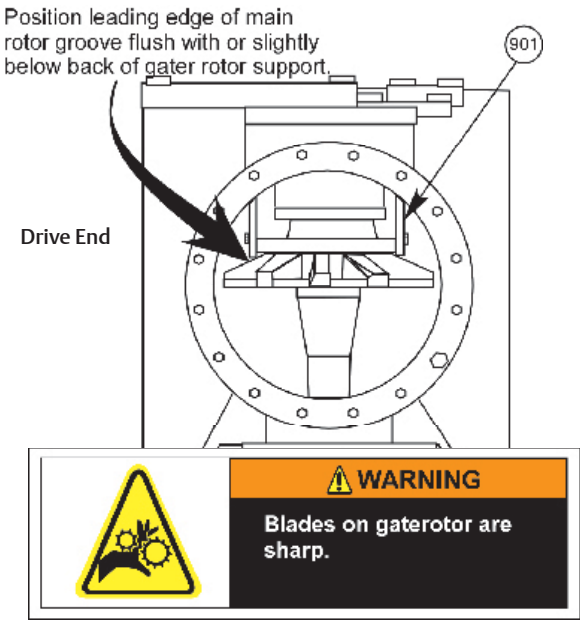


For VSM 451 thru 601 compressors, do not use side rails.



For VSS 751/901 & VSS 1051 THRU 1301 compressors, use side rails and assemble to gaterotor stabilizer as stamped.





GATE ROTOR ASSEMBLY CAUTION

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

REMOVAL

A) Prepare the compressor for servicing.

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

B) 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.

C) 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.

D) Insert the gate rotor stabilizer. The side rails are not required on VSS 451 thru 601. For the VSS 751 thru 901 and VSS 1051 thru 1301 compressors, use the side rails and assemble to the gate rotor stabilizer as stamped. For the VSS 1551 thru 3001, use the side rails and assemble to the gate rotor stabilizer.

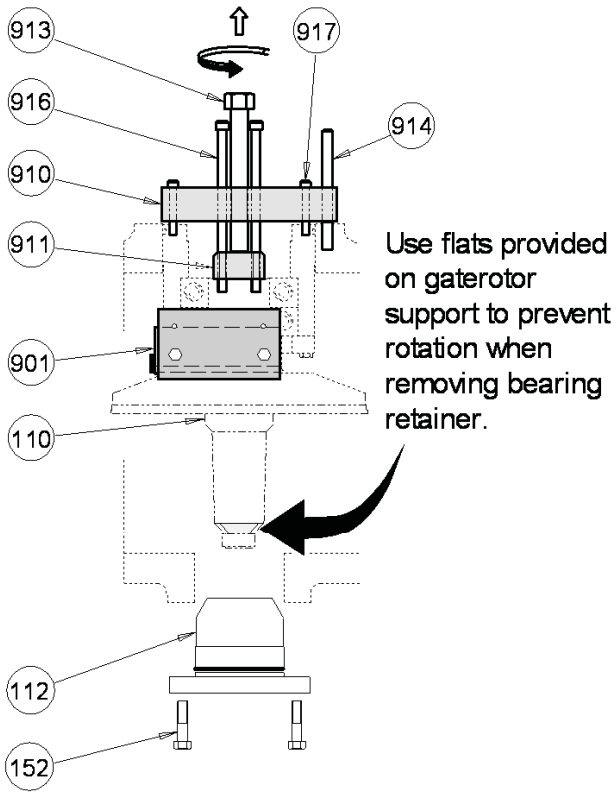
The gate rotor stabilizer is designed to hold the gate rotor support in place and prevent damage to the gate rotor blade as the thrust bearings and housing is being removed.

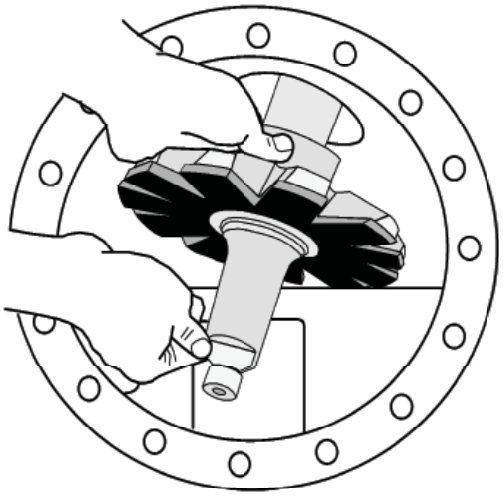
E) Remove the hex head and socket head bolts from the thrust bearing cover. Insert two of the bolts into the threaded jacking holes to assist in removing the cover. Retain the shim pack and keep it with the bearing housing cover.

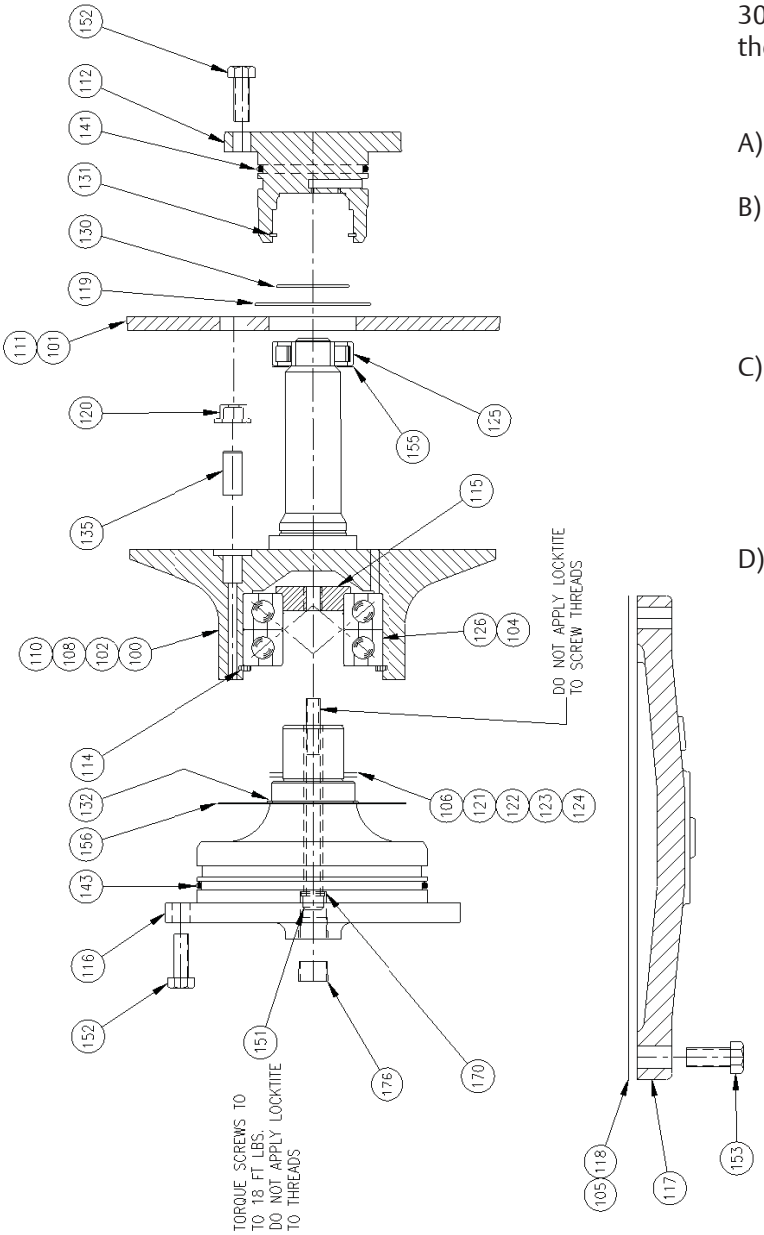
F) Hold the gate rotor support with a suitable wrench on the flats provided near the roller bearing housing. Remove the inner retainer bolts and the retainer. To remove the thrust bearing housing, install the thrust bearing removal and installation tool with the smaller puller shoe. Turn the jacking screw clockwise. The thrust bearings and housing assembly will be pulled off the shaft and out of the frame.

G) 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.

H) 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 VSM 301-701 MODELS)

The removal of the gate rotor assembly for the VSM 301-701 compressors is similar for the VSS 901-3001 compressors. The inner races are secured to the stationary bearing spindle.

A) Prepare the compressor for servicing.

B) 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.

C) 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.

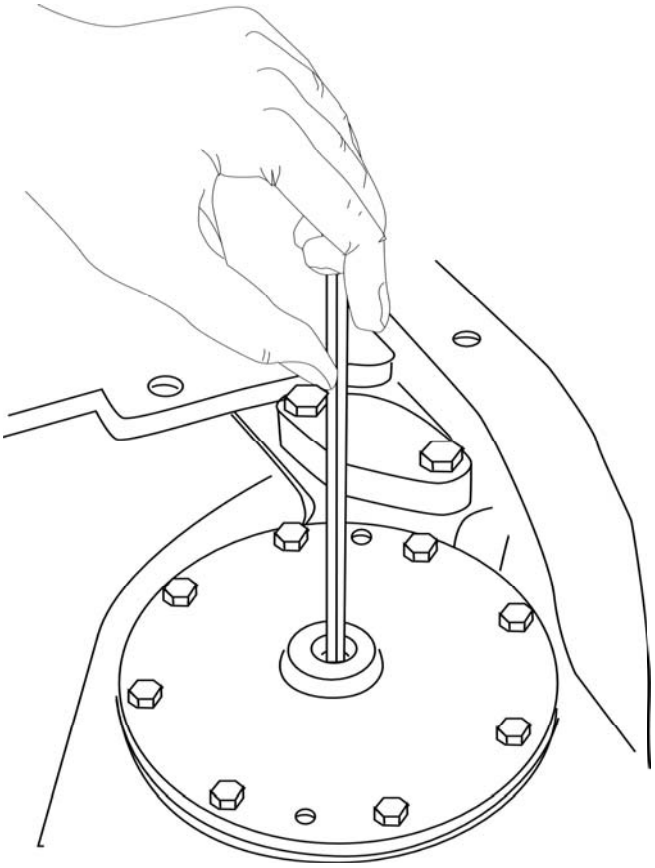
D) Turn the main rotor so the driving edge of the groove is between the top of the shelf or slightly below the back of the gate rotor support. At this point install the gate rotor stabilizing tool.

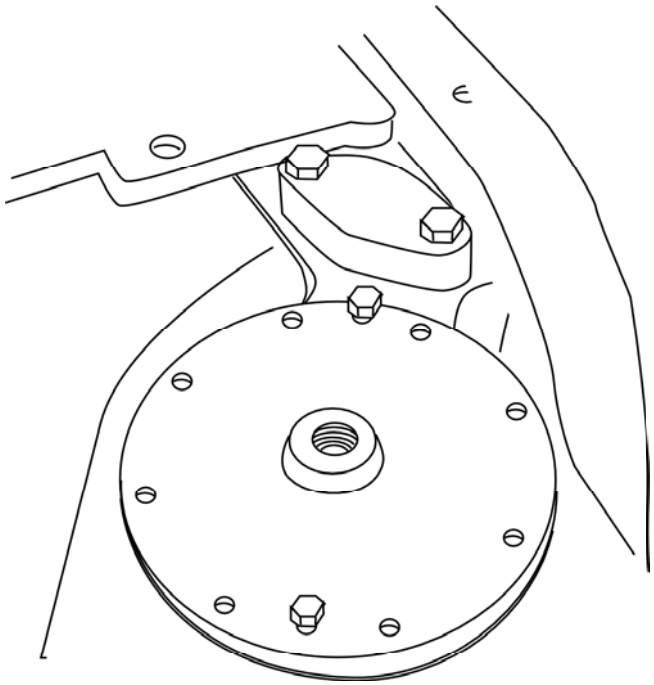
E) Remove plug on the thrust bearing housing. Loosen the socket head cap screw that is located underneath the plug. This secures the inner races of the thrust bearings to the spindle.

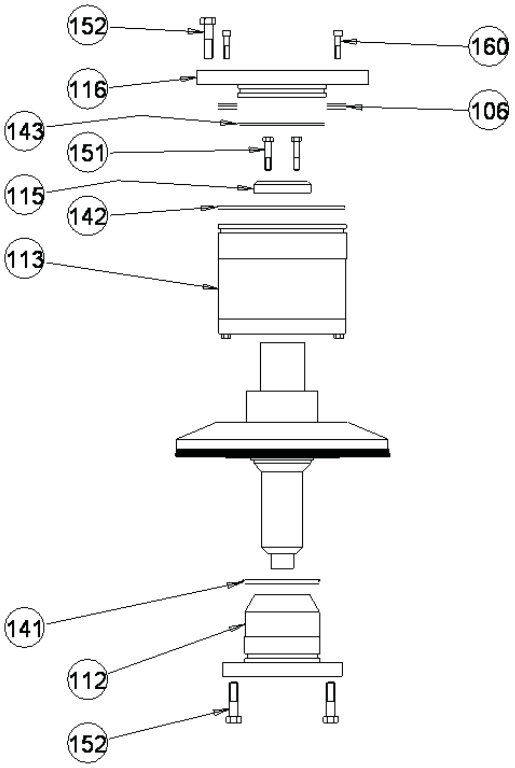
F) Remove bolts that hold the thrust bearing housing to the compressor. Insert two of the bolts into the threaded jacking holes to assist in removing the bearing housing from the compressor. When the housing is removed, there will be shims between the spindle and thrust bearings. These control the clearance between the shelf and gate rotor blades. These must be kept with their respective parts for that side of the compressor.

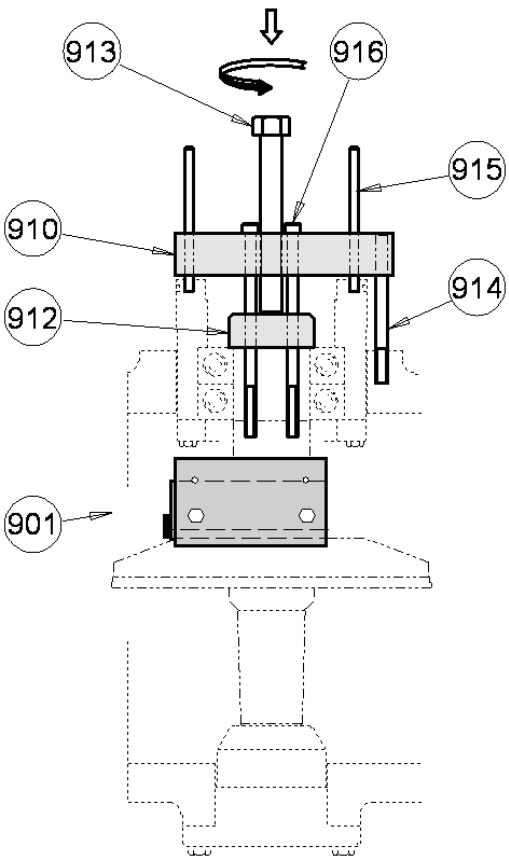
G) Remove the bolts from the roller bearing housing. After the bolts have been removed, the housing can be removed from the compressor.

H) 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.









INSTALLATION (All VSS Models)

A) 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.

B) Install the roller bearing housing (112) with a new O-ring (141). Tighten the bolts (152) to the recommended torque value.

C) 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.

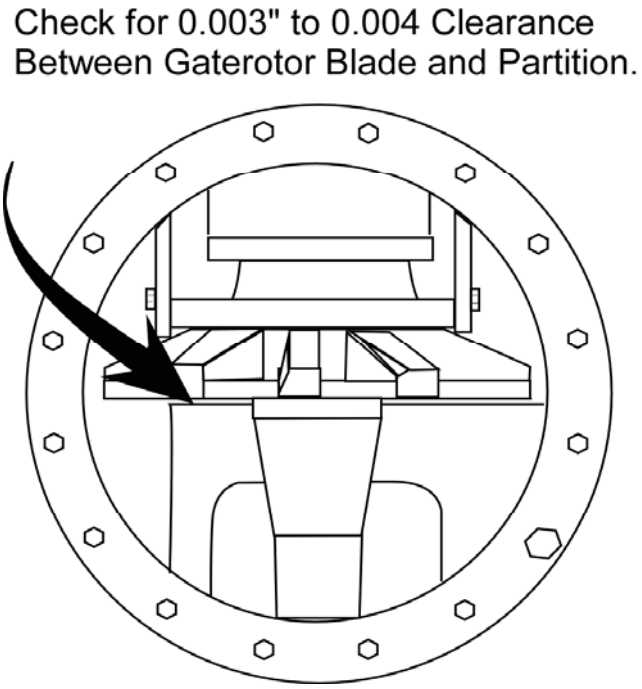
D) Set the clearance between the gate rotor blade and the shelf.

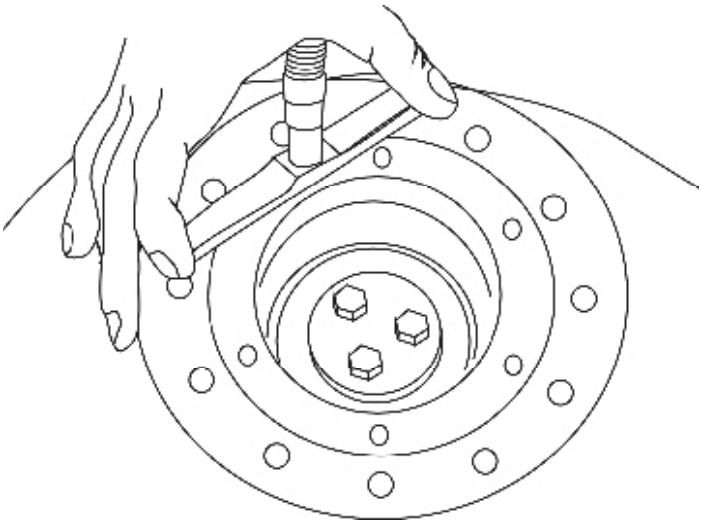
1. Place a piece of 0.003”-0.004” shim stock between the gate rotor blade and the shelf.
2. Measure the depth from the top of the compressor case to the top of the thrust bearing housing. This determines the amount of shims needed for the correct clearance.
3. Use factory installed shim pack (106) and bearing housing cover (116) without the O-ring (143). 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.

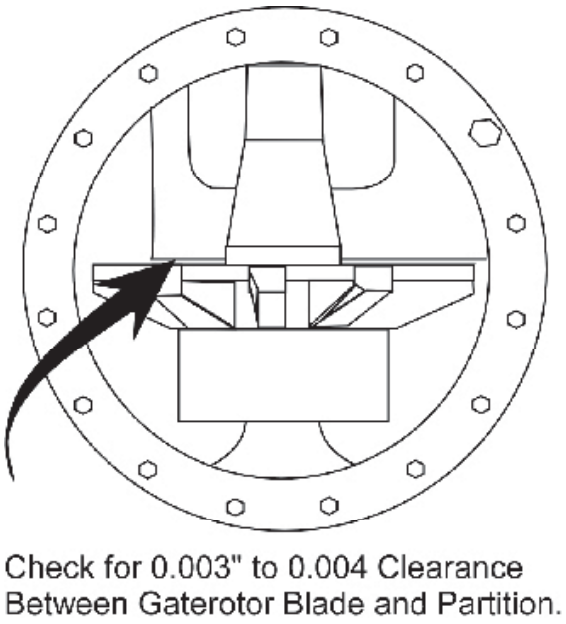
Note: Replacement blades are precisely the same dimensionally as blades installed originally at factory: Therefore, the same amount of shims will be required for replacement blades.

E) 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.

F) 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 0.03.







Gaterotor for C-flange Models

INSTALLATION (All VSM 301-701 Models)

A) 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.

B) Install the roller bearing housing with a new O-ring. Tighten the bolts to the recommended torque value.

C) Install the spindle with shims and o-ring, tighten the bolts to the recommended torque value, measure the clearance between the shelf and blade.

D) 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.

E) 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.

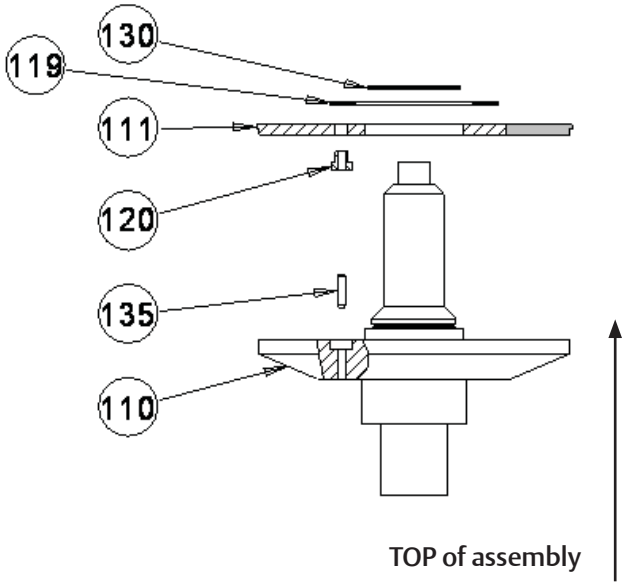
F) Install side covers with new gaskets. Tighten bolts to the recommended torque value. The unit can now be evacuated and leak checked as outlined in section 0.03.

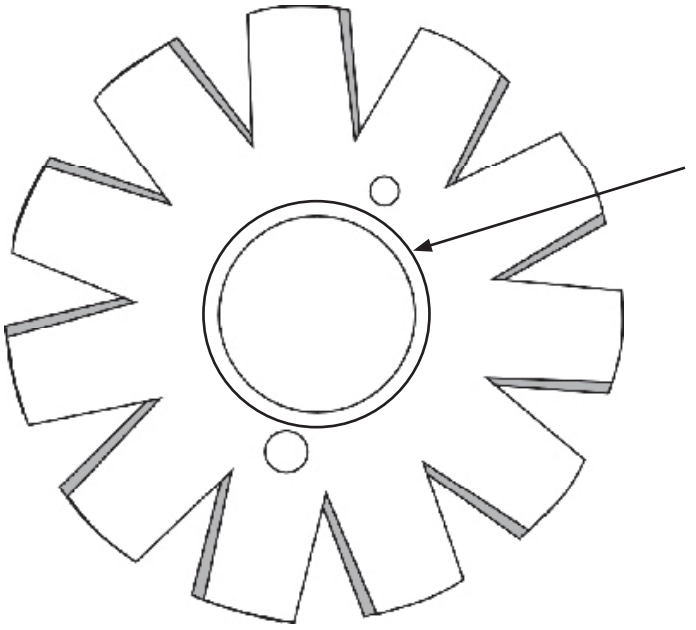
GATE ROTOR BLADE REMOVAL

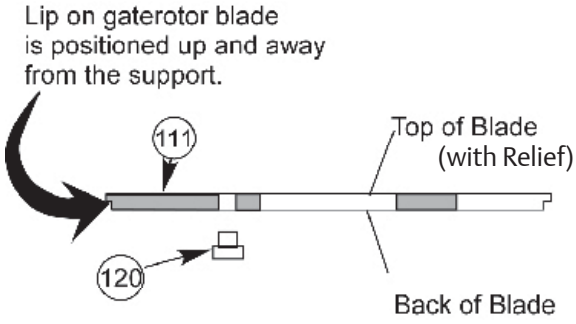
A) Remove the gate rotor assembly.

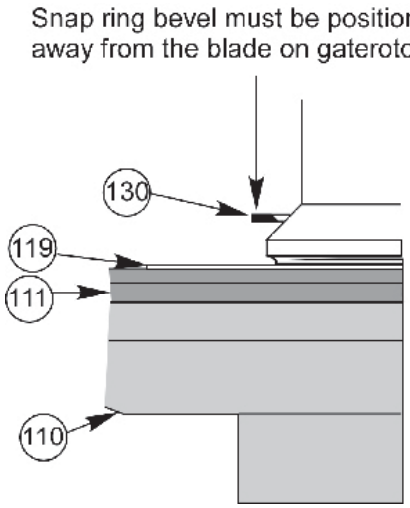
B) Remove the snap ring and washer from the gate rotor assembly. Lift gate rotor blade assembly off the gate rotor support.

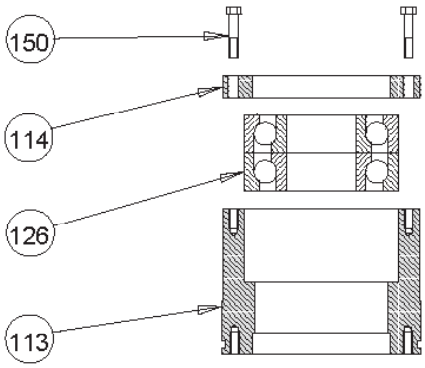
C) Check damper pin and bushing for excessive wear. Replace if necessary.











VSS Models

GATE ROTOR BLADE INSTALLATION

A) Install damper pin bushing (120) in gate rotor blade (111) from the back side of the blade. Be sure the bushing is fully seated.

B) Place the blade assembly on the gate rotor support. Locating Damper over pin.

C) 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.

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

GATE ROTOR THRUST BEARING REMOVAL

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

B) For removal of thrust bearings on VSM units:

1) Remove bolts (150) from the clamping ring (114).

2) Remove thrust bearing clamping ring.

3) Remove thrust bearings (126) from housing (113).

C) For removal of thrust bearings on VSS units:

1) Remove retaining ring from gate rotor support.

2) Remove bearings from support.

3) Remove bearing retainer from inner race.

GATE ROTOR THRUST BEARING INSTALLATION

A) For installation of thrust bearings on VSS 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 VSS Models).**

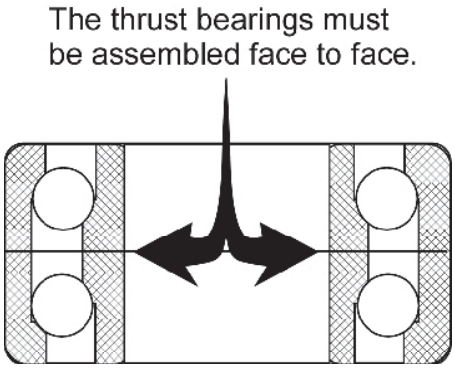
B) For installation of thrust bearings on VSM 301-701 units:

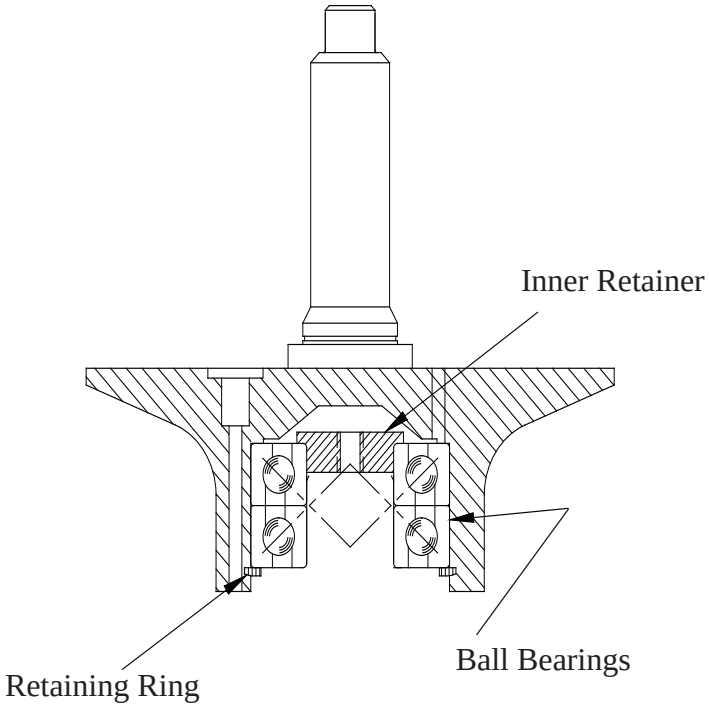
1) Install retainer in the back of the inner race of one of the thrust bearings. The back of the inner race is the narrower of the two sides.

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.

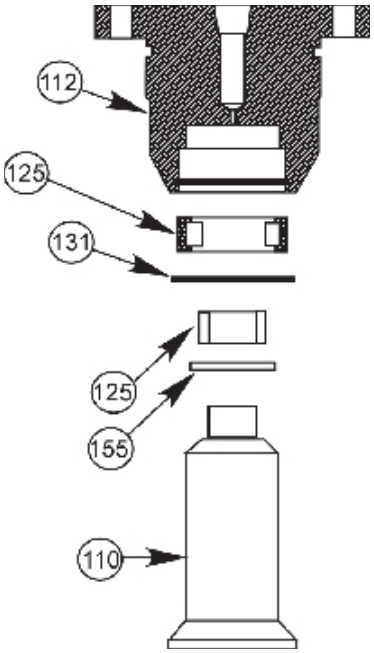
3) Install the bearing retaining snap ring.

4) For installation of the bearing housing and the setting of the gate rotor blade clearance, refer to section **INSTALLATION (All VSM Models).**





VSM Models



GATE ROTOR ROLLER BEARING REMOVAL

A) Refer to section **REMOVAL (All VSS & VSM)** for removal of the gate rotor bearing housings and gate rotor supports.

B) Remove the snap ring (131), which retains the roller bearing in the bearing housing.

C) Remove the roller bearing (125) from the bearing housing (112).

D) Use a bearing puller to remove the roller bearing race (125) from the gate rotor support (110).

GATE ROTOR ROLLER BEARING INSTALLATION

A) 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.

B) 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.

C) For installation of the bearing housing, refer to section **INSTALLATION (All VSS & VSM Models).**

COMPRESSOR SHAFT SEAL REPLACEMENT

COMPRESSOR SHAFT SEAL REMOVAL

A) Prepare the compressor for servicing as outlined in section **REMOVAL.**

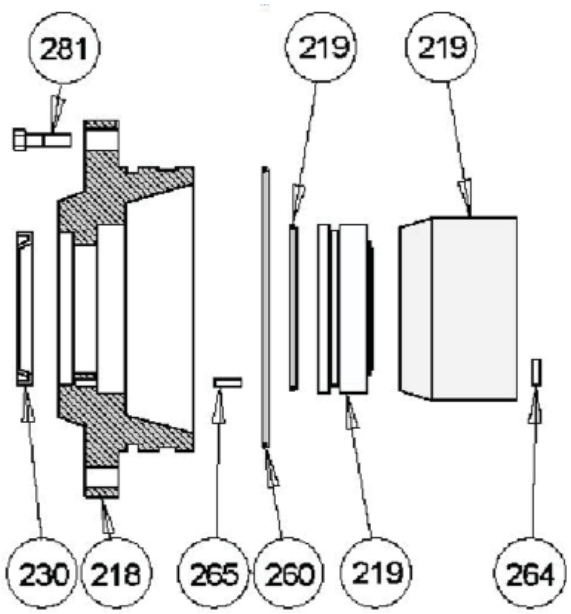
B) Remove bolts (281) holding the shaft seal cover (218). Insert two of the bolts into the threaded jacking holes to assist in removing the cover. There will be a small amount of oil drainage as the cover is removed.

C) Remove the rotating portion of the shaft seal (219C).

D) Remove oil seal (230) from cover.

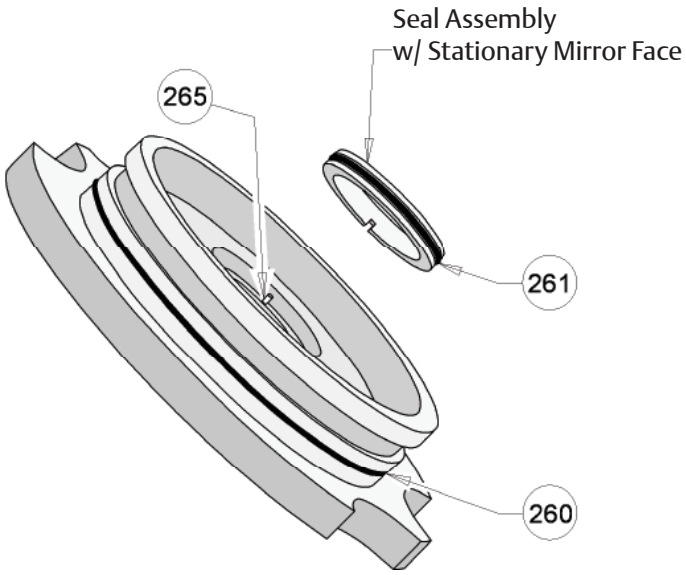
E) Remove the stationary portion of the shaft seal (219B) from the seal cover using a brass drift and hammer to tap it out from the back side of the seal cover.

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



Current Shaft Seal and for all Replacements.

(Roll Pin #265 only used on VSS 751 and larger models.)



COMPRESSOR SEAL INSTALLATION

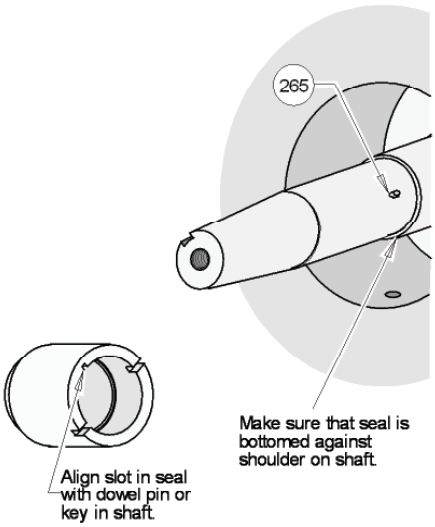
NOTE:

When replacing the stationary members of the seal on the VSS 451 thru VSS 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.

A) 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.



B) 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).

C) 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.

D) 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.

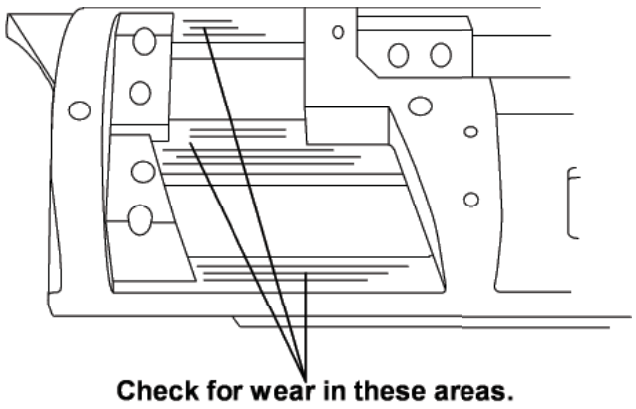
E) Install a new O-ring on the seal cover, making sure the O-ring is placed in the O-ring groove and not the oil gallery groove. Lubricate both seal faces with clean compressor lubricating oil.

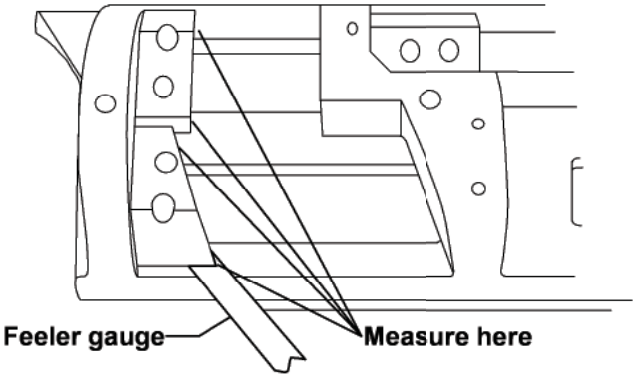
F) Carefully install the seal cover on the compressor shaft, evenly tightening the bolts to the recommended torque values.

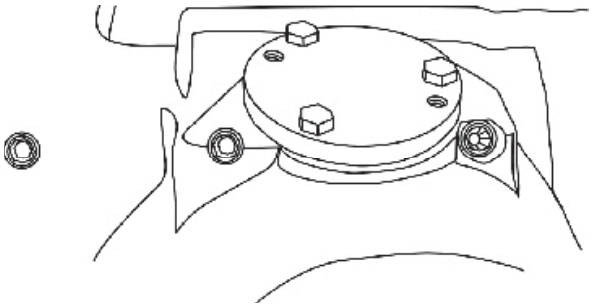
G) Install the coupling and coupling guard. The unit can then be evacuated and leak checked.

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.







INSPECTION OF SLIDE VALVE ASSEMBLIES IN THE COMPRESSOR

Prepare the compressor for servicing.

A) 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.

B) To check the clearance of the slide valve clamps, the gate rotor support must be removed. Refer to removal of the gate rotor support.

C) 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".

D) If the slide valves are worn in excess of the tolerances, the factory should be contacted.

REMOVAL SLIDE VALVE CARRIAGE ASSEMBLIES

A) Prepare the compressor for servicing.

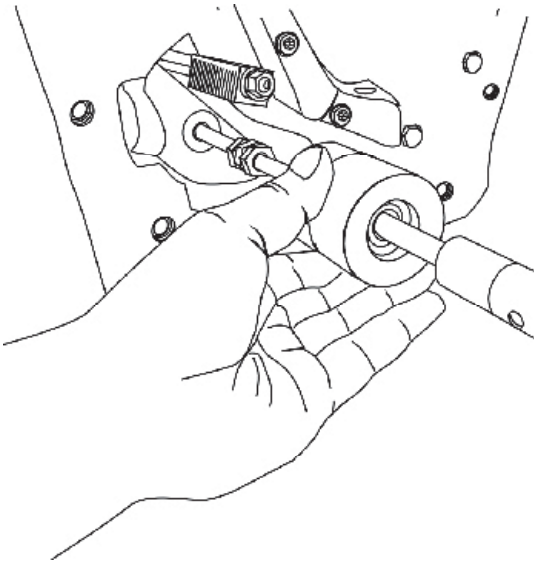
B) If only one of the slide valve carriages is removed only the corresponding gate rotor support needs to be removed. If both carriages are removed both gate rotors must be removed. Remove the gate rotor assemblies.

C) Remove the capacity and volume actuators. Remove the discharge manifold, capacity and volume cross shafts and the slide valve racks.

D) Locate and remove the socket head plugs above the slide valve carriage attachment bolts. Remove the bolts located under the plugs.

E) 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.

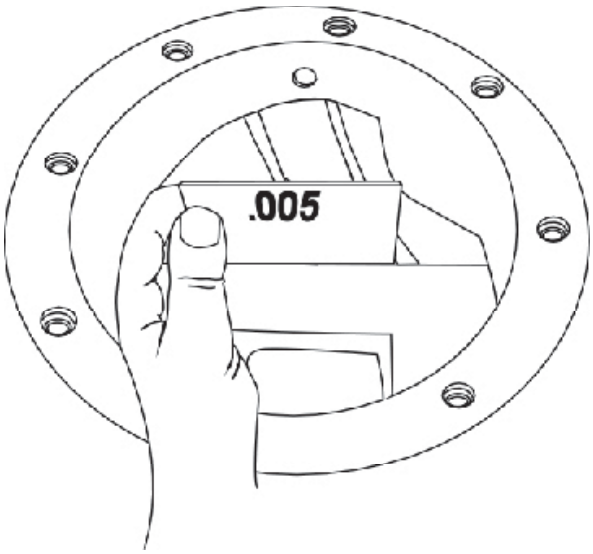


INSTALLATION OF SLIDE VALVE CARRIAGE ASSEMBLIES

A) 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.

B) Install the 3 socket head cap screws with new Nord-Lock washers beneath the heads, but do not tighten them.

C) Work a piece of 0.005"shim stock between the slide valves and the main rotor to help position the carriage.



D) 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.

E) Re- Install the capacity and volume slide valve cross shafts, slide valve racks and discharge manifold.

F) Re-install the gate rotor assemblies.

COMMAND SHAFT ASSEMBLY REMOVAL

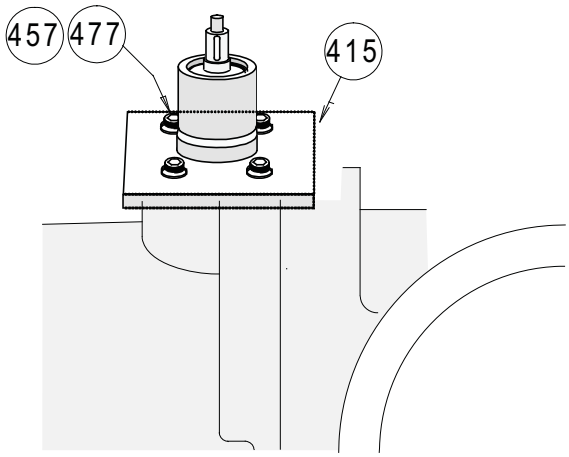
The following steps can be used to remove or install either the capacity or volume command shaft assemblies.

A) Prepare the compressor for servicing.

B) Follow the appropriate instructions to remove control actuator.

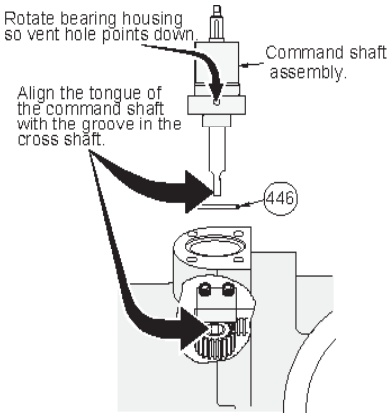
C) Remove four socket head cap screws (457) and Nord-Lock washers (477) securing mounting plate (415) to manifold.

D) The command shaft and mounting plate may now be removed from the compressor.



COMMAND SHAFT ASSEMBLY INSTALLATION

A) 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.



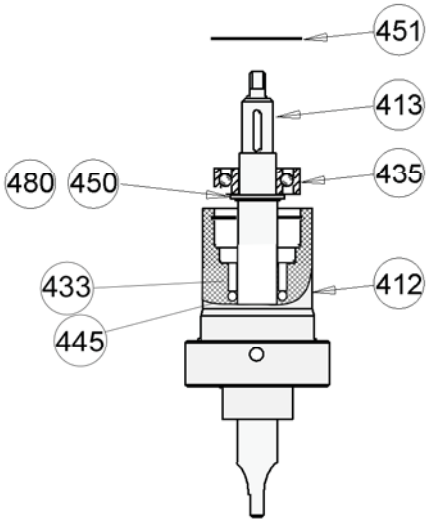
B) Install the actuator mounting plate with the four socket head cap screws and Nord-Lock washers securing it with proper torque.

C) The unit can now be leak checked.

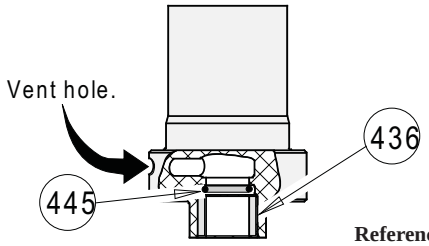
COMMAND SHAFT BEARING AND O-RING SEAL REPLACEMENT

A) Remove command shaft assembly.

B) Remove snap ring retainer (451) from command shaft housing (412). Push the command shaft assembly out of the housing.



C) The command shaft bearing (435) is a press fit on the command shaft (413). Remove the command shaft bearing with a suitable press.



Reference "Parts Section" for current Housing

D) 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.

COMMAND SHAFT BEARING AND O-RING SEAL REASSEMBLY

A) 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 refrigerant 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.

B) 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.

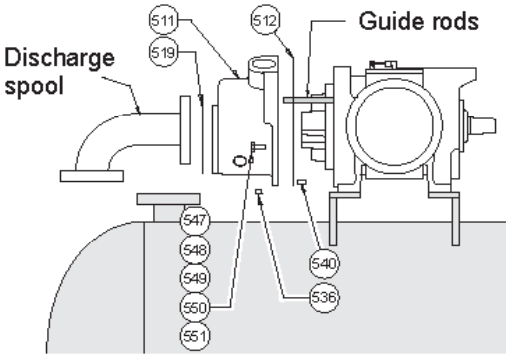
C) Install command shaft assembly.

DISCHARGE MANIFOLD REMOVAL

A) Remove both control actuators and command shaft assemblies.

B) On VSS 451-3001 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: Mainfold 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 VSM 301-701 compressor the compressor must be properly supported to keep the compressor from moving when the manifold is removed.

C) On VSM 301-701 compressors unbolt the discharge flange from the discharge manifold.

D) 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

A) 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.

B) On VSS 451-3001 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.

C) On VSM 301-701 compressors install the bolts in the discharge flange. Install the drain plug in the bottom of the discharge manifold.

D) Install both command shaft assemblies and control actuators.

SLIDE VALVE GEAR AND RACK INSPECTION

A) Remove the discharge manifold.

B) Check rack to rack clamp and rack clamp spacer clearance on all four slide valves.

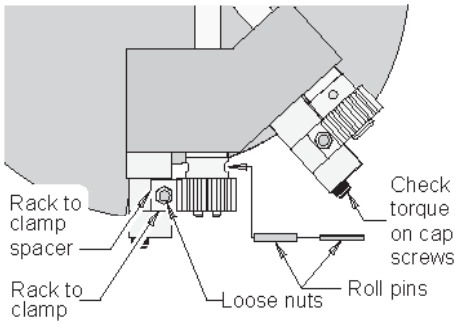
TABLE 4.1
RACK CLEARANCE VALUES

MEASUREMENT	CLEARANCE
Rack to clamp.	0.005 to 0.010”
Rack to clamp spacer.	0.003 to 0.005”

C) Check torque of socket heat cap screws.

D) 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.

E) Check for loose or broken roll pins in gears.



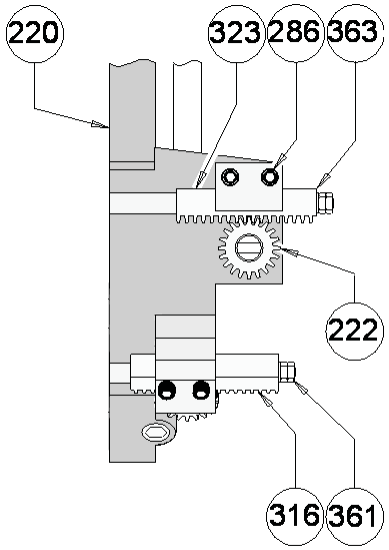
F) Look for any excessive wear on all moving parts and replace the worn parts.

G) Reassemble the manifold and discharge elbow.

REMOVAL OF CAPACITY OR VOLUME CROSS SHAFTS

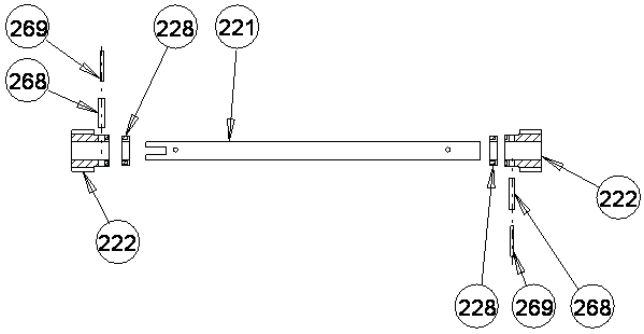
A) Remove the discharge manifold.

B) 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.



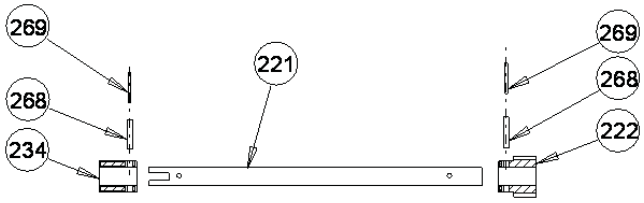
C) To remove the cross shafts, remove socket head bolts, clamp and spacers from both sides.

VSS 751-2101 compressors cross shafts.

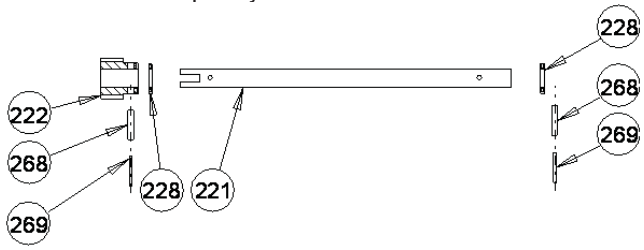


VSM 301-701 & VSS 2601-3001 compressors cross shafts

Volume control cross shaft.



Capacity control cross shaft.

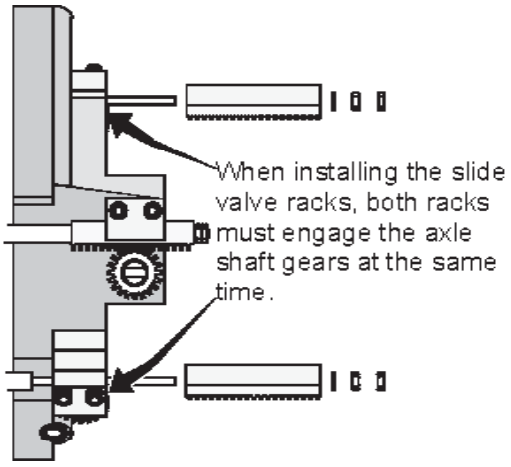


D) Drive the roll pins from pinion gear from one side. Remove pinion gear. Slide the cross shaft with the remaining pinion gear or spacers out of the opposite side. Repeat the procedure for the remaining cross shaft.

INSTALLATION OF CAPACITY OR VOLUME CROSS SHAFTS

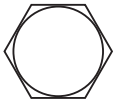
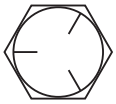
A) To reassemble either set of capacity or volume ratio slide valve racks, install the cross shaft with the pinion gear onto the back plate, place the remaining pinion gear on the shaft and drive in the roll pins. Install clamps, spacers and bolts on both sides. Tighten the bolts to the recommended torque values.

B) The slide valve sets must be synchronized on VSS 451-3001 and dual gate VSM 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.



C) 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.

Torque Specifications (ft-lbs)

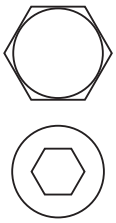
Type Bolt	Head Markings	Nominal Size Numbers or Inches									
		#10	1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4	7/8
SAE Grade 2 Coarse (UNC)		-	5	10	18	29	44	63	87	155	150*
SAE Grade 5 Coarse (UNC)		-	8	16	28	44	68	98	135	240	387
SAE Grade 5 Coarse (UNC)		-	-	18	-	-	-	-	-	-	-
SAE Grade 8 Coarse (UNF)		-	11	22	39	63	96	138	191	338	546
Socket Head Cap Screw (ASTM A574) Coarse (UNC)		5	13	26	46	73	112	115	215	380	614

1) Torque values in this table are not to override other specific torque specifications when supplied.

2) When using loctite, torque values in this table 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.

Torque Specifications for 17-4 Stainless Steel Fasteners (ft-lbs)

Type Bolt/Nut	Head Markings	Nominal Size Numbers or Inches								
		#10	1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4
Hex & Socket Head Cap Screws		3	8	14	25	40	60	101	137	245
Nut		-	8	-	25	-	-	-	-	-

NOTE: Continue use of red loctite #271 (VPN 2205E) on currently applied locations. Use blue loctite #243 (VPN 2205F or 2205G) on all remaining locations.

USING A TORQUE WRENCH CORRECTLY

TORQUE WRENCHES

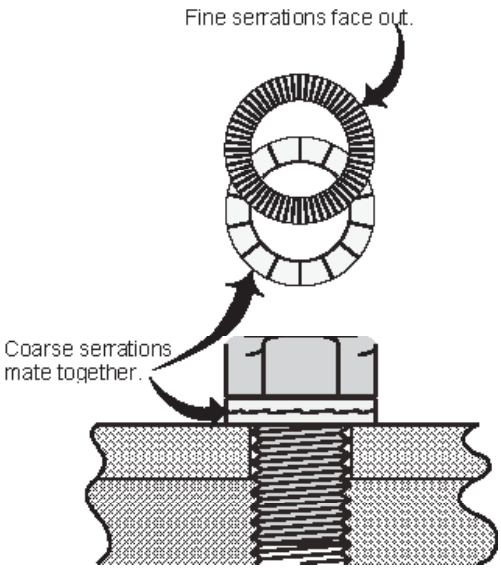
USING A TORQUE WRENCH CORRECTLY INVOLVES FOUR PRIMARY CONCERNS:

A. 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.

B. 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.

C. 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.

D. 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.



A. The Nord-Lock® lock washer sets are used in many areas in both the VSG & VSSG screw compressors that require a vibration proof lock washer.

B. The lock washer set is assembled so the course serrations that resemble ramps are mated together.

C. 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.

6.00 OIL FILTER ELEMENTS

The following is a description of the oil filter elements supplied on standard VSS, VSR and VSM single screw compressor units

6.01 1833C FILTER ELEMENTS

Vilter Part Number	1833C
Usage	VSS 451 to VSS 1801
Dates	All units prior to 3-1-00
Length	18”
Diameter	6-1/8”

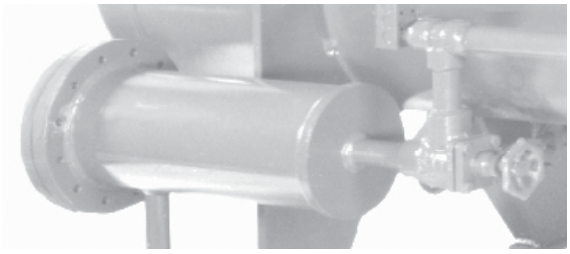
A) Characteristics;

1) The outside of the filter element is covered with a perforated metal surface.

2) At each end of the filter, there is a large thick elastomeric seal.

3) The housing is a fabricated steel housing with bolted end cover. The housing can contain one or two elements.

4) Simplex filter housing is standard with duplex filter housings with a bypass valve arrangement is optional, so that the filter can be changed while unit is in operation.



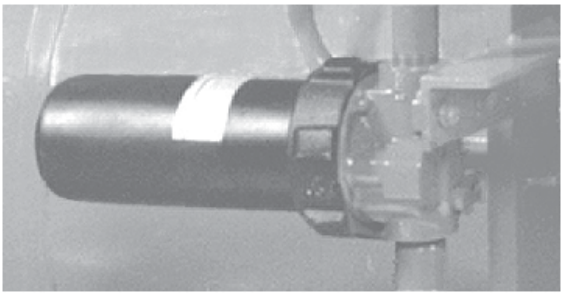
6.02 KT 721 FILTER ELEMENTS

Vilter Part Number	KT 721
Tank O-Ring	2176BU
Usage	VSR Compressors
Dates	1992 to 8-1-96
Length	8”

A) Characteristics;

1) Pleated type element with a screen covering the surface of the element.

2) One end of the element is solid while the other has a pilot hole with a captive “o”-ring.



6.03 KT 722 FILTER ELEMENTS

Vilter Part Number	KT 722
Tank O-Ring	2176AJ
Usage	VSR Compressors
Dates	1996 to 2002
Length	16.8”

A) Characteristics;

1) Pleated type element with a screen covering the surface of the element.

2) One end of the element is solid while the other has a pilot hole with a captive “o”-ring.

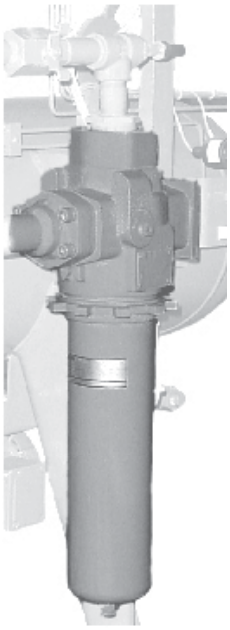
6.04 KT 773A & B FILTER ELEMENTS

Vilter Part Number		KT 773A	KT 773B
Tank O-Ring		2176BY	2176BZ
Usage		3109A Duplex Housing	3111A Simplex Housing
Usage	1.	VSM all models 4/1/00 to present.	
	2.	VSS 451 to 1301 models with 30" and smaller oil separators 3/1/00 to present.	
Length		16"	

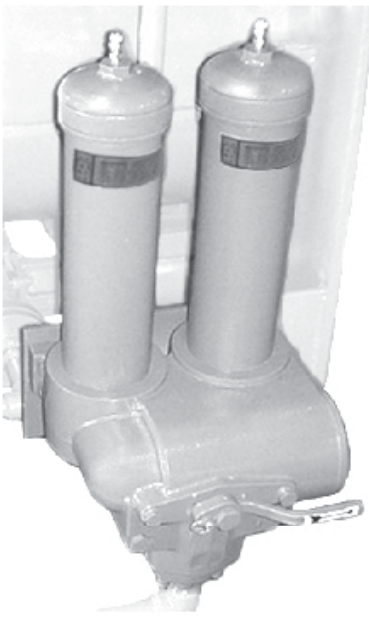
A) Characteristics;
   1) Pleated type element with a screen covering the surface of the element.
   2) One end of the element is solid while the other has a pilot hole with a captive "o"-ring.
   3) On duplex models only the end cap is removed from the filter bowl

B) Usage;
   1) Used in simplex and duplex applications.
   2) The O-rings for the simplex and duplex housings are not interchangeable.

Simplex filter housing.



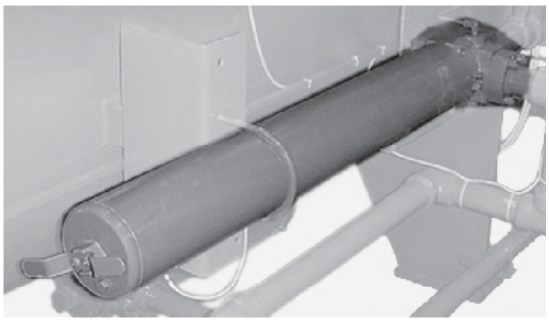
Duplex filter housing.



6.05 KT 774 FILTER ELEMENTS

Vilter Part Number	KT 774	
Tank O-Ring	2176BY	
Usage	3112A Simplex Housings	3110A Duplex Housings
	1. VSS 1501 & 1801 3-1-00 to present.	
	2. All other VSS models with 30” and larger oil separators 3/1/00 to present.	
Length	39”	

Simplex filter housing.



C) Characteristics;

1) Pleated type element with a screen covering the surface of the element.

2) One end of the element is solid while the other has a pilot hole with a captive “o”-ring.

3) Only end cap is removed from the filter bowl.

D) Usage;

1) Used in simplex and duplex applications.

Refrigeration Maintenance and Inspection Schedule

The following service intervals are based on the usage of Vilter Manufacturing Corporation Premium Grade refrigeration oil in VSS, VSM and VSR Single Screw Compressor units.

Group	Inspection Or Maintenance Item	*SERVICE INTERVAL (HOURS)*													
		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 (1)		R		R		R		R		R		R		R
	Oil Analysis (2)		S	S	S	S	S	S	S	S	S	S	S	S	S
	Oil Filters (3)	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
PACKAGE	Coalescing Elements					R			R			R			R
	Suction Screen	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
	Coupling Alignment and Integrity	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
	RTD's	I	I	I	I	I	I	I	I	I	I	I	I	I	I
COMPRESSOR	Inspect Compressor Bearings		I		I		I		I		I		I		I I

Key
- I Inspect.
- R Replace.
- S Sample.

Notes:
(1) The oil should be changed at these intervals, unless oil analysis results exceed the allowable limits. The frequency of changes will depend on the system cleanliness.

(2) Oil analysis should be done at these intervals as a minimum; the frequency of analysis will depend on system cleanliness.

(3) The oil filter(s) on a minimum must be changed at these intervals or annually if not run continuously. However, the oil filter(s) must be changed if the oil filter differential exceeds 12 psi or oil analysis requires it.

NOTE: See Motor Manual for proper lubrication procedures and service intervals.

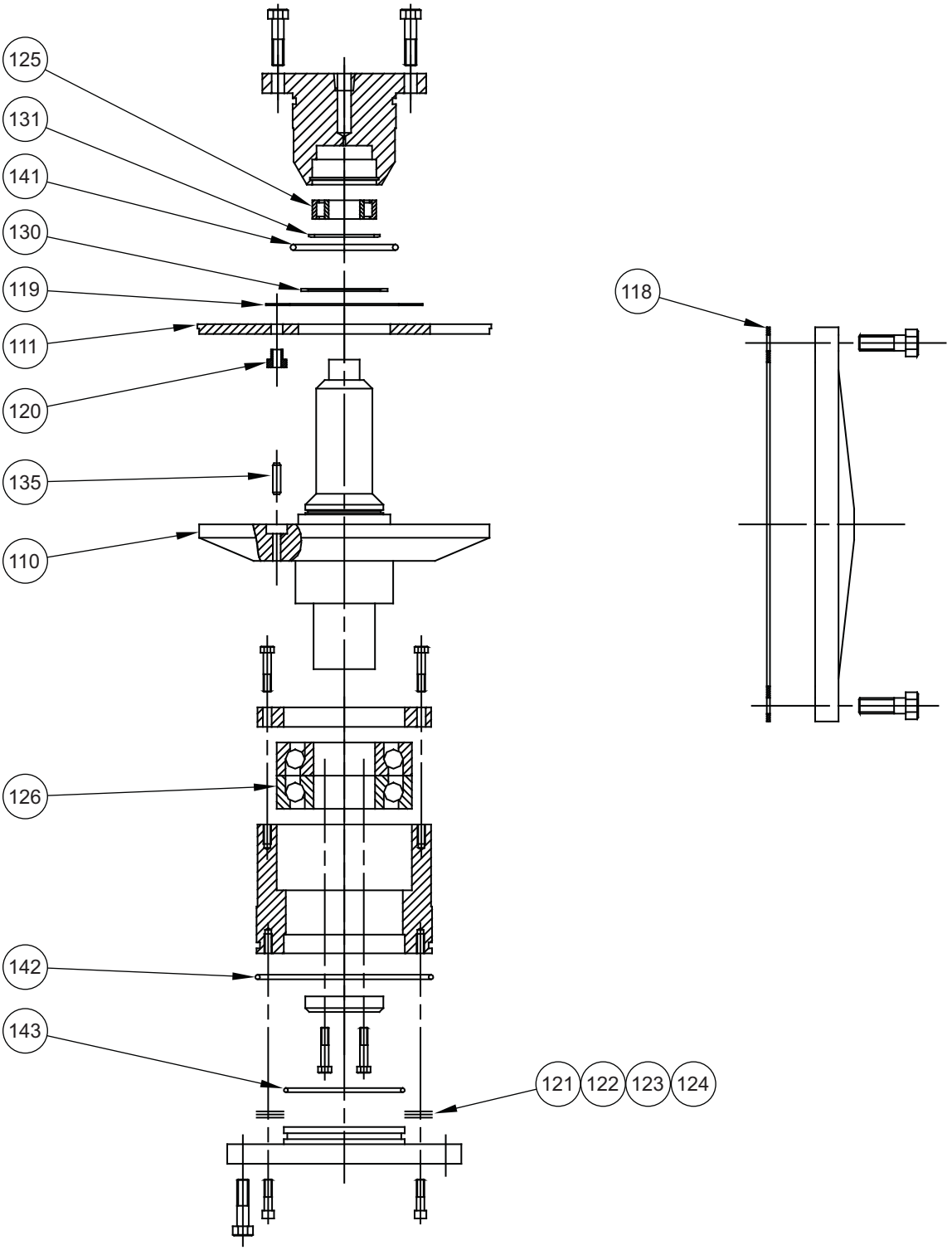
Recommended
Spare Parts List

Refer to the Custom Manual
Spare Parts Section for Specific Applications

Please have your Model # and Sales Order # available when ordering.

These are found on the compressor's Name Plate.

Gate Rotor


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

Gate Rotor

ITEM	DESCRIPTION	MODEL NUMBER					
		VSS 451		VSS 601		VSS 751	
		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	KT712A	2	KT712B	2	KT712C
	GATE ROTOR BLADE REPLACEMENT KIT (111, 118, 120A, 120B, 121, 122, 123, 124, 130, 141, 142, 143)	2	KT713A	2	KT713B	2	KT713C
102	GATE ROTOR SUPPORT ASSEMBLY (100, 111, 120B, 119, 130)	2	A25161BB	2	A25161BA	2	A25161CB
105	GATE ROTOR GASKET SET (118, 141, 142, 143)	2	A25164B	2	A25164B	2	A25164C
106	SHIM PACK SET ((2) 121, (2) 122, (1) 123, (1) 124)	2	A25165B	2	A25165B	2	A25165C
110	SUPPORT	2	25606A	2	25520A	2	25612A
111	GATE ROTOR	2	25557A	2	25534A	2	25608A
112	SMALL BEARING HOUSING	2	25518A	2	25518A	-	N/A
113	LARGE BEARING HOUSING	2	25517A	2	25517A	-	N/A
114	RETAINER	2	25008A	2	25008A	-	N/A
115	RETAINER	2	25009A	2	25009A	-	N/A
116	BALL BEARING COVER	2	25258A	2	25258A	-	N/A
117	GATE ROTOR COVER	2	25519A	2	25519A	-	N/A
118	GATE ROTOR COVER GASKET	2	25259A	2	25259A	2	25088A
119	WASHER	2	25007A	2	25007A	2	25086A
120A	BUSHING, SMALL DOWEL PIN	2	25006A	2	25006A	2	25087A
120B	BUSHING, LARGE DOWEL PIN	2	25760A	2	25760A	2	25760B
121	SHIM 0.002”	AR	25010AA	AR	25010AA	AR	25089AA
122	SHIM 0.003”	AR	25010AB	AR	25010AB	AR	25089AB
123	SHIM 0.005”	AR	25010AC	AR	25010AC	AR	25089AC
124	SHIM 0.010”	AR	25010AD	AR	25010AD	AR	25089AD
125	ROLLER BEARING	2	2864B	2	2864B	2	2864C
126	BALL BEARING	4	2865B	4	2865B	4	2865A
130	RETAINING RING	2	2866A	2	2866A	2	2866B
131	RETAINING RING	2	2867A	2	2867A	2	2867E
135A	DOWEL PIN, SM, 0.250” O.D.	2	2868B	2	2868B	2	2868F
135B	DOWEL PIN, LG, 0.4375” O.D.	2	25910A	2	25910A	2	25910B
141	O-RING ROLLER BEARING HOUSING	2	2176M	2	2176M	2	2176N
142	O-RING BALL BEARING HOUSING	2	2176R	2	2176R	2	2176V
143	O-RING BRG HSG COVER	2	2176N	2	2176N	2	2176U
150	HEX HEAD CAP SCREW	12	2796AJ	12	2796AJ	-	N/A
151	HEX HEAD CAP SCREW	6	2796B	6	2796B	-	N/A
152	HEX HEAD CAP SCREW	40	2796CJ	40	2796CJ	-	N/A
153	HEX HEAD CAP SCREW	32	2796E	32	2796E	-	N/A
160	SOCKET HEAD CAP SCREW	12	2795E	12	2795E	-	N/A

Gate Rotor

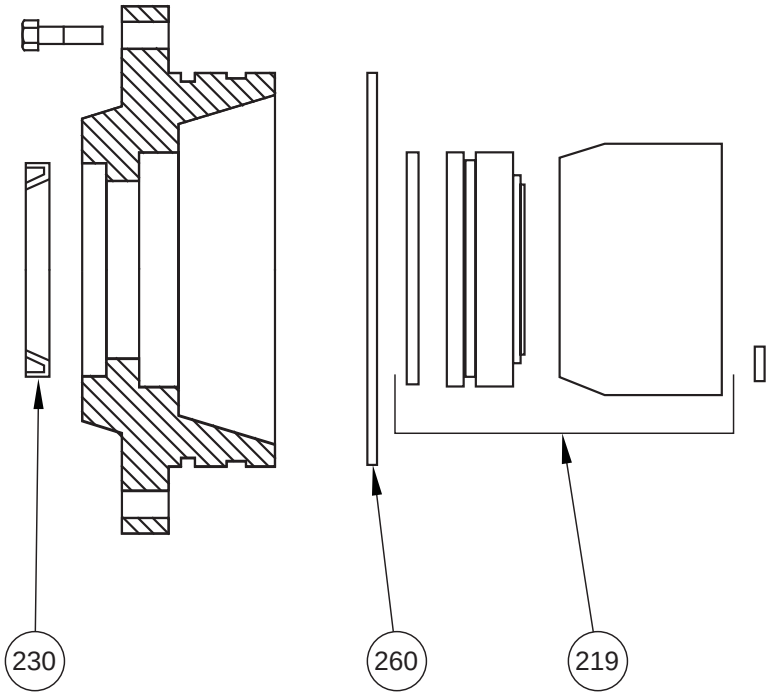
ITEM	DESCRIPTION	MODEL NUMBER							
		VSS 901		VSS 1051		VSS 1201		VSS 1301	
		QTY	VPN	QTY	VPN	QTY	VPN	QTY	VPN
	GATE ROTOR BLADE AND BEARING REPLACEMENT KIT (111, 118, 120A, 120B, 121, 122, 123, 124, 125, 126, 130,131, 141, 142, 143)	2	KT712D	2	KT712E	2	KT712F	2	KT712Y
GATE	ROTOR BLADE REPLACEMENT KIT (111, 118, 120A, 120B, 121, 122, 123, 124, 130, 141, 142, 143)	2	KT713D	2	KT713E	2	KT713F	2	KT713Y
102	GATE ROTOR SUPPORT ASSEMBLY (100, 111, 120B, 119, 130)	2	A25161CA	2	A25161DB	2	A25161DA	2	A25161DH
105	GATE ROTOR GASKET SET (118, 141, 142, 143)	2	A25164C	2	A25164D	2	A25164D	2	A25164D
110	SUPPORT.	2	25553A	2	25614A	2	25587A	2	25587A
111	GATE ROTOR	2	25554A	2	25610A	2	25588A	2	25588F
118	GATE ROTOR COVER GASKET	2	25088A	2	25132A	2	25132A	2	25132A
119	WASHER	2	25086A	2	25086A	2	25086A	2	25086A
120A	BUSHING, SMALL DOWEL PIN	2	25087A	2	25104A	2	25104A	2	25104A
120B	BUSHING, LARGE DOWEL PIN	2	25760B	2	25760B	2	25760B	2	25760B
121	SHIM 0.002”	AR	25089AA	AR	25089AA	AR	25089AA	AR	25089AA
122	SHIM 0.003”	AR	25089AB	AR	25089AB	AR	25089AB	AR	25089AB
123	SHIM 0.005”	AR	25089AC	AR	25089AC	AR	25089AC	AR	25089AC
124	SHIM 0.010”	AR	25089AD	AR	25089AD	AR	25089AD	AR	25089AD
125	ROLLER BEARING	2	2864C	2	2864G	2	2864G	2	2864G
126	BALL BEARING	4	2865A	4	2865A	4	2865A	4	2865A
130	RETAINING RING	2	2866B	2	2866B	2	2866B	2	2866B
131	RETAINING RING	2	2867E	2	2867L	2	2867L	2	2867L
135A	DOWEL PIN, SMALL, 0.3125” O.D.	2	2868F	2	2868H	2	2868H	2	2868H
135B	DOWEL PIN, LARGE, 0.4375” O.D.	2	25910B	2	25910B	2	25910B	2	25910B
141	O-RING ROLLER BEARING HOUSING	2	2176N	2	2176AJ	2	2176AJ	2	2176AJ
142	O-RING BALL BEARING HOUSING	2	2176V	2	2176AM	2	2176AM	2	2176AM
143	O-RING BEARING HOUSING COVER	2	2176U	2	2176U	2	2176U	2	2176U

Gate Rotor

ITEM	DESCRIPTION	MODEL NUMBER					
		VSS 1551		VSS 1851		VSS 2101	
		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	KT712L	2	KT712M	2	KT712K
	GATE ROTOR BLADE REPLACEMENT KIT (111, 118, 120A, 120B, 121, 122, 123, 124, 130, 141, 142 & 143)	2	KT713G	2	KT713H	2	KT713L
101	GATE ROTOR ASSEMBLY (111, 120)	2	A25160EB	2	A25160EA	2	A25160EA
102	GATE ROTOR SUPPORT ASSEMBLY (100, 111, 120B, 119, 130)	2	A25161EB	2	A25161EA	2	A25161EL
105	GATE ROTOR GASKET SET (118, 141, 142 & 143)	2	A25164E	2	A25164E	2	A25164E
	SHIM PACK SET ((2) 121, (2) 122, (1) 123, (1) 124)	2	A25165E	2	A25165E	2	A25165E
110	SUPPORT	2	25687A	2	25665A	2	25495D
111	GATE ROTOR	2	25647A	2	25645A	2	25744D
112	SMALL BEARING HOUSING	2	26507A	2	26507A	2	26507A
113	LARGE BEARING HOUSING	2	26506A	2	26506A	2	26506A
114	RETAINER	2	25141A	2	25141A	2	25141A
115	RETAINER	2	25789A	2	25789A	2	25789A
116	BALL BEARING COVER	2	25351A	2	25351A	2	25351A
117	GATE ROTOR COVER	2	26508A	2	26508A	2	26508A
118	GATE ROTOR COVER GASKET	2	26509A	2	26509A	2	26509A
119	WASHER	2	25788A	2	25788A	2	25788A
120A	BUSHING, SMALL DOWEL PIN	-	N/A	-	N/A	-	N/A
120B	BUSHING, LARGE DOWEL PIN	2	25760C	2	25760C	2	25760C
121*	SHIM 0.002”	AR	25791AA	AR	25791AA	AR	25791AA
122*	SHIM 0.003”	AR	25791AB	AR	25791AB	AR	25791AB
123*	SHIM 0.005”	AR	25791AC	AR	25791AC	AR	25791AC
124*	SHIM 0.010”	AR	25791AD	AR	25791AD	AR	25791AD
125	ROLLER BEARING	2	2864K	2	2864K	2	2864K
126	BALL BEARING	4	2865K	4	2865K	4	2865K
130	RETAINING RING	2	2866G	2	2866G	2	2866G
131	RETAINING RING	2	2867R	2	2867R	2	2867R
135A	DOWEL PIN, SM, 0.250” O.D.	-	N/A	-	N/A	-	N/A
135B	DOWEL PIN, LARGE, 0.500” O.D.	2	25910C	2	25910C	2	25910C
141	O-RING ROLLER BEARING HOUSING	2	2176U	2	2176U	2	2176U
142	O-RING BALL BEARING HOUSING	2	2176BD	2	2176BD	2	2176BD
143	O-RING BEARING HOUSING COVER	2	2176P	2	2176P	2	2176P
150	HEX HEAD CAP SCREW	12	2796CJ	12	2796CJ	12	2796CJ
151	HEX HEAD CAP SCREW	8	2796N	8	2796N	8	2796N
152	HEX HEAD CAP SCREW	32	2796CJ	32	2796CJ	32	2796CJ
153	HEX HEAD CAP SCREW	44	2796R	44	2796R	44	2796R
160	SOCKET HEAD CAP SCREW	16	2795G	16	2795G	16	2795G

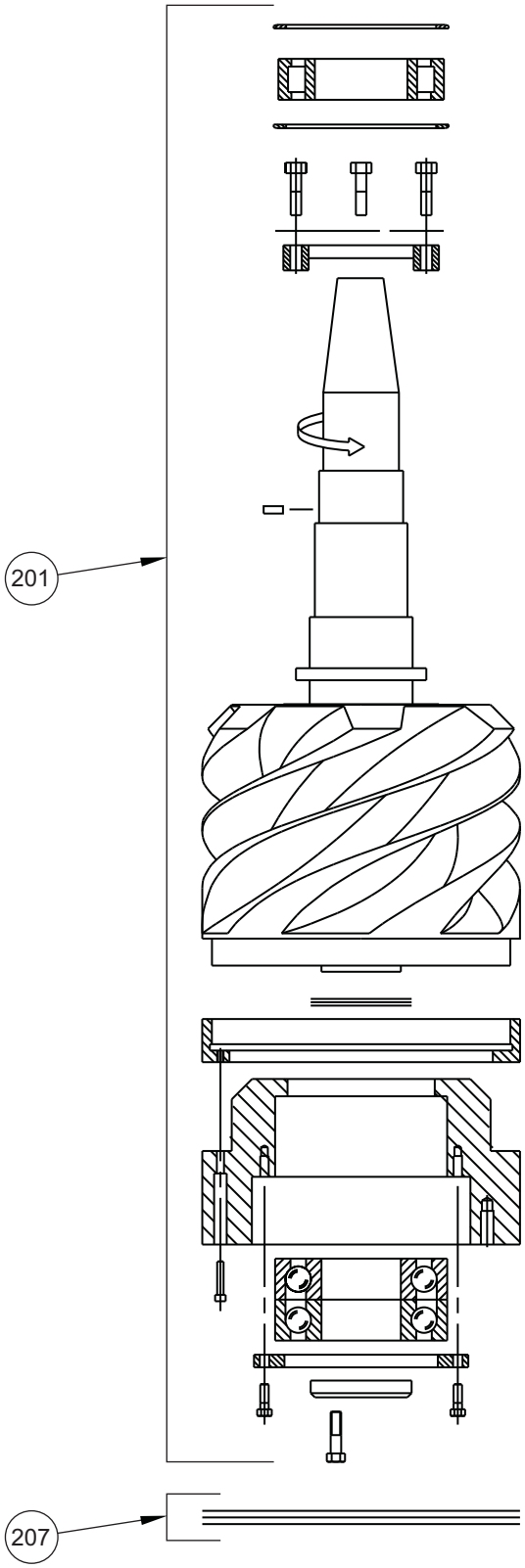
Shaft Seal

Shaft Seal With Stationary Carbon Face



ITEM	DESCRIPTION	MODEL NUMBER							
		VSS 291 thru VSS 601		VSS 751 thru VSS 1201		VSS 1301		VSS 1551 thru VSS 2101	
		QTY	VPN	QTY	VPN	QTY	VPN	QTY	VPN
	SHAFT SEAL AMM KIT (219, 230, 260)	1	KT709A	1	KT709B	1	KT709MB	1	KT709C
	SHAFT SEAL R22 KIT (219, 230, 260)	1	KT781A	1	KT781B	1	KT709MA	1	KT781C
230	OIL SEAL	1	25040A	1	25064A	1	2930F	1	2930B
260	O-RING	1	2176F	1	2176AC	1	2176AC	1	2176BH

Main Rotor

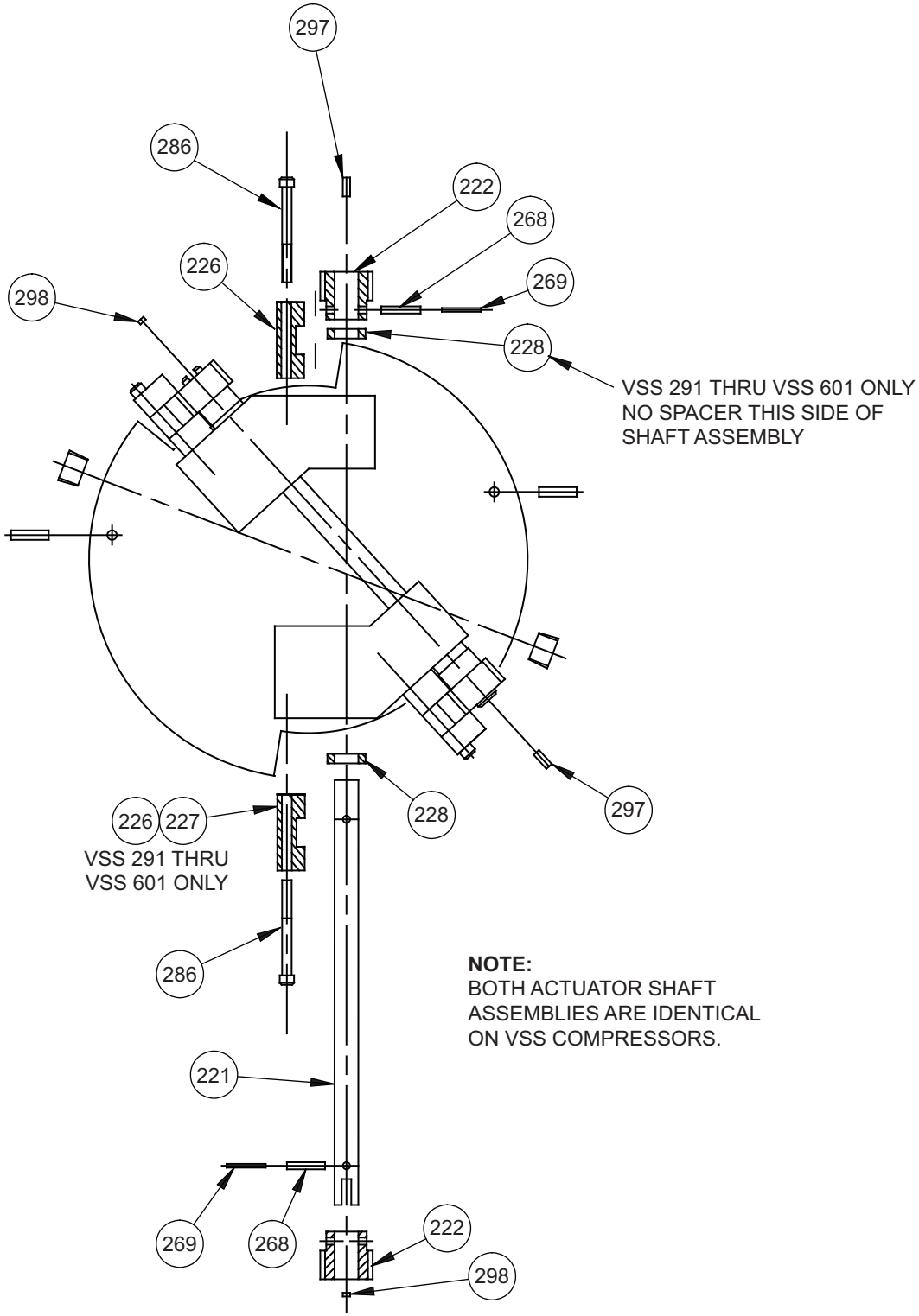


ITEM	DESCRIPTION	MODEL NUMBER							
		VSS 451		VSS 601		VSS 751		VSS 901	
		QTY	VPN	QTY	VPN	QTY	VPN	QTY	VPN
201	ROTOR ASSEMBLY	1	A25226BB	1	A25226BA	1	A25226CB	1	A25226CA
207	SHIM PACK	1	A25177B	1	A25177B	1	A25177C	1	A25177C

ITEM	DESCRIPTION	MODEL NUMBER							
		VSS 1051		VSS 1201		VSS 1301		VSS 1551	
		QTY	VPN	QTY	VPN	QTY	VPN	QTY	VPN
201	ROTOR ASSEMBLY	1	A25226DB	1	A25226DA	1	A25752HA	1	A25226EC
207	SHIM PACK	1	A25177D	1	A25177D	1	A25177D	1	A25177E

ITEM	DESCRIPTION	MODEL NUMBER							
		VSS 1851		VSS 2101					
		QTY	VPN	QTY	VPN				
201	ROTOR ASSEMBLY	1	A25226ED	1	A25226EE				
207	SHIM PACK	1	A25177E	1	A25177E				

Slide Valve Cross Shafts and End Plate

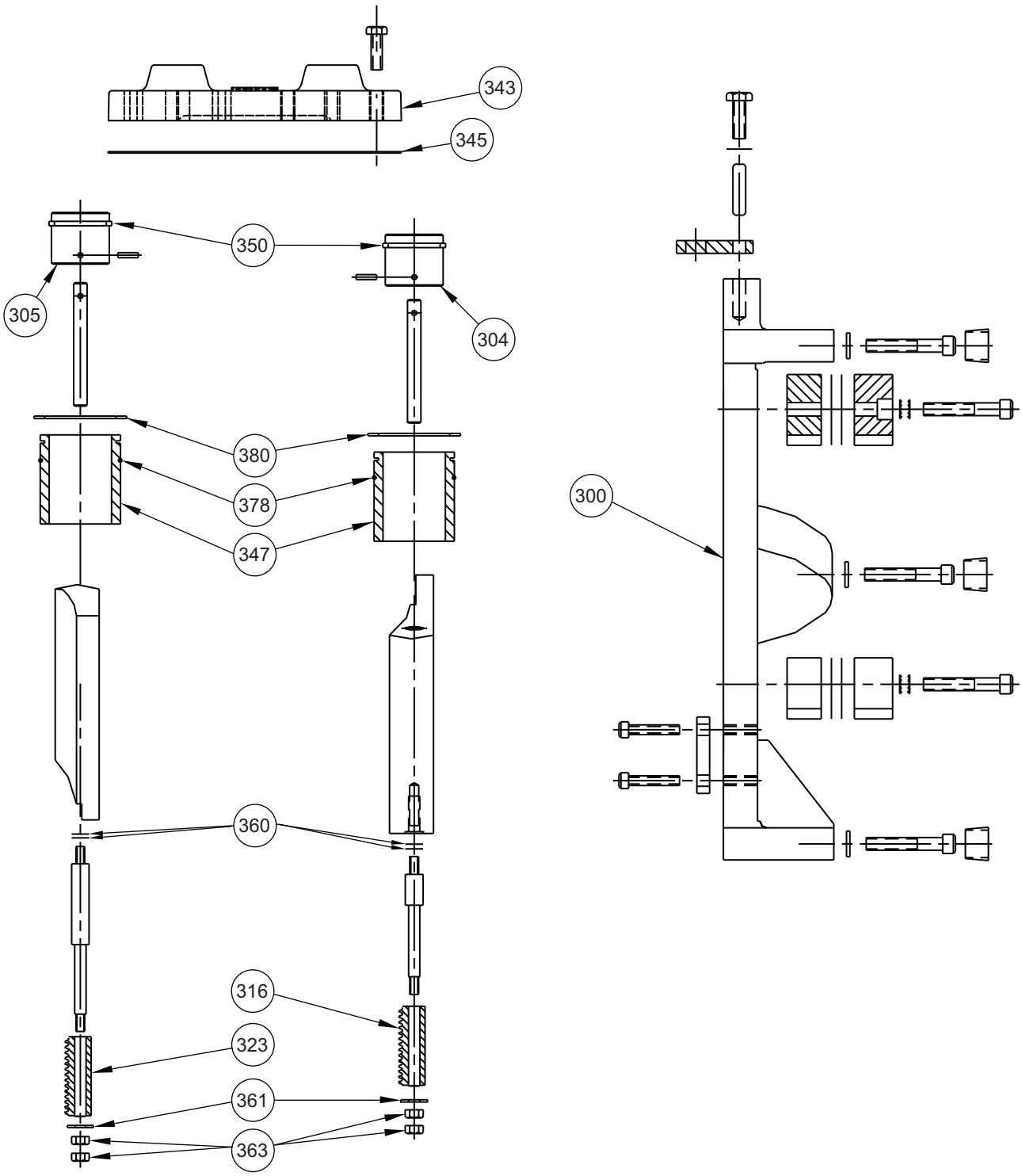


Slide Valve Cross Shafts and End Plate

ITEM	DESCRIPTION	MODEL NUMBER							
		VSS 291 thru VSS 601		VSS 751 VSS 901		VSS 1051 VSS 1201 VSS 1301		VSS 1551 thru VSS 2101	
		QTY	VPN	QTY	VPN	QTY	VPN	QTY	VPN
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

Slide Valve Carriage Assembly

Volume Slide Capacity Slide Carriage Assembly

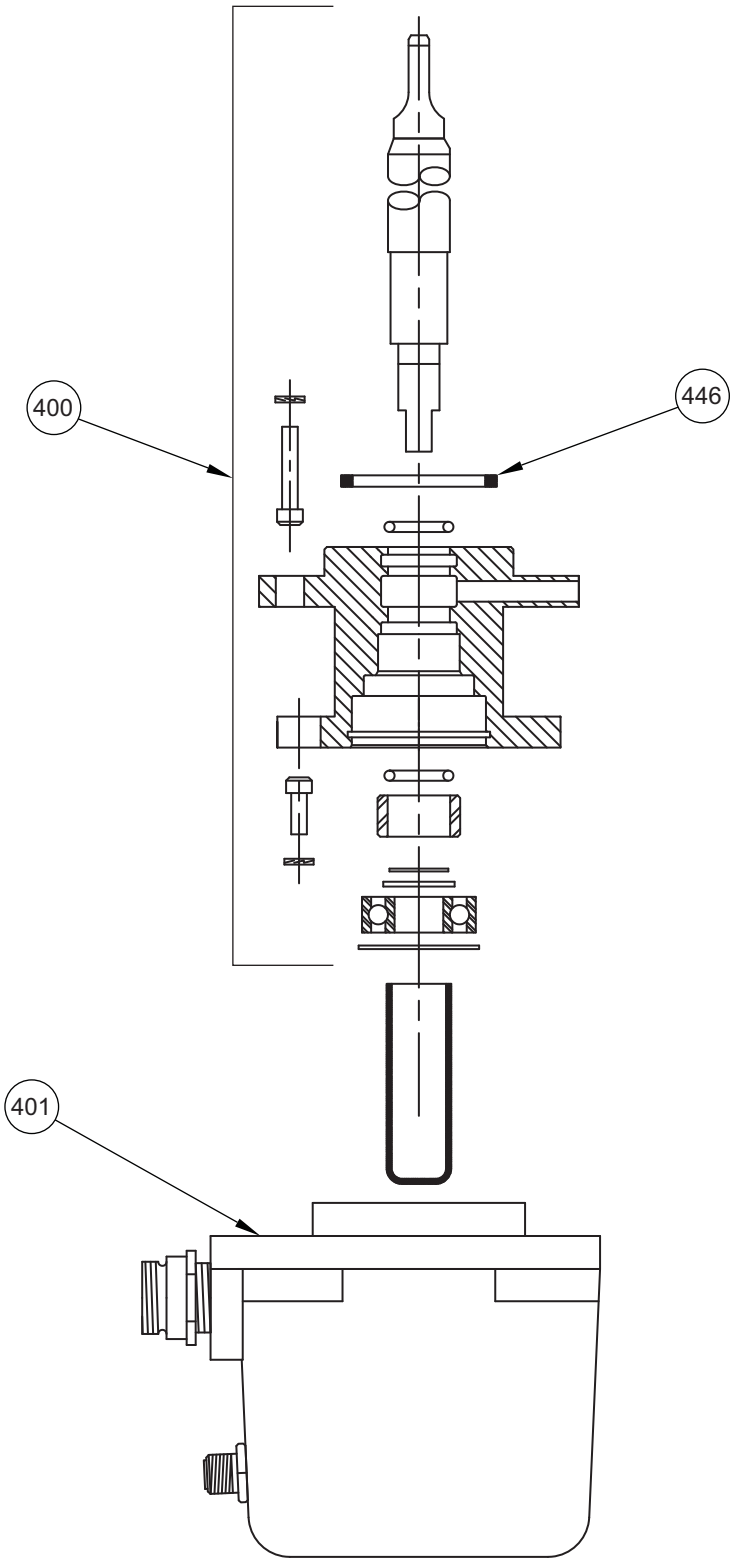


Slide Valve Carriage Assembly

ITEM	DESCRIPTION	MODEL NUMBER							
		VSS 291 thru VSS 601		VSS 751 VSS 901		VSS 1051 VSS 1201		VSS 1301	
		QTY	VPN	QTY	VPN	QTY	VPN	QTY	VPN
300	CARRIAGE ASSEMBLY	2	A25179B	2	A25179C	2	A25179D	2	A25179DSR
304	CAPACITY PISTON (340, 341, 350, 355)	2	A25183B	2	A25183C	2	A25183D	2	A25183DN
305	VOLUME PISTON (340, 342, 350, 355)	2	A25184B	2	A25184C	2	A25184D	2	A25184DN
307A	GASKET SET (345)	2	A25200B	-	N/A	2	A25200D	2	A25200D
307B	GASKET SET (345, 378)	-	N/A	2	A25200C	-	N/A	-	N/A
316	RACK	2	25024A	2	25080A	2	25080C	2	25779B
323	RACK	2	25023A	2	25080B	2	25080D	2	25080DH
325	SHAFT	-	N/A	-	N/A	-	N/A	-	N/A
340	PISTON	-	N/A	4	25076A	4	25138A	4	25138A
341	CAPACITY PISTON SHAFT	-	N/A	2	25078A	2	25078E	2	25078G
342	VOLUME PISTON SHAFT	-	N/A	2	25078B	2	25078F	2	25078H
343	COVER, ONE PIECE CAST	2	25399A	2	25279A	2	25401A	2	25401A
345	GASKET, ONE PIECE CAST COVER	2	25900A	2	25902A	2	25901A	2	25901A
346	GASKET, ONE PIECE CAST COVER	-	N/A	2	25124A	-	N/A	-	N/A
347	PISTON SLEEVE	-	N/A	2	25079A	-	N/A	-	N/A
350	PISTON RING SET	4	2953AA	4	2953AB	4	2953AC	4	2953AC
355	EXPANSION PIN	4	1193PP	4	1193PP	4	1193PP	4	1193PP
359	PIPE PLUG	6	2606D	6	2606D	6	2606E	6	2606E
360	LOCK WASHER (PAIR)	4	3004C	4	3004C	4	3004C	4	3004C
361	WASHER	4	13265B	4	13265B	4	13265B	4	13265B
363	NUT	8	2797A	8	2797A	8	2797A	8	2797A
366	HEX HEAD CAP SCREW	24	2796B	12	2796P	24	2796P	24	2796P
367	HEX HEAD CAP SCREW	-	N/A	12	2796BN	-	N/A	-	N/A
373	SOCKET HEAD CAP SCREW	-	N/A	6	2795N	6	2795P	6	2795P
374	LOCK WASHER (PAIR)	-	N/A	6	3004C	6	3004D	6	3004C
378	O-RING	-	N/A	2	2176Y	-	N/A	-	N/A
380	RETAINER RING	-	N/A	2	2866C	-	N/A	-	N/A

Slide Valve Carriage Assembly

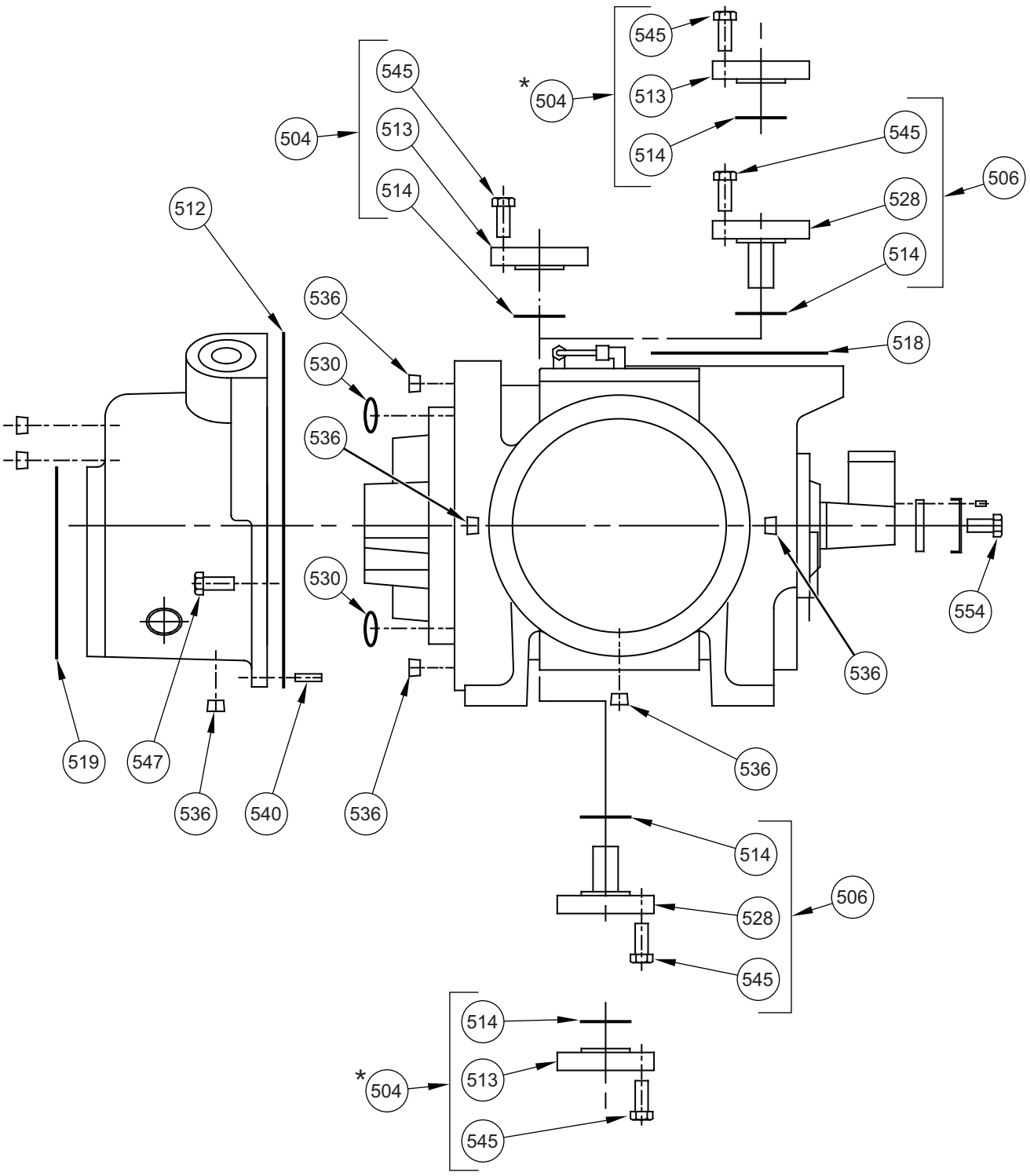
ITEM	DESCRIPTION	MODEL NUMBER							
		VSS 1551 thru VSS 2101							
		QTY	VPN						
300	CARRIAGE ASSEMBLY	2	A25179E						
304	CAPACITY PISTON (340, 341, 350, 355)	2	A25183E						
305	VOLUME PISTON (340, 342, 350, 355)	2	A25184E						
307A	GASKET SET (345)	2	A25200E						
307B	GASKET SET (345, 378)	2	A25200E						
316	RACK	2	25779A						
323	RACK	2	25780A						
325	SHAFT	2	25778A						
340	PISTON	4	25782A						
341	CAPACITY PISTON SHAFT	2	25784A						
342	VOLUME PISTON SHAFT	2	25783A						
343	COVER, ONE PIECE CAST	2	25690A						
345	GASKET, ONE PIECE CAST COVER	2	25384A						
346	GASKET, ONE PIECE CAST COVER	-	N/A						
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						
366	HEX HEAD CAP SCREW	28	2796BL						
367	HEX HEAD CAP SCREW	-	N/A						
373	SOCKET HEAD CAP SCREW	6	2795AG						
374	LOCK WASHER (PAIR)	6	3004D						
378	O-RING	4	2176AG						
380	RETAINER RING	4	2755AG						


400
446
401

Actuator & Command Shaft

ITEM	DESCRIPTION	MODEL NUMBER							
		VSS 291 thru VSS 601		VSS 751 VSS 901		VSS 1051 VSS 1201 VSS 1301		VSS 1551 thru VSS 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 SEAL	2	2176X	2	2176X	2	2176X	2	2176X

VSS Screw Compressor



Miscellaneous Frame Components

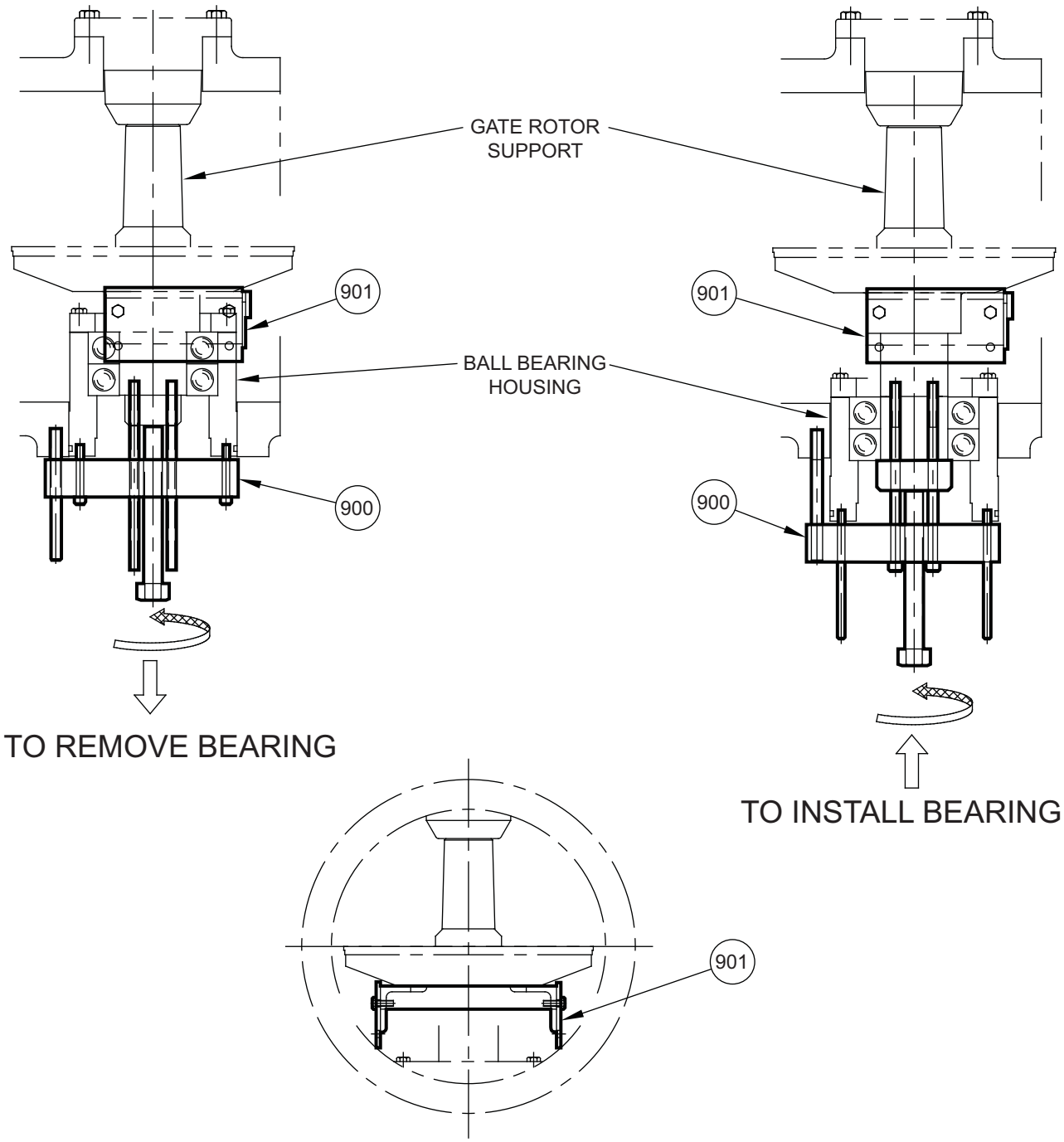
ITEM	DESCRIPTION	MODEL NUMBER							
		VSS 291 thru VSS 601		VSS 751 VSS 901		VSS 1051 VSS 1201		VSS 1301	
		QTY	VPN	QTY	VPN	QTY	VPN	QTY	VPN
-	GASKET & O-RING KIT	1	KT710A	1	KT710B	1	KT710C	1	KT710J
504A	FLANGE SET (513A, 514A, 545A)	1	A25190A	1	A25190A	1	A25190B	1	A25190A
504B*	FLANGE SET (513B, 514B, 545B)	2	A25190B	-	N/A	2	A25190B	2	A25190B
504C*	FLANGE SET (513B, 514C, 545C)	-	N/A	2	A25190D	-	N/A	-	N/A
506A	PLUG SET, ECONOMIZER (514C, 528, 545B)	1	A25243BE	1	A25243CC	1	A25243DC	1	A25243DD
506B	PLUG SET, ECONOMIZER (514A, 514C, 528, 545C)	-	N/A	-	N/A	-	N/A	-	N/A
512	MANIFOLD GASKET	1	25503A	1	25541A	1	25324A	1	25324A
513A	FLANGE	1	25058ASW	1	25058ASW	1	25058B	1	25058ASW
513B	FLANGE	2	25058B	2	25058ASW	2	25058B	2	25058B
514A	GASKET	1	11323D	1	11323D	1	11323E	1	11323D
514B	GASKET	2	11323E	-	N/A	2	11323E	2	11323E
514C	GASKET	2	11323D	2	11323S	2	11323E	2	11323E
518	GASKET, SUCTION	1	25199C	1	25199C	1	25199D	1	25199D
519	GASKET, DISCHARGE	1	25199B	1	25199B	1	25199C	1	25199C
528	ECONOMIZER PLUG	2	25397G	2	25395A	2	25391D	2	25391A
530	O-RING	2	2176AB	2	2176J	2	2176J	2	2176AB
536	PIPE PLUG 3/4” MPT	-	N/A	-	N/A	6	2606A	6	2606A
540	DOWEL PIN	2	2868B	2	2868B	2	2868B	2	2868B
542	PIPE PLUG 3/4” MPT	-	N/A	-	N/A	-	N/A	-	N/A
545A	HEX HEAD CAP SCREW	2	2796GP	2	2796GP	2	2796C	2	2796GP
545B	HEX HEAD CAP SCREW	4	2796C	4	2796C	4	2796C	4	2796C
545C	HEX HEAD CAP SCREW	-	N/A	4	2796GP	-	N/A	-	N/A
547	HEX HEAD CAP SCREW	8	2796C	21	2796GP	24	2796GP	24	2796F
554	HEX HEAD CAP SCREW	1	2796U	1	2796U	1	2796U	1	2796U

*Optional

Miscellaneous Frame Components

ITEM	DESCRIPTION	MODEL NUMBER							
		VSS 1551 thru VSS 2101							
		QTY	VPN	QTY	VPN	QTY	VPN	QTY	VPN
-	GASKET & O-RING KIT	1	KT710D						
504A	FLANGE SET (513A, 514A, 545A)	1	A25190C						
504B*	FLANGE SET (513B, 514B, 545B)	2	A25190D						
504C*	FLANGE SET (513B, 514C, 545C)	-	N/A						
506A	PLUG SET, ECONOMIZER (514C, 528, 545B)	-	N/A						
506B	PLUG SET, ECONOMIZER (514A, 514C, 528, 545C)	1	A25243ED						
512	MANIFOLD GASKET	1	25676A						
513A	FLANGE	1	12477C						
513B	FLANGE	2	25058ASW						
514A	GASKET	1	11323F						
514B	GASKET	2	11323S						
514C	GASKET	2	11323G						
518	GASKET, SUCTION	1	25199D						
519	GASKET, DISCHARGE	1	25199C						
528	ECON-O-MIZER PLUG	2	25393A						
530	O-RING	2	2176J						
536	PIPE PLUG 3/4” MPT	3	2606A						
540	DOWEL PIN	2	2868K						
542	PIPE PLUG 3/4” MPT	1	13163F						
545A	HEX HEAD CAP SCREW	4	11397E						
545B	HEX HEAD CAP SCREW	4	2796GP						
545C	HEX HEAD CAP SCREW	12	11397E						
547	HEX HEAD CAP SCREW	-	N/A						
554	HEX HEAD CAP SCREW	-	N/A						

*Optional



FOR VSS 451, VSS 601, DO NOT USE SIDE RAILS.
FOR VSS 751, VSS 901, VSS 1051 AND VSS 1201, ASSEMBLE SIDE RAILS AS STAMPED.
FOR VSS 1551 AND 1801, SIDE RAILS ASSEMBLE ONLY ONE WAY.

Replacement Tools

ITEM	DESCRIPTION	MODEL NUMBER							
		VSS 291 thru VSS 601		VSS 751 VSS 901		VSS 1051 VSS 1201 VSS 1301		VSS 1551 thru VSS 2101	
		QTY	VPN	QTY	VPN	QTY	VPN	QTY	VPN
900	GATE ROTOR TOOLS	1	A25205B	1	A25205C	1	A25205C	1	A25205E
901A	GATE ROTOR STABILIZER SET (901A, 901B, 901C)	1	A25698A	1	A25698A	1	A25698A	-	N/A
901B	GATE ROTOR STABILIZER SET (901A, 901B, 901C, 901D)	-	N/A	-	N/A	-	N/A	1	A25699A

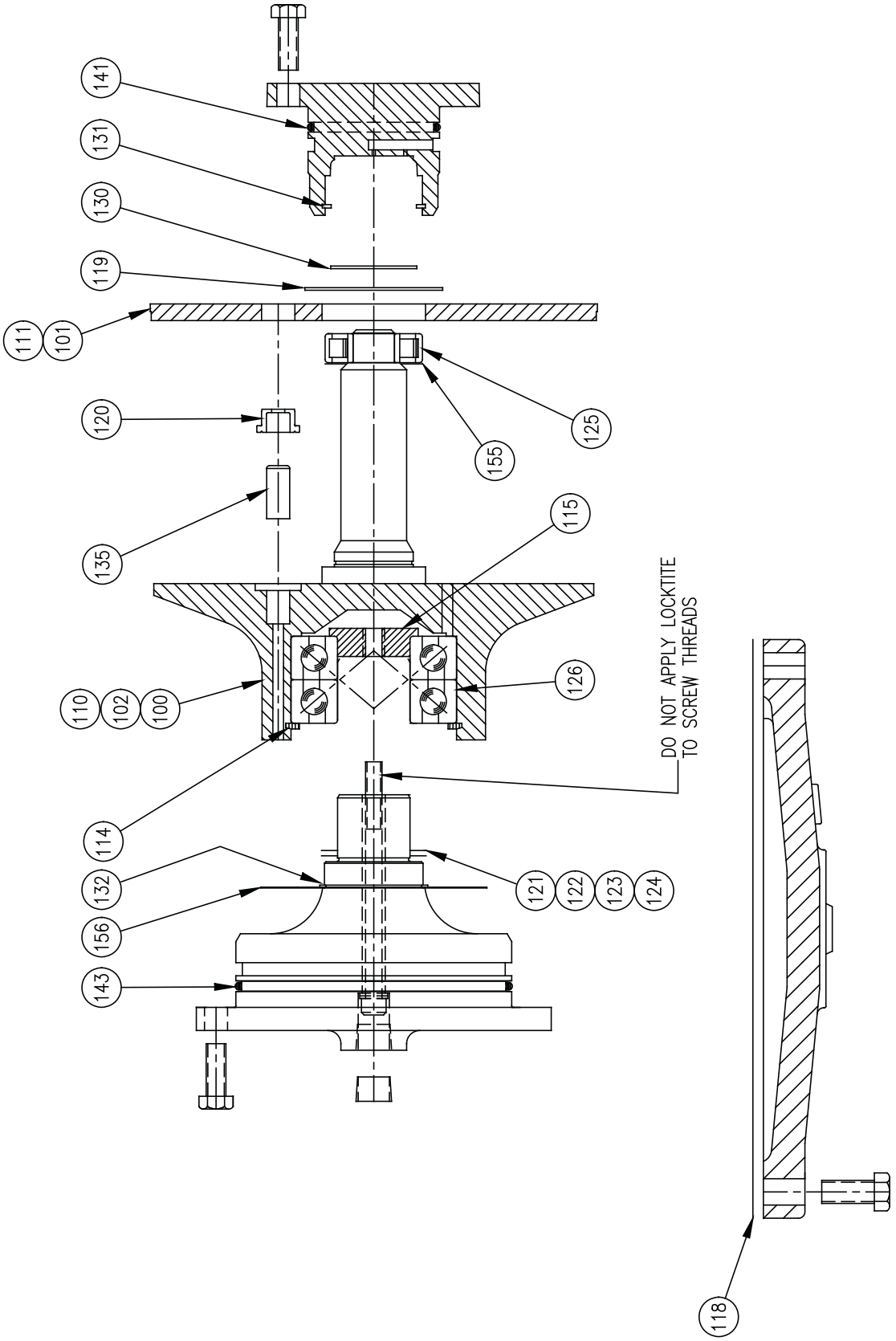
Recommended
Spare Parts List

Refer to the Custom Manual
Spare Parts Section for Specific Applications

Please have your Model # and Sales Order # available when ordering.

These are found on the compressor's Name Plate.

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					
		VSM 301		VSM 361		VSM 401	
		QTY	VPN	QTY	VPN	QTY	VPN
100	SUPPORT ASSEMBLY 110 & 135B.	1	A25222AB	1	A25222AA	1	A25222AC
101	GATE ROTOR & DAMPER ASSEMBLY 111,120.	1	A25160AB	1	A25160AA		A25160AC
102	GATE ROTOR SUPPORT ASSEMBLY 100, 101, 119 & 130.	1	A25161AB	1	A25161AA		A25161AC
	SHIM PACK SET (2) 121, (2) 122, (1) 123, (1) 124.	1	A25165A	1	A25165A		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	2176L	1	2176L	1	2176L
143	O-RING BALL BRG SUPPORT.	1	2176F	1	2176F	1	2176F
155	SHIM	AR	25977D	AR	25977D	AR	25977D
156	SHIM	AR	25977C	AR	25977C	AR	25977C

AR = As Required

Gaterotor Assembly

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

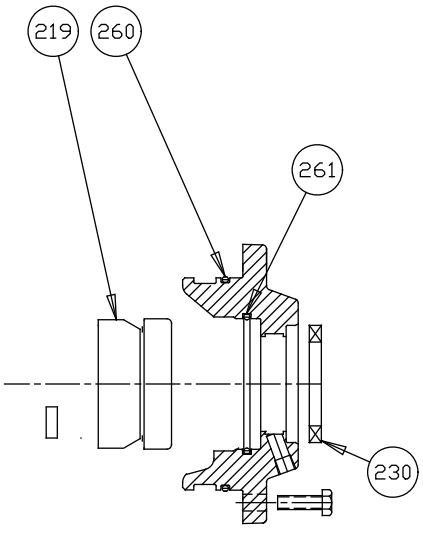
ITEM	DESCRIPTION	MODEL NUMBER					
		VSM 501		VSM 601		VSM 701	
		QTY	VPN	QTY	VPN	QTY	VPN
100	SUPPORT ASSEMBLY 110 & 135B.	1	A26011BB	1	A26011BA	1	A26011BA
101	GATE ROTOR & DAMPER ASSEMBLY 111,120.	1	A26002BB	1	A26002BA	1	A26002BC
102	GATE ROTOR SUPPORT ASSEMBLY 100, 101, 119 & 130.	1	A26003BB	1	A26003BA	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	26027AA	AR	26027AA	AR	26027AA
122*	SHIM 0.003”.	AR	26027AB	AR	26027AB	AR	26027AB
123*	SHIM 0.005”.	AR	26027AC	AR	26027AC	AR	26027AC
124*	SHIM 0.010”.	AR	26027AD	AR	26027AD	AR	26027AD
125	ROLLER BEARING.	1	2864B	1	2864B	1	2864B
126	BALL BEARING.	1	2865B	1	2865B	1	2865B
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 BRG HSG.	1	2176M	1	2176M	1	2176M
143	O-RING BALL BRG SUPPORT.	1	2176R	1	2176R	1	2176R
155	SHIM	AR	25977G	AR	25977G	AR	25977G
156	SHIM	AR	25977H	AR	25977H	AR	25977H

NOTE: * Not pictured
AR = As Required

Shaft Seal

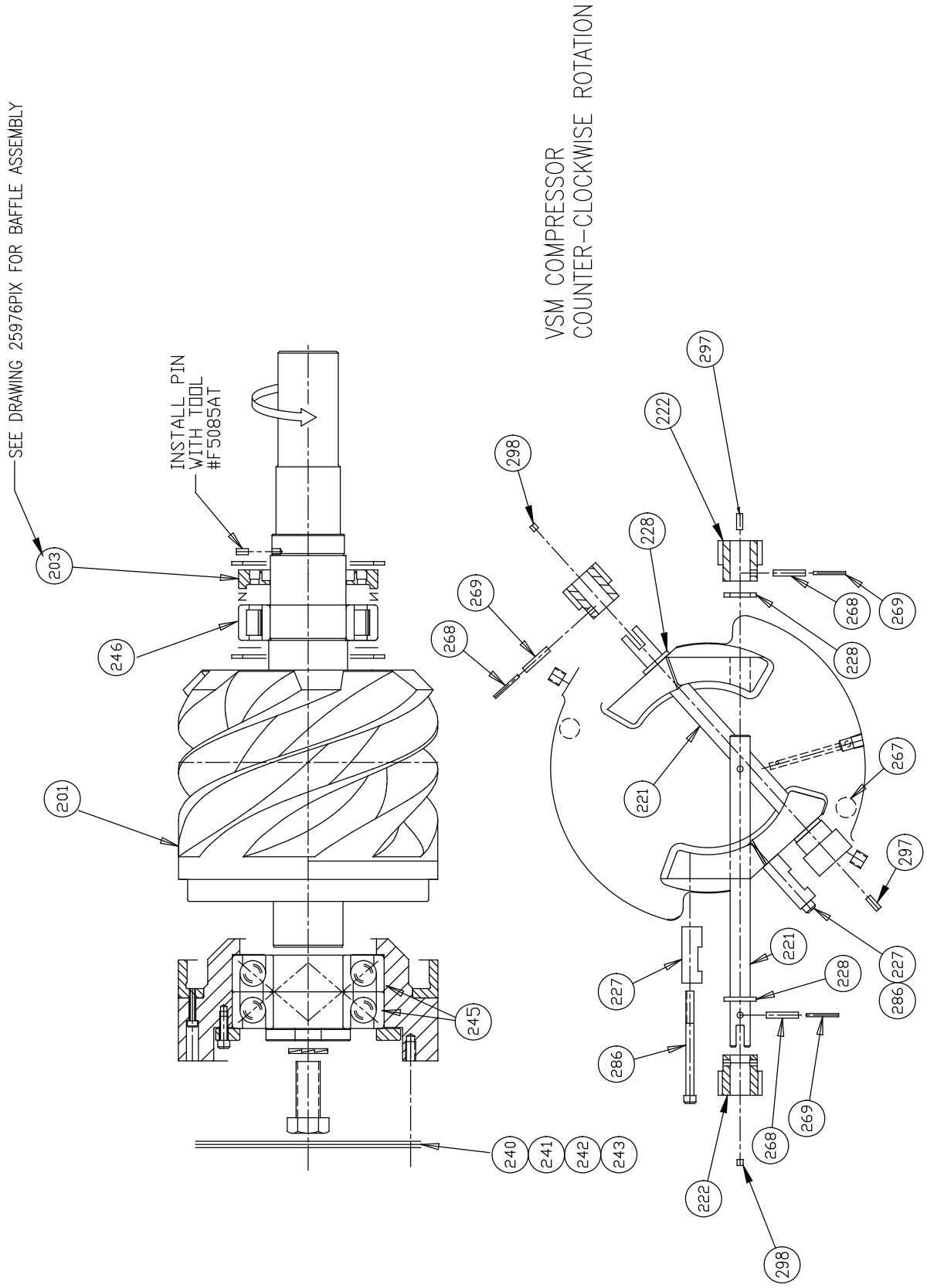
ITEM	DESCRIPTION	MODEL NUMBER			
		ALL VSM 301-401		ALL VSM 501-701	
		QTY	VPN	QTY	VPN
*	SHAFT SEAL KIT (AMM) 219, 230, & 260.	1	KT709D	1	KT709A
*	SHAFT SEAL KIT (HALO) 219, 230, & 260	1	KT781D	1	KT781A
219	SHAFT SEAL.	1	A	1	A
230	OIL SEAL.	1	2930C	1	25040A
244-	TEFLON SEAL	1	25939A	1	25939A
252-	RETAINER RING	1	2928M	1	2928M
260	O-RING	1	2176U	1	2176F
261	O-RING. (205 Only)	1	2176AE		N/A

NOTE * Not pictured.
A Sold only as kit.
- See recommended spare parts lists for complete assembly.



Main Rotor, Slide Valve Cross Shafts & End Plate

Models VSM 301-401 Counter Clockwise ONLY



Main Rotor, Slide Valve Cross Shafts & End Plate

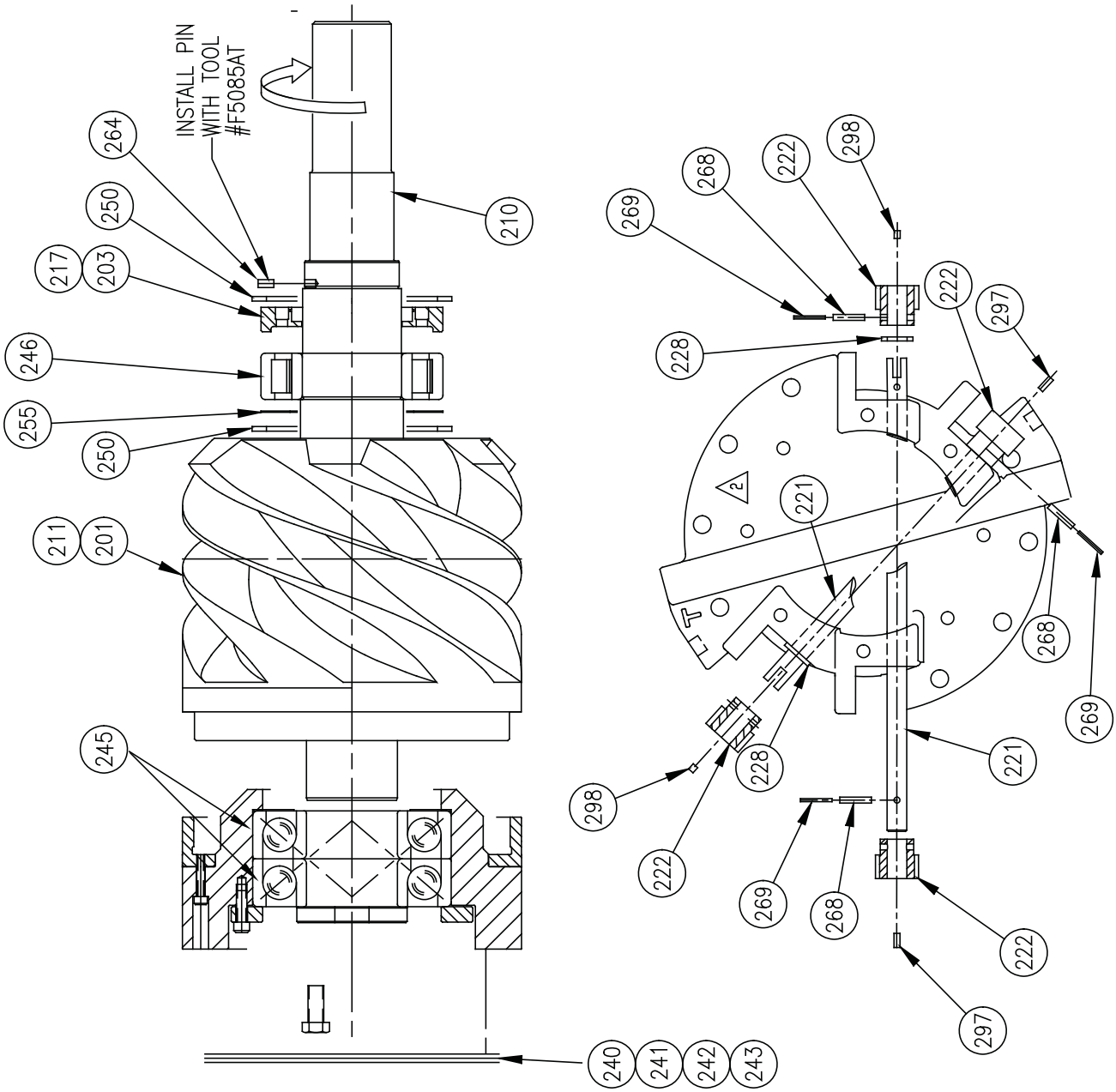
Models VSM 301-401 Counter Clockwise ONLY

ITEM	DESCRIPTION	MODEL NUMBER					
		VSM 301		VSM 361		VSM 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
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	25913D	4	25913D	4	25913D
228	SPACER.	4	25847A	4	25847A	4	25847A
240	SHIM 0.002”	A	25409AA	A	25409AA	A	25409AA
241	SHIM 0.003”	A	25409AB	A	25409AB	A	25409AB
242	SHIM 0.005”	A	25409AC	A	25409AC	A	25409AC
243	SHIM 0.010”	A	25409AD	A	25409AD	A	25409AD
244	TEFLON RING. (BAFFLE)	1	25939A	1	25939A	1	25939A
248	CHECK VALVE. (BAFFLE)	1	3120A	1	3120A	1	3120A
249	CHECK VALVE. (BAFFLE)	1	3120B	1	3120B	1	3120B
252	RETAINING RING. (BAFFLE)	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

NOTE: * Not pictured.
** Required at top locate single gaterotor only.
A As required.

Main Rotor, Slide Valve Cross Shafts & End Plate

Models VSM 501-701 Clockwise ONLY



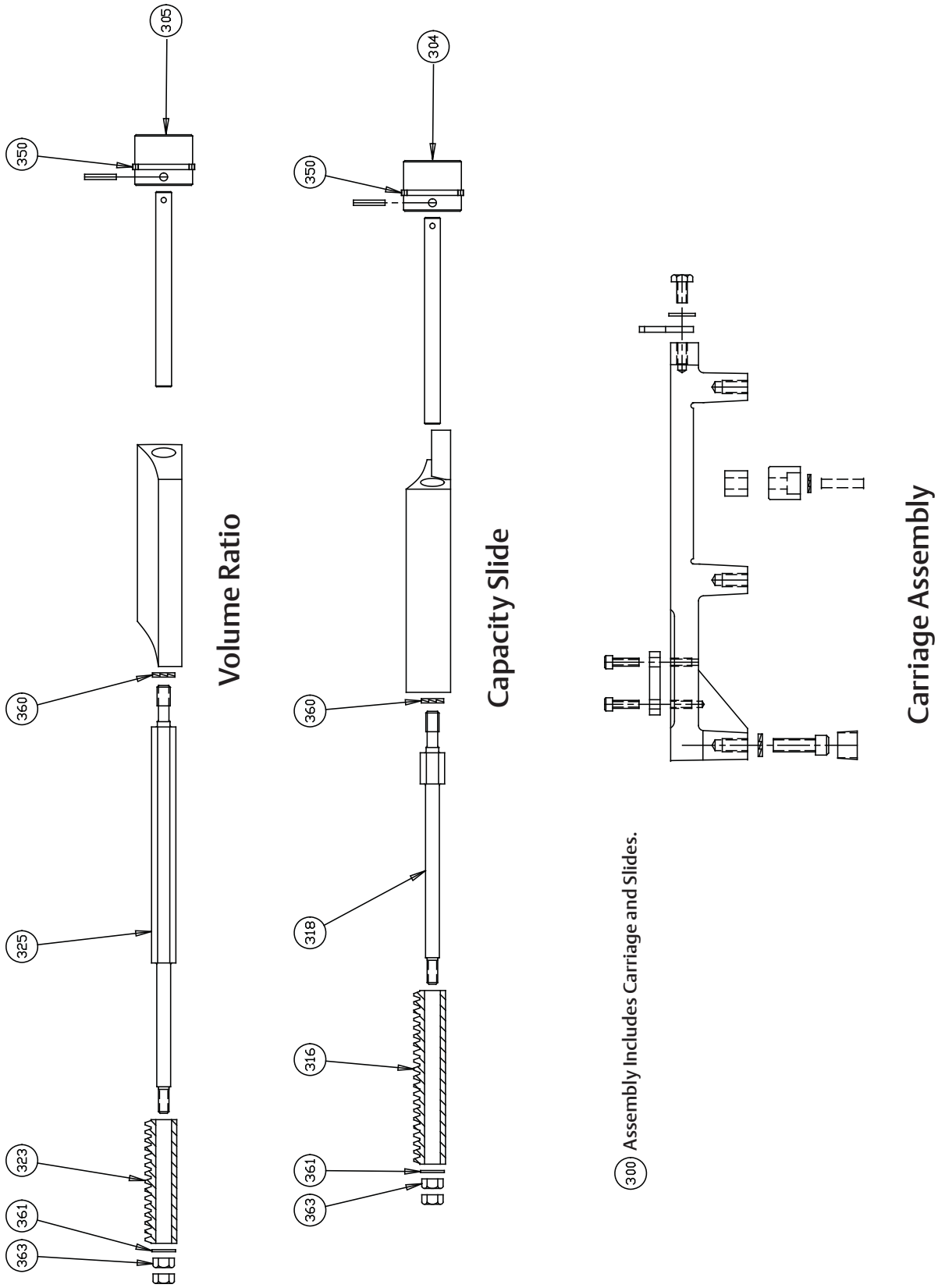
Main Rotor, Slide Valve Cross Shafts & End Plate

Models VSM 501-701 Clockwise ONLY

ITEM	DESCRIPTION	MODEL NUMBER VSM 501		VSM 601		VSM 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”	A	25255AA	A	25255AA	A	25255AA
241	SHIM 0.003”	A	25255AB	A	25255AB	A	25255AB
242	SHIM 0.005”	A	25255AC	A	25255AC	A	25255AC
243	SHIM 0.010”	A	25255AD	A	25255AD	A	25255AD
244	TEFLON RING. (BAFFLE)	1	25929B	1	25929B	1	25929B
248	CHECK VALVE. (BAFFLE)	1	3120A	1	3120A	1	3120A
249	CHECK VALVE. (BAFFLE)	1	3120B	1	3120B	1	3120B
252	RETAINING RING. (BAFFLE)	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

NOTE: * Not pictured.
A As required.

Slide Valve Carriage Assembly

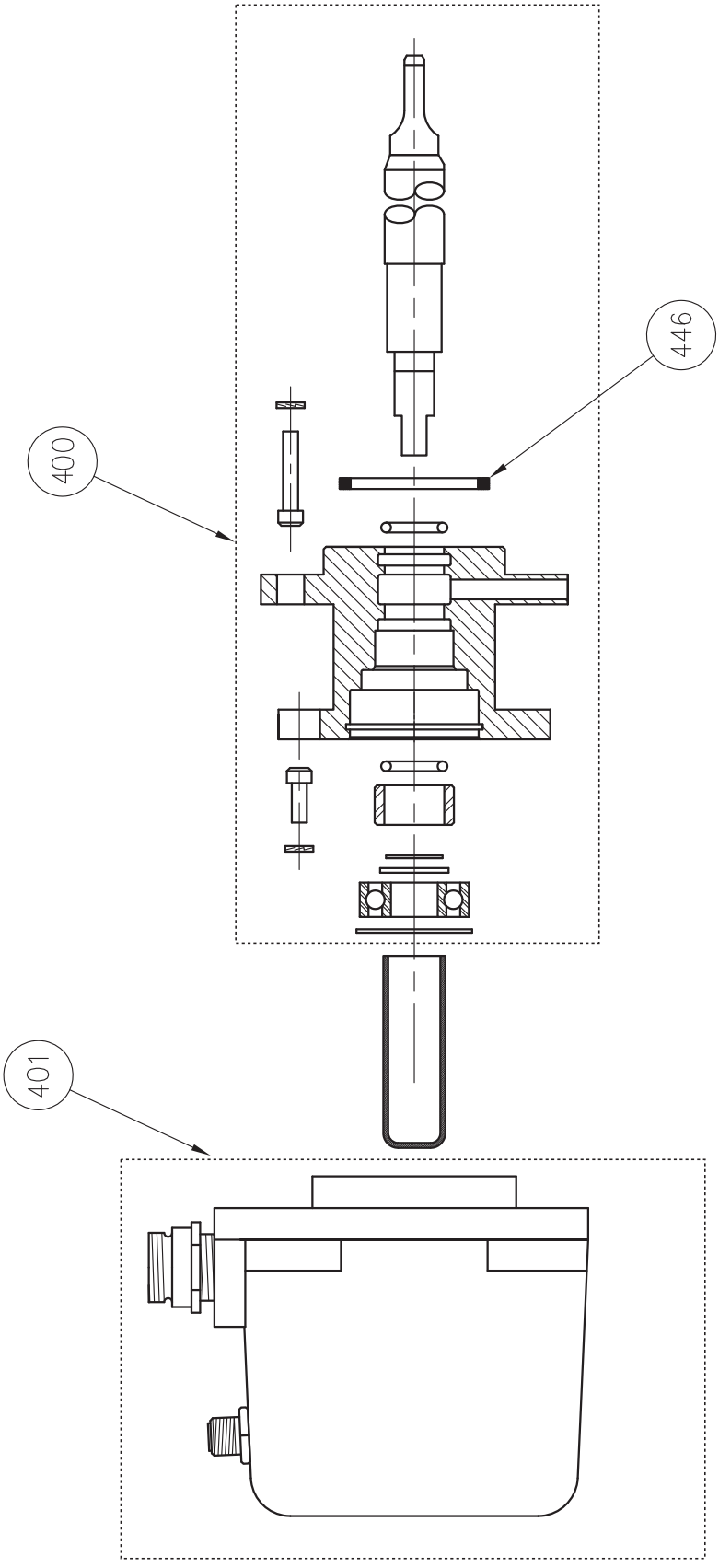


Slide Valve Carriage Assembly

ITEM	DESCRIPTION	MODEL NUMBER			
		ALL VSM 301-401		ALL VSM 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	25023D	1	25024A
318	CAPACITY RACK SHAFT.	1	25772C	1	25772A
323	VOLUME RATIO RACK.	1	25023C	1	25023A
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.		N/A	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 & Command Shaft

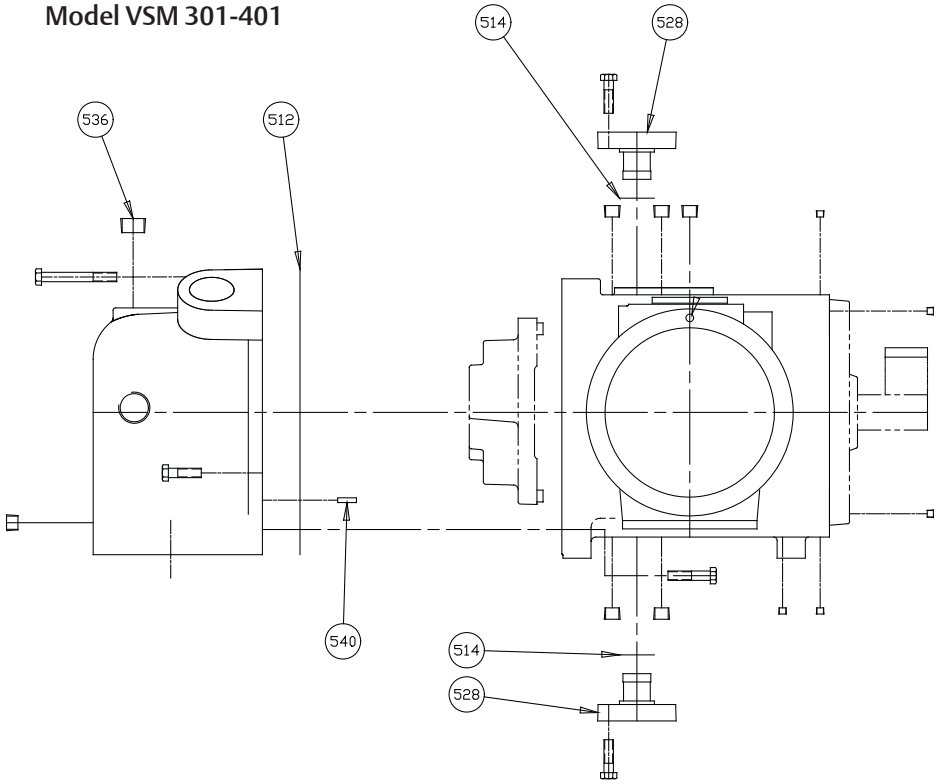


Actuator & Command Shaft

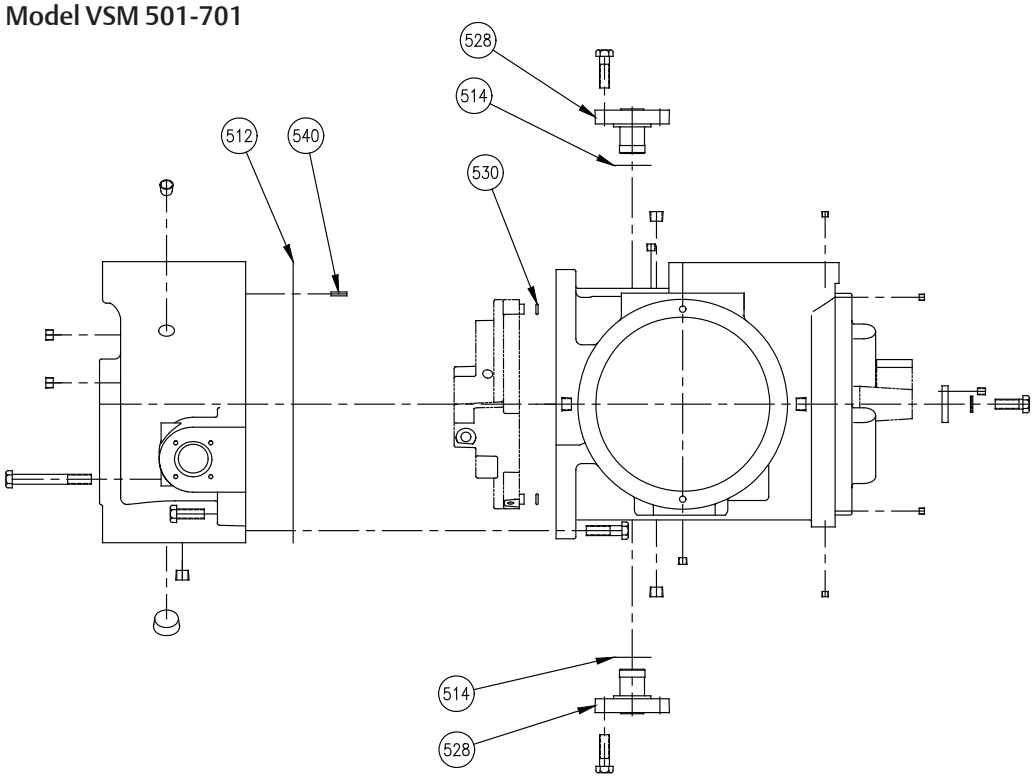
ITEM	DESCRIPTION	MODEL NUMBER VSM 291 thru VSM 601 QTY	VPN	VSS 751 thru VSS 901 VPN	VSS 1051 thru VSS 1201 VPN	VSS 1551 thru VSS 2101 VPN
400	COMMAND SHAFT ASSEMBLY	2	A25994B	A25994C	A25994D	A25994E
401	SLIDEVALVE ACUATOR	2	25972D	25972D	25972D	25972D
446	O-RING SEAL	2	2176X	2176X	2176X	2176X

Miscellaneous Frame Components

Model VSM 301-401



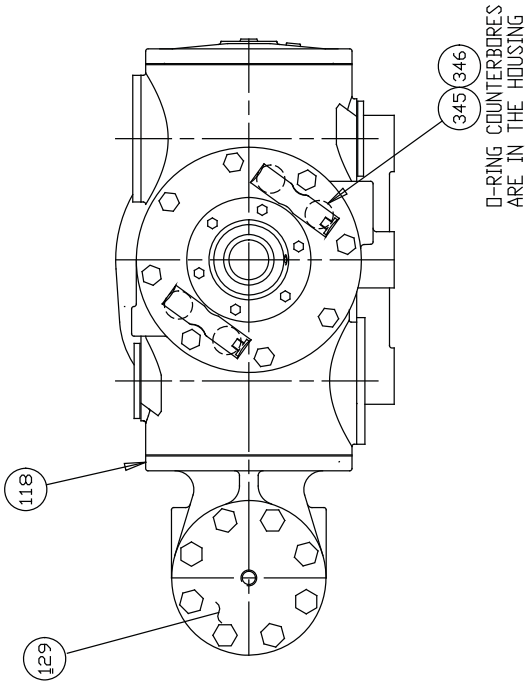
Model VSM 501-701

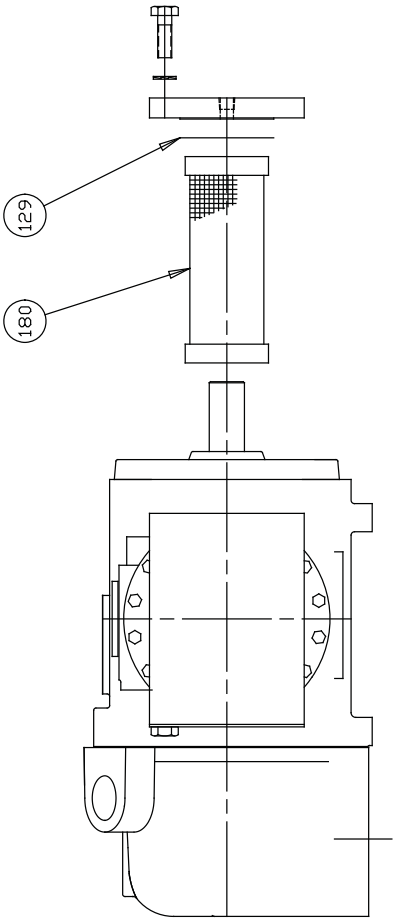


Miscellaneous Frame Components

ITEM	DESCRIPTION	MODEL NUMBER			
		ALL VSM 301-401		ALL VSM 501 - 701	
		QTY	VPN	QTY	VPN
512	MANIFOLD GASKET.	1	25737A	1	26037A
514	ECON-O-MIZER GASKET.	2	11323GG	2	11323D
522	COUPLING LOCK PLATE	N/A		1	25004D
523	LOCK WASHER	N/A		1	3004H
528	ECON-O-MIZER PLUG.	2	25419A	2	25397K
530	O-RING	N/A		2	2176BF
540	DOWEL PIN	2	2868B	2	2868B
542	PIPE PLUG	3	2606C	10	2606B
551	HEX HEAD CAP SCREW	N/A		2	2796C
570	BEARING OIL PLUG	1	25978A	N/A	
571	PLUG	1	25979A	N/A	
572	SPRING	1	3148A	N/A	
*	GASKET / O-RING SET	1	KT1075A	1	KT1075B

Notes. * Not Pictured.





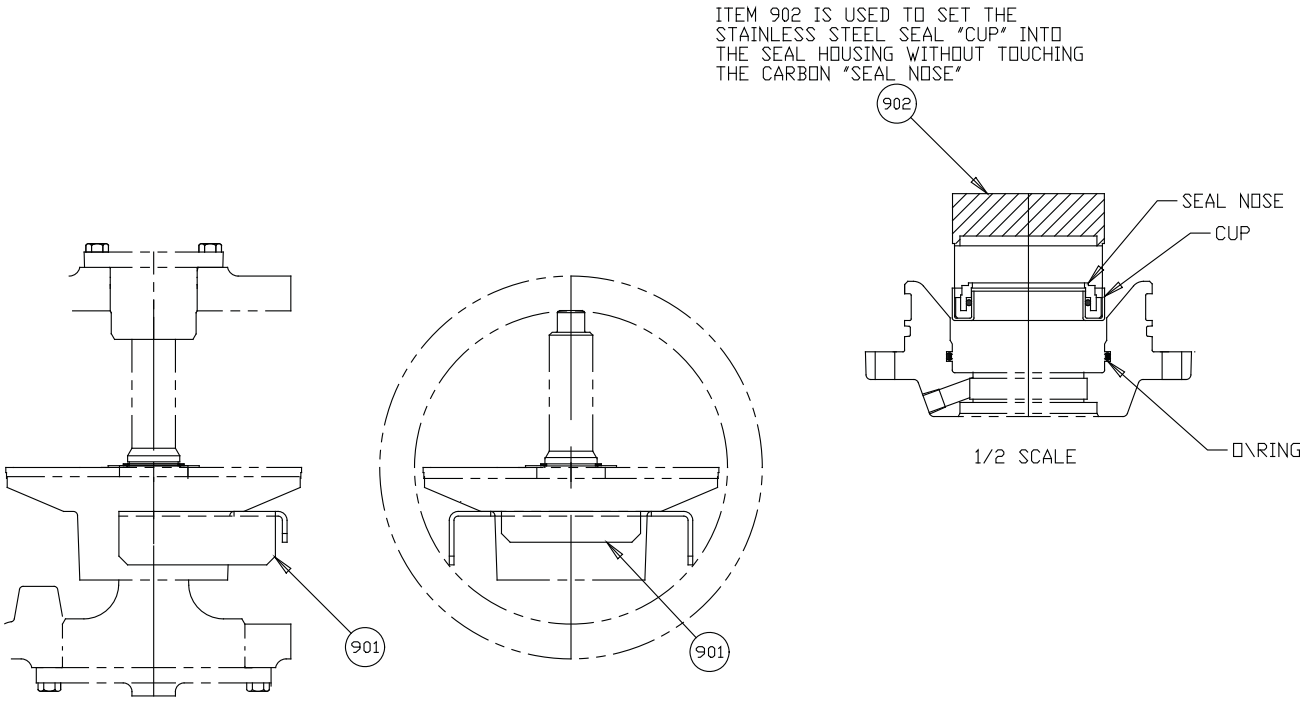
Housing Accessories

Housing Accessories

ITEM	DESCRIPTION	MODEL NUMBER VSM 301 - 701	
		QTY	VPN
117	GATE ROTOR COVER.	1	25416B
118	COVER GASKET.	2	25259B
129	GASKET.	1	11323T
180	INLET SCREEN.	1	25920A
343	PISTON COVER. *	1	25724B

ITEM	DESCRIPTION	MODEL NUMBER VSM 301 - 401		VSM 501 - 701	
		QTY	VPN	QTY	VPN
345	O-RING.	4	2176BX	4	2176CA
346	O-RING.	2	2176BG	2	2176BG

Replacement Tools



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

ICM/ICAD Motorized Valve Setup Instructions

The following items need to be setup in order for the valve to operate properly.

1. Press the “Circle” button on the valve. A value of “01” should be shown on the screen.
2. Press the “Circle” button. There should be a value of “1” shown. If not use the up/down arrows to change it to the correct value. Press the “Circle” button when done.
3. Press the “Up” arrow button. A value of”02” should be shown on the screen.
4. Press the “Circle” button. There should be a value of “1” shown. If not use the up/down arrow buttons to change it to the correct value. Press the “Circle” button when done.
5. Press the “Up” arrow button. A value of “03” should be shown on the screen.
6. Press the “Circle” button. There should be a value of “2” shown. If not, use the up/down arrow buttons to change it to the correct value. Press the “Circle” button when done.
7. Press the “Up” arrow button until a value of “04” is shown on the screen.
8. Press the “Circle” button. There should be a value of “50” shown. If not, use the up/down arrow buttons to change it to the correct value. Press the “Circle” button when done.
9. Press the “Up” arrow button until a value of “07” is shown on the screen.
10. Press the “Circle” button. There should be a value of “1” shown. If not, use the up/down arrow buttons to change it to the correct value. Press the “Circle” button when done.
11. Press the “Up” arrow button until a value of “10” is shown on the screen.
12. Press the “Circle” button. Press the up/down arrow button to change the value to “11”. Press the “Circle” button.

13. Press the “Up” arrow button until a value of “26” is shown on the screen.

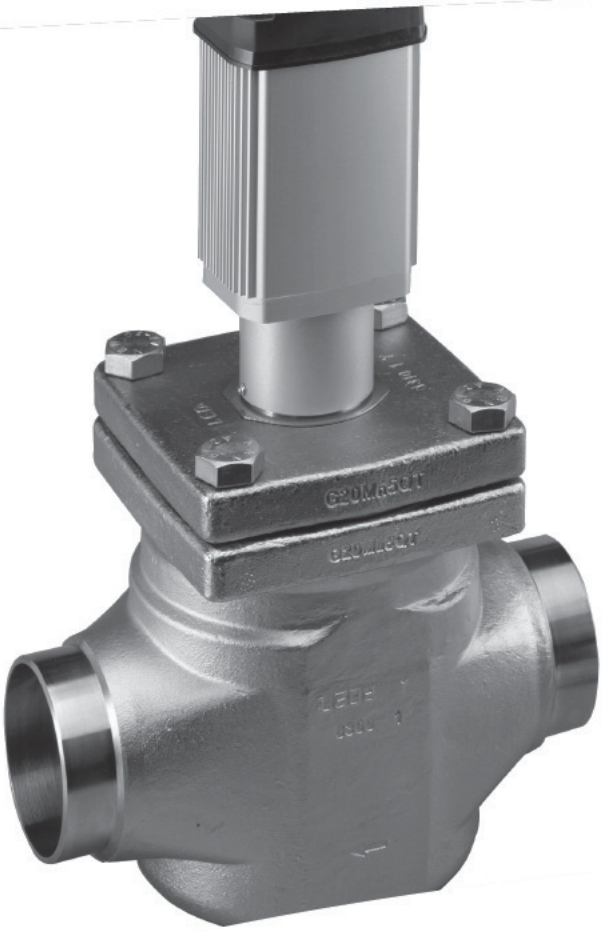
14. Press the “Circle” button. Press the up/down arrow buttons to change the value to the correct valve that is on the unit. The value number is listed on the valve. The values and valves are as follows:

0: No valve selected. Alarm A1 will become active.
1: ICM20 with ICAD 600
2: ICM25 with ICAD 600
3: ICM32 with ICAD 600
4: ICM40 with ICAD 900
5: ICM50 with ICAD 900
6: ICM65 with ICAD 900

15. Press the “Circle” button.

The valve is now ready to be used.

Note:
Refer to the appropriate controller manual for control setup.



ICM/ICAD Motorized Valve

Installation, Programming, and Trouble-shooting

REFRIGERATION &
AIR-CONDITIONING

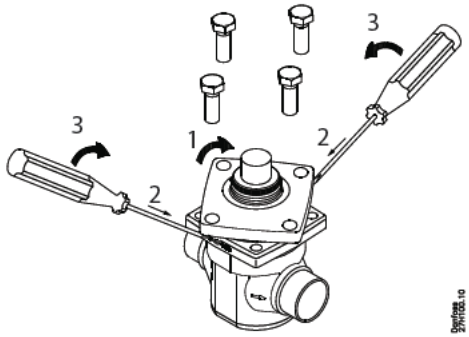
Quick Start Guide

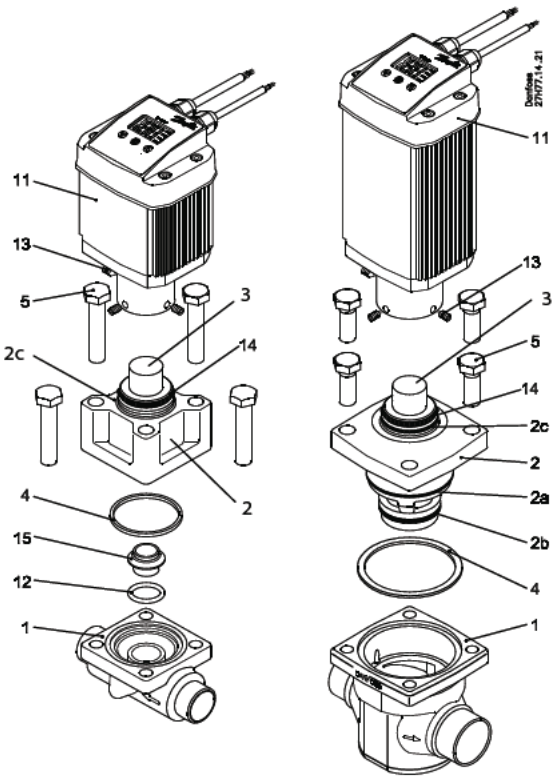
Contents **Page**

Installation

1. The ICM valve and ICAD motor actuator must be installed in horizontal pipelines with the motor actuator pointing upwards.
2. To prevent damage to O-rings and the valve seat, remove the one-piece ICM bonnet and function module from the valve body prior to welding the valve body in the line. For ICM 20 (3/4" size) the valve seat is not integrated with the valve bonnet and must be separately removed from the valve body with a 12 mm hex key prior to welding (see diagrams below).

Removing ICM 25 to 65 bonnets
1) Remove the 4 bolts
2) Rotate the bonnet as shown
3) Pry the bonnet out of the valve body by using screw drivers between the bonnet and valve body as shown





No.	Part description
1	ICM body (housing)
2	ICM bonnet/function module
2a	O-ring for bonnet/function module
2b	O-ring for bonnet/function module
2c	O-ring for sealing ICAD motor with ICM valve
3	ICM adapter/valve stem
4	ICM bonnet gasket
5	Bolts for ICM
11	ICAD motor actuator
12	O-ring for ICM 20 seat orifice
13	ICAD screws
14	Guide ring
15	ICM 20 valve seat orifice

Care should be taken to protect the ICM function module while it is removed from the valve body.

3. Weld the valve body in line making sure the arrow on the valve body is pointing in the direction of flow.
4. Remove all debris from the valve body before re-installing the bonnet.
5. Install the bonnet/function module into the valve body.
   a. For ICM 20, make sure that the removable orifice seat is installed in the valve body with the small O-ring between the orifice seat and body. Make sure the bonnet gasket is installed and in good condition.
   b. For ICM 25 through ICM 65, check that the two O-rings on the bonnet and gasket located between the bonnet and valve body are installed and in good condition. A light coating of refrigerant oil on the bonnet O-rings will facilitate installation of the bonnet.
6. Install the four bolts and torque to the following specifications:

Valve body	Nm	ft lbs
ICM 20	50	37
ICM 25	80	59
ICM 32	80	59
ICM 40	90	66
ICM 50	100	74
ICM 65	110	81

7. Install the ICAD motor actuator on the ICM valve:
   a. The ICM valve must not be in its fully opened position while the ICAD motor is calibrated with the valve at a later step. Therefore, if the opening degree of the ICM valve was changed from the factory setting, it should be set to an opening degree between 0% and 75% using the manual magnet tool. To easily ensure correct positioning, turn the manual tool counter-clockwise until it is clear that it cannot be turned further.
   b. Make sure that the ICM adapter/valve stem and inner ICAD motor magnets are completely dry and free from any debris.
   c. For applications below freezing, the ICM adapter O-ring (position 2c in the diagram on page 3) must be removed, and Molycote G 4500 grease (supplied with ICAD motor) needs to be applied in the O-ring groove on the adapter and on the O-ring before it is re-installed on the ICM adapter. The Molycote grease ensures a good seal between the ICAD motor and the ICM adapter to prevent moisture from entering the ICAD magnets.
   d. Place the ICAD motor on the valve stem.
   e. Push the ICAD motor completely down to the identification ring on the valve stem and use a 2.5 mm hex key to tighten the set screws evenly so the ICAD motor is centered on the ICM adapter (torque: 3 Nm/ 2.5 lb-ft).

Wiring the ICAD

Note: The ICAD is powered by a 24 Volt DC power source.

There are two cables pre-mounted and connected to the ICAD motor actuator. Never try to open the ICAD motor because the special moisture seal will be damaged.

The power cable consists of 3 wires:

- Green: (–) common (ground)
- Brown: (+) positive from 24VDC power source
- White: (+) positive from UPS/battery backup (optional)

The control cable consists of 7 wires:

- Yellow: (–) common (ground)
- Gray: (+) positive 4-20mA or 0-20mA input to control ICAD motor
- Blue: (+) positive 4-20mA or 0-20mA output from ICAD for valve position feedback
- Pink: (+) positive 2-10V or 0-10V input to control ICAD motor. Also used as a digital input with the yellow wire for on/off solenoid valve operation.
- White: common alarm (digital NPN transistor output when combined with yellow wire)
- Brown: indicates ICM is fully open (digital NPN transistor output when combined with yellow wire)
- Green: indicates ICM is fully closed (digital NPN transistor output when combined with yellow wire)

Electrical Data

Supply voltage is galvanically isolated from input and output wires.

Supply voltage
24 V d.c., +10% / -15%
Load ICAD 600: 1.2 A
ICAD 900: 2.0 A

Fail safe supply
Min. 19 V d.c.
Load ICAD 600: 1.2 A
ICAD 900: 2.0 A

Anolog input - Current or Voltage
Current
0/4 - 20 mA
Load: 200 Ω
Voltage
0/2 - 10 V d.c.
Load: 10 kΩ

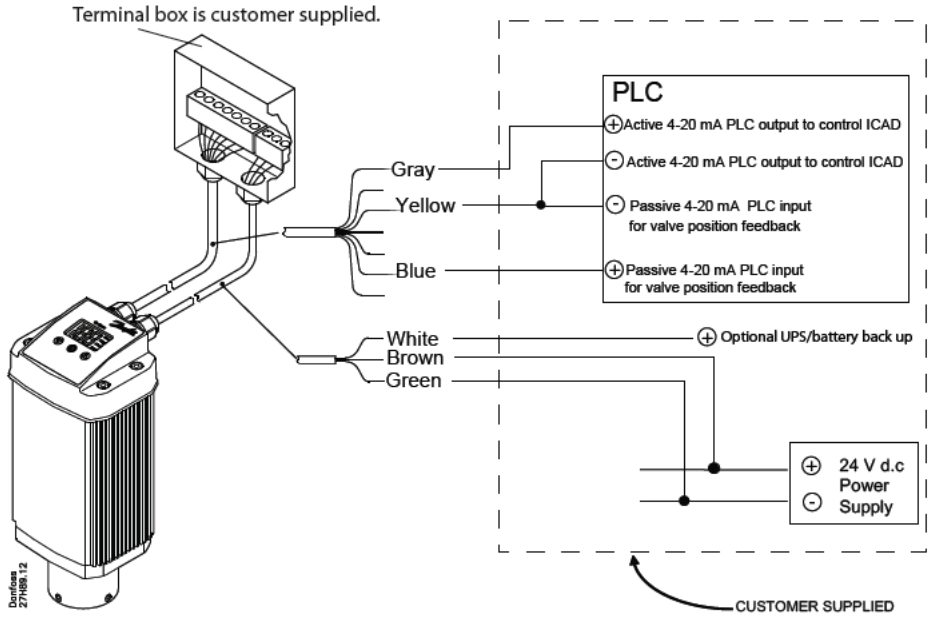
Analog output
0/4 - 20 mA
Load: ≤ 250 Ω

Digital input - Digital ON/OFF input by means of voltfree contact (Signal/Telecom relays with gold-plated contacts recommended) – Voltage input used
ON: contact impedance < 50 Ω)
OFF: contact impedance > 100 kΩ

Digital output - 3 pcs. NPN transistor output
External supply: 5 - 24 V d.c. (same supply as for ICAD can be used, but please note that the galvanically isolated system will then be spoiled).
Output load: 50 Ω
Load: Max. 50 mA

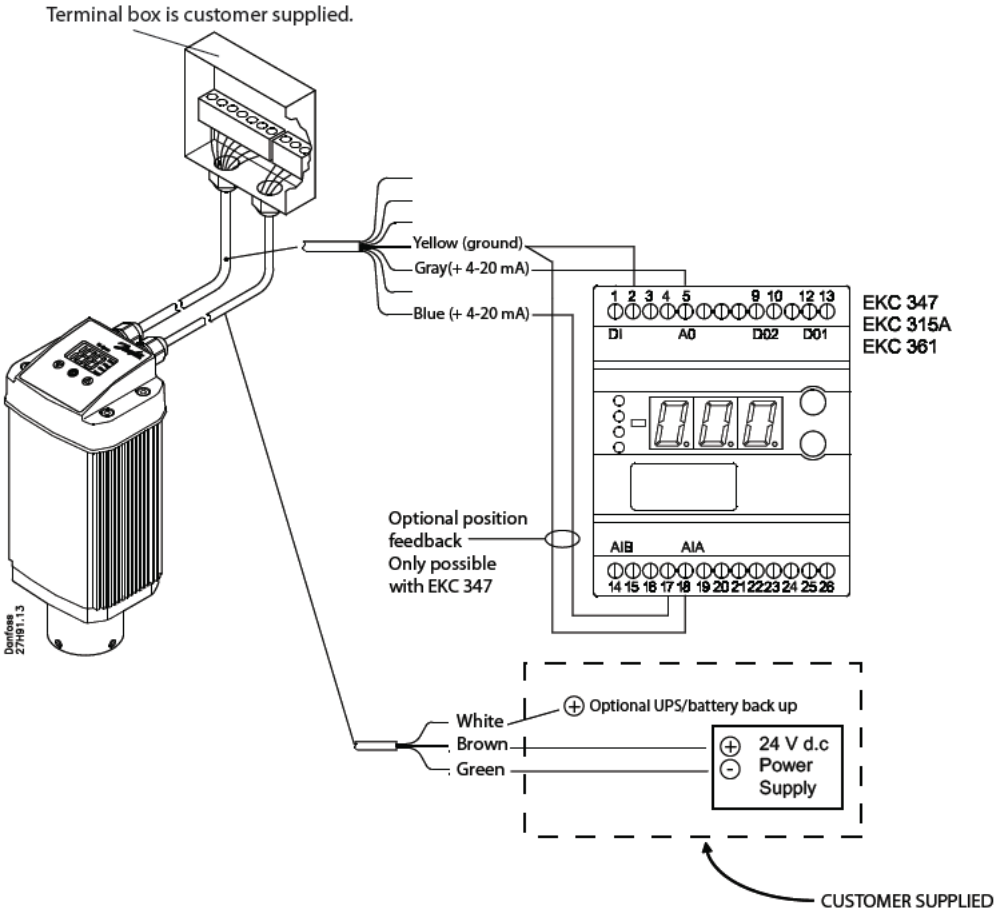
Wiring diagram showing ICAD wired with a PLC or other type of third-party electronics

Note:
The ICAD supplies the power for the 4-20 mA feedback signal.



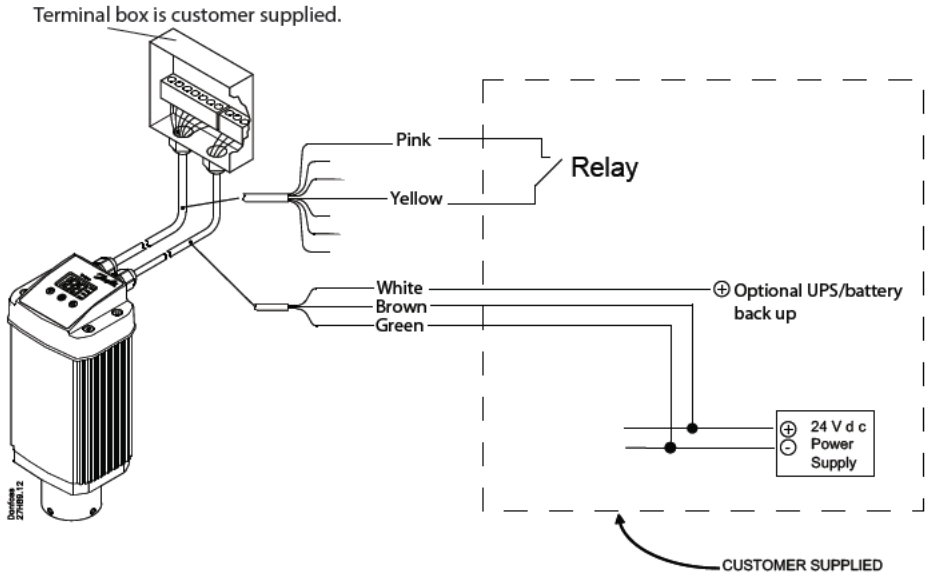
Wiring diagram with Danfoss EKC controllers

Note:
For instructions on completely wiring an EKC controller, please see the relevant EKC controller manual.



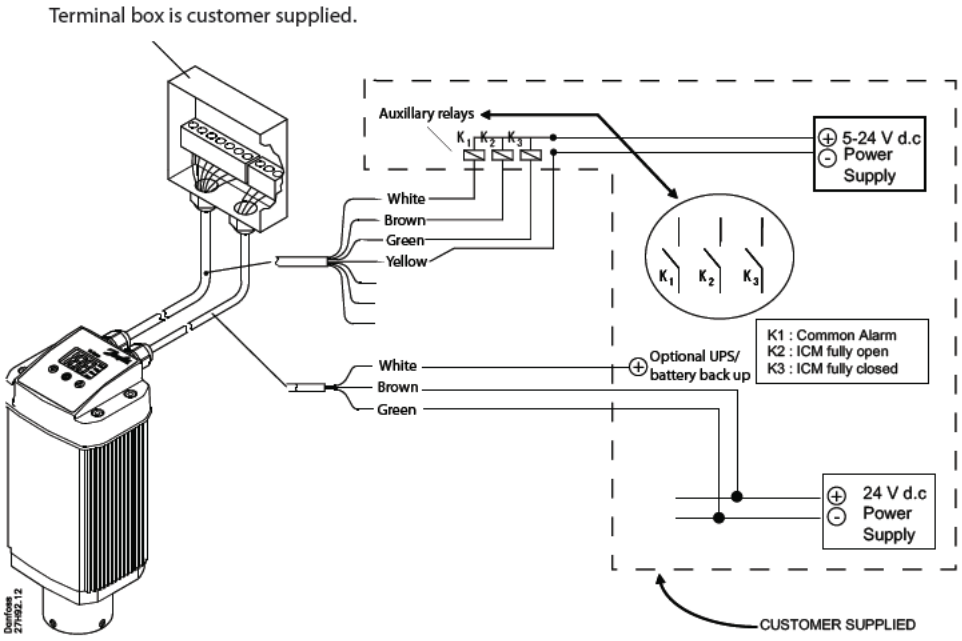
Wiring diagram showing ICAD wired with a digital input for ON/OFF solenoid valve operation

Note:
The ICAD motor can be programmed to open or close when the relay is closed. See parameter ¡09 in programming section.



Wiring diagram showing ICAD digital outputs wired with customer supplied auxiliary relays

Note:
The same 24 Vd.c. power supply that powers the ICAD can be used with the ICAD digital outputs to power auxiliary relays (or other small load devices), but please note that the system will no longer be galvanically isolated.



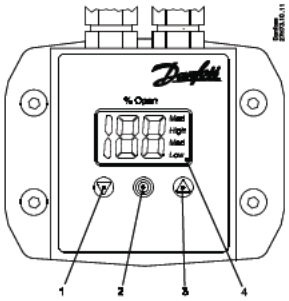
ICAD Overview

Before programming it is important to understand the functionality of the ICAD actuator:

1. The ICAD is a digital stepper motor. As such, it will count steps up and down from the position it believes it is in. Every time, the ICAD is powered on, it will drive itself to the closed position in order to re-establish its base point of reference. It will then move back to the position corresponding to the signal it is receiving from the control wiring.
2. The ICAD can be put into manual mode to move it (using the up and arrows) to a location different from the location that the signal is telling it to be in *(see parameter ¡01, p. 6)*. When in the manual mode, the display screen will be flashing and will continue to flash flashing the % opening of the valve until the ICAD is taken out of the manual mode.
3. The ICAD can be operated in analog mode (for modulating operation) or in digital mode for solenoid operation. The ICAD can receive a variety of control signals *(see parameter ¡03, p. 6)* and can send a valve position output signal to modulate another ICAD or to a PC or PLC for monitoring. *(see parameter ¡06, p. 6)*
4. Because the ICAD is employs a digital stepper motor, its speed can be adjusted to any percentage of full speed through the parameter menu. *(see parameter ¡04, p. 6)*
5. The ICAD can be connected to a 24 VDC UPS (Uninterruptible Power Supply) and can be programmed for actions when the normal power has been cut and the ICAD is operating off of the UPS power. *(see parameter ¡07 and ¡12 , p. 6)*

Operating the ICAD Menu

1. In order to access the menu,
   PRESS and HOLD the middle button (2) until the menu screen appears.



1. Down arrow push button
2. Enter
3. Up arrow push button
4. Display

2. Once you are in the menu, use the up (3) and down (1) arrow keys to move through the list of parameters.
3. To display the current setting of a parameter press the middle button.
   a. To change the value of a parameter setting, use the up or down arrow to establish the new setting while in that particular parameter's display mode.
   b. Once the new setting for a parameter has been selected, push the center button to save the charge and return to the menu.
4. Repeat this procedure for all parameters.
5. Exit from the parameter list by pressing and holding the middle button for 2 seconds. The ICAD will automatically exit if no buttons are pushed for 20 seconds.

Programming the ICAD

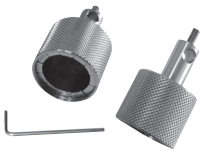
When the ICAD motor is first powered, the ICAD display will flash an A1 alarm. This means that the ICM valve size that is being used with the ICAD motor needs to be selected in parameter **¡26**. Parameter **¡26** is password protected and will not appear in the parameter list until the user enters the password in parameter **¡10**. The password is "11," and will allow the user to access parameter **¡26** where the appropriate valve size is selected. When the ICM valve size is selected, the ICAD will calibrate itself to the ICM valve and will then be ready for control by a 4-20mA signal. For most applications, this is the only programming that will need to be done if the ICAD is going to be controlled by a 4-20mA input.

ICAD Parameters

Description	Display name	Min.	Max.	Factory setting	Unit	Comments
ICM OD (Opening Degree)	-	0	100	-	%	ICM valve Opening Degree is displayed during normal operation. Running display value (see **¡01**, **¡05**).
Main Switch	**¡01**	1	2	1	-	Internal main switch 1: Normal operation 2: Manual operation. Valve Opening Degree will be flashing. With the down arrow and the up arrow push buttons the OD can be entered manually.
Mode	**¡02**	1	2	1	-	Operation mode 1: Modulating – ICM positioning according to Analog Input (see **¡03**) 2: ON/OFF - operating the ICM valve like an ON/OFF solenoid valve controlled via Digital Input. See also **¡09**.
Analog Input signal	**¡03**	1	4	2	-	Type of Analog Input signal from external controller 1: 0 - 20 mA 2: 4 - 20 mA 3: 0 - 10 V 4: 2 - 10 V
Speed at ON/OFF and Modulating Mode	**¡04**	1	100	100	%	Speed can be decreased. Max. speed is 100 % Not active when **¡01** = 2 If **¡02** = 2 the display will indicate speed in display. **Low**, **Med** and **High** also means ON/OFF operation. If **¡04** < = 33, **Low** is displayed 33 < If **¡04** < = 66, **Med** is displayed If **¡04** > = 67 **High** is displayed
Automatic calibration	**¡05**	0	1	0	-	Not active before **¡26** has been operated. Always auto reset to 0. **CA**" will flash in the display during calibration, if Enter push button has been activated for two seconds.
Analog Output signal	**¡06**	0	2	2	-	Type of A0 signal for ICM valve position 0: No signal 1: 0 - 20 mA 2: 4 - 20 mA
Fail safe	**¡07**	1	4	1	-	Define condition at power cut when fail safe is installed. 1: Close valve 2: Open valve 3: Maintain valve position 4: Go to OD given by **¡12**
Digital Input function	**¡09**	1	2	1		Define function when DI is ON (short circuited DI terminals) when **¡02** = 2 1: Open ICM valve (DI = OFF = > Close ICM valve) 2: Close ICM valve (DI = OFF = > Open ICM valve)
Password	**¡10**	0	199	0	-	Enter number to access password protected parameters: **¡26** Password = **11**
Old Alarms	**¡11**	A1	A99	-	-	Old alarms will be listed with the latest shown first. Alarm list can be reset by means of activating down arrow and up arrow at the same time for 2 seconds.
OD at powercut	**¡12**	0	100	50	-	Only active if **¡07** = 4 If fail safe supply is connected and powercut occurs ICM will go to entered OD.
ICM configuration	**¡26**	0	6	0		**NB:** Password protected. Password = **11** At first start up **A1** will flash in display. Enter valve type 0: No valve selected. Alarm **A1** will become active. 1: ICM20 with ICAD 600 2: ICM25 with ICAD 600 3: ICM32 with ICAD 600 4: ICM40 with ICAD 900 5: ICM50 with ICAD 900 6: ICM65 with ICAD 900

Troubleshooting

The Manual Tool



The manual tool should always be ordered with any ICM/ICAD assembly. This tool gives the user the ability to remove the ICAD actuator and manually rotate the valve in the open or close direction depending on need and application. When using the manual tool, a clock-wise rotation will open the valve and a counter-clockwise rotation will close the valve.

NOTE:
It is very important to remember that when rotating the valve manually you are changing the position from that in the actuator's memory. If power is removed from the actuator prior to using the manual tool, no problem will occur because, once the ICAD is powered up again, it will automatically recalibrate to the fully closed position before returning to the position in memory to which the control signal last set the valve. This recalibration will not occur if power is not removed from the ICAD prior to using the manual tool, and erroneous operation will likely occur. Always remove power before using the manual tool, and restore power afterward to ensure recalibration and trouble-free operation.

Service Parameters

The user will be able to troubleshoot and determine many of the conditions and set points within the ICAD by accessing the Service Menu. A list of those service parameters follows below:

Service Menu

Description	Display name	Min.	Max.	Unit	Comments
OD %	**¡50**	0	100	%	ICM valve Opening Degree
AI [mA]	**¡51**	0	20	mA	Analog Input signal
AI [V]	**¡52**	0	10	V	Analog Input signal
AO [mA]	**¡53**	0	20	mA	Analog Output signal
DI	**¡54**	0	1	-	Digital Input signal
DO Close	**¡55**	0	1	-	Digital Output Closed status. ON when OD < 3 %
DO Open	**¡56**	0	1	-	Digital Output Open status. ON when OD > 97 %
DO Alarm	**¡57**	0	1	-	Digital Output alarm status. ON when an alarm is detected
MAS mP SW ver.	**¡58**	0	100	-	Software version for MASTER Microprocessor
SLA mP SW ver.	**¡59**	0	100	-	Software version for SLAVE Microprocessor

It is also possible to restore the original factory settings to the ICAD by the following procedure:

To restore factory settings:
1. Remove the power supply.
2. Activate down arrow and up arrow push buttons at the same time.
3. While holding the up and down arrow reconnect the power supply.
4. Release down arrow and up arrow push buttons.
5. When the display on ICAD is alternating between showing: **CA** and **A1** the factory resetting is complete.

Alarms

There are a number of alarms which are excellent indicators of improper installation or set-up:

Description	ICM alarm text	Comments
No valve type selected	**A1**	At start-up **A1** and **CA** will be displayed
Controller fault	**A2**	Internal fault inside electronics
Input error	**A3**	Not applicable if ¡**01** = 2 or ¡**02** = 2 When ¡**03** = 1 and AI > 22 mA When ¡**03** = 2 and AI > 22 mA or AI < 2 mA When ¡**03** = 3 and AI >12 V When ¡**03** = 4 and AI >12 V or AI < 1 V
Low voltage of fail safe supply	**A4**	If 5 V d.c. < Fail safe supply < 18 V d.c.
Check Supply to ICAD	**A5**	If supply voltage < 18 V d.c.

Troubleshooting Tips

Problem	Possible cause and solution
The valve is not working and an A1 is flashing in the display.	The ICM valve size was not selected in parameter ¡**26**. See the programming section on page 9.
The valve does not appear to be opening or closing properly	1. The ICAD was not mounted properly on the valve stem. ***Solution:*** Check to make sure that the ICAD was mounted evenly on the ICM valve 2. The ICAD is not receiving a proper input signal. ***Solution:*** Use the service parameters (¡**51** for a mA input or ¡**52** for a voltage input) to check the input signal that the ICAD is receiving.
The valve position feedback signal is not working when using customer supplied controller/PLC	1. A power supply was installed in the 4-20mA/0-20mA feedback loop. The ICAD motor actuator supplies the power for the 4-20mA/0-20mA feedback loop. ***Solution:*** Remove any power source that may be supplied to the feedback loop. 2. Wiring problem. ***Solution:*** Check the service parameter ¡**53** to see what the ICAD is outputting. If this does not reveal anything, check the current output (yellow and blue wires in ICAD control cable) with an ammeter. 3. The feedback output signal was turned off in parameter ¡**06**. ***Solution:*** Check to make sure the setting in parameter ¡**06** is correct.
For all other problems, contact Danfoss.	

Common Questions

What happens in the event of a power failure?

The ICAD will remain in the position it is in when power is lost. There are two ways to address this condition:

- Add a UPS (Uninterruptible Power Supply) to the power wiring. This is easily accomplished with the green and white wires in the power cable. A UPS is available from Danfoss. The UPS can provide service for up to 9 ICAD 600's or up to 6 ICAD 900's.

Note: The UPS is not a continuous power supply. It is used to change the valve position (usually to close the valve) in the event of a power failure. Therefore, the system is not to be run in the UPS mode.

- Add a solenoid valve in front of the ICM. This is a very simple solution provided that there is no issue associated with the additional pressure drop through the solenoid valve.

How much power do I need to supply to the ICAD?

The total power required depends on both the ICAD size and the number of ICAD's powered by the DC power supply. The power for each ICAD is:

- For the ICAD 600 (used on ICM 20, 25, and 32), the power requirement is approximately 30 W
- For the ICAD 900 (used on ICM 40, 50, and 65), the power requirement is approximately 50 W

How can I monitor the valve position remotely?

The control wiring provides for a 4 to 20 mA or 0 to 20 mA signal output (blue and yellow wires). This signal can be sent to:

- A remote display
- A PLC or PC
- Another ICAD motor to give the same opening position

Danfoss · Refrigeration & Air-Conditioning Division · 7941 Corporate Drive · Baltimore, MD 21236
Ph 410-931-8250 · Fax 410-931-8256 · E-mail: baltimore@danfoss.com · Internet: www.danfoss.com/North_America

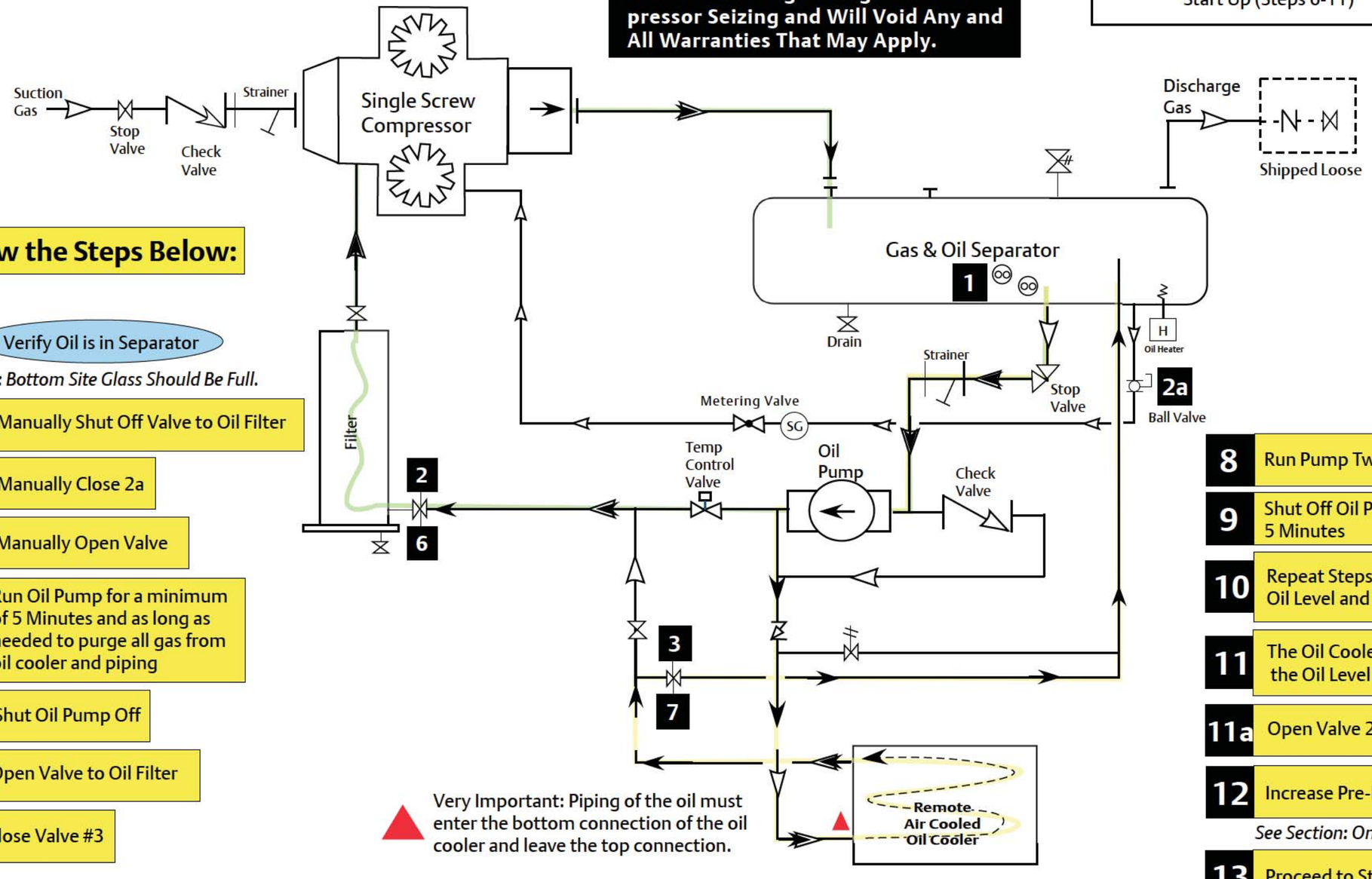
▲ Remote Coolers Only

Pre Start Up for Proper Oil Separator Level and to Prime the Cooler

▲ WARNING

Failure to Follow These Steps Will Result in Bearing Damage and Compressor Seizing and Will Void Any and All Warranties That May Apply.

Shows the Flow for Priming the Oil Cooler (Steps 1-5)
Shows the Flow for Priming the Compressor Prior to Start Up (Steps 6-11)



▲ Very Important: Piping of the oil must enter the bottom connection of the oil cooler and leave the top connection.

Follow the Steps Below:

1. Verify Oil is in Separator
   Note: Bottom Site Glass Should Be Full.
2. Manually Shut Off Valve to Oil Filter
2a. Manually Close 2a
3. Manually Open Valve
4. Run Oil Pump for a minimum of 5 Minutes and as long as needed to purge all gas from oil cooler and piping
5. Shut Oil Pump Off
6. Open Valve to Oil Filter
7. Close Valve #3
8. Run Pump Two Times for Only 1-2 Minutes
9. Shut Off Oil Pump and Wait an Additional 5 Minutes
10. Repeat Steps 2-9 Until Oil Separator is at Proper Oil Level and Oil Cooler is Primed
11. The Oil Cooler is Considered Primed When the Oil Level (Separator) is Constant
11a. Open Valve 2a
12. Increase Pre-Lube Time to 10 Seconds
    See Section: On Set Points In Compact Logix Manual.
13. Proceed to Start-Up
    See Section: On Start Up Check List In Manual.

▲ IMPORTANT! FOR REMOTE OIL COOLERS ONLY. READ BEFORE PROCEEDING.