MYCOM VR Series Screw Compressor

Overhaul Manual

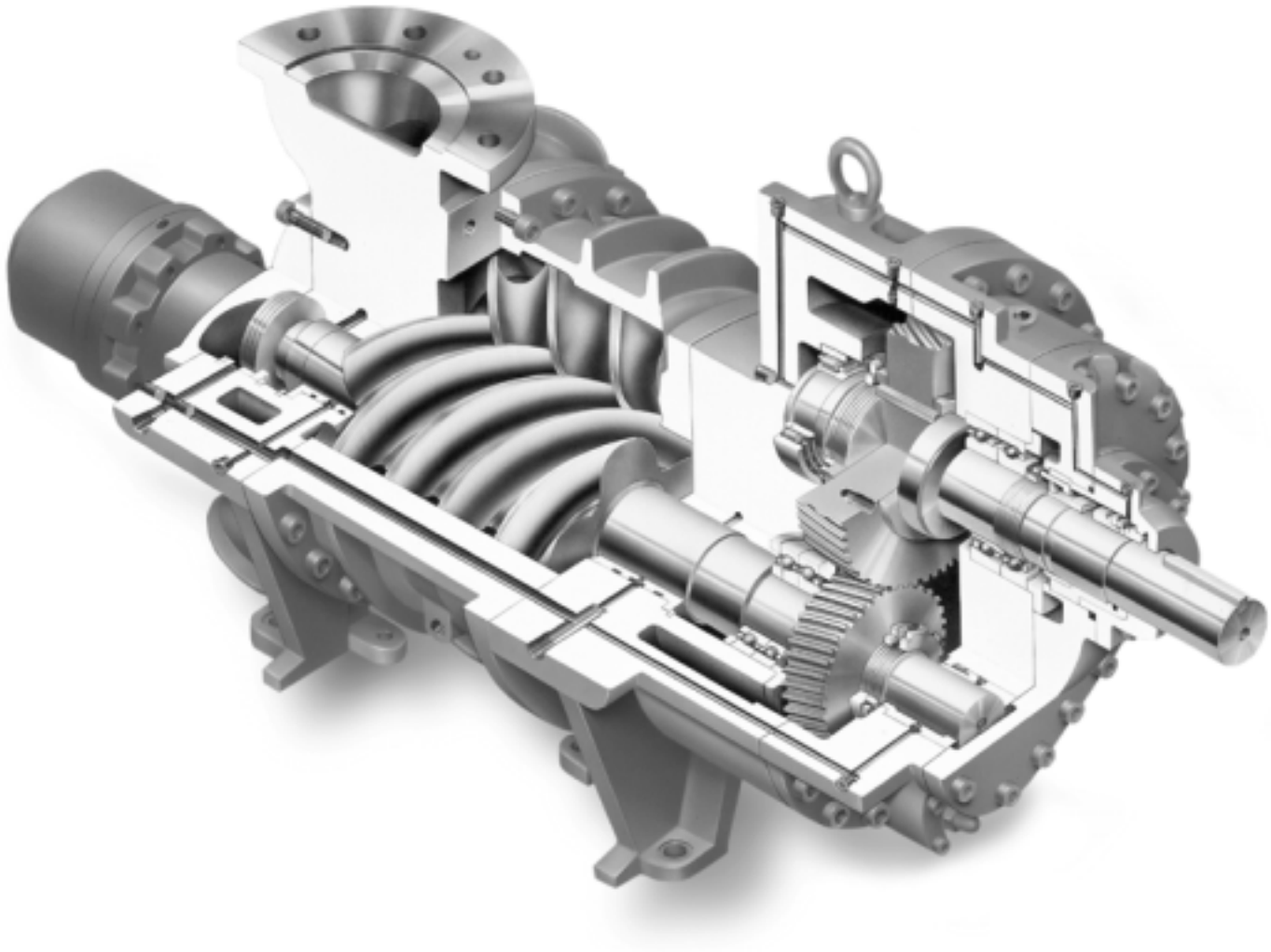
1.0 Introduction

The MYCOM VR-Series Screw Compressor (referred to hereafter as the “VR Series”) incorporates numerous improvements. A variable Vi mechanism allows these compressors to be adjusted readily for most operating conditions and a new tooth profile (0 profile) has been introduced to further improve performance.

The basic construction of the VR Series is the same as standard V Series MYCOM compressors except for the addition of the integral speed increasing gearbox.

The operator should have a thorough knowledge of the compressor and the system it is incorporated into before attempting to disassemble the unit for inspection. Read this instruction manual carefully before undertaking any work on the system.

This screw compressor is classified as a positive displacement rotary type. It compresses gas continuously using the volume change between two rotating screw profile rotors. Gas is trapped in the clearance between the two mated rotors and pressure increased by decreasing the volume. The gas is then discharged as a high-pressure gas



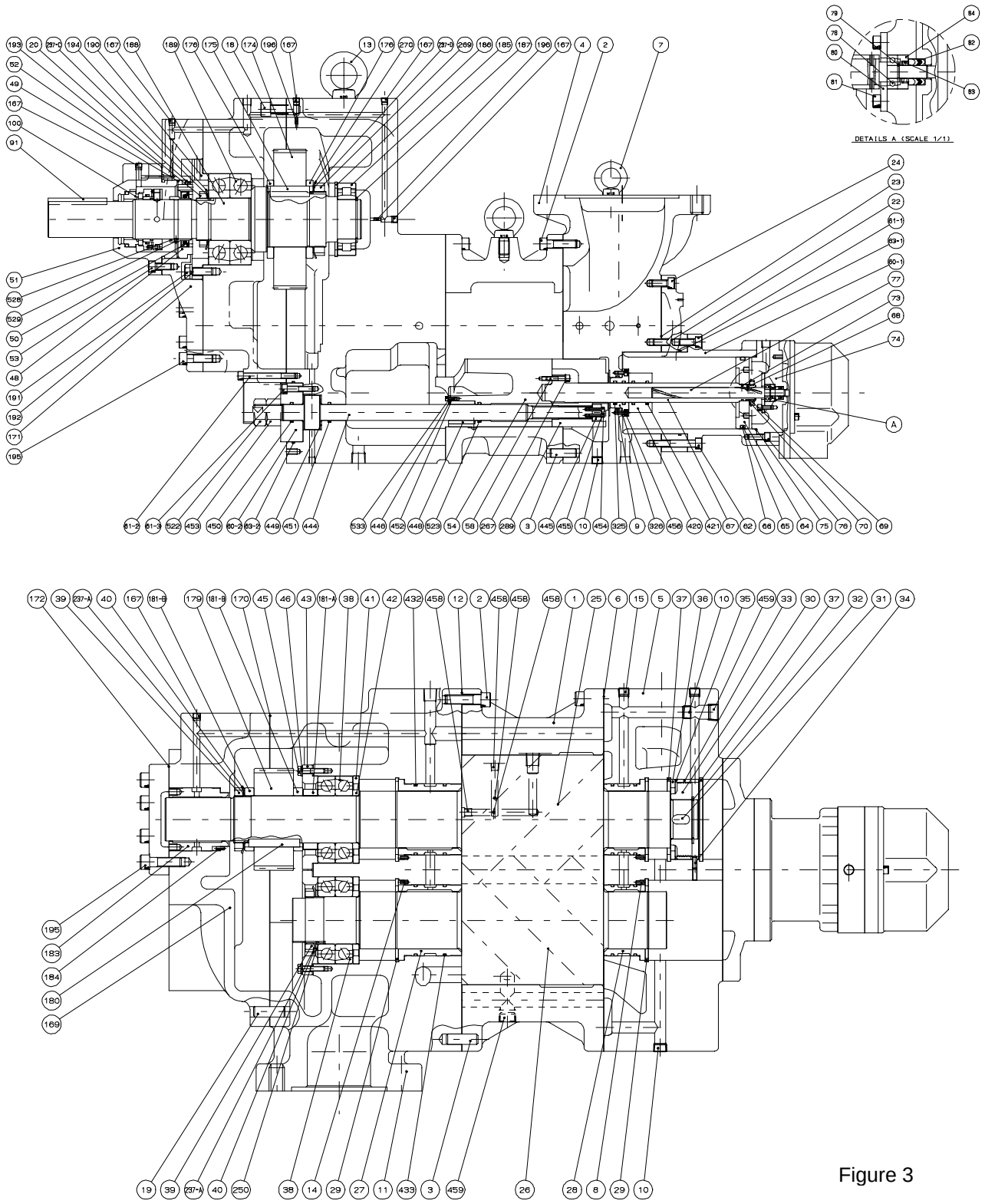


Figure 3

2.3 Longitudinal Assemblies 200VR and 200VRD

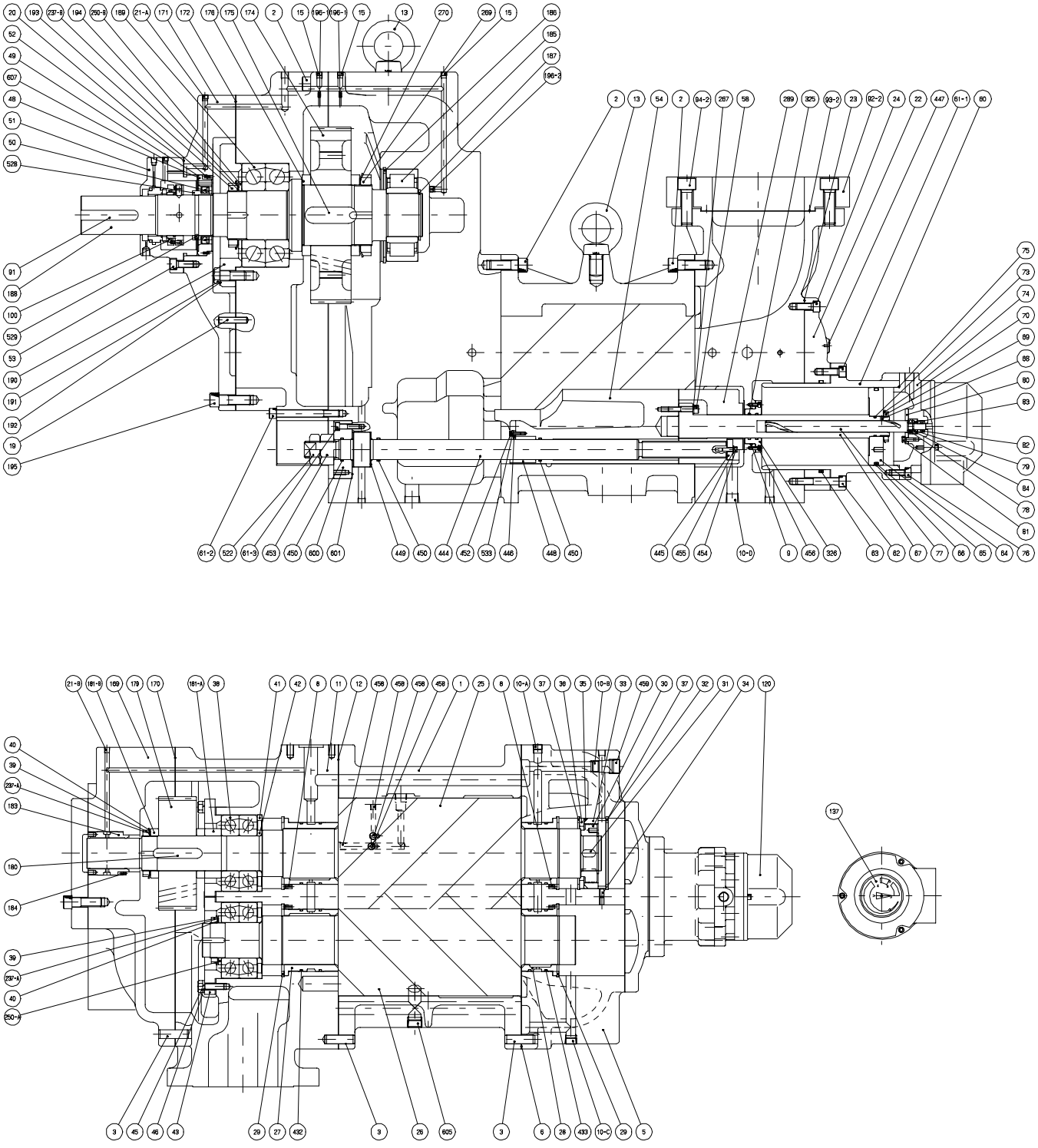


Figure 4

2.4 Longitudinal Assemblies 250VR and 250VRD

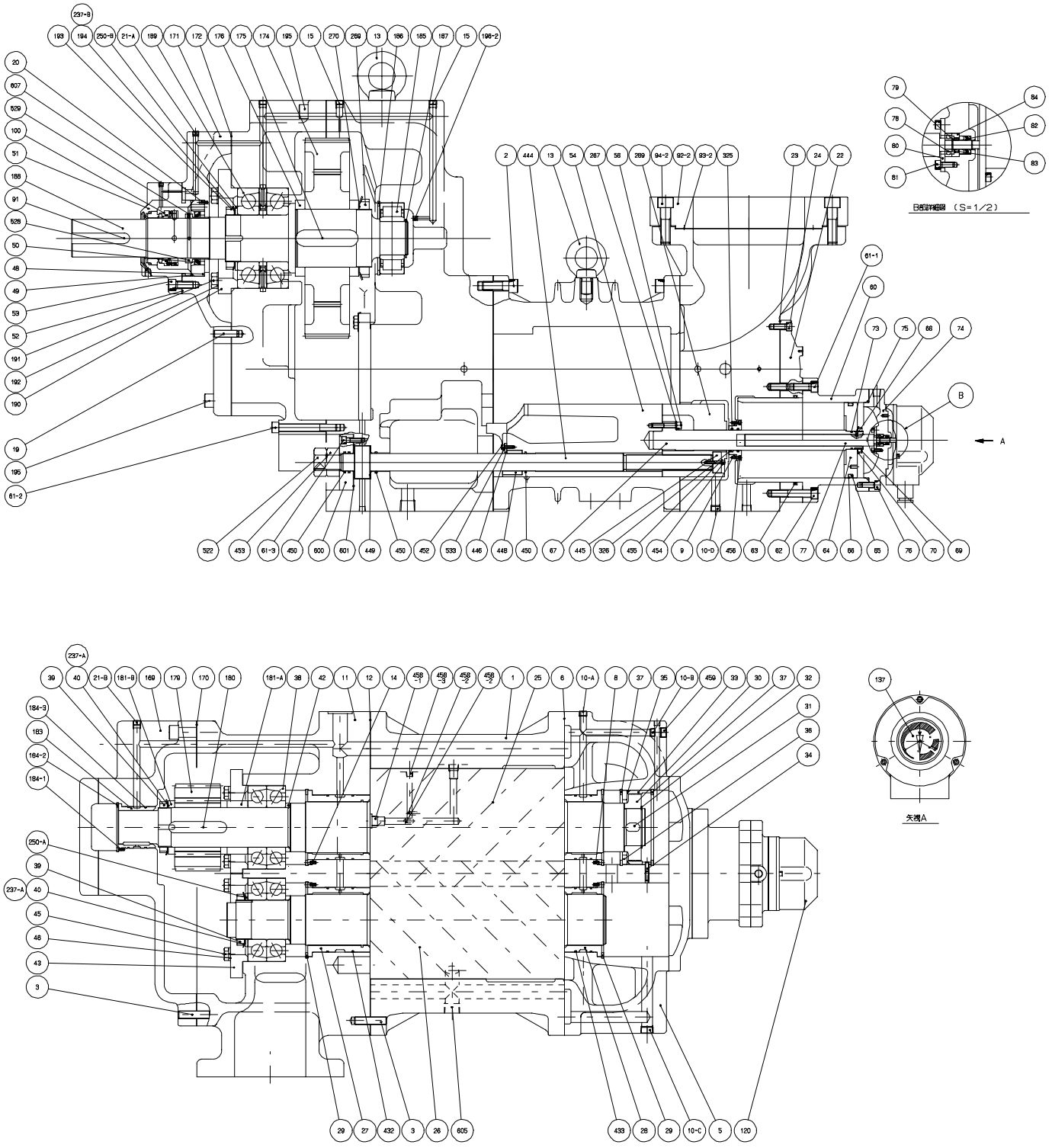


Figure 5

2.5 Disassembly of VR-Series

2.6 Preparations for Disassembly

Disassembly work on a base-mounted compressor unit is limited to the shaft seal; thrust bearing, unloader cylinder and balance piston section. Disassembly and inspection work on other parts of the compressor should be done with the unit removed from the base and positioned for maximum access and ease of disassembly.

Disassembly and inspection work as well as handling of compressor parts should only be undertaken after carefully reading the instructions given in this manual.

2.6.1 Special Tools (ref. Last Page)

Common hand tools such as a hammer, monkey wrench, file, scraper, sandpaper (fine grain) as well as the hand tool kit supplied with the compressor should be prepared prior to commencing disassembly work. In addition cleaning fluid, fresh lubricating oil, and waste cloth should be available.

Work is best performed on a large surface plate positioned on a suitably large workbench.

If a surface plate is unavailable, a steel plate having dimensions of at least 800 mm x 1,000 mm and supported on a low stand is a good substitute.

Needless to say, work should be performed in a location that is well lit, dry and free from sand and dust.

2.7 Removing Compressor

2.7.1 Removing Gas

Gas under high pressure is sealed up to the check valve of the screw compressor unit. Before the compressor is removed from the base, internal pressure should be reduced to atmospheric pressure.

The methods for reducing pressure inside the compressor vary according to the type of system. In most cases of natural gas systems, the packager’s method should be used to maintain safe atmospheric discharge.

2.7.2 Disconnecting Auxiliary Equipment

Disconnect parts such as the drive coupling, suction/discharge piping, lubrication piping and other pipes such as those for liquid injection and the economizer as well as all control wiring and mounting bolts.

∗When removing piping, a drain pan should be positioned under the joint being loosened to catch oil drips.

2.7.3 Raising and Removing Compressor

The weight of the suction piping bears on the suction port of the compressor. After removing the bolts securing the pipe to the port, suspend the suction piping and cover the suction port flange.

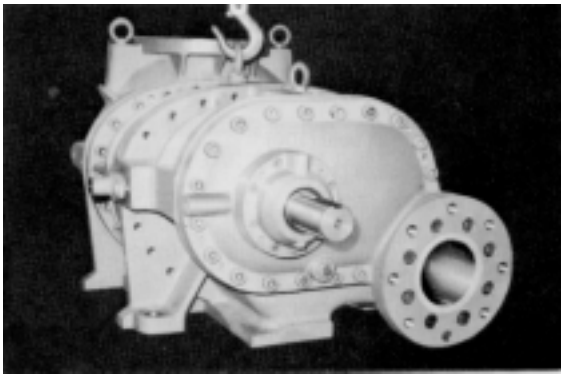


Fig. 6 Lifting the Compressor

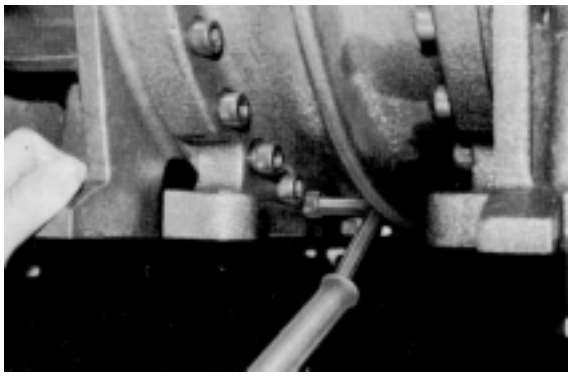


Fig. 7 Lower cover Bolt

Lift the compressor and remove the 6~8 bolts (2) that secure the bearing head, suction cover and rotor casing before placing the compressor on the workbench. These bolts cannot be accessed once the compressor is sitting on the workbench.

Since the compressor and its component parts are heavy, the disconnection and lifting work involves some danger. Take all necessary safety measures and arrange to support the compressor on matching steel stands or square timbers (100 mm x 100 mm).

2.8 Disassembly Sequence

Disassembly and inspection of VR-Series compressors should be carried out according to the following work sequence.

Disassembly Sequence

1) Mechanical shaft seal (100)
2) Unloader indicator (139)
3) Unloader cover (74)
4) Unloader piston (64) and cylinder (60)
5) Blind cover (22)
6) Balance piston (30)
7) Gear casting (169), casting cover (171) and Vi adjusting rod (444)
8) Thrust bearing (38)
9) Suction cover (5) and side bearing (28)
10) Rotors (25,26) and rotor casing (1)
11) Slide valve for variable Vi (289) and unloader slide valve (54)
12) Bearing head (11) and main bearing (27)

2.8.1 Mechanical Seal (100)

2.8.1.1 Disassembly

A new balance type single seal (100) is incorporated into VR-Series compressors. A combination hard metal and carbon alloy is used for the frictional surface of the seal and an O-ring is provided for packing.

As shown in Fig. 9, the balance type mechanical seal functions well under a wide range of conditions.

An oil seal (50) is fitted to the inside of the seal to act as an oil retainer. Because the frictional portion of the seal is subject to wear due to the rapid rotation of the shaft, a collar (109) is provided for the friction portion on models 200~250 so that the friction portion can be replaced.

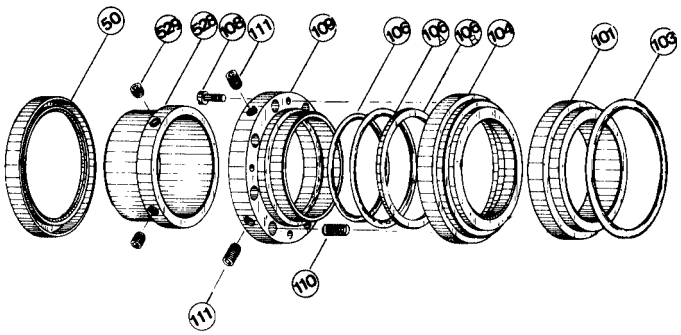


Fig. 8 Exploded View of Mechanical Seal (100)

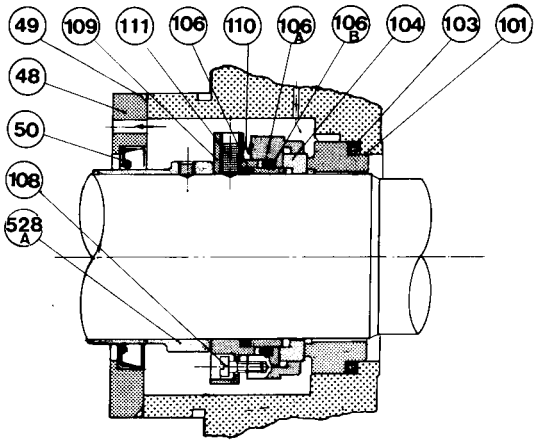


Fig. 9 Cross Section of Mechanical Seal (100)

Component parts of mechanical seal assembly

(48)	Seal retainer	(104)	Seal ring	(110)	Spring
(49)	O-ring	(106A)	O-ring	(111)	Set screw
(50)	Oil seal	(106B)	O-ring	(528)	Sleeve, oil seal
(101)	Carbon insert	(108)	Drive pin	(529)	Socket detent screw
(103)	O-ring	(109)	Shaft seal collar		

a) Remove four of the six hex-head socket cap screws (53) securing the seal cover (51), leaving two screws symmetrically positioned. Now loosen the remaining two screws alternately, allowing the shaft seal spring (110) to push off the cover slightly. If the cover adheres to the gasket, free it manually after the screws have been loosened.

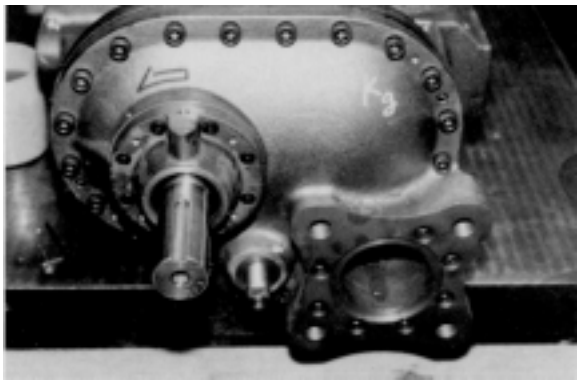


Fig. 10 Seal Cover Portion

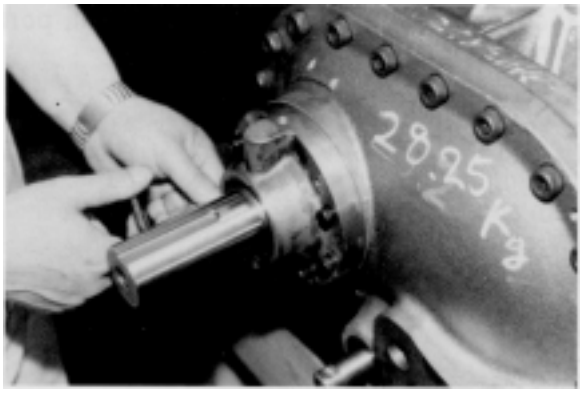


Fig. 11 Removing Seal Cover (51)

b) Remove the seal cover. The carbon insert (101) is fitted inside the cover. Draw the cover out over the end of the shaft being careful to prevent the carbon from hitting against the shaft.

Next, remove the O-ring (49) between the seal cover (51) and the seal retainer (48).

c) After the seal cover has been removed, wipe the shaft off and inspect it closely.

If any scratches are observed on the shaft surface, finish with fine emery paper in order to prevent damaging the O-ring when it is pulled out of the seal.

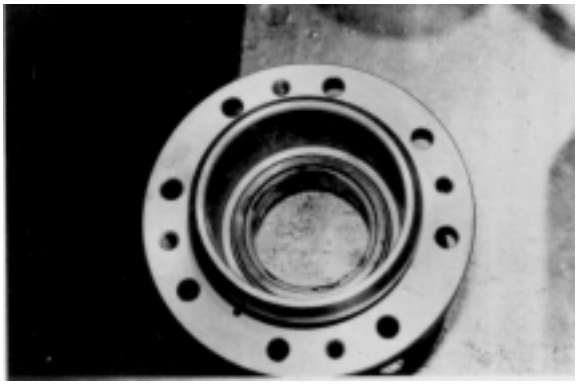


Fig. 12 Shaft Seal Cover (51)

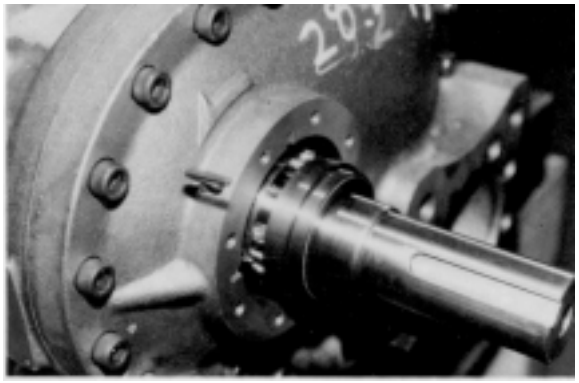


Fig. 13 Loosening Seal Collar Set Screws

d) Loosen the setscrews (111) securing the shaft seal collar (109). In the case of Model 160, the plugs must first be removed from the bearing cover before a hex wrench can be inserted.

In the case of model 200 and above, start from the seal cover disassembly procedure.

Loosen the setscrews 3~4 turns (do not remove completely) until the end clears the shaft and enters the seal collar.

e) Grasp the seal collar (109) with your fingertips and withdraw carefully, making sure that the setscrew points do not catch on the shaft and scratch it.

f) Insert two eye bolts into the screw holes in the seal retainer (48) and draw it off parallel to the shaft. Be careful not to slant the retainer when withdrawing.

g) Remove the sleeve of the oil seal (528) after loosening the two setscrews (529).

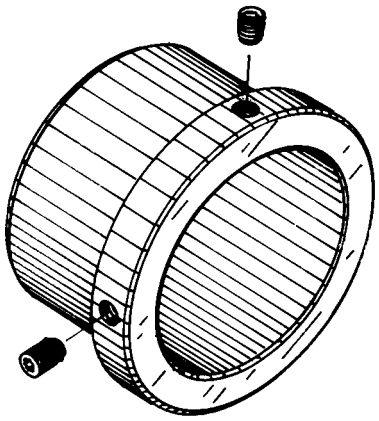


Fig. 14 Oil Seal Sleeve

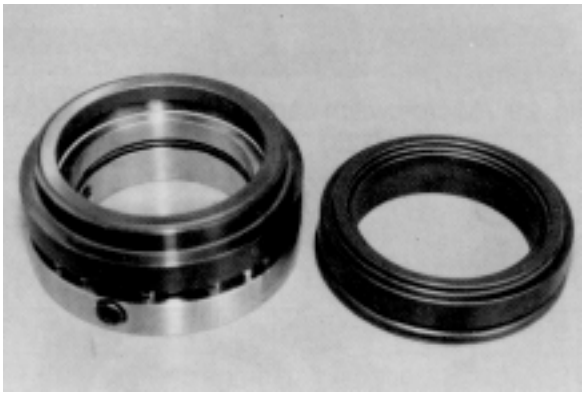


Fig. 15 Shaft Seal Assembly

2.8.1.2 Inspection

a) Inspect the frictional surfaces of the carbon and seal ring (104). A carbon with a smooth, unblemished face can be reused but if there are any signs of damage or peeling, replace the carbon, otherwise oil leakage may result.

b) Inspect the O-rings. With Freon refrigerant systems, the O-rings may suffer from swelling or deformation. If any abnormality is observed in an O-ring, replace it. A total of four O-rings are used for the seal cover, seal carbon and seal collar.

c) Inspect the frictional surface of the oil seal sleeve (528). If any wear is found, replace the oil seal and the sleeve with new parts. Since the oil seal is specially designed for the compressor, only genuine parts should be used.

d) If the seal cover gasket (527) proves difficult to remove when the seal is being disassembled, replace with a new one.

2.8.2 Unloader Indicator

The unloader indicator shows the position of the unloader slide valve (54) based on conversion of the angle of rotation of the cylinder cam (77) to an electric signal. Two types of unloader indicator are available. One is a contact resistance potentiometer type and the other is a non-contact electronic type. Both are used for the same purpose as a rule. An explosion-proof indicator is also available as an option for special applications.

2.8.2.1 Removing Unloader Indicator Assembly

When disassembling the compressor, the unloader indicator should be removed as an assembly.

a) Detach the wiring to the unloader indicator and remove the three hex-head (147) securing the indicator cover (146)

b) The indicator cover, glass (141) and glass spacer (142) can now be removed. Be careful not to drop the glass or glass spacer.

c) The micro-switch cam (127) or coupling which connects the potentiometer or magnetic turntable and cylinder cam is located on the unloader cover side. Loosen the fixing screws (128) to free the cylinder cam.

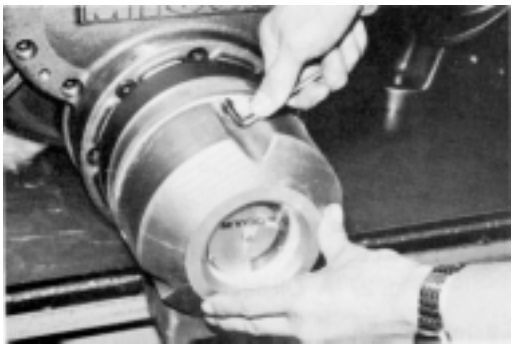


Fig. 16 Removing Indicator Cover

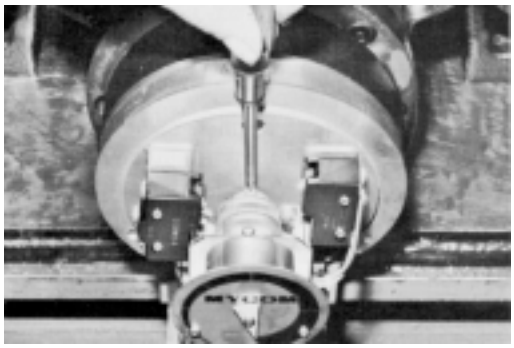


Fig. 17 Micro-switch Cam (127) and Coupling fixing screws (128)

d) Remove all of the hex socket head cap screws (122) securing the micro-switch base plate (121) to the unloader cover.

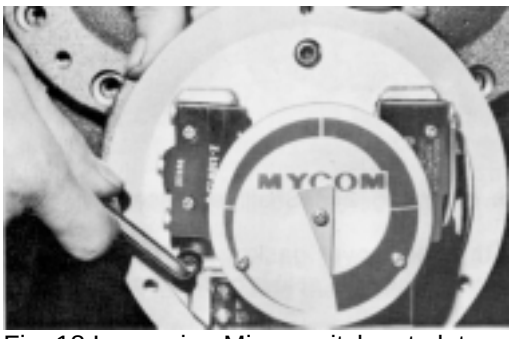


Fig. 18 Loosening Micro-switch set plate screws

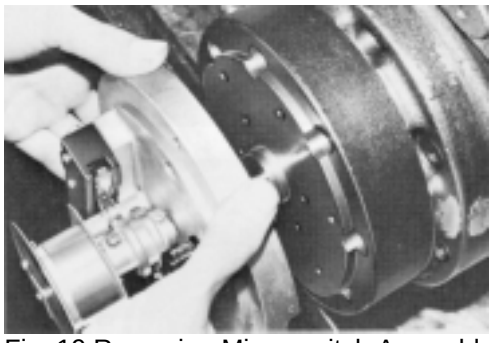


Fig. 19 Removing Micro-switch Assembly

e) Draw out the unloader indicator parallel to the cylinder cam.

2.8.3 Unloader Cover (74)

The cylinder cam (77), shaft bearing (78) and seal are mounted in the unloader cover (74) provided at the end of the unloader cylinder (60). It is not necessary to disassemble these parts unless there is some abnormality (e.g., seal leakage or cylinder cam groove wear).

2.8.3.1 Disassembly

a) Remove the hex-head socket cap screws (76) securing the unloader cover (174) to the cylinder (60).

b) The cylinder cam (77) fixed to the cover is fitted in the bore of the unloader push rod (67) and the cam groove mates with the push rod pin. Pull of the cover parallel to the cylinder center.

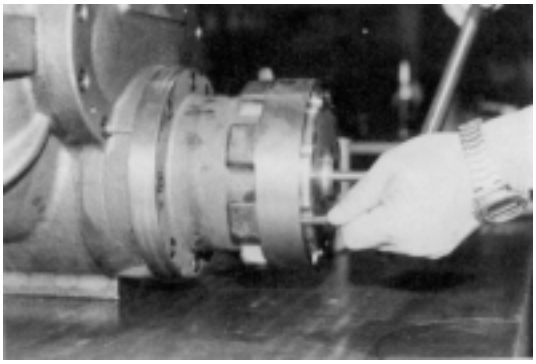


Fig. 20 Removing Unloader Cover Bolts

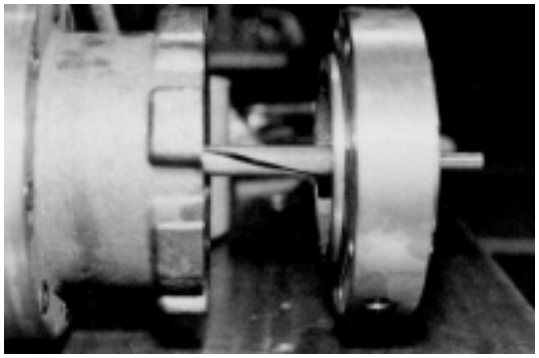


Fig. 21 Unloader Cover (74) and Cylinder Cam (77)

2.8.3.2 Inspection

a) If the indicator is not actuating normally, check the cylinder cam groove, bearing and slotted pin (unloader push set side) for abnormality.

b) If there is refrigerant or oil leakage, replace the Teflon V-ring (82).

In such a case, the shaft seal portion of the cylinder cam (77) should be disassembled according to the following procedures.

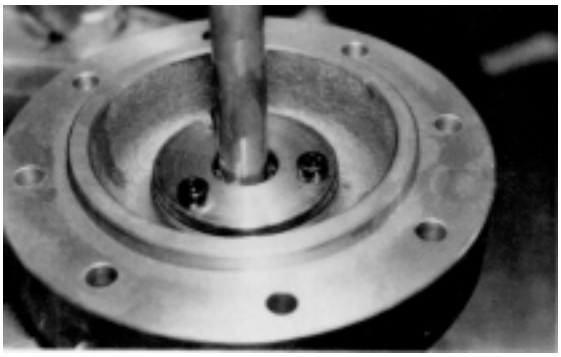


Fig. 22 Cylinder Cam Mounting Portion

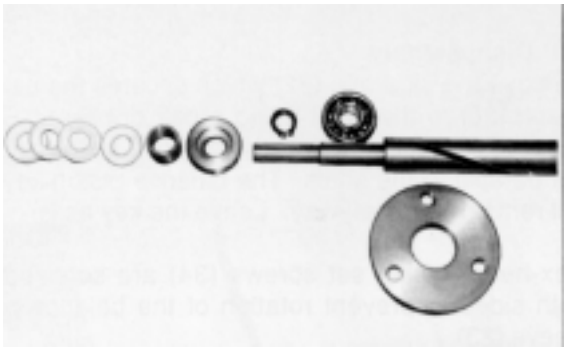


Fig. 23 Unloader Indicator Cam Shaft Portion

1) A bearing gland (80) provided at the unloader cover cylinder side secures the cylinder cam (77). Remove the bearing gland (80) by loosening and removing the hex-head socket cap screws (81).

2) The cylinder cam (77), ball bearing (78) and stop ring (79) can now be removed together. If the cylinder cam and ball bearing are to be replaced, remove the stop ring first and replace the cylinder cam and ball bearing.

3) A spring retainer (84), spring (83) and Teflon V-ring assembly (82) are fitted inside the cover.

4) Check the packing and the groove in the cylinder cam for damage or abnormal wear and replace if necessary.

2.8.4 Unloader Piston (64) and Unloader Cylinder (60)

2.8.4.1 Disassembly

a) Pull out the unloader piston to the full load position. If the Vi is adjusted to the H port, the unloader piston will stop a bit closer than otherwise.

Straighten the claws of the lock washer (70) on the lock nut (69) securing the piston (64) to the push rod (67).

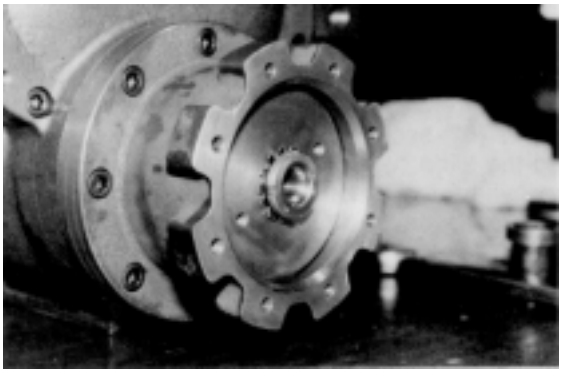


Fig. 24 Piston Lock Nut (69)

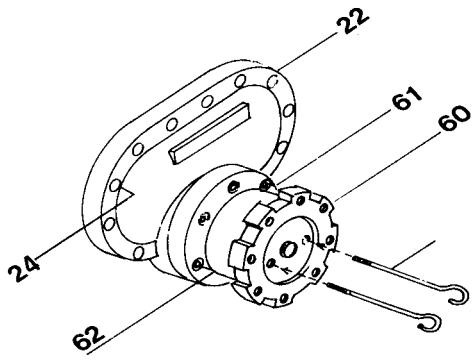


Fig. 25 Pulling out Unloader Piston (64)

b) Loosen the lock nut (69) using the lock nut wrench provided in the tool kit.

If the wrench does not reach the nut, turn the Vi changing rod counterclockwise to shift the variable Vi slide valve (289) to the L port position and then pull the piston out further.

c) Pull out the unloader piston using two eyebolt screws secured in the two screw holes located in the unloader piston.

d) The unloader cylinder is fitted to the blind cover (22) by two short hex-head socket cap screws (61) and to the suction cover by six long hex-head socket cap screws (62).

Remove the bolts and pull out the cylinder.

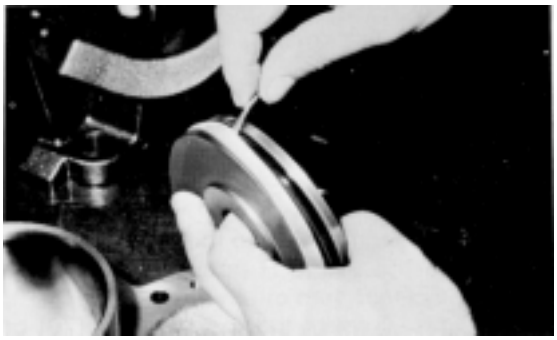


Fig. 26 Checking Unloader Piston Cap Seal (66) And O-Ring (65)

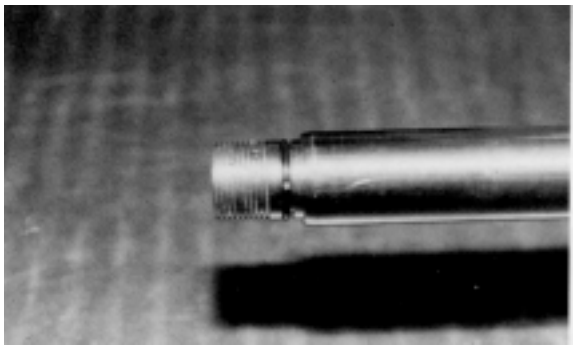


Fig. 27 Push Rod (67) and O-Ring

e) Alternately, the blind cover and cylinder can be removed together as an assembly from the suction cover by removing the six long hex-head socket cap screws (62) securing the cylinder to the suction cover and the blind cover fitting screws (24). In this case, the cylinder will not drop off even if the bolts are removed because the cylinder remains fixed to the suction cover.

Draw out the cylinder from the suction cover and disassemble.

2.8.4.2 Inspection

a) Inspect the cap seal (66) and O-ring (65) on the unloader piston (64) and replace if any damage or abnormality is found.

These parts should be replaced at least once every two years.

b) The inner surface of the cylinder may sometimes be coated with oil residue or scored.

Finish the inner surface with fine emery paper after cleaning.

c) Inspect the push rod (67) and O-ring (65) on the unloader piston and the O-ring (63) on the cylinder. If the O-rings show signs of deformation, or have become hardened, replace with new ones.

2.8.5 Blind Cover (22)

Remove the bolts (24) that secure the blind cover (22) to the suction cover (5), leaving one bolt in place at the top to prevent the cover from falling suddenly.

The blind cover is fitted to a flat flange (92) on the suction cover and is held in place with the bolts only. When the gasket has come free, support the cover firmly and remove the last bolt. If the gasket adheres to the cover and flange, tap the side of the blind cover lightly with a hammer to separate the gasket.

2.8.6 Balance Piston (30) and Balance Piston Sleeve (33)

With screw compressors the male rotor is subjected to strong thrust load from the discharge side and rotates considerably faster than the female rotor. If the same type of thrust bearing were used for both the male and female rotors, the male side bearing life would be much shorter.

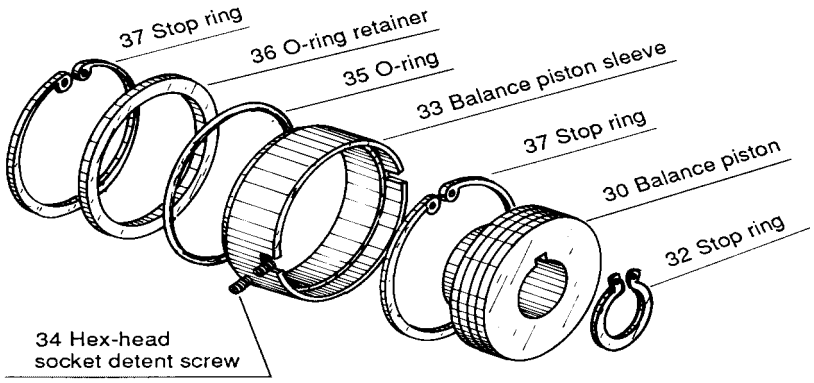


Fig. 28 Exploded View of Balance Piston

A piston (30) is provided on the end of the drive shaft of the male rotor to offset thrust load hydraulically. This piston is commonly called the balance piston.

The clearance between the balance piston and the sleeve is extremely small (smaller than the clearance between the bearing and the shaft) in order to prevent oil leakage.

2.8.6.1 Disassembly

a) Remove the stop ring (32), which secures the balance piston (30) to the shaft using a pair of pliers. Screw an eyebolt into the hole in the balance piston and pull out parallel to the shaft. The balance piston key (31) will remain in the keyway. Leave the key as is.

b) Hex-head socket set screws (34) are screwed into both sides to prevent rotation of the balance piston sleeve (33).

Loosen the F side screw and remove the M side screw or screw in until the head is recessed in the suction cover.

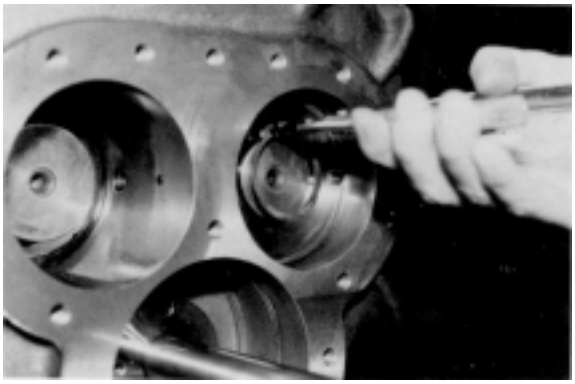


Fig. 29 Removing Stop Ring

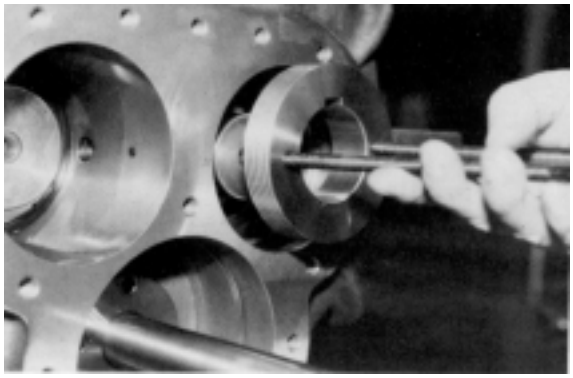


Fig. 30 Pulling out Balance Piston (30)

c) Remove the balance piston sleeve stop ring (37).

Since the O-ring (35) pushes on the stop ring (37), it can easily be removed by pushing on the sleeve (33).

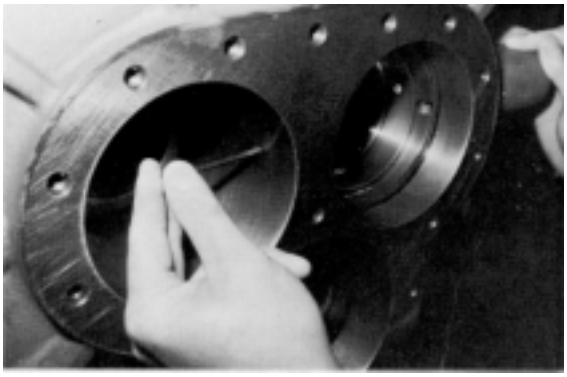


Fig. 31 Loosening Balance Piston Sleeve Detent Screws (74)

Fig. 32 Balance Piston Sleeve Set Screw Portion

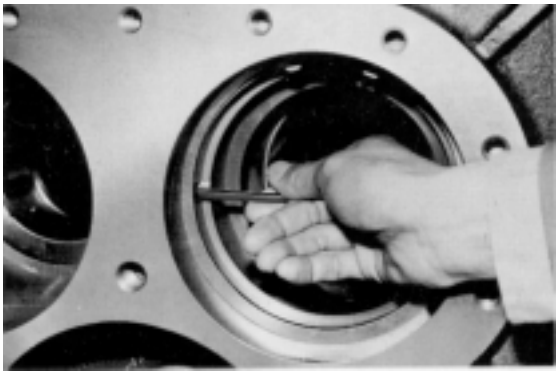


Fig. 33 Screwing in Position Detent Pin (34)

Fig. 34 After Screwing in Positioning Detent Pin (34)

d) Pull out the balance piston sleeve. This is easily accomplished as the sleeve is fitted with some clearance.

Now remove the O-ring (35) and O-ring retainer (36).

e) If you plan to remove the side bearing (28) also, at this time remove the inside stop ring (29).

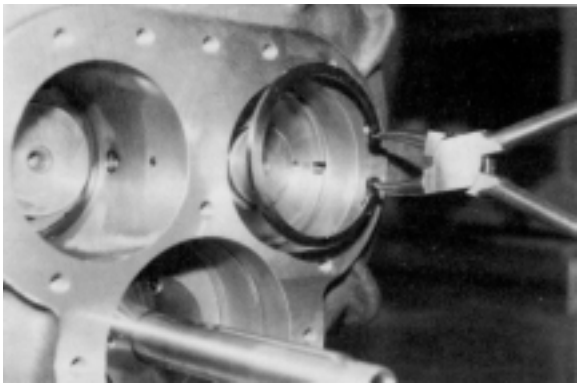


Fig. 35 Removing Stop Ring (29)

2.8.6.2 Inspection

Since the clearance between the balance piston (30) and the balance piston sleeve (33) is smaller than the clearance between the rotor shaft and the bearing, the sleeve (33) may experience wear.

If the sleeve dimensions exceed the service limits indicated at the end of this manual, replace the sleeve. The clearance provided on the periphery of the balance piston is designed to be adjusted by

the peripheral clearance and elasticity of the O-ring but sleeve wear is not unusual. Inspect the O-ring (35) and replace if any deformation is found.

2.8.7 Gear casing cover (20)

Replace 2 top bolts with 2 stud bolts and remove all bolts (195) and remove gear casing cover (20) from gear casing (169)

2.8.7.1 Side bearing for the gear (183)

Use eyebolts and pull it out.

2.8.7.2 Gear casing (169)

Remove 4 bolts (191) from thrust bearing gland (190).

The entire gear casing can be removed from the bearing head (11). Install 2 eyebolts on top the gear casing per a picture shown below and hang to support equally. Replace 2 bolts (195) on top part with 2 stud bolts. Use removed bolts to push the gear casing off from the bearing head. Push them equally.

2.8.7.3 Drive gear (174)

Place gear casing on a bench (see a picture below). Remove a lock washer (270) and loosen the locknut (269) and leave it loose.

Flip the gear casing and place it on the bench. Remove the lock washer (194) and locknut (193) completely. Push gear spindle (188) down by hitting the end of the spindle with a soft hammer. The spindle and the drive gear should move from the gear casing together. Be careful to prevent these items from hitting the ground.

Remove the locknut (193) from the spindle and remove the drive gear (174) from the spindle (188) by using a puller. Then remove thrust bearing (189) from the casing.

2.8.7.4 Roller bearing (174)

Remove the stop ring (186) and roller bearing (185) from the bearing head (11).

2.8.7.5 Vi rod retainer (600)

Remove Vi rod retainer (600) and thrust washer (449)

2.8.7.6 Driven gear (179)

Remove the lock washer (40) and locknut (39) with a locknut wrench. Then remove the driven gear (179) and key (180).

2.8.8 Thrust bearings (38)

Remove all bolts (45) and thrust bearing glands (43). Remove locknut washer (40). Remove locknut (39) using a locknut wrench.

Then remove thrust-bearing spacers (181-1A, B) and thrust bearings (38). Each thrust bearing has a marking indicating male (M) or female (F) and its location by arrow. Be sure to keep them together as they were taken out.

2.8.9 Suction Cover (5) and Side Bearing (28)

2.8.9.1 Disassembly

a) Remove all bolts securing the suction cover (5) to the rotor casing (1). Remember that several of the lower bolts were removed when the compressor was lifted off the base and positioned on the workbench.

b) Screw several of the bolts into the threaded blind holes provided on the rotor casing side to press the suction cover off evenly. The bolts should be alternately tightened little by little in order to press the cover off evenly.

When clearance between the cover and the casing flange is sufficient, separate the gasket (6) from one side.

c) After removing the parallel pin (3), the rotor shafts and the unloader push rod (67) remain connected to the suction cover (5). Slide the suction cover away from the rotor casing in line with the rotor shaft. Be sure to keep the rotors in the casing (there is a possibility that they may come free with the suction cover due to friction).

Fig. 46 O-Ring Gland (326)

d) Remove the O-ring gland fixing screw (456) and remove the O-ring gland (326).

e) To remove the side bearing (28), first remove the stop ring (29), and then push the side bearing out from the rotor side. If a hammer must be used to free the bearing, cushion with a wooden block or the like to prevent damage.

2.8.9.2 Inspection

a) Inspect the unloader push rod (67), O-ring (73) and suction cover side O-ring (9) for deformation or other damage and replace with new ones if necessary.

b) Inspect the inner face of the side bearing (28) for foreign matter imbedded in the bearing metal. Also, measure the dimensions of the bearing (ref. Service limits provided at the end of this manual).

2.8.10 Rotors (25,26), Casing (1) and Variable Vi Slide Valve (289)

The variable Vi slide valve and the unloader slide valve are mounted together in the rotor casing.

2.8.10.1 Disassembly

a) As the screw compressor rotors are very heavy, a hemp rope or nylon belt should be made available for use when the rotors are being removed. Suspend the rotor from the rope or belt as it is clears the casing. Either the male or the female rotor may be removed first. When removing the female rotor, rotate the rotor counterclockwise as you pull out. When the rotor is approx. two-thirds of the way out, lift it slightly and pull it all out the way, suspended from the rope or belt.

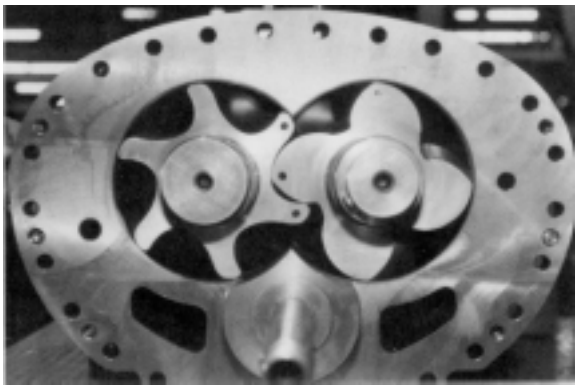


Fig. 47 Rotors (25, 26)

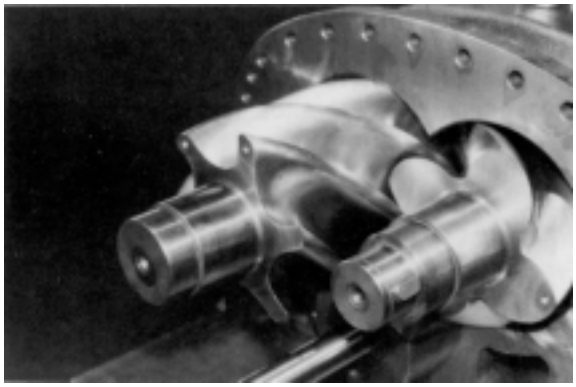


Fig. 48 Pulling out Rotors

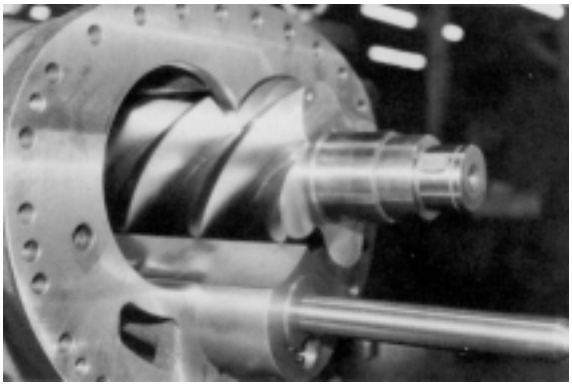


Fig. 49 Pulling out M rotor (25)

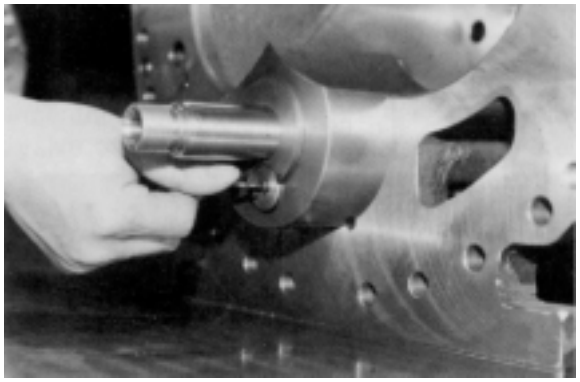


Fig. 50 Removing Lock Washer Bolt

b) Remove the remaining rotor in the same manner, taking care not to damage the main bearing in the bearing head as you pull the rotor free.

c) Do not lay the rotors directly on the floor or the edges of the lobes may be damaged. Rest the rotor shaft ends on V-blocks.

d) Remove the hex-head socket cap screw (454) securing the lock washer (445) on the end of the Vi changing rod of the variable Vi slide valve (289) and remove the lock washer (445).

e) Turn the bearing side rod counterclockwise and draw the rod out. When the threaded portion comes free, pull it out of the bearing head. Place the thrust washers (449) together to prevent them from becoming lost.

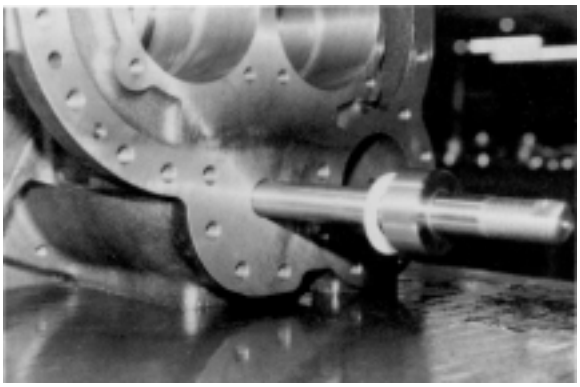


Fig. 51 Pulling out Variable Vi Slide Valve Changing Rod (444)

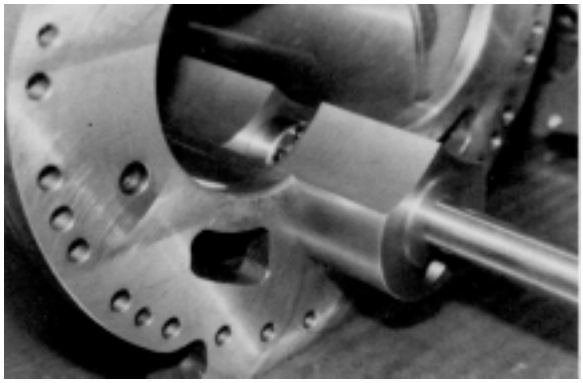


Fig. 52 Pulling out Unloader Slide Valve (54) and Variable Vi Slide Valve (289)

f) Pull the unloader slide valve (54) and the variable Vi slide valve (289) out of the casing while holding the unloader push rod.

By pulling on the variable Vi slide valve changing rod (444), the unloader slide valve (54) can be separated.

2.8.10.2Inspection

a) Inspect the rotor journals for damage.

The shaft seal and bearing mounting portions must be inspected.

b) Inspect the rotor lobes, especially the edges, for damage or abnormal wear. If the compressor has been operating normally, there should be no damage found. If, however, scoring or scratches, etc. are found, it points to a problem with the suction strainer as such damage can only be made by foreign matter entering the system.

c) Inspect the unloader slide valve (54) and the frictional surfaces and clearance between the variable Vi slide valve (289) and the casing (1).

Also, check if the Vi changing rod (444) and the unloader slide valve bushing (448) are fitted together. If any wear or abnormal fitting is found, replace the parts.

d) Inspect the inner surface of the rotor casing.

If no rotor damage is found, there should be no damage or abnormality of the casing inner surface either. If rotation traces are visible on the inner surface of the rotor casing, a problem with the journals is the most probable cause. Performance will remain unchanged despite wear of up to 0.3% of the rotor diameter; excessive wear of the leading edges of the rotors will result in a drop in performance.

e) With some special applications, the bearing journal and the shaft seal portions are finished with chrome plating. If any damage is found, contact the nearest MYCOM subsidiary for repair or replacement.

2.8.11 Bearing Head (11) and Main Bearing (27)

Normally, further disassembly of this portion of the compressor is not required as there is nothing to be gained from separation of the bearing head and rotor casing. Leave the two joined together.

To draw out the main bearing, remove the stop ring (29) from the bearing cover side using a pair of pliers and push the main bearing out from the rotor casing side. If the bearing fit is tight, tap out using

a hammer cushioned with a plastic or wooden block. Do not strike the bearing directly with the hammer.

Inspect the rotor shaft and the inner diameter of the bearing.

Also, examine the inner diameter of the bearing and the outer diameter of the rotor shaft to determine if any foreign matter is imbedded in the bearing metal.

Inspect the O-ring (451) of the Vi changing rod (444) for damage or other abnormality.

3.0 Reassembly

When disassembly, inspection and any necessary repair work are completed, the compressor must be correctly reassembled. Before commencing reassembly, confirm that all parts are available.

Reassembly work is essentially carried out in the reverse order of disassembly. All tools and parts should be cleaned thoroughly before beginning reassembly and parts should be coated with compressor oil before being mounted.

3.1 Bearing (11) Head and Main Bearing (27)

a) The main bearing is clearance fitted in some cases while it is lightly press fitted in others.

Arrange a simple jig (washer and bolt) to fit the main bearing.

A positioning spring pin (14) is provided on the bearing head. Align the pin with the notch in the main bearing (11). If the bearing must be tapped in, cushion with a plastic or wooden block.

If the bearing gets out of position as it is being inserted, remove and carefully insert again.

Be sure to fit the O-ring oil retainer (432) provided on the outer diameter.

b) Mount the stop ring (29) to secure the bearing.

c) Confirm that the O-ring (451) is properly fitted in the hole for the Vi changing rod.

d) Apply oil to both sides of the gasket before fitting it between the bearing head and rotor casing. Since the positions of the holes in the gasket are unsymmetrical, care should be taken to position the gasket correctly.

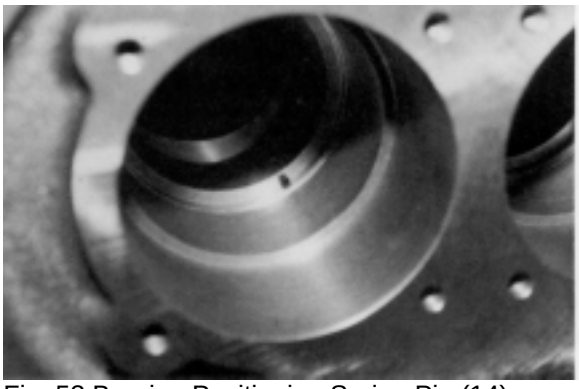


Fig. 53 Bearing Positioning Spring Pin (14)

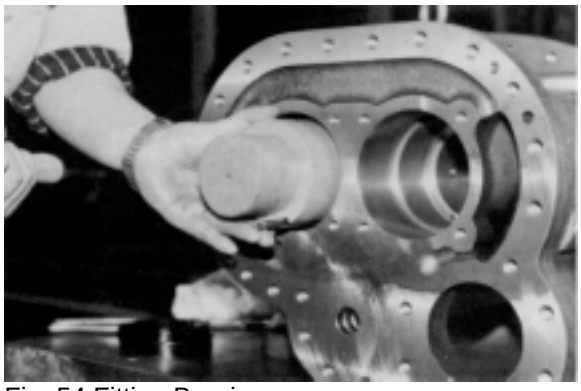


Fig. 54 Fitting Bearing

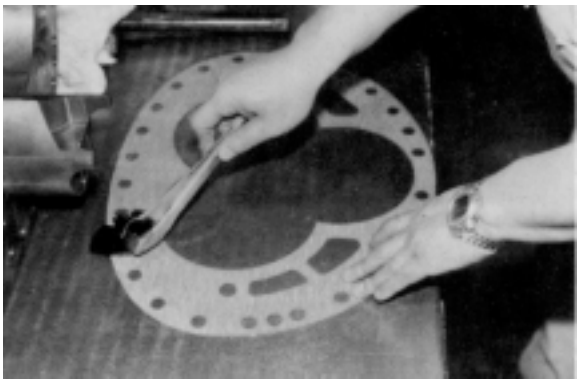


Fig. 55 Applying Oil to Gasket


Fig. 56 O-Ring for Vi Changing Rod (451)

3.2 Rotor Casing (1), Unloader Slide Valve (54), Variable Vi Slide Valve (289) and Bearing Head (11)

a) Unloader slide valve (54)

Confirm that the Vi changing rod (444) moves properly. Mount the unloader push rod (67) and fit the gasket to the hole for the Vi changing rod shaft.

b) Rotor casing (1)

Clean the oil injection holes thoroughly, fit the plug (10) and mount the unloader slide valve (54). Confirm smooth movement of the unloader slide valve.

c) If the rotor casing (1) and bearing head (11) have been separated, assemble them now (normally, these two parts are not disassembled). Tighten the bolts (2) to the specified torque in a symmetrical crisscross pattern. A number of the bolts on the bottom cannot be accessed at this time and must be tightened later when the compressor is raised.

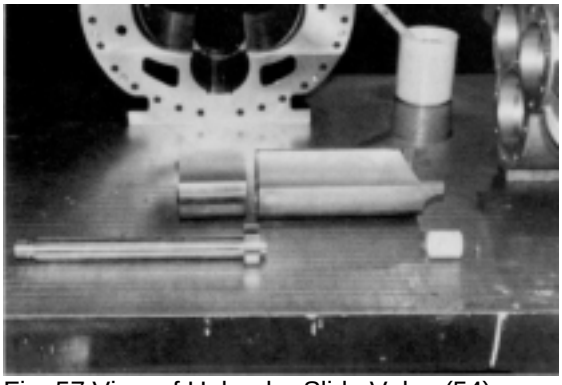


Fig. 57 View of Unloader Slide Valve (54), Variable Vi Slide Valve (289) and Vi changing Rod (444) Removed from Rotor Casing (1)

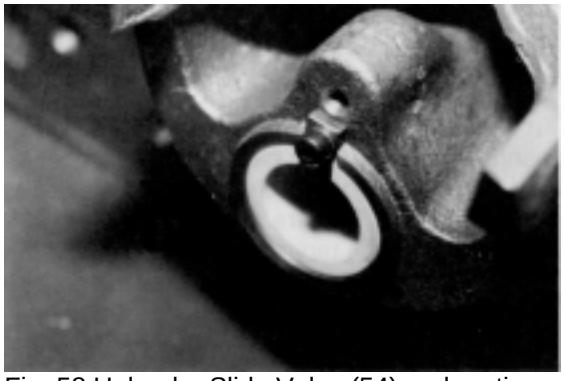


Fig. 58 Unloader Slide Valve (54) and portion

d) Mount the Vi changing rod (444) from the bearing head side. Be careful not to forget to install the thrust washer (449).

Push the unloader slide valve (54) to the discharge side and fit the female screw of the variable Vi slide valve on the Vi changing rod.

When the end of the Vi changing rod extends from the variable Vi slide valve, secure the round lock washer (445).

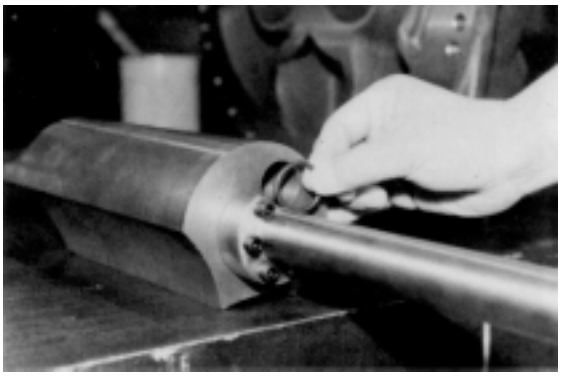


Fig. 59 O-Ring for Vi Changing Rod (451) of Unloader Slide Valve (54)

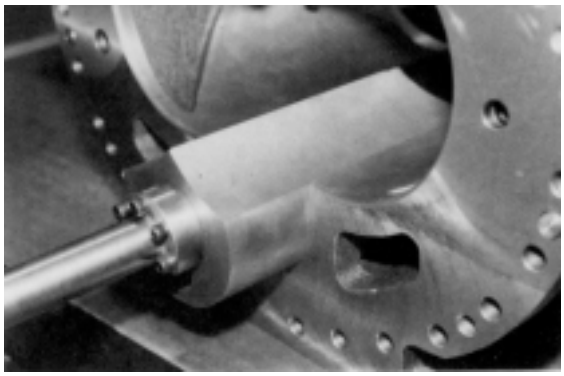


Fig. 60 Mounting Unloader Slide Valve (54)

e) If the gasket on the bearing head protrudes into the rotor casing, trim the excess gasket material away. If the gasket is caught between the end face of the rotor and the bearing head, thrust clearance cannot be adjusted properly.

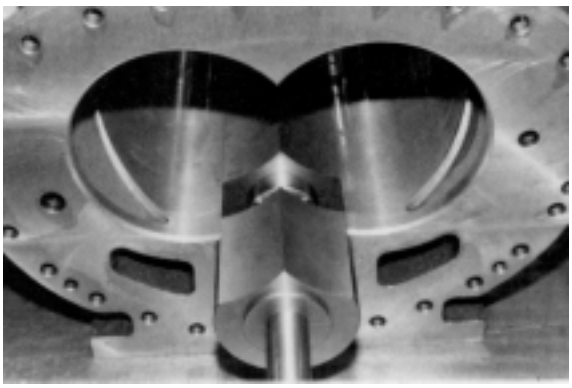


Fig. 61 Mounting Variable Vi Slide Valve (289)

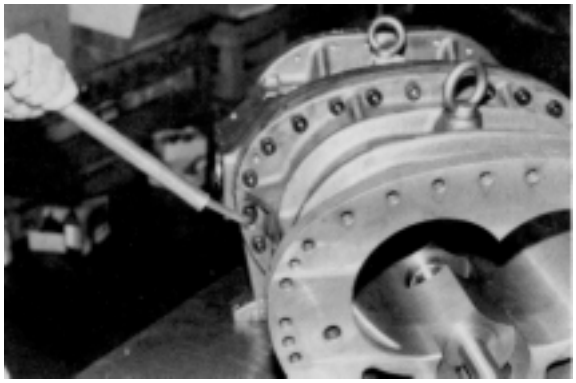


Fig. 62 Mounting Bearing Head (11) and Rotor Casing

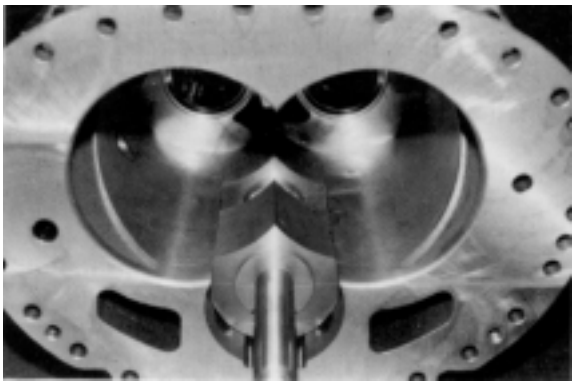


Fig. 63 Overall View of Unloader Slide Valve (54) And Variable Vi Slide Valve

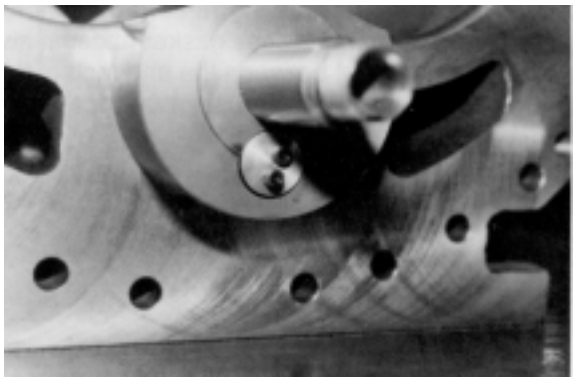


Fig. 64 Fit Vi Slide Valve Lock washer (round) (445)

3.3 Rotor Casing (1) and Rotors (25,26)

a) Coat the main bearing and the shaft portion of the male rotor with compressor oil and install first. Suspend the rotor from a rope or strap at its mid point and insert into the casing half way. Release the rope or strap and push the rotor in fully.

b) The suction side leading edges of the female rotor stamped with the numbers “1” and “2” should be oriented toward the male rotor side.

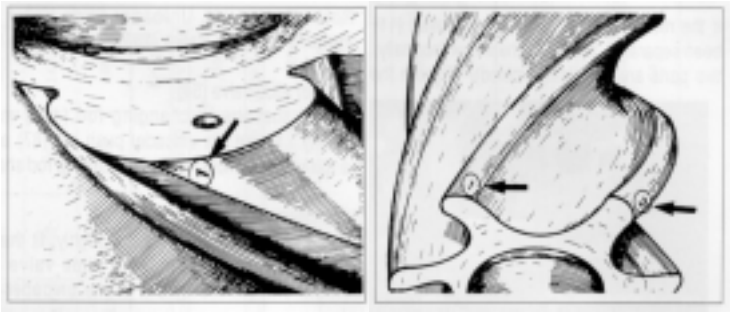


Fig. 65 Stamp Marks on Lobe Edges

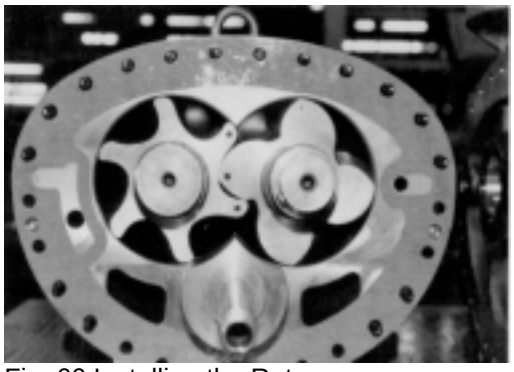


Fig. 66 Installing the Rotors

c) Lift the male rotor with the rope or strap. The number “1” stamped on the leading edge of one lobe should be oriented toward the female rotor side.

d) Mate the rotors so that the leading edge of the male rotor lobe stamped with the number “1” fits between the leading edges of the female rotor lobes stamped “1” and “2” and push the female rotor in to half its length. Remove the belt suspending the female rotor and push it the remainder of the way in. Proper orientation of the male and female rotor lobes is essential, otherwise irregular lobe meshing will occur and the compressor will generate abnormal noise.

3.4 Suction Cover (5)

a) Fit the side bearing into the casing in the same manner as for the main bearing.

An O-ring (433) for the oil retainer is provided on the outer diameter. Be sure to install the O-ring (433). If the cover must be tapped in, cushion with a plastic or wooden block and tap around the positioning pin (8).

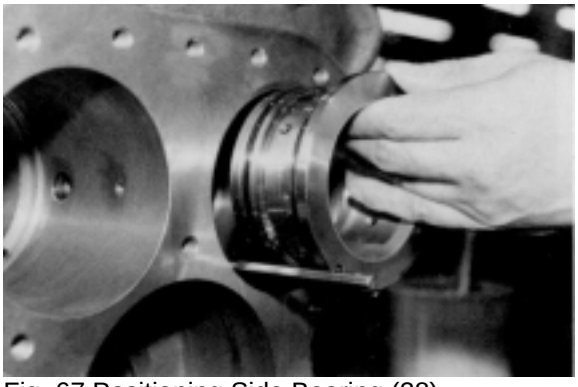


Fig. 67 Positioning Side Bearing (28)

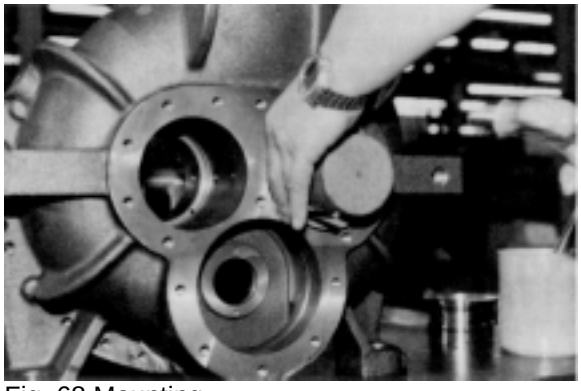


Fig. 68 Mounting

b) Secure the stop ring.

c) Mount the O-ring retainer (326) for the unloader push rod. The suction cover side also requires an O-ring so do not forget to mount during the assembly work.

d) Mount the balance piston sleeve in the order of stop ring (32), O-ring retainer (36), O-ring (35), balance piston sleeve (33) and stop ring (32).

When installing the stop ring, tap the side face of the ring slightly to ensure that it fits snugly in the groove.

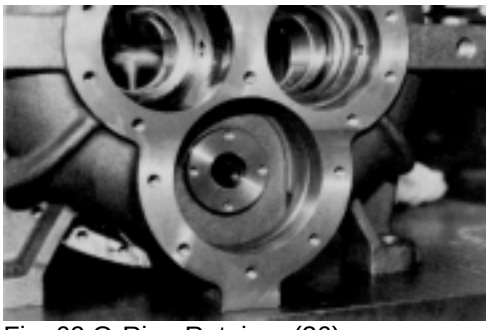


Fig. 69 O-Ring Retainer (36)

e) Secure the balance piston sleeve (33) with the hex-head socket detent set screw (34) from the female rotor side.

f) Turn the Vi changing rod (444) in the rotor casing/bearing head assembly in the counterclockwise direction to set the Vi to the L port position. Set the unloader slide valve (54) at the full load position.

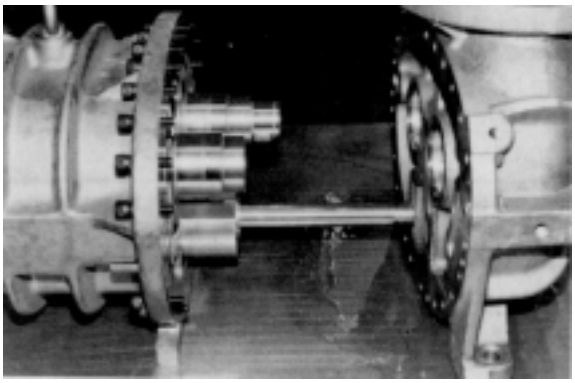


Fig. 70 Fitting Suction Cover

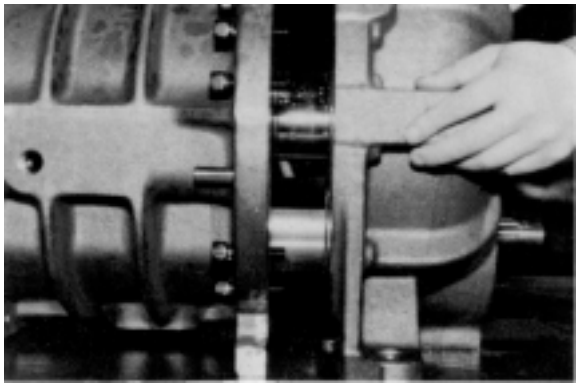


Fig. 71 Suction Cover Assembled

g) Slide the suction cover across the surface plate and align the suction cover O-ring retainer with the push rod (67)

h) Mate the side bearing (28) and rotor shafts and push the cover and casing together parallel with the shaft.

i) Drive the positioning parallel pin (19) in from the rotor casing side and secure the bolts (94).

j) Confirm that the unloader slide valve (54) and variable Vi slide valve (289) move normally.

Rotate the male rotor shaft to confirm smooth movement.

3.5 Thrust bearings

Install thrust-bearing spacers (42 & 41) into bearing head (11) and install thrust bearings (38). Make sure to match the arrows markings and male (M) or female (F) on the bearings as shown below.

Insert a sleeve (for adjusting thrust bearing) into the gear section of the male rotor, and then tighten the locknut (39) with a locknut wrench. For female rotor, install thrust washer (250), lock washer (40), washer (237-A) and a locknut (39) and tighten the locknut with a locknut wrench.

If installing new sets of thrust bearings, end clearance of the thrust gap must be measured as tightening the locknut. When there is no end clearance and rotor does not rotate by hand, grind the outer bearing spacer (41) equally or add thrust-bearing shims to the inner thrust spacer (42) to gain the thrust gap.

Measurement method of the thrust gap is as follows:

First, push the rotor that you are measuring toward discharge end of the bearing head. Do not use a hammer since this makes the rotor bounces back.

Secondly, install an accurate and periodically corrected dial gauge onto the side face of the suction cover as shown below. Then set the dial to zero (no thrust gap).

Install the thrust-bearing gland (43) and tighten bolts (45) equally and gradually toward design torque, as shown in table below, as the dial gauge is read.

Make sure the thrust gap reading on the dial gauge is at the design torque. If the target gap is not met try to adjust the thrust spacers until achieved.

Model	Torque (lbf-in)	Thrust gap (inch)
160VR and 160VRD	206	1.6/1000 – 2.4/1000
200VR and 200VRD	570	2/1000 – 2.8/1000
250VR and 250VRD	684	3.2/1000 – 4.3/1000

In case the measured gap is not met:

a. When it is larger than the target:
Lap the inner spacer (42) by the difference in measurement and try it again. Make sure to lap it equally and accurately (do not use sand paper).

b. When it is smaller than the target:
Add shims by the difference in measurement to the inner spacer (42) (install them between the inner spacer and the thrust bearing). Or try a new inner spacer and lap it as necessary.

When all the target gaps are met, bend one of teeth of the lock washer (40). On the male side thrust bearing, untighten the sleeve and tighten the locknut then finish the lock washer.

3.6 Driven gear

Install gear spacers A, B (181-1A, B), and key (180) to the M rotor then install the driven gear (179) Install gear spacer B (181-1B), lock washer (40), plate A (237A), and a locknut (39) then tighten the locknut with a locknut wrench. Bend one of teeth of the lock washer (40).




3.6.1 Roller bearing

Install roller bearing (185) in the bearing head (11) and secure it with a stop ring (186).


3.6.2 Vi rod retainer (600)

Install thrust washer (449), gasket (601) and Vi rod retainer (600) in the bearing head (11).


3.6.3 Drive gear (174)

Install thrust ball bearing into the gear casing (169) then secure it with a special securing retainer and bolts (191).


Place the gear casing on the bench. Insert the gear spindle (188) into the thrust ball bearing and install the key (175), gear spacer (176) and the drive gear (174).


Install gear spacer (176), lock washer (270), plate D (237-D) and tighten a locknut (269) with a locknut wrench. Bend one of teeth of the washer (270).


3.6.4 Gear casing

Attach the entire gear casing to the bearing head (11). Use stud bolts on top part of the casing to support the gear casing and use eyebolts to hang the casing while attaching it to the bearing head. Install alignment pins (19) and tighten bolts (18) all equally.


3.6.5 Spindle

Remove the special securing retainer from the gear casing (169).
Install a lock washer (194), plate C (237-C), and locknut (193) on the spindle (188) and tighten the locknut. Bend one of teeth of the lock washer (194). Tighten the bearing retainer (190) with bolts at specified torque shown below;

Model	Torque (lbf-in)
160VR and 160VRD	570
200VR and 200VRD	684
250VR and 250VRD	1042

3.6.6 Side bearing

Install the side bearing for the gear into the gear casing (169). Make sure to fit the notch on the bearing to a pin (184) that is installed in the gear casing.

3.6.7 Gear casing cover

Use stud bolts and install alignment pins (19) and tighten bolts (195) equally to install the gear casing cover (171) onto the gear casing (169).

3.7 Blind Cover (22), Unloader Cylinder (60) and Unloader Piston (64)

a) Fit the O-ring (65) on the unloader piston (64) and cover the cap seal (66).

Mount the piston in the unloader cylinder (60) from the beveled (rotor) side.

Adjust the position so that the threaded blind hole for the piston faces the unloader cover side.

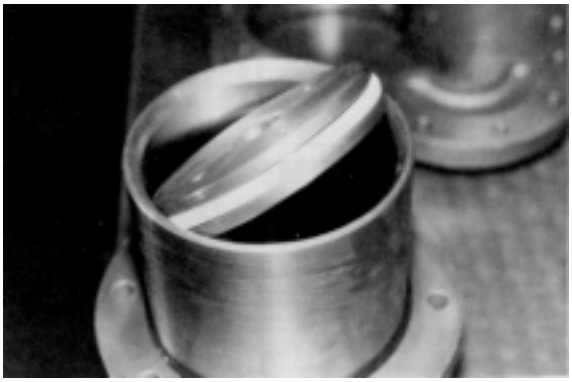


Fig. 84 Unloader Piston (64) and Unloader Cylinder (60)

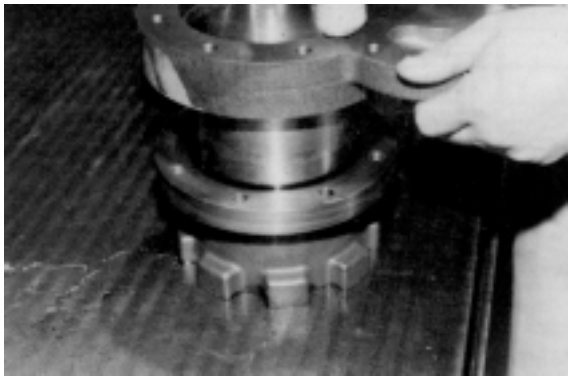


Fig. 85 Mounting Blind Cover (22) on Unloader Cylinder

b) Fit the O-ring (63) between the unloader cylinder (60) and the blind cover (22) and mount the blind cover on the cylinder, securing it with two short bolts. (61).

c) Fit the gasket (23) and push the unloader cylinder (60) into the suction cover (5). Fit the blind cover (22) temporarily using two or three bolts. Fix the unloader piston (64) to the unloader push rod (67) using the lock washer (70) and lock nut (69). Be sure to bend the claw of the lock washer.

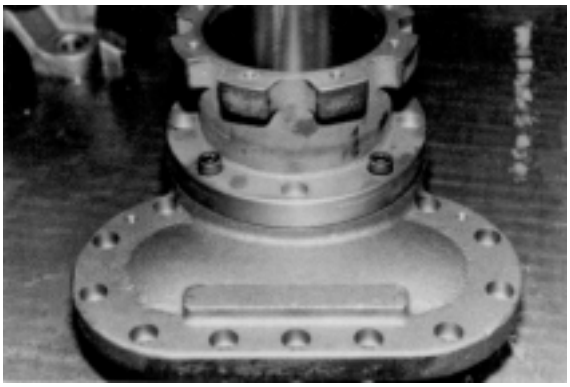


Fig. 86 Unloader Cylinder and Blind Cover

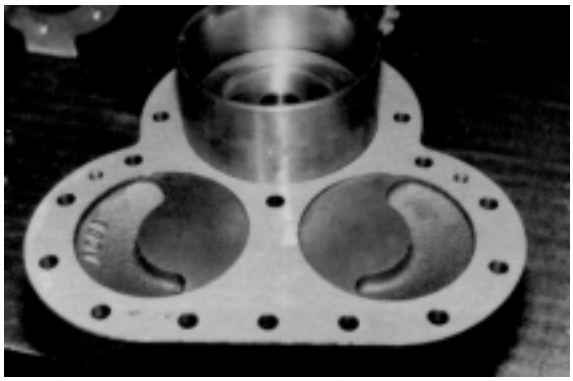


Fig. 87

d) Tighten the bolts securing the blind cover and unloader cylinder to the suction cover (5).

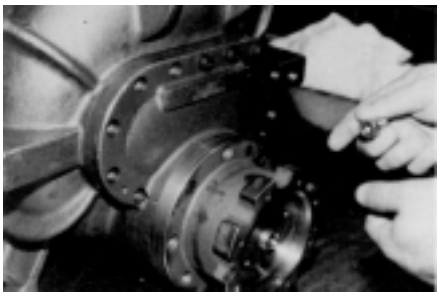


Fig. 88 Unloader Cylinder (60)

e) Screw and eye bolt into the unloader piston (64) and manipulate to confirm smooth movement of the slide valve (54).

3.8 Unloader Cover (74)

When the shaft seal portion of the indicator cylinder cam (77) has been disassembled, assembly work is carried out according to Fig.90.

a) Fit the ball bearing (78) on the cylinder cam shaft. When pushing the bearing onto the shaft, apply pressure on the inner race of the bearing only, otherwise the bearing may be damaged. Push the bearing onto the stepped portion of the cylinder cam and fix with the stop ring (79).

b) Apply a generous coating of oil to the V-ring (82) and fit the V-ring on the cover side, positioning the top of the “V” of the ring to face the inside and the bottom of the “V” to face the outside.

c) Fit the spring (83) and the spring retainer (84) and mount the shaft of the cylinder cam assembled in a) above on the V-ring (82). Fasten the bearing (78) with the bearing gland (80).

No.	Name	No.	Name
74	Unloader cover	80	Bearing gland, cylinder cam
75	O-ring, unloader cover / unloader cylinder	81	Hex-head socket cap screw, bearing gland
76	Hex-head socket cap screw, unloader cover	82	Teflon V-ring, cylinder cam
77	Cylinder cam, unloader indicator	83	Spring, cylinder cam
78	Ball bearing, cylinder cam	84	Spring retainer, cylinder cam
79	Stop ring, cylinder cam ball bearing		

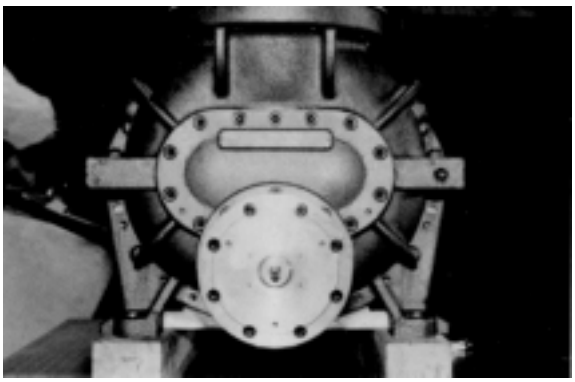


Fig. 89 Mounting Unloader Cover

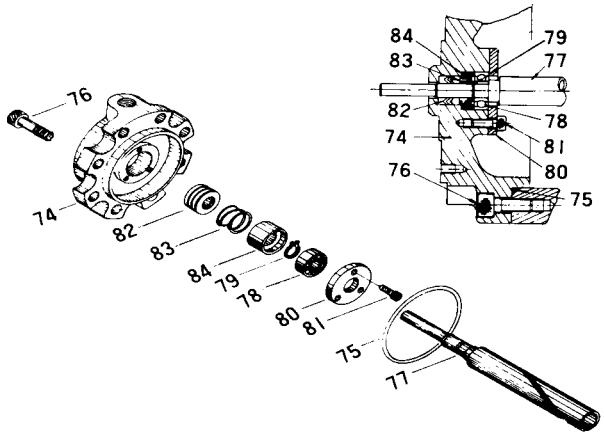


Fig. 90 Exploded View of Unloader Cover (74)

d) Rotate the cylinder cam (77) manually to confirm smooth rotation.

Fit the O-ring (75) on the unloader cover (74).

e) Position the unloader slide valve (54) in the no-load position (piston at the innermost point) and push in the cover while mating the groove on the cylinder cam with the pin on the push rod (67).

Fasten the screws (76) with the outlet of the unloader piston hydraulic piping facing up (ref. Fig.90).

3.9 Mechanical Shaft Seal

a) Clean the contact surface of the shaft seal thoroughly before assembling.

b) Carefully inspect the seal contact surface on the stepped portion of the shaft for flaws and scratches before assembling.

c) When mounting the seal retainer (48), confirm that it is positioned in the correct direction.

Position the seal retainer so that the oil induction hole is located above the shaft. Be sure that the seal retainer detent screw (529) and the notch in the retainer are correctly mated and turn the seal retainer to the left and right using an eye bolt to confirm that it is securely fixed.

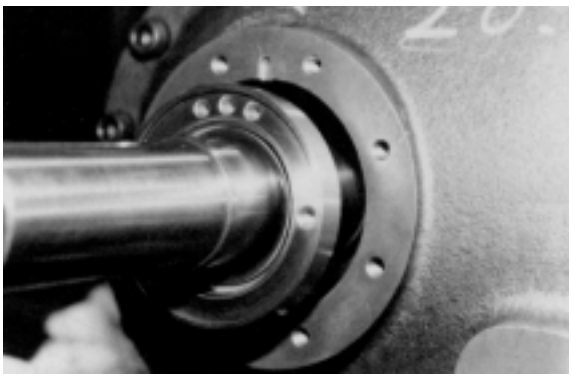


Fig. 91 Seal Retainer (48) and Oil Seal

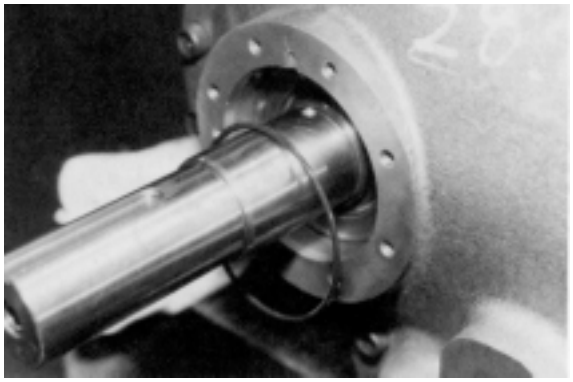


Fig. 92 O-Ring (49)

d) Next, insert the seal cover O-ring (49). Note that this part is sometimes forgotten during assembly.

e) Fit the oil seal sleeve (528) and secure the two set screws (529).

f) Mount the shaft seal assembly (100).

Push the O-ring (49) in carefully so that it is not damaged. Two screws are provided for the seal collar (109). Secure the screws (111) making sure that they mate with the countersunk holes in the shaft. After mounting, push on the seal ring (104) manually to confirm axial movement.

g) Fit the O-ring (103) for the carbon and the carbon insert (101) in the seal cover (50).

Fit the gasket (52) on the seal cover (50) and position it correctly to match the oil holes in the bearing cover and then fit the seal cover by sliding it onto the shaft. When fastening the seal cover, the carbon should first contact the seal ring (104).

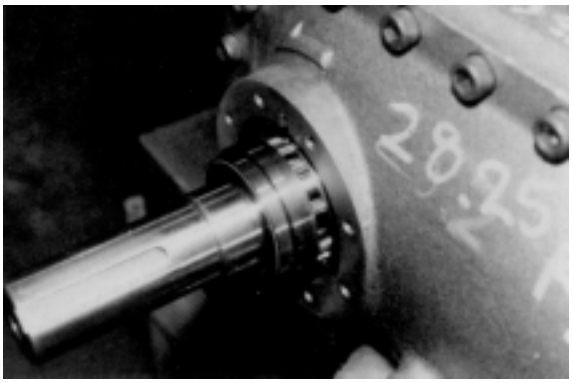


Fig. 93 Mechanical Shaft Seal (100)


Fig. 94 Mounting Carbon Insert (101)

Hold the seal cover securely against the bearing cover and secure it first with two diagonally positioned bolts (53), then mount and tighten all of the other bolts (53).

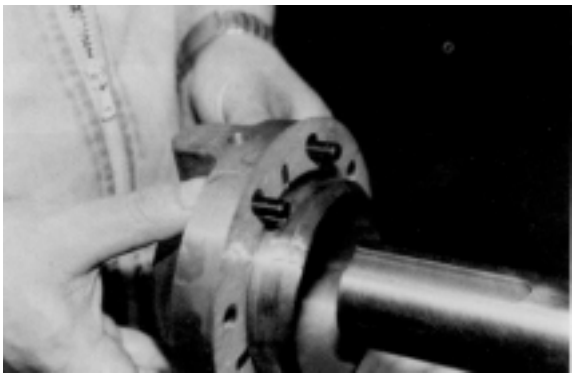


Fig. 95 Seal Cover (50)


Fig. 96 Plug for Model 160V** Seal Collar

h) Model 160V∗∗ has holes for the seal collar set screws in the bearing cover. These holes must be plugged with blind plugs after mounting the seal cover (ref. Fig. 96).

4.0 Disassembly and Adjustment of Unloader Indicator

The potentiometer (129), micro-switch (125) and micro-switch cam (127) are mounted in the automatic control indicator portion of the compressor.

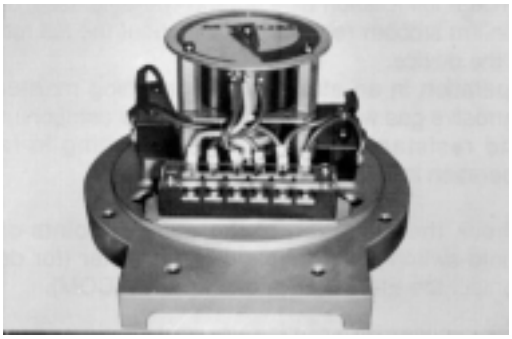


Fig. 97 106V**~250V** Standard Indicator

4.1 Disassembly and Adjustment of Unloader Indicator (120)

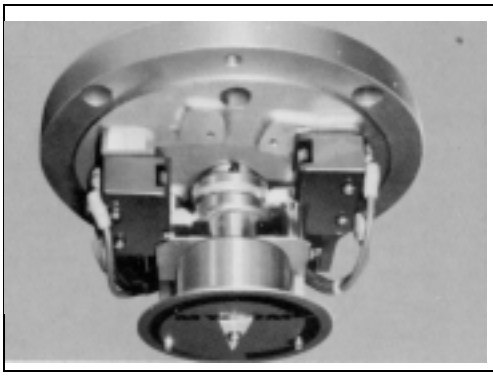
a) Remove the machine screw (140) securing the indicator pointer (139).

b) Remove the machine screw (138) securing the dial plate (137).

c) The potentiometer mounting plate (130) is fitted between the dial plate support (1) (134) and dial support (2) (135).

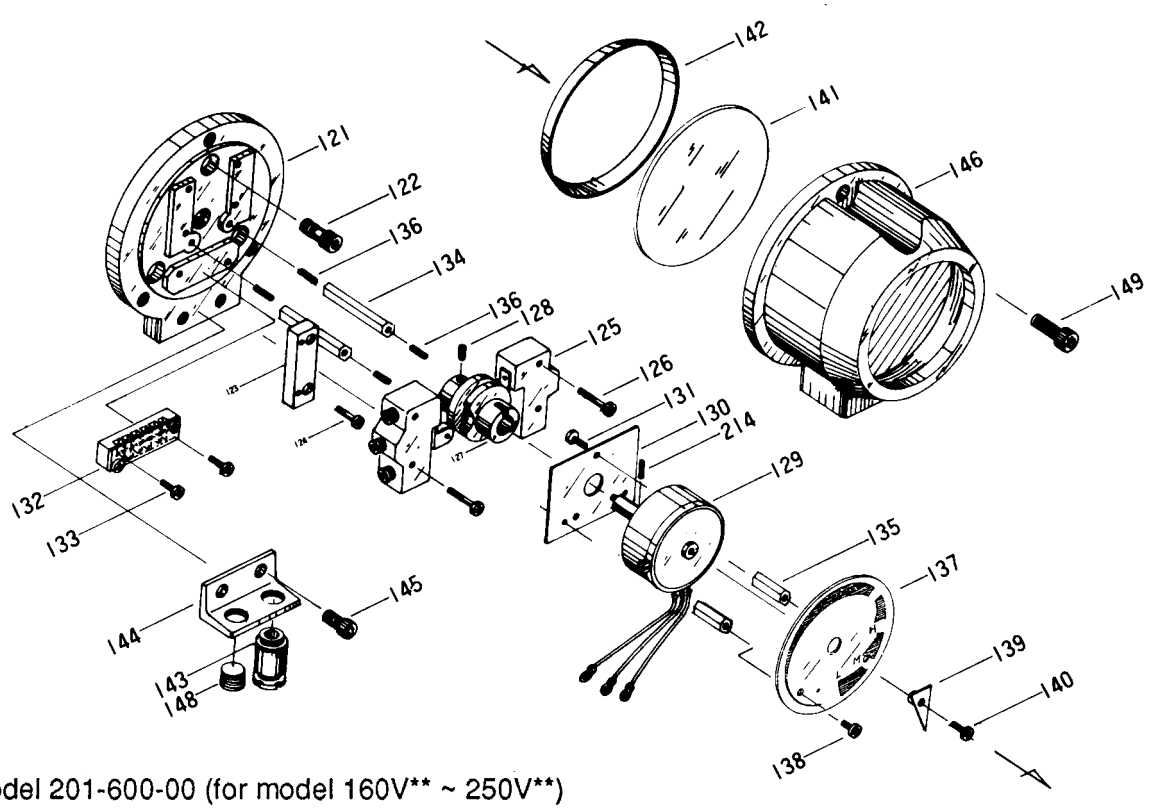
Loosen and remove support (2) by turning counterclockwise while holding support (1) securely.

d) When the right and left supports are removed, the potentiometer (129) can be removed together with the mounting plate (130).



	Automatic Standard	Special Specification (1)	Special Specification (2)
Potential for slide valve position feedback	①	①	①
Micro-switch for slide valve no-load position signal	①	①	
Micro-switch for slide valve full-load position signal		①	
Micro-switch for slide valve special position signal			②
Micro-switch cam for standard actuation	①	①	
Micro-switch cam for standard actuation			①

Fig. 98 System with Two Micro-Switches



Model 201-600-00 (for model 160V** ~ 250V**)

Fig. 99 Exploded view of unloader indicator portion

e) The potentiometer is secured to the mounting plate with three machine screws (131).

f) The micro-switch (125) is secured with two long machine screws (126).

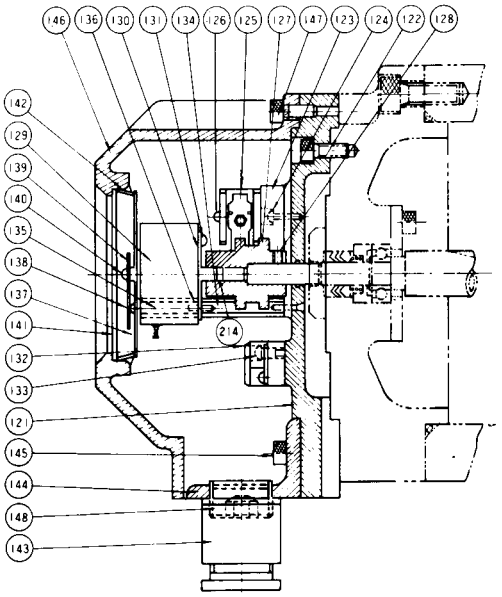
Loosen these screws to remove the micro-switch.

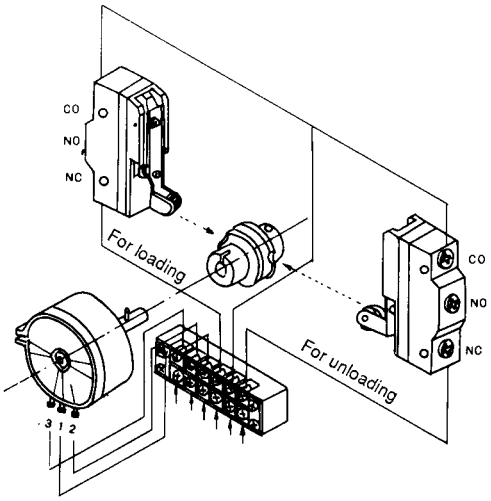
The micro-switch component on the right side is for the no-load position signal and the one on the left side is for the full-load position signal.

The micro-switch set plate (123), secured by other screws (124), is mounted under the left side micro-switch component. The micro-switch component on the right side is for the no-load position signal while the one on the left side is for the full-load position signal.

The micro-switch set plate (123), secured by other screws (124) is mounted under the left side micro-switch component. Adjustment of the micro-switch is accomplished using with micro-switch cam (127).

g) The terminal block (132) and other parts can be removed by removing the screws (133) securing them.





No.	Name	160V**~ 250V**	No.	Name	160V**~ 250V**	No.	Name	160V**~ 250V**
121	Micro-switch base plate	1	131	Machine screw	3	141	Indicator glass	1
122	Hex-head socket cap screw	3	132	Terminal block	1	142	Indicator glass space ring	1
123	Micro-switch set plate	1	133	Machine screw	2	143	Electric wiring connector	1
124	Machine screw	2	134	Dial plate support (1)	2	144	Connector support	1
125	Micro-switch	2	135	Dial plate support (2)	2	145	Hex- head socket cap screw	2
126	Machine screw	4	136	Hex-head socket cap screw	4	146	Indicator cover (2)	1
127	Micro-switch cam	1	137	Dial plate	1	147	Hex head socket cap screw	3
128	Hex-head socket set screw	2	138	Machine screw	2	148	Plug	1
129	Potentiometer	1	139	Indicator pointer	1	214	Spring pin	1
130	Potentiometer mounting plate	1	140	Machine screw	2			

Fig. 100 Unloader indicator of model 160V**~250V**

4.2 Inspection

a) Only actuation of the electrical components needs to be inspected.

Since a full rotation type potentiometer is used, test to confirm smooth resistance throughout the full rotation of the device.

Operation in an atmosphere containing moisture or corrosive gas will lead to rusting of the components and resistance may change, resulting in faulty operation indication.

b) Check the actuation of the contact points of the micro-switch components using a tester (for details contact the Electric Department of MYCOM).

4.3 Assembly and Adjustment

The procedures for reassembling the unloader indicator are the reverse of disassembly.

Adjustment after assembly is, of course, very important. There are basically two aspects of adjustment.

1) The physical relationship between the micro-switch cam (127) and the slide valve (54).

2) The relationship between the no-load position and the resistance value of the potentiometer.

Adjustment of these factors should be carried out after the micro-switch base plate (121) has been mounted on the unloader cover (74).

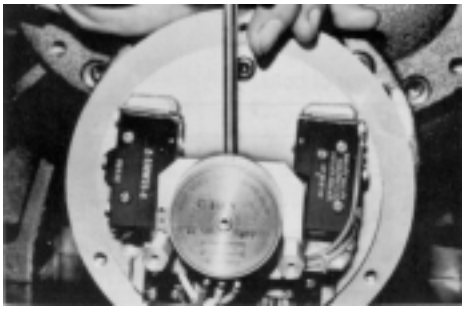


Fig. 101 No-Load Cam Adjustment

a) The unloader cover is fitted on the compressor with the unloader piston (64) in the no-load position. Secure the micro-switch cam with the hex-head socket head set screw (128) to bring it into line with the countersunk hole in the unloader indicator cylinder cam (77). The micro-switch cam (127) is then in the no-load position.

   Align the concave point of the micro-switch cam (127) facing the unloader cover (47) with the actuation arm point of the micro-switch (ref. “A” and “B” in Fig. 100).

b) When mounting the potentiometer (129), fit the spring pin (214) of the potentiometer shaft in the groove of the shaft support (2) (135) (ref. Figs. 103, 104).

c) Correct positioning of the potentiometer is established by the work indicated in the above paragraph b).

d) Fit the dial plate and mount the indicator pointer (139), aligning it to the no-load position.

   If a full load micro-switch is provided, adjust the micro-switch setting screw (126) so that it is actuated by the cam.

   Actuation of the micro-switch (125) is confirmed by moving the unloader slide valve (54) to the full load position with oil pressure when the hydraulic pump can be operated or by supplying low-pressure air to the unloader piston (64).

   If the machine screws (126) of the micro-switch are loose, the micro-switch may slip out of position, resulting in irregular or faulty actuation. Secure the micro-switch tightly after confirming actuation.

e) After confirming proper actuation, connect the control wiring as before and mount the unloader indicator cover (146). Be careful not to pinch the wires with the cover.

Disassembly, inspection and reassembly of the VR-Series compressor unit are now completed.

Fig. 102 Adjustment of Potentiometer at No-Load Position

Fig. 103 Groove in Micro-Switch Cam

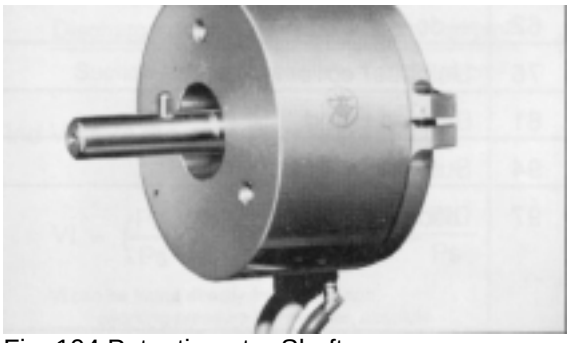


Fig. 104 Potentiometer Shaft

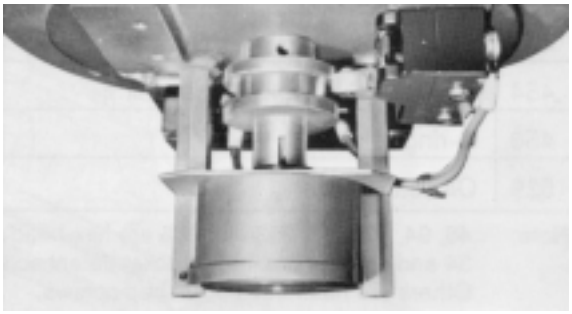


Fig. 105 Potentiometer

5.0 Standards of Components

End Clearance (rotor discharge end clearance) (mm)

Model	Pd - Ps > 100psid	Pd - Ps=<100psid		
		VSR*	VMR*	VLR*
160V**	0.04 ~ 0.06	0.20 ~ 0.22	0.22 ~ 0.24	0.24 ~ 0.26
200V**	0.05 ~ 0.07	0.26 ~ 0.30	0.28 ~ 0.32	0.31 ~ 0.35
250V**	0.08 ~ 0.11	0.40 ~ 0.44	0.45 ~ 0.49	0.50 ~ 0.54

Bolt Sizes (numbers in brackets indicate number of bolts)

No.	Location	160V*R*	200V*R*	250V*R*
2	Rotor casing	M12X45 (52)	M16X50 (78)	M20X60 (44)
24	Balance piston cover	M10X25 (11)	M12X30 (11)	M12X30 (11)
34	Balance piston sleeve	M6X15 (2)	M8X15 (2)	M8X20 (2)
45	Thrust bearing gland	M6X30 (12)	M12X40 (8)	M16X45 (8)
53	Seal cover	M10X25 (8)	M12X30 (8)	M16X40 (8)
58	Unloader slide valve	M6X30 (5)	M8X45 (5)	M10X55 (5)
61	Unloader cylinder	M10X25 (2)	M12X30 (2)	M16X40 (2)
62	Unloader cylinder	M10X65 (6)	M12X75 (6)	M16X90 (6)
76	Unloader cover	M8X25 (8)	M10X25 (8)	M12X30 (8)
81	Bearing gland	M6X15 (3)	M6X15 (3)	M6X15 (3)
94	Suction flange	M20X55 (8)	ANSI#300-6”B	ANSI#300-10”B
97	Discharge flange	M20X55 (4)	ANSI#300-5”B	ANSI#300-6”B
191	Thrust bearing gland	M12x35 (4)	M16x45 (4)	M20x55 (4)
195	Speed-up gear casting	M12x40 (21)	M16x50 (21)	M20x70 (49)
217	Lubrication oil supply flange	N/A	M12X35 (2)	M12X35 (4)
452	Push rod lock washer (square)	M4X10 (1)	M5X15 (1)	M6X20 (1)
453	Vi slide valve nut	M24	M30	M36
454	Vi slide valve lock washer (dif.)	M4X20 (2)	M6X20 (2)	M6X35 (2)
456	O-ring retainer	M5X10 (2)	M5X10 (2)	M5X10 (4)
529	Oil seal sleeve	M6X5 (2)	M6X10 (2)	M6X10 (2)

Note: 45, 94, 97, 217, 253 and 256 are hex-head screws.
34 and 529 are hex-head socket detent screws.
Others are hex-head socket cap screws.

Bolt fastening torque

Hex socket head cap screw fastening torque (Kgf•cm)

M4	38
M5	75
M6	160
M8	320
M10	560
M12	860
M14	1 240
M16	1 800
M20	3 000
M24	4 600

Thrust bearing gland fastening bolt (45) torque

Model	Torque	
	(lbf•in)	(kgf•cm
160VR and 160VRD	206	237
200VR and 200VRD	570	657
250VR and 250VRD	684	788

Lock nuts & washers (numbers in brackets indicate number of bolts)

No.	Location	160V*R*		20V*R*		250V*R*	
		Nut	Washer	Nut	Washer	Nut	Washer
39	Thrust bearing	AN12 (2)	AW12 (2)	AN13 (2)	AW13 (2)	AN17 (2)	AW17 (2)
69	Unloader push rod	AN05 (1)	AW05 (1)	AN07 (1)	AW07 (1)	AN07 (1)	AW07 (1)
193	Thrust bearing, Drive gear	AN13 (1)	AW13 (1)	AN17 (1)	AW17 (1)	AN17 (1)	AW17 (1)
269	Drive gear	AN17 (1)	AW17 (1)	AN21 (1)	AW21 (1)	AN21 (1)	AW21 (1)

Lock nut fastening torque (Kgf•cm)

Size	Standard Torque	Maximum Torque
AN05	280	350
AN06	490	610
AN07	790	990
AN08	900	1130
AN10	2 060	2 580
AN11	3 120	3 900
AN12	4 080	5 100
AN13	5 220	6 530
AN14	6 560	8 200
AN15	8 100	10 120
AN16	9 840	12 300
AN17	11 860	14 830
AN18	14 130	17 660
AN19	16 640	20 800
AN20	18 760	23 450
AN21	22590	28240
AN26		

Stop rings (numbers in brackets indicate number of locations)

No.	Location	160V*R*	200V*R*	250V*R*
29	Main bearing	H102 (2)	H130 (2)	H160 (2)
29	Side bearing	H102 (2)	H130 (2)	H160 (2)
32	Balance piston	S50 (1)	S65 (1)	S80 (1)
37	Balance piston sleeve	H102 (2)	H130 (2)	H160 (2)
79	Indicator cam	S10 (1)	S10 (1)	S10 (1)
184-2	Side bearing, Speed-up gear			H102 (1)
186	Rolling bearing	H110 (1)	H160 (1)	H160 (1)
187	Rolling bearing	S60 (1)	S75 (1)	S75 (1)

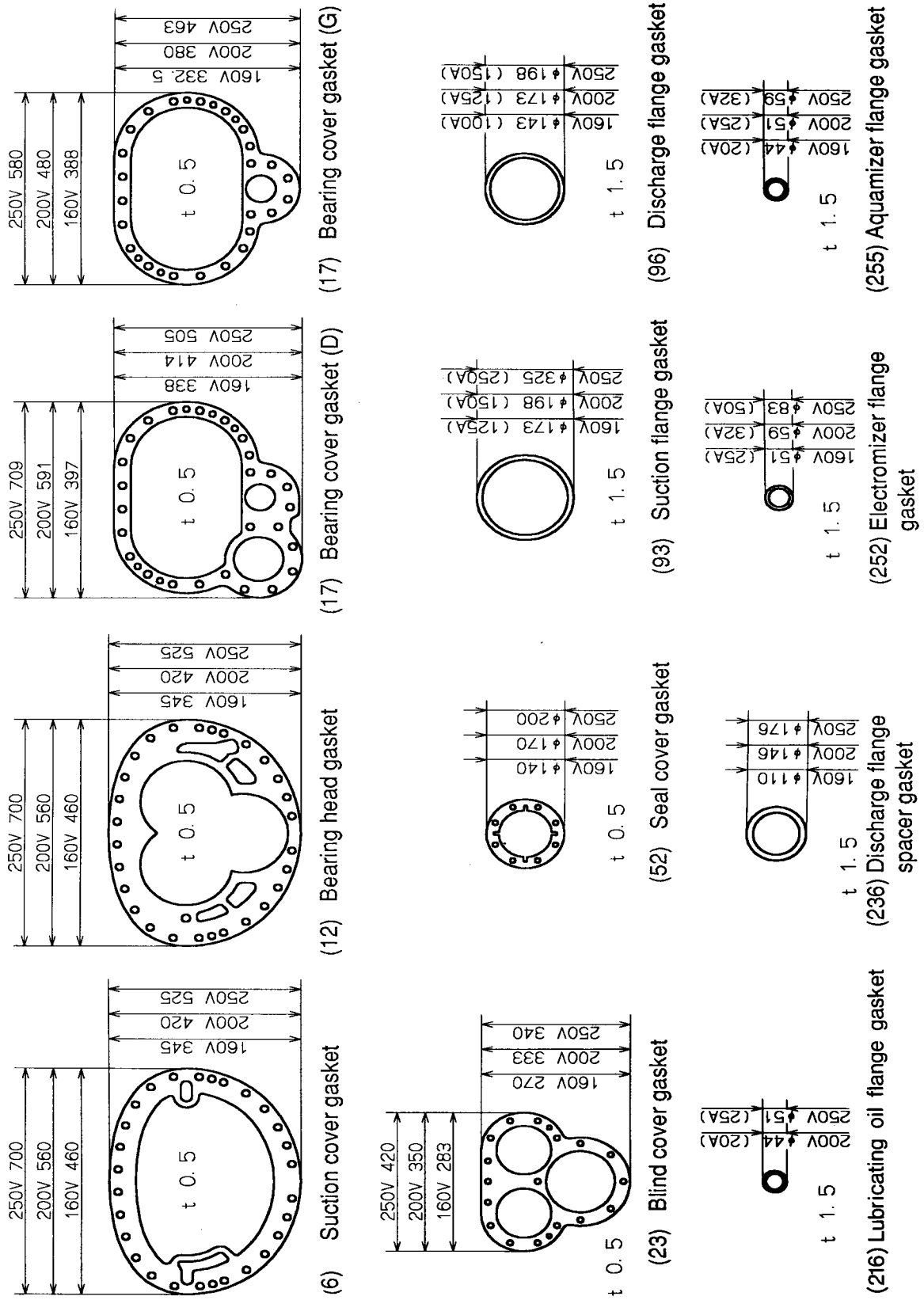
O-ring list

No.	Location	160V*R*	200V*R*	250V*R*
9	Suction cover / O-ring retainer	P46 (1)	G60 (1)	G65 (1)
35	Balance piston sleeve	G95 (1)	P120 (1)	P150 (1)
49	Seal retainer seal cover	G115 (1)	G135 (1)	G160 (1)
63	Unloader cylinder / Blind cover	G125 (1)	G150 (1)	G190 (1)
65	Unloader piston	P100 (1)	P125 (1)	P155 (1)
66	Cap seal	CAP-1BE100	CAP-3BE125	CAP-1BE155
73	Unloader push rod / unloader piston	P21 (1)	G30 (1)	G35 (1)
75	Unloader cover / Unloader cylinder	G110 (1)	G135 (1)	G170 (1)
184-3	Side bearing, Speed-up gear			G85 (2)
325	Unloader push rod / O-ring gland	P30 (2)	P40 (2)	P46 (2)
421	Stroke positioning spacer / Unloader push rod	P30 (2)	P40 (2)	P46 (2)
432	Main bearing / Bearing head	G85 (4)	☆G22 (4)	G135 (4)
433	Side bearing / Suction cover	G85 (4)	☆G22 (4)	G135 (4)
450	Vi changing rod / Bearing cover	P25 (1)	P35 (3)	P40 (4)
451	Vi changing rod / Bearing head	P25 (1)		
523	Vi changing rod / Unloader slide valve	P25 (1)		

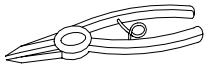
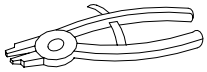
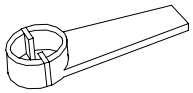
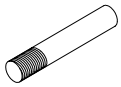
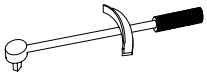
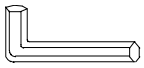
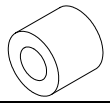
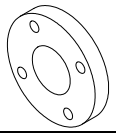
Numbers in ( ) indicate number of o-rings used.
Material: Viton
Standard: JIS B 2401
Items marked ☆ are JIS W 1516

V-Series Gasket List

* MYCOM standard



SPECIAL TOOLS

TOOL	IMAGE	250VR	200VR	160VR	NOTES
Plier for stop ring		ST-3	ST-3	ST-2N	
Plier for stop ring		RT-4	RT-4	RT-3	
Locknut wrench		AN-8	AN-7	AN-5	
		AN-17	AN-13	AN-12	
		AN-17L	AN-13L	AN-12L	
		AN-21	AN-17	AN-13	
		AN-26	AN-21	AN-17	
Eyebolts (2 each)		M8	M8	M8	MYK standard
		M16	M16	M12	JIS
Stud bolts (2 pcs)		M20×240	M16×173	M12×100	
Socket wrench		30	24	19	(mm)
		24	19	10	
Torque wrench		1300	920	920	(kgf･cm)
Allen wrench		2	2	2	(mm)
		3	3	3	
		4	4	4	
		5	5	5	
		6	6	6	
		8	8	8	
		10	10	10	
		14	14		
		17			
Sleeve for thrust bearing gap adjustment		S7317	S7313	S7312	
Bearing retainer		B7321	B7317	B7313	For securing ball bearing