



**TECHNICAL MANUAL**

**OVERHAUL INSTRUCTIONS**

**EXPEDITIONARY DEPLOYABLE OXYGEN  
CONCENTRATION SYSTEM  
120 LITERS PER MINUTE**

**MODEL EDOCS-120  
PART NUMBER -793035-001**

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**T.O. EDOCS-120-3**

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Only those work packages and subordinate work packages assigned to this manual are listed in this index, therefore, WP/WSP numbers may not be sequential.

WP/WSP Number	Change Number	Title
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002 00	0	Foreword- General Description of the Equipment
003 00	0	Master List of Special Tools and Consumables
004 00	0	Blower Removal, Overhaul and Installation
005 00	0	Scroll Compressor Overhaul
006 00	0	Booster Compressor Overhaul





WORK PACKAGE

ALPHABETICAL INDEX

**OVERHAUL INSTRUCTIONS**

EFFECTIVITY: EXPEDITIONARY DEPLOYABLE OXYGEN CONCENTRATION SYSTEM- P/N 793035-001

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WORK PACKAGE

FOREWORD

**OVERHAUL INSTRUCTIONS**

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Figure 1. Expeditionary Deployable Oxygen Concentration System (EDOCS-120).





## **1. SCOPE**

The equipment to which these overhaul instructions apply is the Expeditionary Deployable Oxygen Concentration System, PCI Model Number EDOCS-120 (see Figure 1). The part number is 793035-001. The unit is manufactured by Pacific Consolidated Industries, Santa Ana, California.

The unit consists essentially of the following components and sub-systems.

- a. Blower
- b. Blower aftercooler
- c. VSA pressure/vacuum switching valve and valve operator
- d. Adsorber vessel and controls
- e. Buffer storage tank
- f. Scroll compressor and controls
- g. Oxygen storage tank and controls
- h. Oxygen product distribution box
- i. High pressure oxygen booster compressor
- j. Oxygen backup supply system
- k. Vacuum pump
- l. Electrical controls with programmable logic controller (PLC)

## **2. OPERATING ENVIRONMENT**

The EDCOS-120 is designed for outdoor installation. However, for best performance it is recommended that it be placed under a tented roof to reduce the effects of solar radiation during the day in warm environments.





WORK PACKAGE

MASTER LIST OF SPECIAL TOOLS AND CONSUMABLES

**OVERHAUL INSTRUCTIONS**

EFFECTIVITY: EXPEDITIONARY DEPLOYABLE OXYGEN CONCENTRATION SYSTEM- P/N 793035-001

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**1. SPECIAL TOOLS**

Table 1 below lists the special tools necessary to accomplish the tasks described in this publication.

**2. CONSUMABLE MATERIALS**

Table 2 is a master list of the consumable items that are necessary for maintenance and overhaul of the EDOCS-120. Included in the list are lubricating oils, greases, solvents, and sealants.

Table 1. Master List of Special Tools.

<b>Tool Part Number</b>	<b>CAGE Code</b>	<b>Nomenclature</b>	<b>Use</b>
793768-001	75906	Belt Adjustment Tool	Adjusting the blower drive belts. Refer to WP 004 00, paragraph 5.2.
2903000400 582313-001	28953 75906	Grease Pump with Tip Adapters	Greasing the scroll compressor pin crank bearings. Refer to WP 005 00, paragraph 3.
2892610020 582313-002	28953 75906	Grease Cartridge For Grease Pump	Greasing the scroll compressor pin crank bearings. Refer to WP 005 00, paragraph 3.

Table 2. Master List of Consumable Materials.

<b>Nomenclature</b>	<b>Specification/ Part No.</b>	<b>CAGE Code</b>	<b>Use</b>	<b>Reference</b>
Bearing grease	W46040-777	75906	Greasing the blower shaft bearings and scroll compressor bearings	WP 004 00, para. 3.1; WP 005 00, para. 3
Bruhin solvent	Bruhin 815GG, 1990GD, MP1793	94098	Oxygen cleaning system components	WP 005 00, para.1.
Gear oil	W49100-011	75906	Lubricating the blower gears	
General cleaning solvent (NSN 6850-01-383-3058 or equal)	3-D Degreaser or equal	0SPP4	General parts cleaning and degreasing	General use
Lint-free cloth	N/A		General parts cleaning	General use
Molybdenum-disulfide grease	214290-001 MIL-G-21164 or equal	75906 81349	Thread lubricant	General use
Oxygen compatible grease	582380-001	75906	Greasing the high pressure booster compressor seals and bearings	General oxygen component use
Teflon pipe thread sealing tape	W14420-050 MIL-T-27730 or equal	75906 81349	Sealing pipe threads	General use



WORK PACKAGE

BLOWER OVERHAUL

**OVERHAUL INSTRUCTIONS**

EFFECTIVITY: EXPEDITIONARY DEPLOYABLE OXYGEN CONCENTRATION SYSTEM- P/N 793035-001

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## FOREWORD

This Work Package (WP) contains procedures for removing and installing the blower in the EDOCS-120. Proce-

dures are also included for disassembling, inspecting, reassembling and lubrication the blower.

## SAFETY SUMMARY

### COMPRESSED AIR

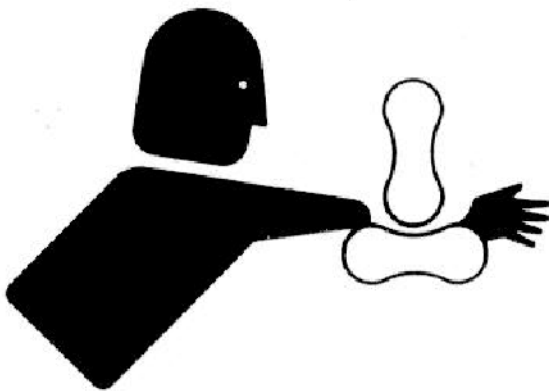
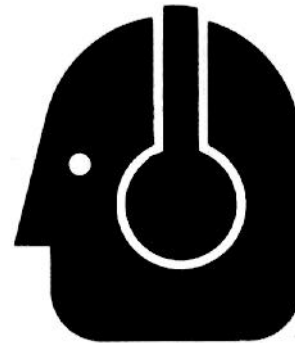
Some procedures in this WP require the use of compressed air to dislodge and remove components. Do not direct air streams towards self or other personnel. Never stand in front of the component being dislodged and always place a barrier in front of the component being dislodged.

### CLEANERS/CHEMICALS/PAINTS/PRIMER

Some cleaners, chemicals, paints, and primers have adverse effects on skin, eyes, and the respiratory tract. Observe manufacturer's Warning labels, Material Safety Data Sheets (MSDS) instructions for proper handling, storage, and disposal, and current safety directives. Use only in authorized areas. Unless otherwise indicated in the text, use as described in this TO should not result in any immediate health concerns. Consult the local Bioenvironmental Engineer and Base Safety Office for specific protection equipment and ventilation requirements.

### WARNING TAGS

The following warning tags were attached to the blower. Do not remove, paint over or obscure in any manner. Failure to heed these warnings could result in serious bodily injury to the personnel operating and maintaining this equipment.





## 1. BLOWER REMOVAL

- a. Open the rear left door and remove the drive belt cover panel on the side of the adsorber assembly. The panel is below the VSA control electrical box.
- b. Remove the access panel below the backup supply system (see Figure 1).



Figure 1. Motor Adjustment Access Panel.

- c. Loosen the motor mounting bolts sufficiently to allow the motor to be moved with the adjusting bolts.
- d. Move the motor toward the blower using the adjusting bolts. Remove the drive belts (see Figure 2).
- e. Loosen the three (3) screws on the pulley hub. Remove the pulley and hub. Refer to Figure 2.
- f. Loosen the clamps on the hoses at the bottom of the muffler and at the upper side of the muffler (see Figure 3). Remove the muffler.
- g. Drain the oil from the blower. Remove the fill tube, drain tube and overflow tube from the blower gear case housing. Refer to Figure 3.
- h. Remove the mounting bolts attaching the blower mounting brackets to the base.

### CAUTION

The blower weighs over 200 pounds. Use proper lifting equipment for removing the blower from the unit.

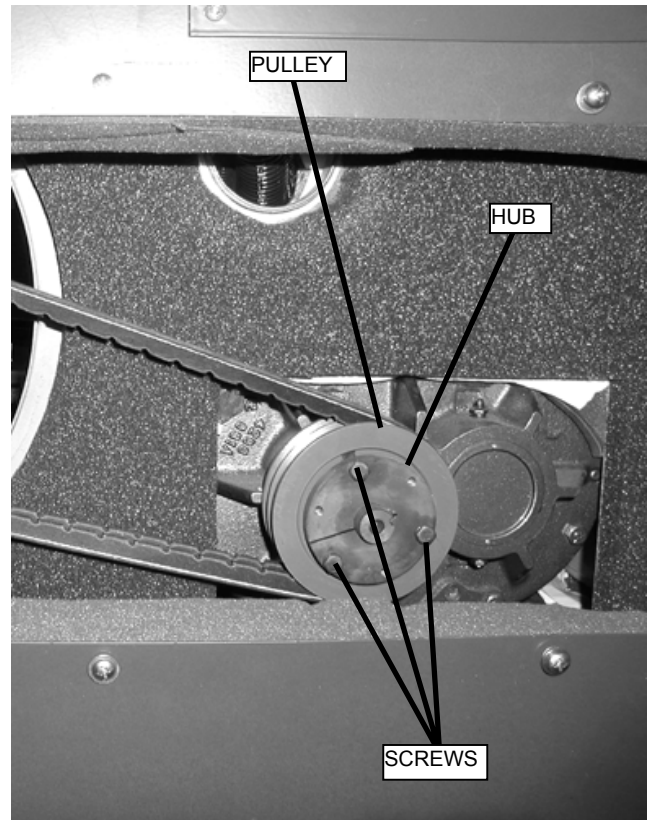


Figure 2. Blower Pulley Removal.

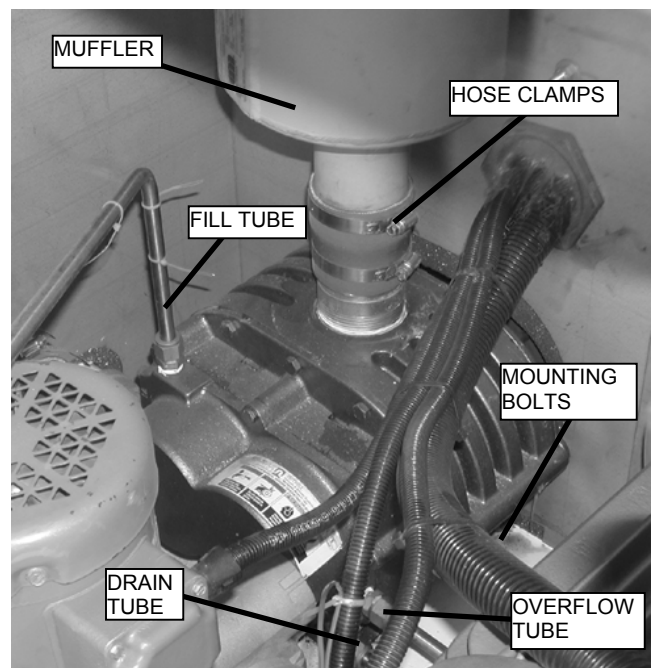


Figure 3. View of Blower In the EDOCS-120.



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WP 004 00**

- i. Lift the blower straight up until the inlet pipe nipple clears the mounting base. Place the blower on a suitable work table, if it is to be disassembled.

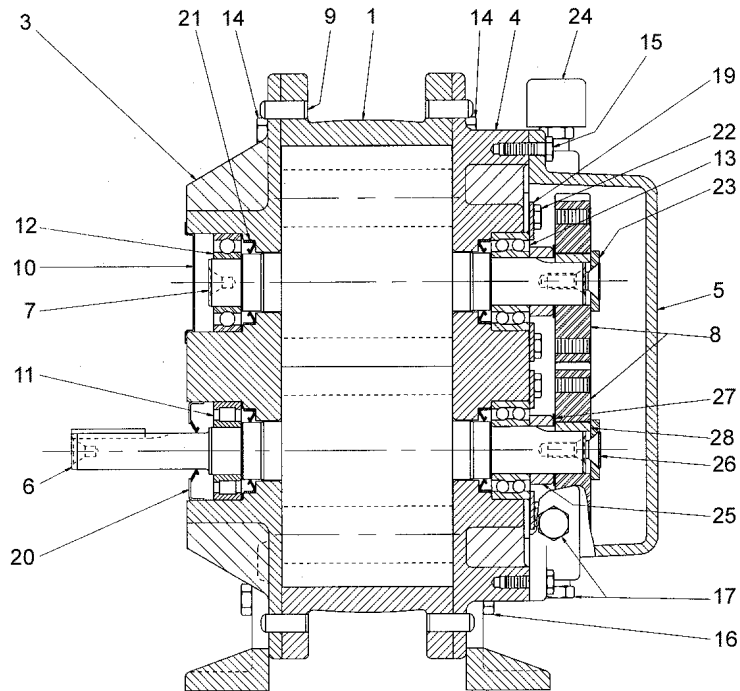
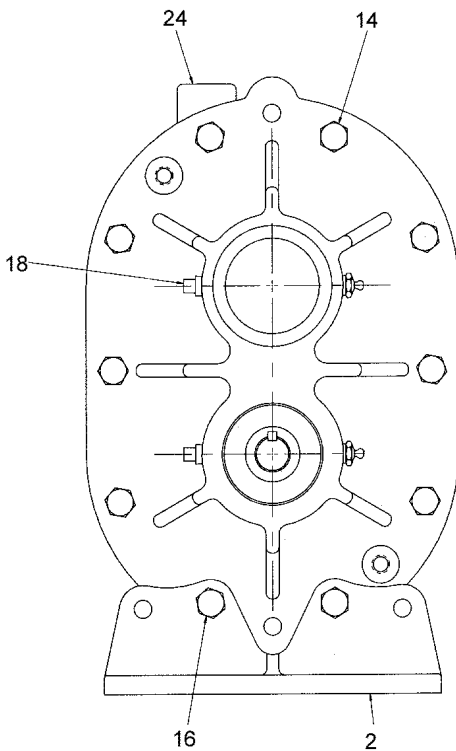
**2. BLOWER DISASSEMBLY AND INSPECTION**

With proper maintenance and lubrication, normal life expectancy for gears, bearings, and seals can be achieved. However, over a period of time these parts must be repaired or replaced to maintain the efficiency of your blower. This section is written in a way that will allow you to completely disassemble your blower. The inspection of certain repairable or replaceable parts is referred to at the point of disassembly where these parts are exposed. If at any point of inspection, repair or replacement is deemed necessary, ap-

propriate instruction will be given to achieve these repairs or replacements.

Take out eight cap screws [15] and remove the gear cover. It may be necessary to tap the sides with a mallet or wooden block to break the seal joint. Gears are now exposed for visual inspection. Items in brackets [ ] are referenced to item numbers on Figure 4. Inspect the gears for the following:

- Broken teeth
- Chipped teeth
- Uneven wear
- Excessive wear
- Any other abnormalities



ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	Housing	1	11	Drive shaft roller bearing	1	20	Drive shaft lip seal	1
2	Mounting foot	2	12	Bearing	1	21	Lip seal	4
3	Drive end plate	1	13	Bearing	2	22	Screw, hex head	4
4	Gear end plate	1	14	Screw, hex head	16	23	Washer	2
5	Gear cover	1	15	Screw, hex head	8	24	Breather	1
6	Drive rotor	1	16	Screw, hex head	4	25	Spacer	2
7	Driven rotor	1	17	Oil plug	3	26	Screw, hex head	2
8	Timing gear	2	18	Relief fitting	2	27	Timing shim (qty as reqd)	10
9	Dowel pin	4	19	Bearing retainer	4	28	Timing gear key	2
10	Bearing cover plate	1						

Figure 4. Blower Cross Section.





## 2.1 Blower Disassembly.

- a. Position the blower with the drive gear on the left, when facing the gears. Remove socket head screws and washers. [Items 26 & 23].
- b. Align timing marks and count four (4) teeth down and place reference marks on the gears. Refer to Figure 5 below.

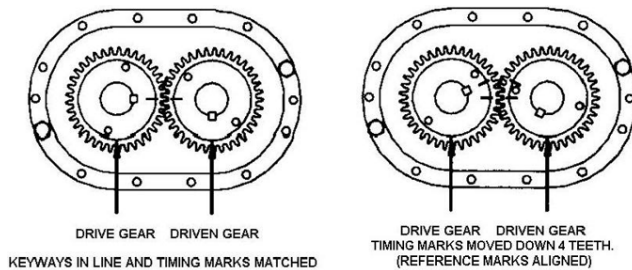


Figure 5. Timing Gear Alignment.

- c. Align reference marks and use puller to pull the driven gear. (Gear on right side.) Refer to Figure 6 below.

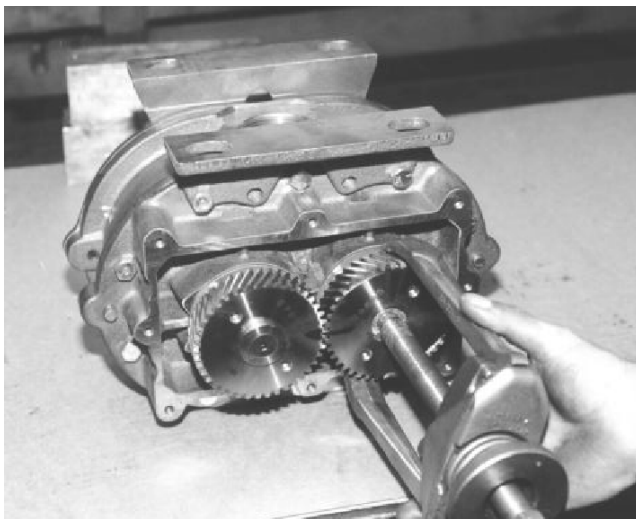


Figure 6. Pulling Drive Gear With Jaw Puller.

- d. Use puller to remove drive gear. A bar puller or jack screws can be used. Refer to Figure 7 below.
- e. Remove shim and spacer [Items 25 & 27].
- f. Turn blower around and remove bearing cover plate [Item 10].
- g. Remove eight (8) cap screws. [Item 14].

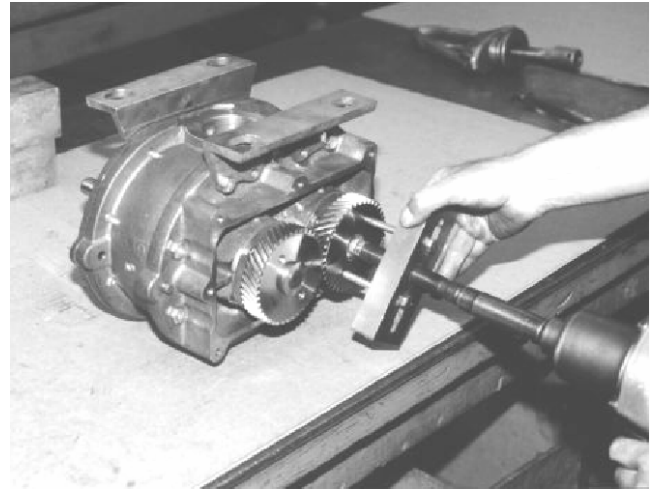


Figure 7. Pulling Drive Gear With Bar Puller.

- h. Use jackscrews to remove end plate. Refer to Figure 8 below.

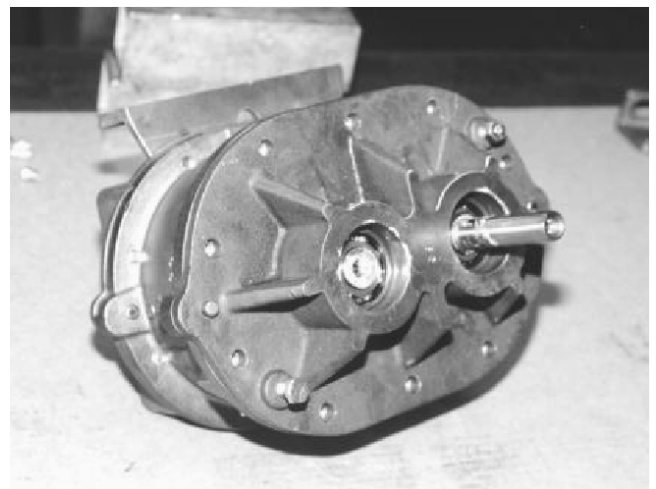


Figure 8. Pulling Drive End Plate.

- i. Press rotors out of end plate in press if available. If press is not available, support end plate and rotors in the housing. Block up housing and use a soft mallet to drive the rotors out. Refer to Figure 9 below. A jaw type puller can also be used (see Figure 10).
- j. Using a tube or round bar of a slightly smaller diameter than the shaft clearance holes in the end plates, tap the bearings out of the end plates. Bearing retainers [Item 19] must be removed before knocking out the bearings. Refer to Figure 11 below.
- k. Remove seals from both end plates with a punch or dull chisel. The seals *will* be damaged during removal and must be replaced.

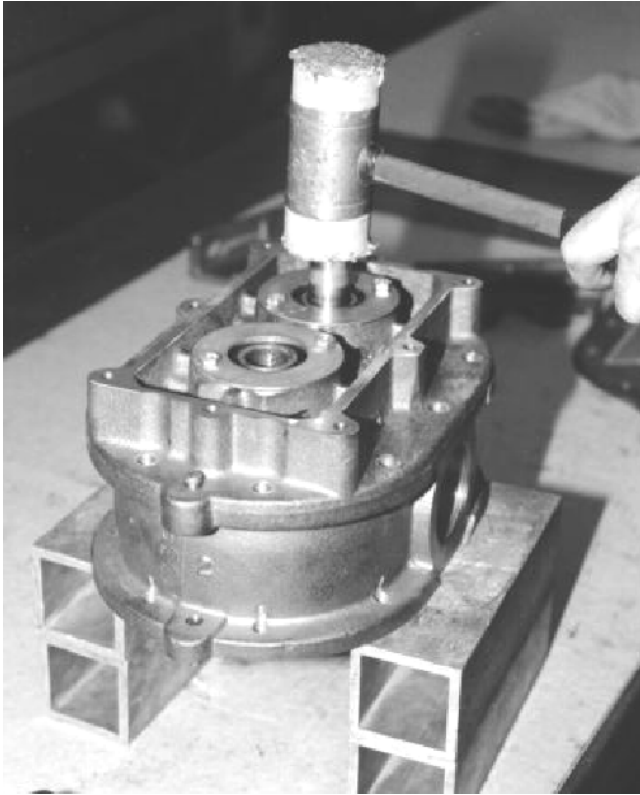


Figure 9. Driving Rotors Out Using Soft mallet.



Figure 10. Driving Rotors Out Using Jaw Puller.

- l. Inspect all parts for wear and or damage.
- m. Clean and inspect all parts for burrs and polish seal journals with at least 320 grit emery or crocus cloth.



Figure 11. Tapping Bearings Out of End Plates.

**Note**

Items in brackets [ ] are referenced to item numbers on Figure 4.

**3. BLOWER ASSEMBLY**

- a. After thorough cleaning of the seal and bearing bores of both end plates apply a thin coat of sealant on the outside diameter of the new seals and press them into the end plate using a tool that will bear on the outer edge of the seal. Spring side of the seal should be facing you. Apply a thin coat of grease to the seal lip.
- b. Using the drive end plate as a fixture, support it high enough so the input shaft of the drive rotor clears the assembly surface. Refer to Figure 12 below.
- c. Place rotors in fixture with the drive rotor to the left. See Figures 12 and 13 below.
- d. Place end plate [Item 4] on rotors.
- e. Apply a thin coat of lubricant on the rotor shafts and the inner race of the bearings. Tap the bearings [13] into place using a tube with a flanged end that will contact both the inner and outer bearing races. Refer to Figure 14 below.

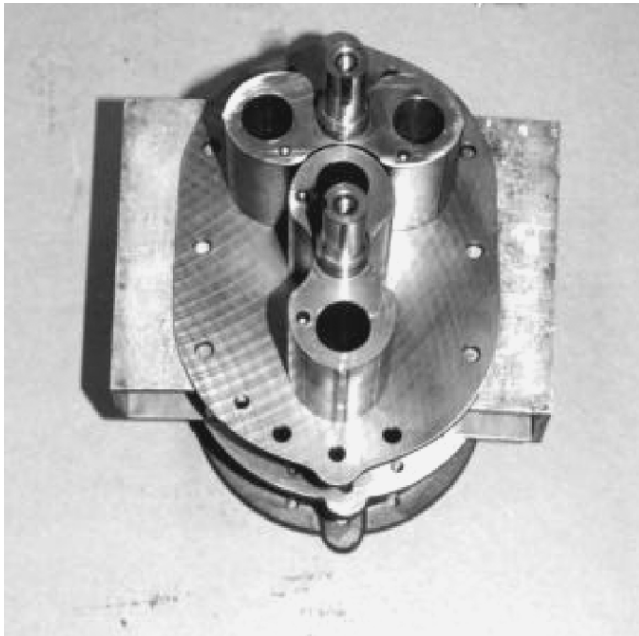


Figure 12. Rotors Assembled on Drive End Plate.

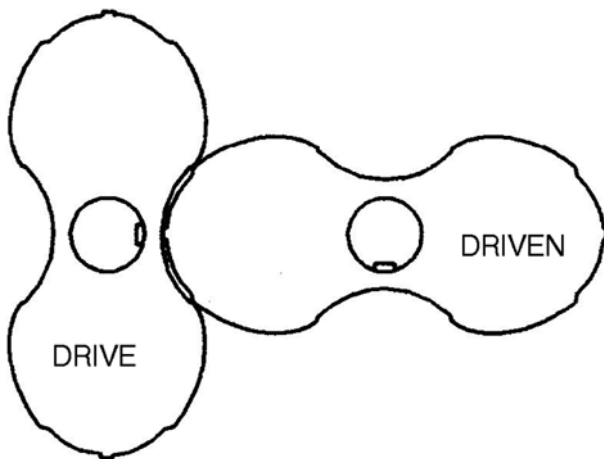


Figure 13. Detail of Proper Keyway Positions.

**WARNING**

KEEP HANDS AND LOOSE CLOTHING AWAY FROM LOBES AND GEARS.

- f. Install bearing retainers [Items 19 & 22] to both bearings.
- g. Check clearances between the end of the rotors and the face of the end plate. Refer to Table 1 for proper clearances. Refer to paragraph 3.1 for procedures for checking and adjusting the clearances.

Table 1. Blower Assembly Clearances.

Lobes to End Plates			Lobe to Casing		Interlobe
Total (Min/Max)	Drive End (Min)	Gear End (Min)	Min	Max	Min
.005"/.010"	.003"	.002"	.004"	.008"	.006"

- h. If clearances check OK, put a spacer [25] and a shim [27] on each shaft. Timing shims that were removed should be put back on the shaft from which they were removed. Refer to Figure 15.

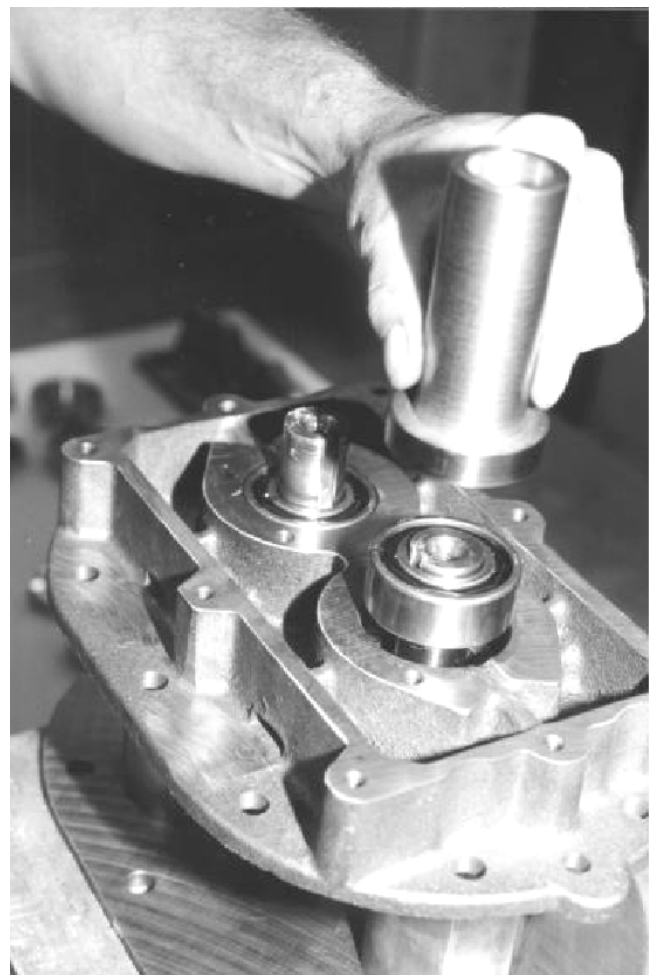


Figure 14. Tapping Bearings Into End Plates.

- i. Lubricate shafts and bores on gears. Begin by pressing on the DRIVE gear. This will be pressed on the drive rotor, which is to the left.
- j. Start the driver gear on the shaft and align the reference timing marks and press gear on. Lock gears in



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WP 004 00**

place with cap screw [26] and washer [23]. Turn assembly over and rest the unit on the cap screws and washers on the gear end.

- k. Set dowel pins [9] in housing and position housing over the rotors and fasten with cap screws [14]. Check housing to rotor clearance. (Refer to Figure 15) A depth micrometer can be used.

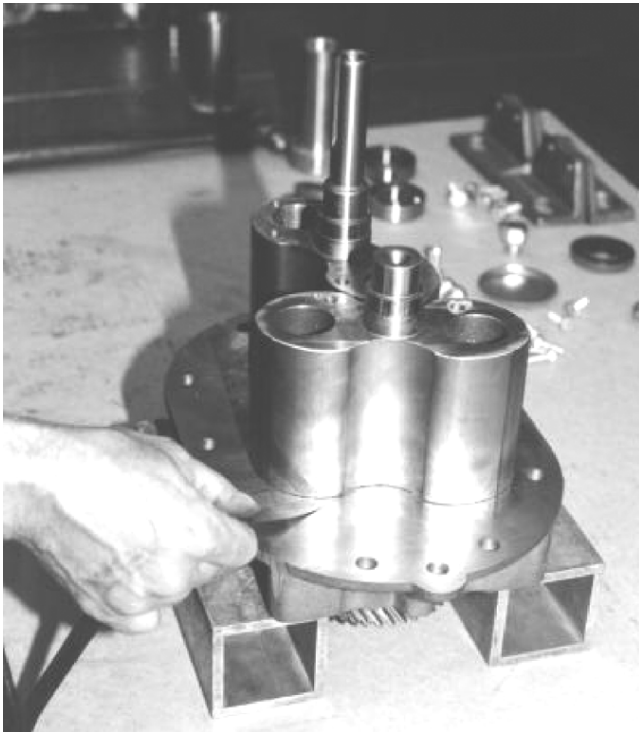


Figure 15. Checking Lobe to End Plate Clearances.

- l. Set on drive end plate [3] and fasten with cap screws [14]. (**ATTENTION:** There are four cap screws [16] which are used to fasten the feet on.) Lubricate shafts and bearings. Install the ball bearing [12] on the driven rotor and the roller bearing [11] on the input shaft.
- m. Install grease cover [Item 10] and drive shaft seal [20].
- n. Install any removed plugs [17] if required.

**Note**

Items in brackets [ ] are referenced to item numbers on Figure 4.

**3.1 Adjusting Interlobe Clearances.**

Using feeler gauges take interlobe readings and record on each side of housing as indicated in Figure 16 below. By removing or adding shim behind the helical gear, it rotates as it is moved in or out and the driven rotor turns with it, thus changing the clearance between rotor lobes.

Changing the shim thickness .006" (.15 mm) will change the rotor lobe clearance .003" (.08 mm) or one-half the amount.

**EXAMPLE:** Referring to Figure 16 below, check the clearance at AA (right hand reading) and BB (left hand reading). If AA reading is .009" (.23 mm) and BB reading is .003" (.08 mm) by removing .006" (.15 mm) shims, the readings will change one half the amount removed or .003" (.08 mm). AA should then read .006" (.15 mm) and BB should read .006" (.15 mm). The final reading should be within .002" (.05 mm) of each other.

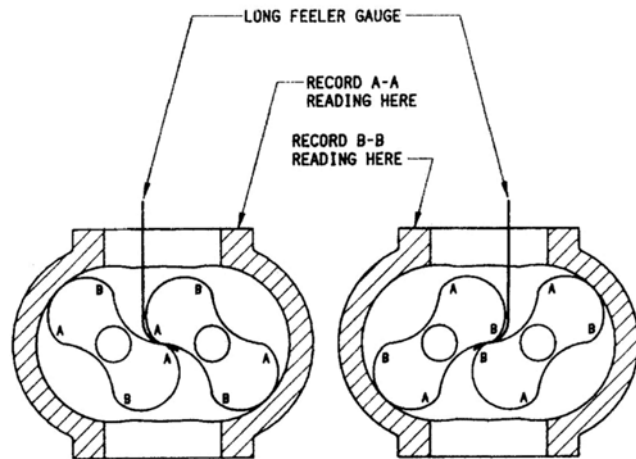


Figure 16. Checking Interlobe Clearances.

To determine the amount of shim to add or remove, subtract the small figure from the larger. If the right side is higher than the left side, remove a shim. If the right side is reading lower, add a shim.

**4. LUBRICATION AND FINAL ASSEMBLY**

- a. Pack the bearing cavities with suitable grease. Install bearing cover plate [10]. Refer to WP 003 00, Table 2 for the recommended grease.
- b. Replace front lip seal [20] taking care not to damage the lip as it passes over the keyway. Lip must point inward toward the bearing.



- c. Apply a good quality RTV silicone sealant to the inner surface of the gear cover [5]. Install the gear cover with cap screws [16] and tighten evenly.
- d. Grease front-end bearings using a pressure grease gun. Force grease into each bearing grease fitting until traces of clean grease come out of the relief fittings on the lower side of the bearing housing. Refer to Figure 17.

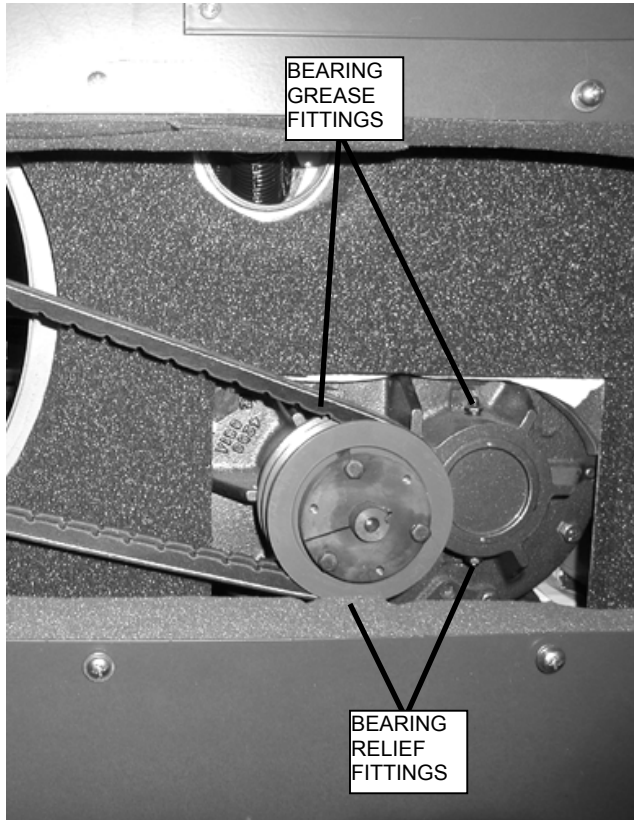


Figure 17. Blower Bearing Grease Fittings.

**Note**

The gear case is filled with oil after the blower is installed in the EDOCS-120. Refer to paragraph 5.1.

**5. BLOWER INSTALLATION**

**CAUTION**

The blower weighs over 200 pounds. Use proper lifting equipment for installing the blower in the unit.

- a. Lift the blower and position it over the blower inlet port in the base frame.

**Note**

If the blower is a replacement blower, make sure the inlet and outlet pipe nipple fittings on the old blower are removed and installed on the replacement blower. Do not mix up the inlet and outlet fittings. Otherwise, the blower cannot be properly installed.

- b. Slowly lower the blower onto the base frame while ensuring that the inlet pipe nipple on the blower is aligned with the blower inlet port.
- c. Install the blower mounting bolts. Tighten the bolts hand tight.
- d. Slide the pulley and hub onto the blower shaft. Do not tighten the screws at this time. Refer to Figure 2.
- e. Place a straight edge long enough to span the blower and motor pulleys on the motor pulley. Position the blower pulley against the straight edge.
- f. Rotate the blower housing as required so that the blower pulley is flush with the straight edge when the straight edge is also flush with the motor pulley. Tighten the blower mounting bolts securely (see Figure 3).
- g. To insure the blower has not been distorted during mounting in the installation, turn the shaft by hand to make sure they are not making contact prior to connecting to the motor.
- h. Tighten the screws on the pulley hub securely, while maintaining the pulley alignment with the straight edge (see Figure 2).
- i. Install the fill tube, drain tube and overflow tube to the blower gear case housing.

**Note**

If the blower is a replacement blower, make sure the fittings on the old blower are removed and installed in the appropriate ports on the replacement blower.

- j. Slide the hose and four (4) clamps over the blower outlet pipe nipple. Install the muffler into the hose. Refer Figure 3. Position the hose so about half of the hose is on each side of the pipe nipples.
- k. Slide the hose and four (4) clamps over the outlet pipe on the muffler. Align the muffler outlet pipe with the existing pipe. Slide the hose over the exist-



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WP 004 00**

ing pipe. Position the hose so about half of the hose is on each side of the pipe nipples.

- 1. Position the end clamps about 1/4-1/2” from the hose ends. Position the inside clamps about 1/4” from each outside clamp. Tighten all clamps securely.

**5.1 Lubricating the Blower.**

Before starting the blower, the gear case must be filled with oil. Removing the plugs on the oil fill port and the oil level port then pour the proper oil (WP 003 00, Table 2) into the fill port until oil begins to trickle from the oil level port. Refer to Figure 18.



Figure 18. Blower Gear Case Oil Ports.

For proper maintenance, drain the oil every 1000 hours of operation and refill with new oil. See WP 003 00, Table 2 for the proper grade of oil to use.

**5.2 Adjusting the Blower Drive Belt.**

- a. Open the rear left door and remove the drive belt cover panel on the side of the adsorber assembly (if not already removed). The panel is below the VSA control electrical box.

- b. Remove the access panel below the backup supply system (if not already removed) (see Figure 1).
- c. Install the three (3) belts.

**Note**

Always replace all three belts when installing new belts, whether or not one or more of the belts may appear to be in good shape.

- d. Check the belt tension by pressing one of the belts at the mid-point and measuring the force required to deflect the belt 0.30 inches. The force required should be 9-12 pounds for a used belt and 12-15 pounds for a new belt. Refer to Figure 19.

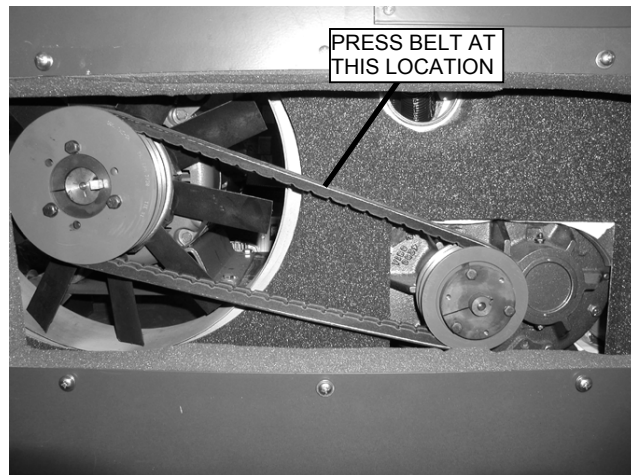


Figure 19. Blower Drive Belt Adjustment.

- e. Adjust the tension adjusting bolts on the motor base to achieve the required force at the 0.30-inch deflection.
- f. Tighten the motor mounting bolts securely.
- g. Install the access panel. Tighten the panel attaching screws securely.
- h. Install the drive belt cover panel. Tighten the attaching bolts securely. Close the door.

**Note**

An adjustment tool is available from Pacific Consolidated Industries for adjusting the drive belts. The part number is 793768-001 (see WP 003 00, Table 1).



WORK PACKAGE

SCROLL COMPRESSOR OVERHAUL

**OVERHAUL INSTRUCTIONS**

EFFECTIVITY: EXPEDITIONARY DEPLOYABLE OXYGEN CONCENTRATION SYSTEM- P/N 793035-001

LIST OF EFFECTIVE WP PAGES

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## **FOREWORD**

This Work Package (WP) contains procedures for replacing the seals on the scroll compressor. Procedures are also provided for removal and installation of the scroll compressor,

and for greasing the pin crank bearings on the scroll compressor.

## **SAFETY SUMMARY**

### **COMPRESSED AIR**

Some procedures in this WP require the use of compressed air to dislodge and remove components. Do not direct air streams towards self or other personnel. Never stand in front of the component being dislodged and always place a barrier in front of the component being dislodged.

### **CLEANERS/CHEMICALS/PAINTS/PRIMER**

Some cleaners, chemicals, paints, and primers have adverse effects on skin, eyes, and the respiratory tract. Observe manufacturer's Warning labels, Material Safety Data Sheets (MSDS) instructions for proper handling, storage, and disposal, and current safety directives. Use only in authorized areas. Unless otherwise indicated in the text, use as described in this TO should not result in any immediate health concerns. Consult the local Bioenvironmental Engineer and Base Safety Office for specific protection equipment and ventilation requirements.





## 1. TIP SEAL REPLACEMENT

The scroll compressor does not require removal in order to replace the tip seals. The tip seal on the compressor is self-lubricated and allows the unit to operate efficiently without oil and expensive filtration. The tip seal should be replaced every 1000 hours of operation. The following procedures should be used to replace the tip seals.

- a. Shut down the EDOCS-120 and lock-out the power source. Set the main circuit breaker (CB-1) to the OFF position.
- b. Open the left front door to gain access to the scroll compressor. Refer to Figure 1 for the location of the scroll compressor and the attached components.

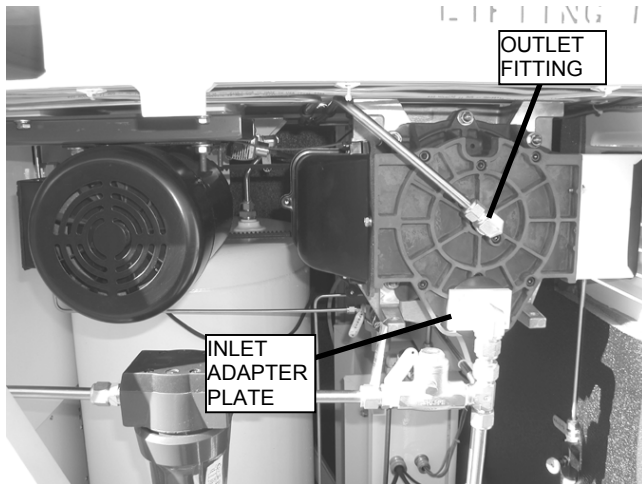


Figure 1. View of Scroll Compressor In the EDOCS-120.

### WARNING

DANGEROUS GAS PRESSURES MAY EXIST. ENSURE THAT ALL PRESSURE HAS BEEN REMOVED FROM THE SCROLL COMPRESSOR BEFORE CONTINUING WITH ANY DISASSEMBLY.

- b. Remove the inlet adapter plate from the scroll compressor. Refer to Figure 1.
- c. Remove the outlet tube from the outlet fitting. Refer to Figure 1.
- d. Remove the six (6) nuts securing the fixed scroll to the housing. Remove the fixed scroll. Refer to Figure 2.

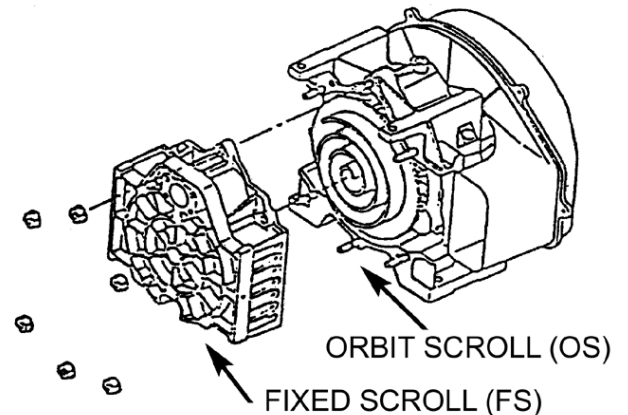


Figure 2. Removing the Fixed Scroll.

Table 1. Tip Seal Kit Contents.

Item No.*	Description	Qty
1	High pressure tip seal for fixed scroll	1
2	Low pressure tip seal for fixed scroll	1
3	High pressure tip seal for orbit scroll	1
4	Low pressure tip seal for orbit scroll	1
5	Dust seal	1
6	Backup tube	1

\*Refer to Figure 3 for item numbers.

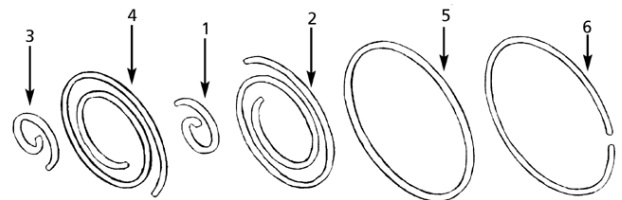


Figure 3. Tip Seal Kit Contents.

- e. Remove the low pressure and high pressure tip seals from the fixed scroll set and the orbit scroll set. Using a ballpoint pen at the start will make it much easier (see Figure 4).
- g. Thoroughly clean the fixed and orbit scrolls with an oxygen compatible solvent. Refer to WP 003 00, Table 2.

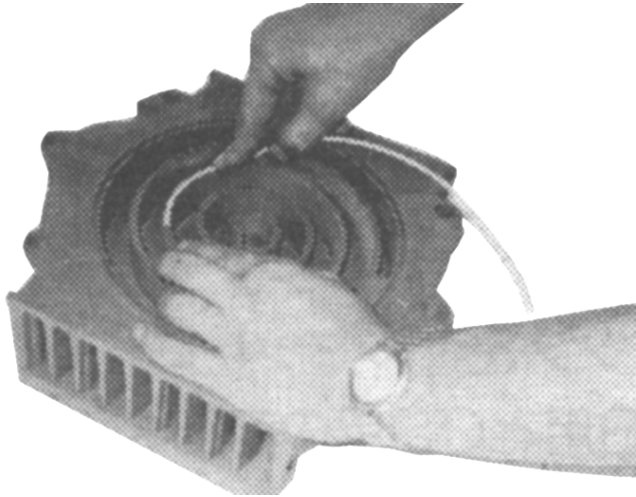


Figure 4. Removing the Tip Seals From the Groove.

**Note**

Be sure that the tip seal grooves are free of foreign particles.

- h. Prior to installing the tip seals, the fixed and orbit scroll tip seals must be identified. They have opposing seal cut angles. See Figure 5 to identify the fixed and orbit tip seals.
- i. Insert the tip seal so that the lip of the tip seal is at the bottom of the seal groove and inner side of involute, and the direction of the lip faces the center of the involute (curving spiral). Refer to Figure 6. This is to be done for both the fixed scroll and orbit scroll sets. Use caution not to tear or distort the seal lip.
- j. Insert the new high pressure tip seal from the center section for the orbit scroll so that there will be no clearance at the tip (start) section (see Figures 6 and 7).
- k. Insert the seal so that the new low pressure tip seal will contact closely with the high pressure tip seal inside the scroll seal groove (see Figure 4).

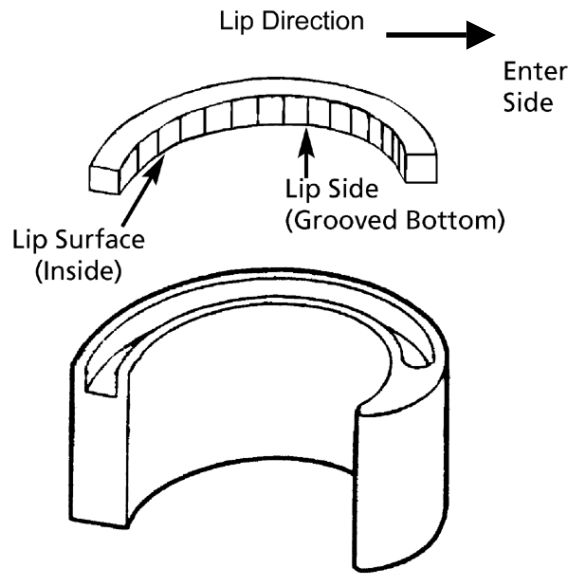


Figure 6. Tip Seal Orientation.

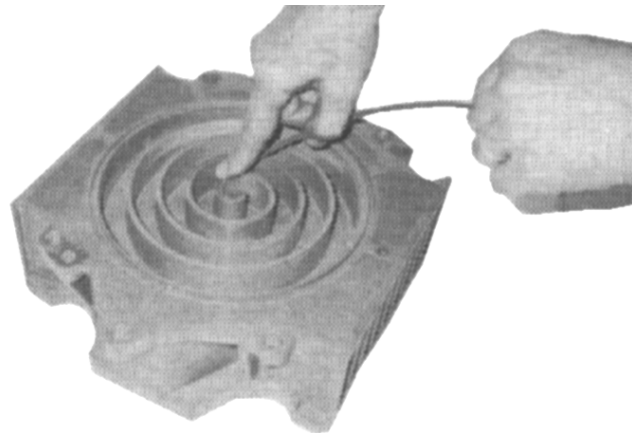


Figure 7. Inserting High Pressure Tip Seal.

**NOTE:** In order to distinguish between the tip seal for Fixed Scroll and the tip seal for Orbit Scroll place the tip seal as shown below then view from the arrow direction and refer to the figure on the right.

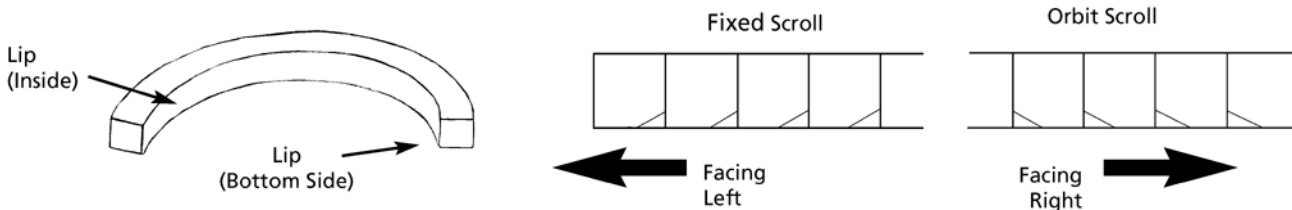


Figure 5. Identifying Fixed and Orbit Scroll Tip Seals.



**CAUTION**

Insert approximately half of the low pressure tip seal then remove it to confirm that a notch in the tip seal has been achieved. This will prevent movement during installation (see Figure 8).

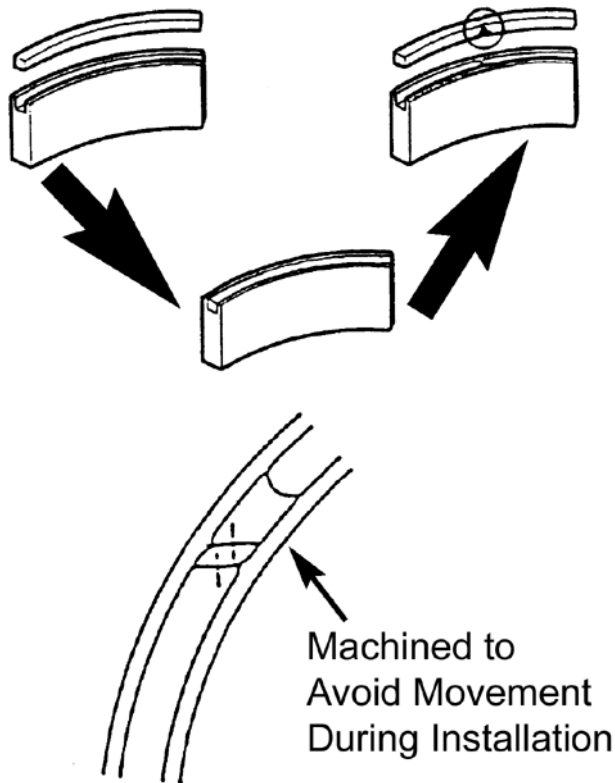


Figure 8. Detail of Tip Seal Groove.

- l. Repeat the same procedure for the fixed scroll tip seal set.
- m. Remove the dust seal and the backup tube from the outermost groove on the fixed scroll set (see Figure 9).
- n. Insert the new backup tube in the fixed scroll groove with the ends positioned in the 6 o'clock position (see Figure 9).
- o. Insert the new dust seal over the backup tube. Face the seamed section on the dust seal in the 3 o'clock position (see Figure 9).
- p. After replacing the tip seal set, reassemble the fixed scroll set onto the orbit scroll set. Tighten the six (6) nuts temporarily and confirm if the crankshaft rotates smoothly by hand. If so, then tighten them firmly.

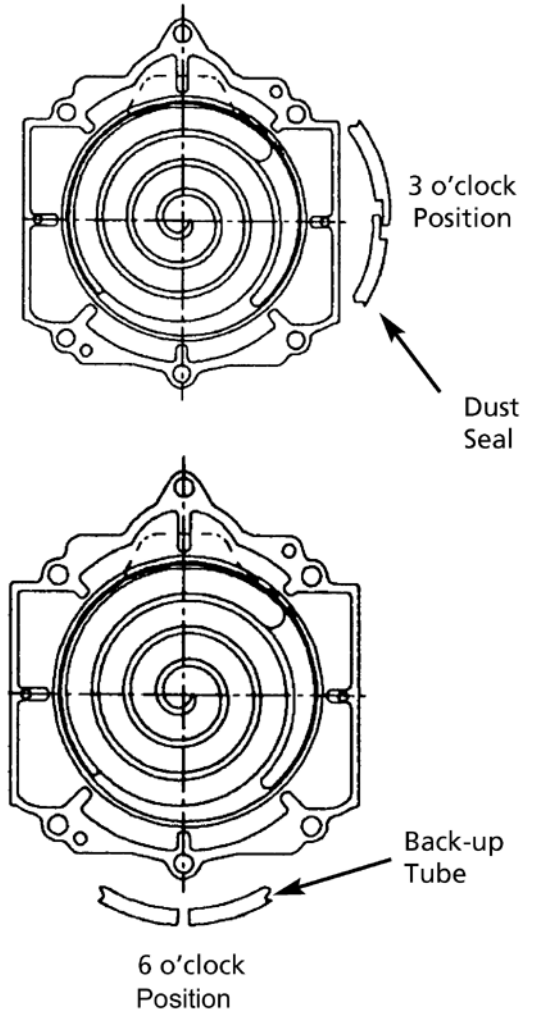


Figure 9. Dust Seal and Backup Tube Orientation.

The tightening torques are 15 inch pounds for the temporary tightening and 175 inch pounds for the final tightening.

**Note**

Assemble so that the dust seal and tip seal will not drop between the orbit scroll set and the fixed scroll set.

**2. SCROLL COMPRESSOR REMOVAL**

**CAUTION**

The scroll compressor weighs approximately 40 pounds. Have a person hold the compressor while removing the mounting bolts.



**T.O. EDOCS-120-3  
WP 005 00**

- a. Shut down the EDOCS-120 and lock out the power source. Set the main circuit breaker (CB-1) to the OFF position.
- b. Remove the inlet adapter plate from the scroll compressor. Refer to Figure 11.
- c. Remove the outlet tube from the outlet fitting. Refer to Figure 11.
- d. Loosen the four (4) motor mounting bolts sufficiently to allow the motor to be moved with the tension adjusting bolt (see Figure 10).

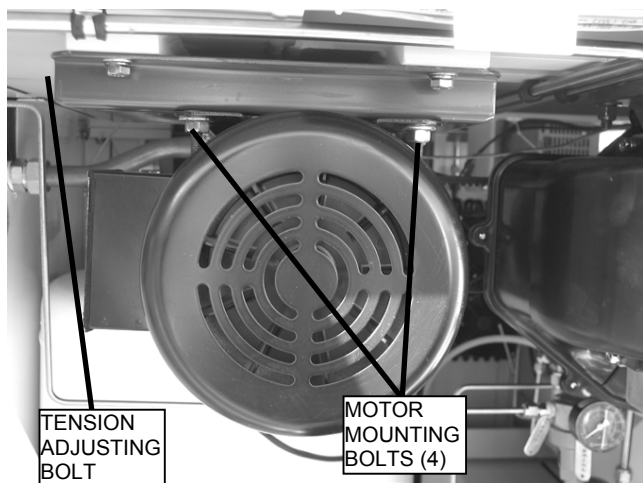


Figure 10. Scroll Compressor Motor Mount.

- e. Turn the tension-adjusting bolt in the direction that moves the motor toward the scroll compressor. Move the motor enough to remove the scroll compressor drive bolt (about 3/4 to 1 inch). Remove the belt.
- f. Remove the tube from the flow control valve (FCV-1). Refer to Figure 11.
- g. While supporting the scroll compressor, remove the mounting bolts, nuts and washers that attach it to the upper frame of the EDOCS-120 (see Figure 11).
- h. Remove the compressor. If the scroll compressor is to be replaced, remove the exhaust duct from the housing and install it on the new compressor.

**3. GREASING SCROLL COMPRESSOR BEARINGS**

The scroll compressor must be partially disassembled to accommodate greasing of some of the bearings. Use the following procedures to grease those bearings. Refer to

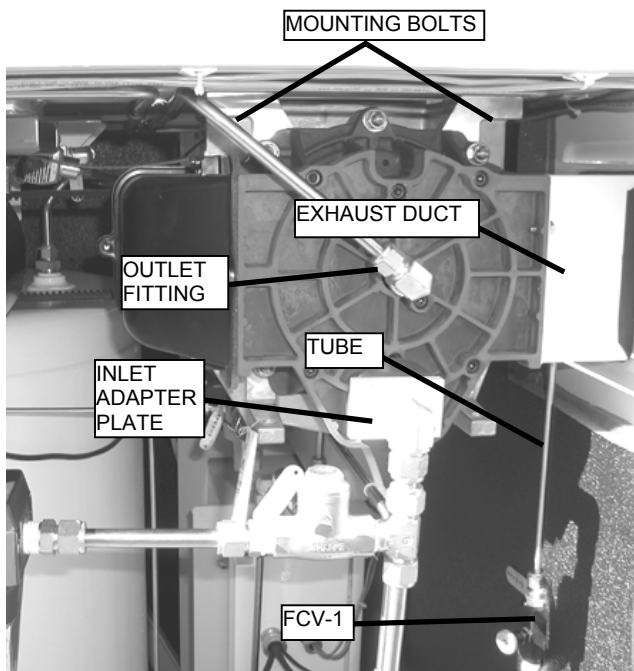


Figure 11. Scroll Compressor Mounting Bolts.

Table 2 and Figure 12 for the parts list and illustration of the scroll compressor assembly.

Table 2. Parts List For Figure 12.

Find No.	Description	Part Number	Cage Code	Qty
1	Stationary Scroll Set	IP600100AV	1BRC5	1
2	Air end Pulley	IP600300AV	1BRC5	1
3	Key	IP600600AV	1BRC5	1
4	Centrifugal Fan	IP601300	1BRC5	1
5	Fan Entrance Duct	IP601400AV	1BRC5	1
6	Fan Exit Duct	IP601500AV	1BRC5	1
7	Fan Cover	IP601700AV	1BRC5	1
8	Fan Exit Dust Gasket	IP601800AV	1BRC5	1
9	Heat Insulation Pipe	IP602000AV	1BRC5	1
10	Fan Dust Gasket	IP602400AV	1BRC5	1
11	Inlet Nipple	IP603300AV	1BRC5	1
12	Dust Cap	IP603500AV	1BRC5	2
13	Tip Seal Set	582250-001	75906	1

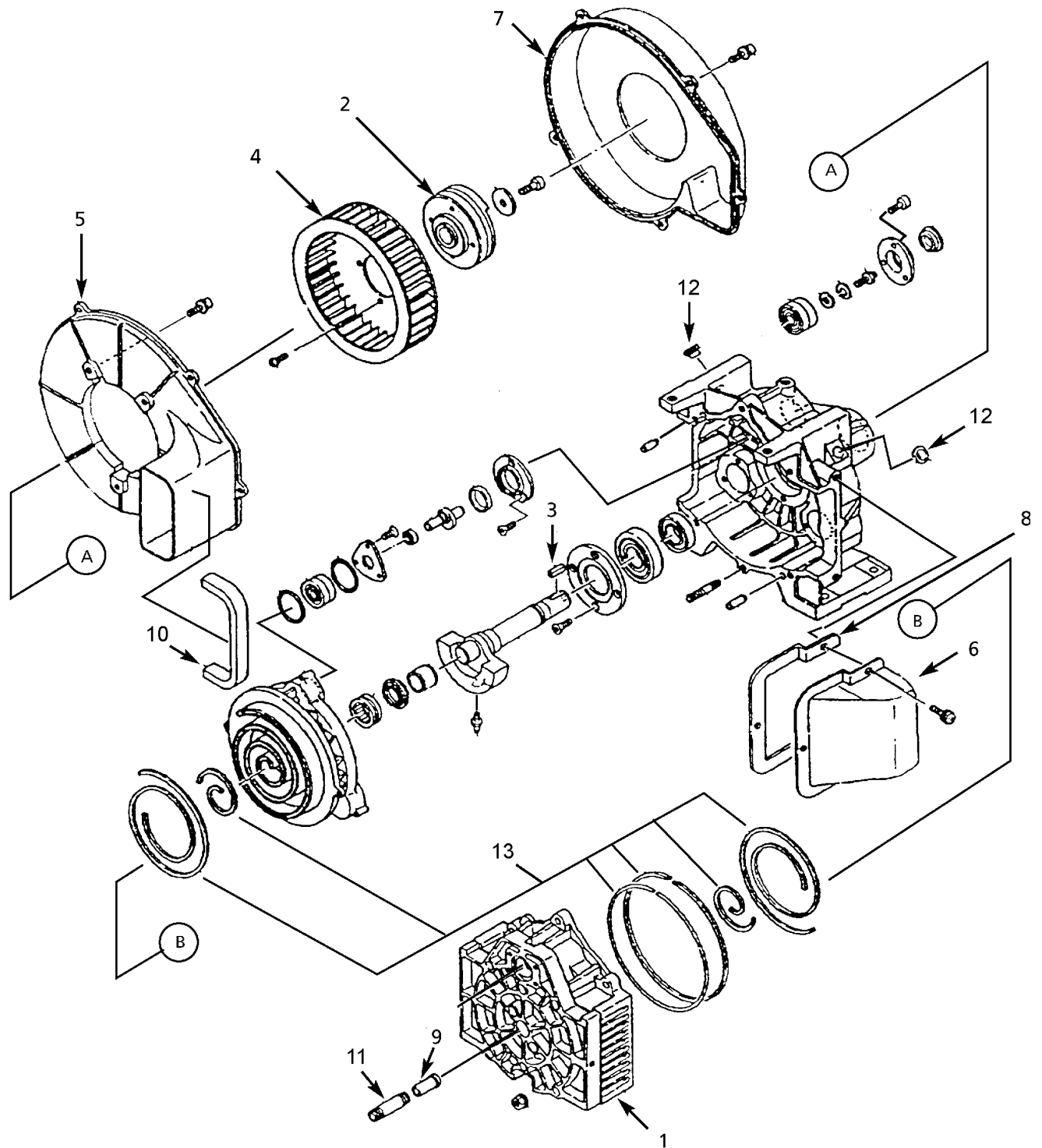


Figure 12. Scroll Compressor Parts.



**Note**

The pin crank bearings should be greased yearly or every 5000 hours of operation, whichever comes first.

- a. Remove the fan cover (Figure 12, item 7).
- b. Remove the air end pulley and centrifugal fan using a gear puller (Figure 12, items 2 and 4).
- c. Remove the entrance fan duct (Figure 12, item 5).
- d. Remove the three grease caps (see Figure 13).

**CAUTION**

Never loosen or tighten the screws as they are used to adjust the axial clearance between the fixed scroll and the orbiting scroll.

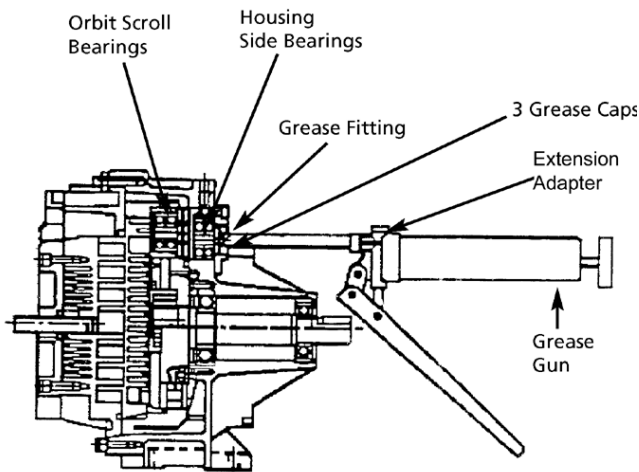


Figure 13. Greasing the Pin Crank Bearings.

**CAUTION**

Pump the grease gun before engaging the grease fitting to eliminate air from the grease passage on the extension adaptor before engaging the grease fitting.

- e. Grease all three pin crank bearings using the grease gun and the extension adaptor or the needle adaptor as required. Refer to Figures 13, 14 and 15. The housing side bearing requires use of the needle adaptor for greasing. Pump the grease gun five (5) times for new compressors and three (3) times for existing compressors. Each pump of the grease gun equals 0.65 grams of grease.

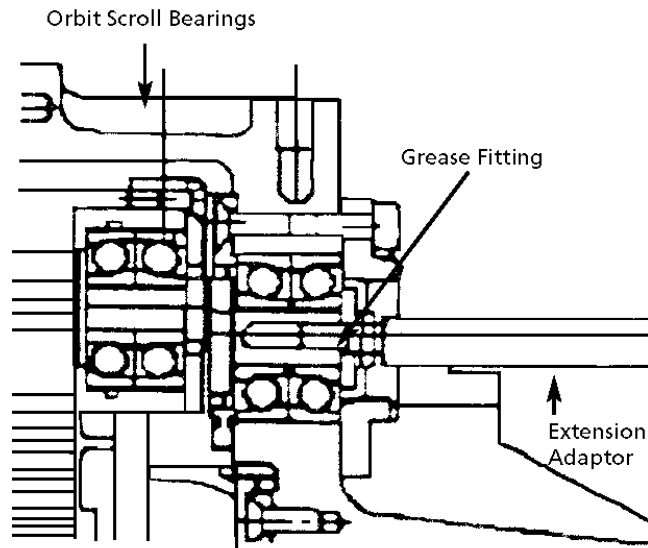


Figure 14. View of Orbit Scroll Bearings.

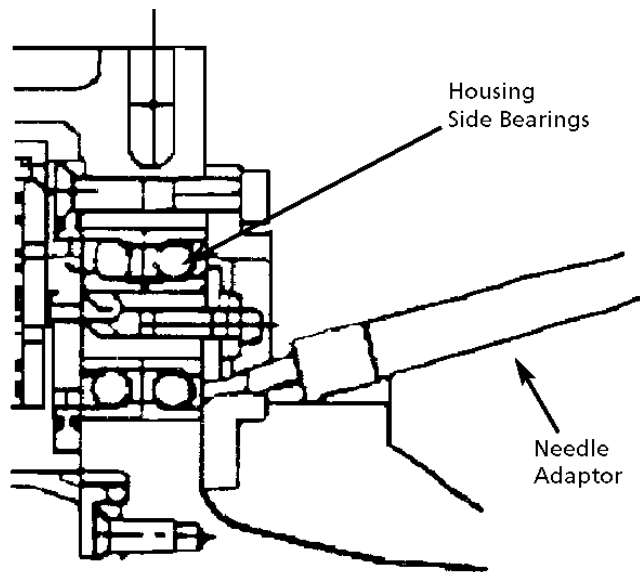


Figure 15. View of Housing Side Bearings.

**Note**

Refer to WP 003 00, Table 1 for the part number of the grease gun with adapters.

- f. Replace the grease caps.
- g. Install the fan entrance duct (Figure 12, item 5).
- h. Install the air end pulley and centrifugal fan (Figure 12, items 2 and 4).



- i. Install the fan cover (Figure 12, item 7).

#### **4. SCROLL COMPRESSOR INSTALLATION**

- a. Position the scroll compressor mounting holes to the holes in the frame. Install the bolts through the top side with a washer at the bolt head. Install washers and lock nuts. Snug the lock nuts such that the compressor can be moved by lightly tapping its base.
- b. Place a straight edged piece of metal on the motor pulley and align the scroll compressor such that the straight edge is flush with the compressor pulley. Tighten the lock nuts securely.
- c. Install the scroll compressor drive belt on the pulleys. Adjust the tension on the drive belt per the procedures in paragraph 4.1 below.
- d. Install the tube to the flow control valve (FCV-1) by first inserting the tube in the hole in the exhaust duct then on the fitting on the valve. Tighten the fitting snugly. Refer to Figure 11.
- e. Install the outlet tube to the outlet fitting on the scroll compressor. Refer to Figure 11.
- f. Assemble the inlet adapter plate to the inlet port on the scroll compressor. Ensure that the rubber gasket is in place. Refer to Figure 11.

#### **4.1 Adjusting the Scroll Compressor Drive Belt.**

- a. Check the belt tension by pressing the belt at the mid-point and measuring the force required to deflect the belt 0.22 inches. The force required should be 3.6-4.8 pounds for a used belt and 5.1-6.5 pounds for a new belt. Refer to Figure 16.
- b. Loosen the four (4) motor mounting bolts sufficiently to allow the motor to be moved with the tension adjusting bolt (see Figure 10).
- c. Adjust the tension-adjusting bolt on the motor base to achieve the required force at the 0.22-inch deflection.
- d. Tighten the motor mounting bolts.
- e. Close the door.

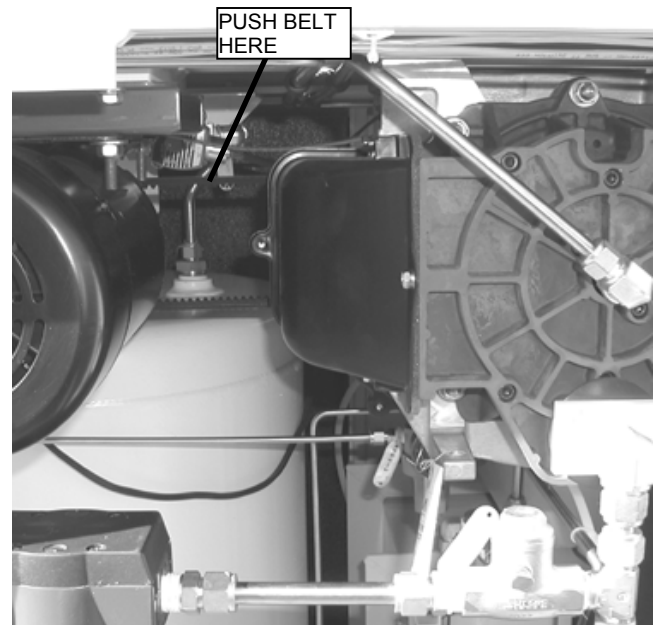


Figure 16. Checking Scroll Compressor Belt Tension.







WORK PACKAGE

BOOSTER COMPRESSOR OVERHAUL

**OVERHAUL INSTRUCTIONS**

EFFECTIVITY: EXPEDITIONARY DEPLOYABLE OXYGEN CONCENTRATION SYSTEM- P/N 793035-001

LIST OF EFFECTIVE WP PAGES

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## FOREWORD

This Work Package (WP) contains procedures for servicing the valves and piston rings on the booster compressor. Procedures are also provided for removal and installation

cedures are also provided for removal and installation of the compressor.

## SAFETY SUMMARY

### COMPRESSED AIR

Some procedures in this WP require the use of compressed air to dislodge and remove components. Do not direct air streams towards self or other personnel. Never stand in front of the component being dislodged and always place a barrier in front of the component being dislodged.

### CLEANERS/CHEMICALS/PAINTS/PRIMER

Some cleaners, chemicals, paints, and primers have adverse effects on skin, eyes, and the respiratory tract. Observe manufacturer's Warning labels, Material Safety Data Sheets (MSDS) instructions for proper handling, storage, and disposal, and current safety directives. Use only in authorized areas. Unless otherwise indicated in the text, use as described in this TO should not result in any immediate health concerns. Consult the local Bioenvironmental Engineer and Base Safety Office for specific protection equipment and ventilation requirements.

### WARNING

TO PREVENT FIRE, SERIOUS INJURY, AN/OR DEATH, IT IS THE USER'S RESPONSIBILITY TO ENSURE ALL PARTS USED IN THE COMPRESSION ASSEMBLY, GAS PLUMBING AND OF THIS COMPRESSOR AND ANY OTHER EXISTING PORTIONS OF THE GAS STREAM THAT MAY BE EXPOSED DURING THE INSTALLATION OF NEW OR REPLACEMENT PARTS ARE CLEANED PRIOR TO INSTALLATION.

ANY WORK TO BE DONE ON THE COMPRESSOR WHERE THE GAS STREAM COMPONENTS MAY BE EXPOSED MUST BE DONE IN ACCORDANCE WITH SAFE OXYGEN EQUIPMENT HANDLING PROCEDURES.

NO ATTEMPT SHOULD BE MADE TO WORK ON THE MACHINE WITHOUT FULL KNOWLEDGE OF OXYGEN EQUIPMENT

HANDLING AND THE POTENTIAL HAZARDS OF CONTAMINATION.

FACTORY OXYGEN CLEANED PARTS ARE PACKAGED WITH A GREEN OXYGEN CLEANED LABEL, AN "X" PREFIX AT THE BEGINNING OF THE PART NUMBER, OR MARKED "CLEANED FOR OXYGEN SERVICE". IT IS THE USER'S RESPONSIBILITY TO MAINTAIN THE CLEANLINESS OF FACTORY CLEANED PARTS OR ANY OTHER EXISTING PORTIONS OF THE GAS STREAM THAT MAY BE EXPOSED DURING THE INITIAL INSTALLATION, START UP, OR DURING INSTALLATION OF REPLACEMENT PARTS.

IT IS RECOMMENDED THAT THE USER ESTABLISH A PROCEDURE FOR WORKING WITH OXYGEN MACINERY. REFER TO COMPRESSED GAS ASSOCIATION, INC. PUBLICATION NUMBER CGA G-4.1, CLEANING EQUIPMENT FOR OXYGEN SERVICE. REFER TO WP 003 00, TABLE 2 FOR THE RECOMMENDED CLEANING FLUID.



## 1. REPAIRING THE COMPRESSOR VALVES

Each stage has a valve assembly whose main components are a suction reed, discharge reed and a valve seat. A bad suction or discharge valve in the 2<sup>nd</sup> stage will usually be indicated by higher pressures than normal on the 1<sup>st</sup> stage. A bad suction or discharge valve in the 1<sup>st</sup> stage will cause a loss of flow. Severe usage over long periods of time may result in worn or broken valves, which may be destructive if the unit is allowed to operate with them in this condition. Clacking noises in the cylinder head can evidence worn or broken valves. Remove, disassemble, inspect and service the valves every 4000 hours of operation. This may be readily accomplished by removing the cylinder heads. To gain access to the compressor, remove the front panel from the EDOCS-120.

### 1.1 Removal of 1<sup>st</sup> Stage Valves.

- a. Relieve the pressure from the compressor and allow the heads and piping to cool.
- b. Remove the inlet and discharge piping from the head. The 1<sup>st</sup> stage head is at the bottom side of the compressor. Refer to Figure 1.

#### Legend For Figure 1

- 1 Cylinder Head, 2<sup>nd</sup> Stage
- 2 Valve Assembly, 2<sup>nd</sup> Stage
- 8 Spool/Guide Cylinder Assembly
- 9 2<sup>nd</sup> Stage cylinder
- 10 Rider Ring

- 11 1<sup>st</sup> Stage Piston Assembly
- 17 Bearing Plate
- 18 Machine Screw
- 19 Rod Bearing
- 20 Connecting Rod
- 21 Bearing
- 22 Wrist Pin
- 23 Snap Ring
- 24 Shim
- 25 1<sup>st</sup> Stage Cylinder
- 26 Cylinder Head, 1<sup>st</sup> Stage
- 27 1<sup>st</sup> Stage Valve Assembly
- 32 Threaded Stud
- 33 Hex Nut
- 34 Flat Washer
- 35 Compression Ring
- 36 O-Ring
- 37 Rider Ring
- 38 Crankcase
- 39 Lock Nut
- 40 Lock Washer
- 41 Crankshaft
- 42 Bearing
- 43 Bearing
- 44 Rider Ring
- 45 2<sup>nd</sup> Stage Mounting Ring
- 46 2<sup>nd</sup> Stage Piston Assembly
- 48 Crankcase Cover

- c. Remove the nuts (33) and washers (34) that hold down the 1<sup>st</sup> stage head (26) and drop the head off. Make sure the cylinder (25) does not come out of the crankcase (38) with the head. Refer to Figure 1.

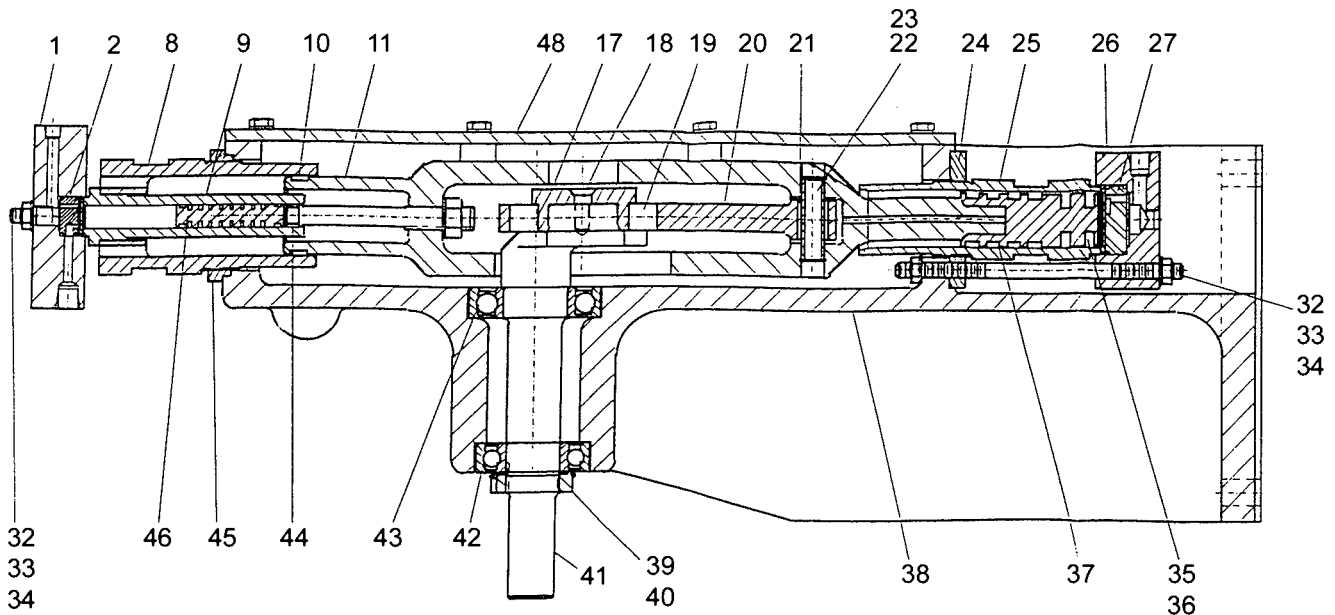


Figure 1. Crankcase Cross Section.



**T.O. EDOCS-120-3  
WP 006 00**

- d. Remove the suction reed valve (28) and inspect it. Refer to Figure 2.

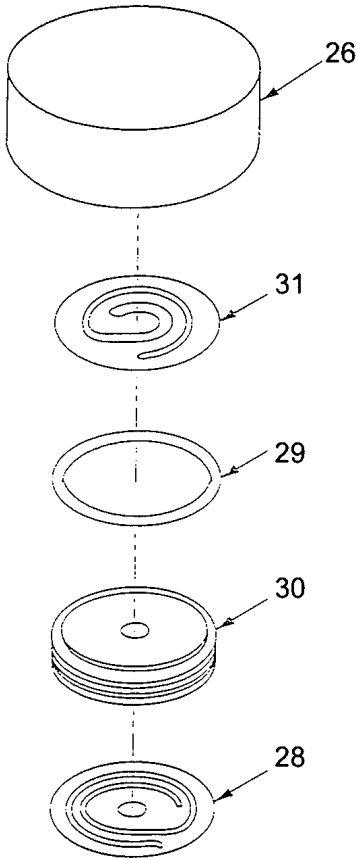


Figure 2. 1<sup>st</sup> Stage Valve Assembly.

**Legend For Figure 2**

- 26 1<sup>st</sup> Stage Head
- 28 1<sup>st</sup> Stage Suction Reed Valve
- 29 O-Ring
- 30 1<sup>st</sup> Stage Valve Seat
- 31 1<sup>st</sup> Stage Discharge Reed Valve

- e. Remove the valve seat (30). Remove the discharge reed valve (31). Discard pitted, cracked or broken valves. A scratched or pitted valve seat (30) may need to be lapped. Discard the O-ring (29). Refer to Figure 2.
- f. Inspect and replace or repair the parts as necessary.

**1.2 Installation of 1<sup>st</sup> Stage Valves.**

- a. Once the reed valves (28 and 31) have been examined or replaced and the seat has been examined,

lapped or replaced, reassemble in reverse order of disassembly. Refer to Figure 2.

- b. Install the discharge reed valve (31) and new O-ring (29) in the head (26). A light coating of oxygen compatible grease (PCI P/N 582380-001, see WP 003 00, Table 2) should be used on the O-ring. Refer to Figure 2.
- c. Install the valve seat (30). Push down to engage the O-ring (29) properly. Refer to Figure 2.
- d. Put the suction reed valve (28) on the valve seat (30).
- e. Carefully position and orient the head on the cylinder and in line with the threaded studs (32). Move the head assembly against the 1<sup>st</sup> stage cylinder (25) and torque the nuts (33) in 2 or 3 ft-lbs. increments, using a cross sequence until 15 ft-lbs. torque is reached. Refer to Figures 1 and 2.
- e. Install the inlet and outlet piping. Tighten the tubing nuts securely.

**1.3 Removal of 2<sup>nd</sup> Stage Valves.**

- a. Relieve the pressure from the compressor and allow the heads and piping to cool.

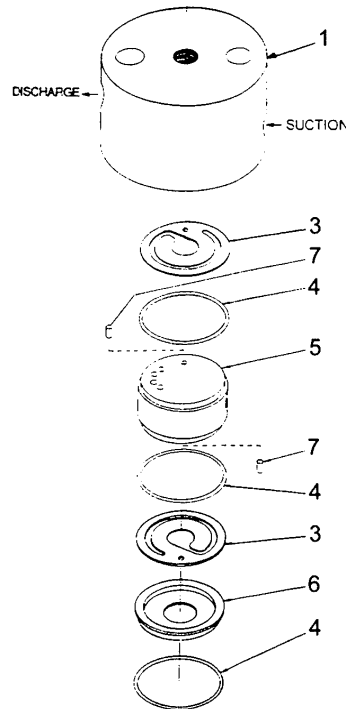


Figure 3. 2<sup>nd</sup> Stage Valve Assembly.



### Legend For Figure 3

- 1 2<sup>nd</sup> Stage Head
- 3 2<sup>nd</sup> Stage Inlet and Outlet Reed Valves
- 4 O-Ring
- 5 2<sup>nd</sup> Stage Valve Seat
- 6 2<sup>nd</sup> Stage Valve Stop
- 7 Pin

- b. Remove the inlet and discharge piping from the 2<sup>nd</sup> stage head. The 2<sup>nd</sup> stage head is at the top side of the compressor. Refer to Figure 1.
- c. Remove the nuts (33) and washers (34) that hold down the 2<sup>nd</sup> stage head (1) and lift the head off. Refer to Figure 1.
- d. Remove the O-ring (4), valve stop (6), suction valve (3), locating pin (7), and second O-ring (4). Discard the O-rings. Refer to Figure 3.
- e. Remove the valve seat (5) from the cylinder head (1). Removal can be assisted by removing the plug in the head and using an object, such as a bolt with a blunt end, and putting it through the discharge port in the top of the head, then tapping lightly on the seat. Care must be taken not to damage the valve seat. Refer to Figure 3.
- f. Remove the O-ring (4), discharge reed valve (3) and the second locating pin (7). Discard the O-ring. Refer to Figure 3.

### 1.4 Installation of 2<sup>nd</sup> Stage Valves.

#### **CAUTION**

When reinstalling valves with O-ring seals, care must be taken to avoid damaging the O-rings. Lubricate the O-ring with oxygen compatible grease. Avoid tilting the valve when installing into the head and apply even finger pressure about the circumference until the valve is completely installed.

- a. Apply a light film of oxygen compatible O-ring grease to the new O-rings (4) (PCI P/N 582380-001, see WP 003 00, Table 2). Refer to Figure 3.
- b. Set the discharge valve (3) over the pin (7) in the head and place the first new O-ring (4) in the valve (5) pocket. Refer to Figure 3 for proper orientation of the valve.

### **NOTE**

If the discharge or suction valves are installed in the inverted position, the valve will not be able to open properly.

- c. Insert valve seat (5) into head (1) with the pin hole in the discharge side of the seat aligned with the pin in the head. Look through the suction port in the head to check that the locating pin (7) has engaged the hole in the seat and the seat is inserted all the way to the bottom of the head. Be sure valve seat is not inverted. Refer to Figure 3.
- d. Install the O-ring (4) and new pin (7) on the suction side of valve seat (5). Install the suction valve (3), referring to Figure 3 for proper orientation.
- e. Install the valve stop (6) in the head (1) and the O-ring (4) on the valve stop.
- f. Carefully position and orient the head on the 2<sup>nd</sup> stage cylinder (9) and in line with the threaded studs (32). Move the head assembly against the 2<sup>nd</sup> stage cylinder (9) and torque the nuts (33) in 2 or 3 ft-lbs. increments, using a cross sequence until 15 ft-lbs. torque is reached. Refer to Figures 1 and 3.
- g. Install the inlet and outlet piping. Tighten the tubing nuts securely.

### 1.5 Valve Inspection and Repair.

The valve disassembly, inspection and repair instructions here cover all the compressor valve assemblies. Figures 2 and 3 should be used as guides for assembly.

- a. Inspect the reed valves for cracking or pitting. Remove any deposits from the reeds. A thin impression of a circle should be evident where the reed seals over the valve seat ports. Any radial lines or streaks extending outward from these circles indicate valve leakage.
- b. Examine the valve seat carefully for cracks or pits and for leakage past the seat. Streaked marks on the seat also indicate leakage. Replace or repair parts as required.
- c. Lap the valve seat on a lapping plate or regrind the valve seat, using a very fine valve-grinding compound. When lapping or grinding, remove a minimum of material to just clean up the surface. When the trepans or grooves between sealing surfaces on



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the valve are reduced to less than .100 inches deep, the seat should be replaced (1<sup>st</sup> stage only).

- d. Carefully clean the valve parts to remove the compression residue and valve grinding compound from the seat.
- e. Reassemble the valve in the reverse order of disassembly.

### **2. CYLINDERS**

The compression cylinders must be removed to service the rings and pistons. The 2<sup>nd</sup> stage has a removable liner. There is no scheduled maintenance required on the cylinders or liner.

#### **2.1 Remove and Install Cylinders.**

Refer to Figure 1.

- a. Remove the cylinder heads (1 and 26) in accordance with paragraphs 1.1 and 1.3.
- b. Turn the flywheel by hand to position the piston (11) at bottom dead center (1st stage only).
- c. Remove retaining nuts (33).
- d. Use caution to prevent side stress on the piston and rod assembly (11), slide the cylinder (25) off the piston. Remove and discard the used O-ring (36).
- e. Be careful not to damage the shims (24).
- f. Remove the 2<sup>nd</sup> stage guide cylinder (8) and liner (9).

#### **Note**

The 2<sup>nd</sup> stage piston (46) will remain in the liner (9) when the liner is removed.

- g. Reinstall the 1<sup>st</sup> stage cylinder and 2<sup>nd</sup> stage cylinder (9) in the reverse sequence of removal. Use new O-rings (36).

### **3. REPLACING PISTON RINGS AND SEALS**

The compressor is single acting, meaning that in a single crankshaft revolution, suction and compression occur once in each cylinder. In order to accomplish sealing and to deliver oil-less gas, high pressure, non-lubed rings are used. A Viton expander is used under the compression rings. In addition to the compression rings, rider rings are used on each piston to keep the pistons centered in the cylinder,

preventing metal-to-metal contact with the cylinder wall. The rings should be inspected for wear and replaced as necessary. The 2<sup>nd</sup> stage piston rings should be replaced every 2000 hours. The 1<sup>st</sup> stage piston rings should be replaced every 3000 hours. Rings not meeting the tolerances specified in Table 1 should be replaced.

#### **3.1 Replacing 1<sup>st</sup> Stage Piston Rings.**

- a. Relieve the pressure from the compressor and allow the heads and piping to cool.
- b. Remove the inlet and discharge piping from the head. The 1<sup>st</sup> stage head is at the bottom side of the compressor. Refer to Figures 1 and 4.
- c. Remove the nuts (33) and washers (34) that hold down the 1<sup>st</sup> stage head (26) and drop the head off. Make sure the cylinder (25) does not come out of the crankcase (38) with the head. Refer to Figure 1.
- d. Turn the flywheel by hand to position the piston at bottom dead center.
- e. For the 1st stage compression area, the 1st stage cylinder must be removed (see paragraph 2.1).
- f. Remove and discard the used rings and expanders.
- g. Clean the ring grooves, replace expanders and, by hand, carefully spread a new ring and install in the ring groove. Repeat for each ring, being certain the ends of the spiral fit completely into the groove to insure proper sealing.
- h. Discard old rider rings.
- i. Install new rider rings on the piston and on piston rod (big end) and follower.
- j. Clean and inspect the cylinder liner for wear or damage. Wear must be within the tolerance specified in Table 1.
- k. Carefully position and orient the head on the cylinder and in line with the threaded studs (32). Move the head assembly against the 1<sup>st</sup> stage cylinder (25) and torque the nuts (33) in 2 or 3 ft-lbs. increments, using a cross sequence until 15 ft-lbs. torque is reached. Refer to Figures 1 and 2.
- l. Install the inlet and outlet piping. Tighten the tubing nuts securely.



- m. Rotate the flywheel by hand several times to be certain that the parts are not binding. See paragraph 7.1 for piston clearance adjustment.

### **3.2 Replacing 2<sup>nd</sup> Stage Piston Rings.**

The 2<sup>nd</sup> stage piston comes with the piston rings and rider rings already installed. When the rings require replacement, the entire piston assembly must be replaced. Figure 5 shows the orientation of the piston assembly and piston rings when installed in the cylinder.

Refer to Figure 1.

- a. Relieve the pressure from the compressor and allow the heads and piping to cool.
- b. Remove the inlet and discharge piping from the 2<sup>nd</sup> stage head. The 2<sup>nd</sup> stage head is at the top side of the compressor.
- c. Remove the nuts (33) and washers (34) that hold down the 2<sup>nd</sup> stage head (1) and lift the head off.
- d. Rotate the flywheel by hand to position the 2<sup>nd</sup> stage piston at bottom dead center.
- e. Remove the 2<sup>nd</sup> stage cylinder assembly (see paragraph 2.1).
- f. Remove the 2<sup>nd</sup> stage guide cylinder (8) and liner (9).

#### **Note**

The 2<sup>nd</sup> stage piston (46) will remain in the liner (9) when the liner is removed.

- g. Push the floating piston assembly (46) from the cylinder.

- h. Clean and inspect the cylinder liner for wear or damage. Wear must be within the limits of Table 1.
- i. Install the new piston assembly (46) into the into the cylinder (9).
- j. Reinstall the compression cylinder and liner (9), with the piston assembly in the reverse sequence of removal.
- k. Carefully position and orient the head on the 2<sup>nd</sup> stage cylinder (9) and in line with the threaded studs (32). Move the head assembly against the 2<sup>nd</sup> stage cylinder (9) and torque the nuts (33) in 2 or 3 ft-lbs. Increments, using a cross sequence until 15 ft-lbs. torque is reached. Refer to Figures 1 and 3.
- l. Install the inlet and outlet piping. Tighten the tubing nuts securely.
- m. Rotate the flywheel by hand several times to be certain that the parts are not binding. See paragraph 7.2 for piston clearance adjustment.

### **4. REPLACING 1<sup>ST</sup> STAGE PISTON ASSEMBLY**

The 1<sup>st</sup> stage piston assembly (see Figure 1 and 4) is connected together with the connecting rod (20) and retaining cap. The piston assembly may only be removed or installed as an assembled unit.

- a. Remove both heads and cylinders (see paragraphs 1.1, 1.23 and 2.1).
- b. Rotate the flywheel to position the 2<sup>nd</sup> stage piston (46) to the lowest point of its stroke (bottom dead center). Refer to Figure 1.
- c. Remove the flat head screw (18) on the bearing plate

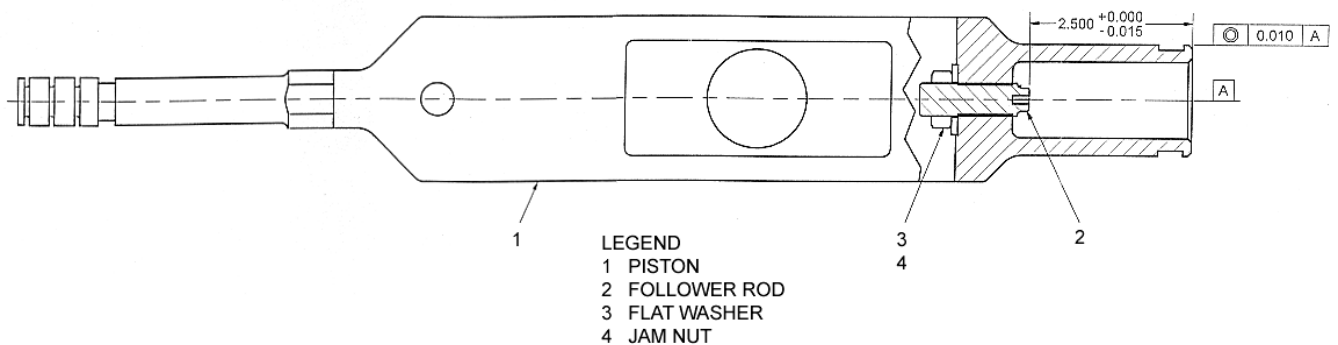


Figure 4. 1<sup>st</sup> Stage Piston Assembly.

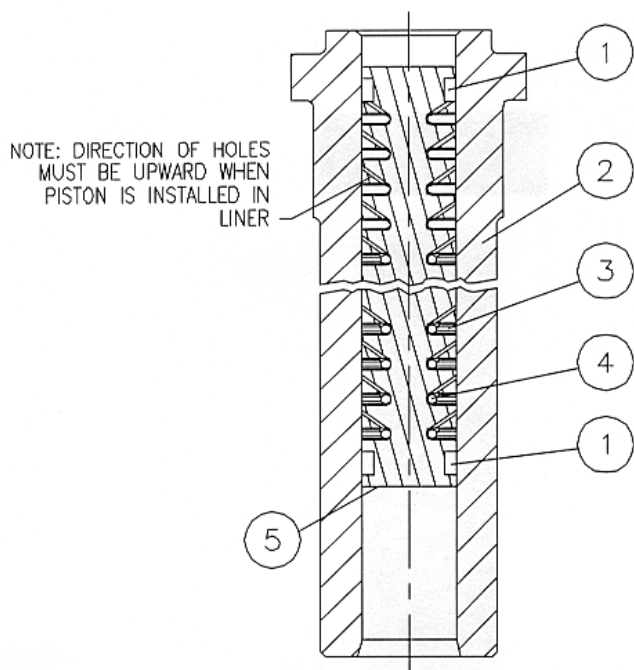


(17). Refer to Figure 1.

- d. Gently slide the assembly outward by pulling the connecting rod (20) off of the crankshaft (41) allowing the neck of the piston to pass through the slot in crankcase (38). Refer to Figure 1.
- e. Remove the connecting rod (20) from the piston assembly (11) by removing the snap rings (23) and pressing out the wrist pin (22). Refer to Figure 1.
- f. Inspect the rod bearing (19) and replace as necessary. Refer to Figure 1.
- g. Installation is reverse order of disassembly.

**Note**

The connecting rod and retainer cap must be installed prior to installing the piston assembly.



NOTE: DIRECTION OF HOLES MUST BE UPWARD WHEN PISTON IS INSTALLED IN LINER

NOTES:  
1. INSURE .08 TO .15 RIDER RING GAP.  
2. INSERT PISTON ASS'Y IN THE CYLINDER AS SHOWN.

Figure 5. 2<sup>nd</sup> Stage Cylinder Assembly.

Legend For Figure 5

- 1 Rider Ring
- 2 2<sup>nd</sup> Stage Cylinder
- 3 Compression Ring
- 4 O-Ring
- 5 Piston

Table 1. Compressor Clearances and Tolerances.

Component	Nominal Dimensions	Wear Limit
Bearings		By inspection for knocking or rough running
Connecting rod, lower bore	3.146 dia.	.001 inch max. dia.
Connecting rod, upper bore	.687 dia.	.001 inch max. dia.
Wrist pin	.5000 dia.	.0005 inch max. dia.
1 <sup>st</sup> stage piston	1.25 dia.	1.21 dia min.
2 <sup>nd</sup> stage piston	.500 dia.	.498 dia. min.
1.75 in. dia. rider ring	.110 thick	.020 in. radial wear
1.25 in. dia. rider ring	.118 thick	.010 inch radial wear
.50 in. dia. rider ring	.057 thick	.003 in. radial wear
1 <sup>st</sup> stage piston rings	.125 thick	When average radial wear is 2/3 of ring or blow-by occurs
2 <sup>nd</sup> stage piston ring	.065 thick	When average radial wear is 2/3 of ring or blow-by occurs
1 <sup>st</sup> stage cylinder liner	1.251 in. dia.	.002 in. dia wear
2 <sup>nd</sup> stage cylinder liner	.501 in. dia.	.010 in. dia. wear
1 <sup>st</sup> stage valve plates	.025 in. thick	.002 in. wear or when pitted enough to cause insufficient seating
2 <sup>nd</sup> stage valve plates	.010 in. thick	.002 in. wear or when pitted enough to cause insufficient seating
Valve seats	Pitted or streaks	.010 in. wear or when pitted enough to cause insufficient seating

**5. REPLACING MAIN BEARINGS**

The crankshaft is supported in the crankcase by two main bearings (42 and 43). They are radial ball bearing design, consisting of an inner race, outer race, ball bearings, cage and seals. Refer to Figure 1.





### **5.1 Removing Main Bearings.**

- a. Remove piston assembly in accordance with paragraph 4.
- b. Remove the flywheel from the crankshaft (41). Refer to Figure 1.
- c. Bend down the locking tab on the lock washer (40) and remove the bearing nut (39). A special tool is required to remove the nut. Refer to Figure 1.
- d. Heat bearing housing (43) and push out of the crankshaft (41). Refer to Figure 1.

#### **Note**

The flywheel side bearing stays in the housing.

- e. Heat the outboard bearing housing (42) and push the bearing out from far end of the crankcase (38) using a suitable fixture. Refer to Figure 1.

### **5.2 Installing Main Bearings.**

- a. Slide new main bearing (43) onto the crankshaft (41). Verify that the bearing is pressed up against the shoulder on the crankshaft. Refer to Figure 1.
- b. Slide the crankshaft into the crankcase. (Heating may be required.)
- c. Install the outboard bearing (42) over the crankshaft (41) and into the crankcase (38). Refer to Figure 1.
- d. Install a new lock washer (40) with the bearing nut (39) and torque the nut to 50 ft.-lb. Bend the tabs of the lock washer into the slots on the bearing nut.
- e. Install the piston assembly (see paragraph 4).
- f. Install the cylinders and heads (see paragraphs 1.2, 1.4 and 2.1).

### **6. REPLACING CONNECTING ROD BEARINGS**

The connecting rod is cast aluminum, with a closed eye at the upper larger and lower ends. The smaller closed eye has a needle bearing (21) around the wrist pin. The larger closed eye has a ball bearing (19) around the crankshaft (41). Refer to Figure 1. These bearings are supplied grease packed for life with polyurea grease. At specified intervals all the bearings are replaced. If the clearances are not within the tolerances specified in Table 1, the wrist pin should be replaced.

Refer to Figure 1 for the item numbers in the following procedure.

- a. Remove the piston assembly per paragraph 4.
- b. With a pair of snap ring pliers, remove the snap rings (23) from wrist pin bore.
- c. Remove the wrist pin (22) by pushing it through the needle bearings (21) from one side of the piston (11) to the other (may require a press). The piston may need to be heated to allow the wrist pins to slide through.
- d. Remove the connecting rod (20) from piston assembly (11).
- e. Remove the retaining plate (17) from the connecting rod bearing (19).
- f. Press the needle bearing (21) out of the small end of connecting rod (20).
- g. The large end connecting rod ball bearing (19) has a shrink fit. Therefore, the connecting rod (20) should be heated in an oven to 300°F so that the ball bearing will slip out of the connecting rod.
- h. To install the new ball bearing (19), heat the connecting rod (20) to 300°F in an oven. Once heated, lay the large end of the connecting rod on a flat surface and slip the ball bearing into the bore in the connecting rod. Allow the assembly to cool for a shrink fit.
- i. Press a new needle bearing (21) packed with oxygen compatible grease (see WP 003 00, Table 2) into the small end of the connecting rod (20). Be sure to only press against the stamped end (end with identification markings) of the needle bearing.
- j. Assemble the connecting rod (20) into the piston (11) by pushing the wrist pin (22) through the piston and needle bearing (21) in the connecting rod (20). The piston may have to be heated to allow the wrist pin to slide through.
- k. Put the snap rings (23) into the grooves in the piston (11).
- l. Install the retaining plate (17) over the connecting rod bearing (19). Install the flat head machine screw (18) and torque to 15 ft.-lbs.
- m. Install the cylinders and heads (see paragraphs 1.2, 1.4 and 2.1).



## 7. PISTON CLEARANCE ADJUSTMENT

Prior to adjusting each piston, rotate the crankshaft (41) to bring its respective piston to the top of its stroke. The 1<sup>st</sup> stage piston is at the top of its compression stroke when the piston is all the way down. Refer to Figure 1.

### 7.1 Adjusting Clearance on 1<sup>st</sup> Stage Piston.

- a. Relieve the pressure from the compressor and allow the heads and piping to cool.
- b. Remove the inlet and discharge piping from the head. The 1<sup>st</sup> stage head is at the bottom side of the compressor. Refer to Figure 1.
- c. Remove the nuts (33) and washers (34) that hold down the 1<sup>st</sup> stage head (26) and drop the head off. Make sure the cylinder (25) does not come out of the crankcase (38) with the head. Refer to Figure 1.
- d. While holding the cylinder (25) firmly in place, rotate the crankshaft (41) to assure that the piston is all the way down (top dead center). Refer to Figure 1.
- e. Measure the clearance between the piston (11) and the top of the cylinder (25). Refer to Figure 1. The proper clearance is .011" to .015" (see Table 1).
- f. Shims (24) can be added or removed to reach the specified clearance.

#### **Note**

The clearance is factory set and should not need adjustment unless one or more parts are replaced (cylinder, piston assembly, connecting rod, crankshaft or crankcase).

- g. Carefully position and orient the head on the cylinder and in line with the threaded studs (32). Move the head assembly against the 1<sup>st</sup> stage cylinder (25) and torque the nuts (33) in 2 or 3 ft-lbs. Increments, using a cross sequence until 15 ft-lbs. torque is reached. Refer to Figures 1 and 2.
- h. Install the inlet and outlet piping. Tighten the tubing nuts securely.

### 7.2 Adjusting Clearance on 2<sup>nd</sup> Stage Piston.

- b. Remove the inlet and discharge piping from the 2<sup>nd</sup> stage head. The 2<sup>nd</sup> stage head is at the top side of the compressor. Refer to Figure 1.
  - c. Remove the nuts (33) and washers (34) that hold down the 2<sup>nd</sup> stage head (1) and lift the head off. Refer to Figure 1.
  - d. While holding the cylinder (9) firmly in place, rotate the crankshaft (41) to assure that the piston (46) is all the way up (top dead center). Refer to Figure 1.
  - e. Measure the clearance between the piston (45) and the top of the cylinder liner (9). Refer to Figure 1. The proper clearance is .012" to .016" (see table 1).
  - f. Rotate the spool/guide cylinder (8) to reach the specified clearance. Refer to Figure 1.
- Note**
- The clearance is factory set and should not need adjustment unless one or more parts are replaced (cylinder, liner, floating piston assembly, connecting rod, crankshaft or crankcase).
- g. Carefully position and orient the head on the 2<sup>nd</sup> stage cylinder (9) and in line with the threaded studs (32). Move the head assembly against the 2<sup>nd</sup> stage cylinder (9) and torque the nuts (33) in 2 or 3 ft-lbs. Increments, using a cross sequence until 15 ft-lbs. torque is reached. Refer to Figures 1 and 3.
  - h. Install the inlet and outlet piping. Tighten the tubing nuts securely.