



STANDARD OVERHAUL PRACTICES MANUAL

INSTALLATION OF O-RINGS AND TEFLON SEALS

**PART NUMBER
NONE**

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STANDARD OVERHAUL PRACTICES MANUAL

Revision No. 16
Jul 01/2009

To: All holders of INSTALLATION OF O-RINGS AND TEFLON SEALS 20-50-06.

Attached is the current revision to this STANDARD OVERHAUL PRACTICES MANUAL

The STANDARD OVERHAUL PRACTICES MANUAL is furnished either as a printed manual, on microfilm, or digital products, or any combination of the three. This revision replaces all previous microfilm cartridges or digital products. All microfilm and digital products are reissued with all obsolete data deleted and all updated pages added.

For printed manuals, changes are indicated on the List of Effective Pages (LEP). The pages which are revised will be identified on the LEP by an R (Revised), A (Added), O (Overflow, i.e. changes to the document structure and/or page layout), or D (Deleted). Each page in the LEP is identified by Chapter-Section-Subject number, page number and page date.

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STANDARD OVERHAUL PRACTICES MANUAL

INTRODUCTION

1. General

- A. The instructions in this manual tell how to do standard shop procedures during maintenance functions from simple checks and replacement to complete shop-type repair.
- B. This manual is divided into separate sections:
 - (1) Title Page
 - (2) Transmittal Letter
 - (3) Highlights
 - (4) Effective Pages
 - (5) Contents
 - (6) Revision Record
 - (7) Record of Temporary Revisions
 - (8) Introduction
 - (9) Procedures
- C. Refer to SOPM 20-00-00 for a definition of standard industry practices, vendor names and addresses, and an explanation of the True Position Dimensioning symbols used.
- D. The data is general. It is not about all situations or specific installations. Use it as a guide to help you write minimum standards.
- E. If the component overhaul instructions are different from the data in this subject, use the component overhaul instructions.

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INTRODUCTION

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STANDARD OVERHAUL PRACTICES MANUAL

INSTALLATION OF O-RINGS AND TEFLON SEALS

1. INTRODUCTION

- A. The data in this subject comes from Boeing process specification BAC5506 for installation of elastomeric seals. The etch procedure for bonded teflon seal rings comes from BAC5481. Other data comes from seal vendors. The airline has a copy of the Boeing Process Specification Manual.
- B. The data is general. It is not about all situations or specific installations. Use this data to help you write minimum standards.
- C. Refer to SOPM 20-00-00 for a list of all the vendor names and addresses.

2. GENERAL

- A. Destroy removed O-ring seals so they cannot be used again.
- B. Be very careful when you remove seals not to scratch or damage the sealing surfaces. Use your fingers to remove the seals, or use tools made of soft wood or plastic.
- C. Unless specified by the overhaul instructions, clean all sealing surfaces before seal installation.
- D. Any cuts, scratches, dents, distortions or deposits of foreign material must be removed from O-ring grooves and adjacent flat surfaces before you clean the sealing surfaces.
- E. Clean all sealing surfaces and installation tools with clean, lint-free gauze wet with aliphatic naphtha or methyl ethyl ketone or methyl propyl ketone. When you install omniseals (Paragraph 14.), clean tools with DuPont Freon Precision Cleaning Agent (V18873), filtered through a 5-micron absolute filter. Wipe the solvent off the surface with clean gauze before it evaporates.
- F. If parts with seals must be vapor degreased, remove all of the seals first. Install new seals after the part is cleaned.
- G. Use ST-848 series O-ring installation tools or other protective cover when you install O-rings over sharp edges such as threaded fasteners, keyways, slots, splines and ports.
- H. Do not stretch the internal diameter of elastomeric O-ring seals more than 50 percent during installation.
- I. Do not stretch the internal diameter of seals made of Teflon, polyethylene or other plastics more than 5 percent during installation.
- J. If the O-ring seals must be rolled into their grooves, make sure all twists are removed before you close the gland.
- K. Make sure the O-rings are not pinched before you continue with assembly. Make sure the related fasteners are correctly tightened.
- L. Keep all O-rings sealed in the packages until immediately before installation, to make sure they are clean and to permit age control and identification.

3. CLEANING

- A. Unless specified by the overhaul instructions, clean all seals before installation, by the solvent cleaning method or the dry wiping method (when no solvent is called out), as specified in Figure 1.

(1) Method 1 – Solvent cleaning

CAUTION: SEALS USED IN SYSTEMS WITH FIRE RESISTANT HYDRAULIC FLUID (BMS 3-11) MUST NOT BE CLEANED WITH SOLVENT. USE ONLY THE DRY WIPE METHOD.

- (a) Wipe the seal with clean, lint-free gauze wet with cleaning solvent per Figure 1.
- (b) Immediately wipe dry with clean, lint-free gauze. Do not let the solvent evaporate dry.

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- (c) Do steps (a) and (b) again, if necessary, until all unwanted matter is removed.
- (2) Method 2 – Dry wipe
 - (a) Wipe the seal with clean, dry, lint-free gauze until all contamination is removed. Do not use a solvent.

4. INSPECTION/CHECK

- A. Examine all of the surface of the seal carefully for cuts, nicks, grooves, excessive flash or dents. Do not use O-rings with these defects or if they have cracks, decomposition, or other deterioration.
- B. Examine the O-ring and sealing surfaces of the fitting or component for dirt, chips, grease or other contamination. Make sure there are no rough areas or burrs.
- C. Obey the limits on storage time to be sure of a serviceable O-ring. If not, O-ring cracks and deterioration, and unusually short service life can occur. Refer to SOPM 20-70-01 for more details.

5. LUBRICATION

- A. Static seals
 - (1) Apply a thin layer of the lubricant, as specified per Figure 1, to all surfaces of the seal. Be careful not to put contamination in the lubricant or on the surfaces.
 - (2) Remove unwanted lubricant with clean, lint-free gauze after installation.
- B. Dynamic seals
 - (1) Put the seal in the lubricant as specified per Figure 1. Then let the seal drip drain for a maximum of 1 minute before installation. When the specified lubricant is grease, apply a thin smooth layer of the grease to the seal before installation.
 - (2) By hand, apply a large quantity of lubricant to all surfaces over which the seal will slide during operation. Use a clean, lint-free gauze to apply lubricant.
 - (3) Remove unwanted lubricant after installation.

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System and Fluid	Seal Material	Seal Specification	Seal Part Number Example	Seal Lubricant	Cleaning Solvent (SOPM 20-60-01)	Cleaning Method (Par. 3)	
Hydraulic BMS 3-11	Ethylene Propylene	NAS 1613	NAS 1611	BMS 3-11 or	None	Dry	
			NAS 1612	MCS 352 Assy Lube			
MIL-H-5606 or MIL-PRF-6083 or BMS 3-32	Nitrile/Buna N	MIL-P-25732	MS28775	MIL-H-5606 or	*[1] or *[2]	Solvent	
		AMS-P-5510	MS28778	VV-P-236			
	Fluoro-Silicone	MIL-R-25988	M25988/1	or MIL-PRF-6083			
MIL-PRF-83282	Nitrile/Buna N	MIL-P-83461	M83461/1	MIL-PRF-83282 or VV-P-236	*[1] or *[2]	Solvent	
Fuel ASTM D910 (Aviation Gasoline) or MIL-DTL-5624 (Turbine Fuel) JP-4, JP-5 or ASTM D1655 (Turbine Fuel) Jet A, A-1, B	Nitrile/Buna N	AMS-P-5315	MS29513	MIL-H-5606 or Petrolatum VV-P-236	*[1] or *[2]	Solvent	
	Fluoro-Silicone	MIL-R-25988	M25988/1				
	Fluoro-Carbon	MIL-R-83248	M83248/1				

Lubricant and Cleaner Selections
Figure 1 (Sheet 1 of 4)

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System and Fluid	Seal Material	Seal Specification	Seal Part Number Example	Seal Lubricant	Cleaning Solvent (SOPM 20-60-01)	Cleaning Method (Par. 3)
Oil MIL-L-6081 or SAE J1966	Nitrile/Buna N	MIL-P-83461	MS28775	VV-P-236 or MIL-L-6081 or SAE J1966	*[1] or *[2]	Solvent
	Fluoro-Silicone	MIL-R-25988	M25988/1			
MIL-PRF-7808 or P & W 521 or MIL-PRF-23699	Nitrile/Buna N	-	BACG10T	MIL-PRL-7808 or P & W 521 or	*[1] or *[2]	Solvent
		-	BACG10U			
	Fluoro Carbon	AMS7276	AS3208 AS3209	MIL-PRF-23699 or		
		MIL-R-83485	M83485/1	VV-P-236		
MIL-L-27502	Fluoro-Silicone	MIL-R-25988	M25988/1	MIL-L-27502		
Potable Water and Water Drain	Ethylene Propylene	NAS 1613	NAS 1611	Water or Tribolube 21 or ZC 750, 755 or Dow Chemical Food Grade Grease	None	Dry
			NAS 1612	or Royco 90 or DC111		
Pneumatic Air	Nitrile	AMS-P-5510	MS28778	Protopet 1S or VV-P-236	None	Dry
	Silicone	AMS3337	BACP11J BACP11K	Fluorinated Lubricants	None	Dry
Vacuum Waste Air	Nitrile/Buna N	MIL-P-25732	MS28775	VV-P-236	*[1] or *[2]	Solvent
		AMS-P-5315	MS29512 MS29513	or AMS-G-4343		
Ammonia (O-A-445) or Water	Ethylene Propylene	NAS 1613	NAS 1611	Fluorinated Lubricants	*[3]	Solvent
			NAS 1612	BMS 3-25		

Lubricant and Cleaner Selections
Figure 1 (Sheet 2 of 4)

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System and Fluid	Seal Material	Seal Specification	Seal Part Number Example	Seal Lubricant	Cleaning Solvent (SOPM 20-60-01)	Cleaning Method (Par. 3)
Propulsion IRNFA (MIL-H-7254)	Teflon	AMS3660	-	None	None	Dry
Hydrazine (MIL-P-26536)	Ethylene Propylene	NAS 1613	NAS 1611	Fluorinated	*[4]	Solvent
			NAS 1612	Lubricants		
JP-X (MIL-P-26694) or ANFA	Teflon	AMS3660	-	None	*[1], *[2] or *[4]	Solvent
	Poly-Ethylene	L-P-390	-	Fluorinated Lubricants		
Auxiliary Power Helium or Ammonia (O-A-445)	Nitrile/Buna N	MIL-P-83461	MS28775	MIL-H-5606 or MIL-PRF-83282 or VV-P-236	None	Dry
Hydrazine (MIL-P-26536)	Ethylene Propylene	NAS 1613	NAS 1611	Fluorinated	*[4]	Solvent
			NAS 1612	Lubricants		
Exhaust Gas Hydrazine (Hot)	Silicone	AMS3337	BACP11J	Fluorinated Lubricants	None	Dry
			BACP11K			
		AMS3305	-			
Solid Rocket (Hot)	Teflon	AMS3660	-	Fluorinated Lubricants	None	Dry
	Silicone	AMS3305	-			

Lubricant and Cleaner Selections
Figure 1 (Sheet 3 of 4)

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System and Fluid	Seal Material	Seal Specification	Seal Part Number Example	Seal Lubricant	Cleaning Solvent (SOPM 20-60-01)	Cleaning Method (Par. 3)
Guidance Air and MIL-H-5606	Nitrile/Buna N	MIL-P-83461	MS28775	Fluorinated Lubricants	*[1] or *[2]	Solvent
Air and BMS 3-11	Ethylene Propylene	NAS 1613	NAS 1611	Fluorinated Lubricants	O-A-51 *[4]	Solvent
			NAS 1612			
Air	Nitrile/Buna N	MIL-P-5510	MS28778	Fluorinated Lubricants	*[1] or *[2]	Solvent
Hydraulic	Teflon	ASTM D1457	STBS11AP 212A1H	STB3-13	*[5]	Solvent
		-	Omniseal			
Gas Pressure	Teflon	ASTM D1457	STBS11AP 011A1H	None	*[5]	Solvent
Hydrazine	Teflon	-	Omniseal	None	*[5]	Solvent

*[1] ALIPHATIC NAPHTHA, TT-N-95, TYPE 1

*[2] SOLVENT MIL-PRF-680, TYPE 1

*[3] AMMONIA, O-A-445

*[4] ACETONE, O-A-51

*[5] FREON PRECISION CLEANING AGENT, DUPONT (V18873)

Lubricant and Cleaner Selections
Figure 1 (Sheet 4 of 4)

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**STANDARD OVERHAUL PRACTICES MANUAL****6. INSTALLATION OF O-RINGS**

- A. Before installation, lubricate the O-ring seals per Figure 1, to let the seal slide into position easily and seal correctly (Figure 2).
- B. Use a O-ring installation tool, ST848 or equivalent, to install the O-ring seals over sharp threads as shown.

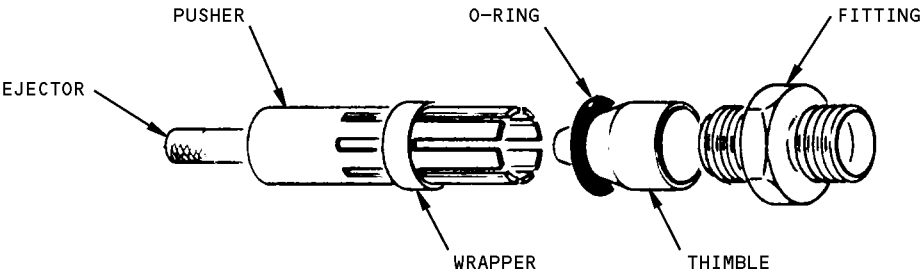
CAUTION: O-RINGS ARE EASILY DAMAGED DURING INSTALLATION. ELASTOMERIC O-RINGS MUST NOT BE STRETCHED TO MORE THAN 50 PERCENT INCREASE IN ID. PLASTIC (TEFLON, POLYETHYLENE, ETC.) O-RINGS MUST NOT BE STRETCHED MORE THAN 5 PERCENT INCREASE IN ID.

- C. Use the correct tool dash number for the tube or fitting diameter. (Dash number is the same as nominal tube size in thousandths of an inch.) This will make sure the O-ring is not stretched too much.
- D. Adjust the finger stiffness of the tool to let the pusher slide over the thimble easily, but still touch the thimble and not go up over the O-ring. Move the wrapper forward to increase finger stiffness. Move the wrapper back to make the fingers more flexible.
- E. With the stiffness correctly adjusted, put the thimble in position over the threads. Put the O-ring seal and the backup washer (if applicable) on the thimble.
- F. Use the pusher to slide the O-ring seal and the backup washer over the thimble and into the groove.
- G. Remove the tool from the fitting. Remove the thimble.

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TUBE SIZE (INCHES)	3/16	1/14	5/16	3/8	1/2	5/8	3/4	1	1-1/4	1-1/2	1-3/4
ST848 TOOL DASH NO.	187	250	312	375	500	625	750	1000	1250	1500	1750

ST848 Installation Tool
Figure 2

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**STANDARD OVERHAUL PRACTICES MANUAL****7. INSTALLATION OF LOW PRESSURE ROTARY SEAL RINGS (OD)**

CAUTION: DO NOT GET UNWANTED FOREIGN MATERIAL BETWEEN SEAL RING AND SHAFT. MAKE SURE THAT INSTALLATION TOOLS HAVE NO BURRS OR SURFACE DEFECTS THAT COULD DAMAGE OR LOCALLY STRETCH THE HEATED SEAL RING.

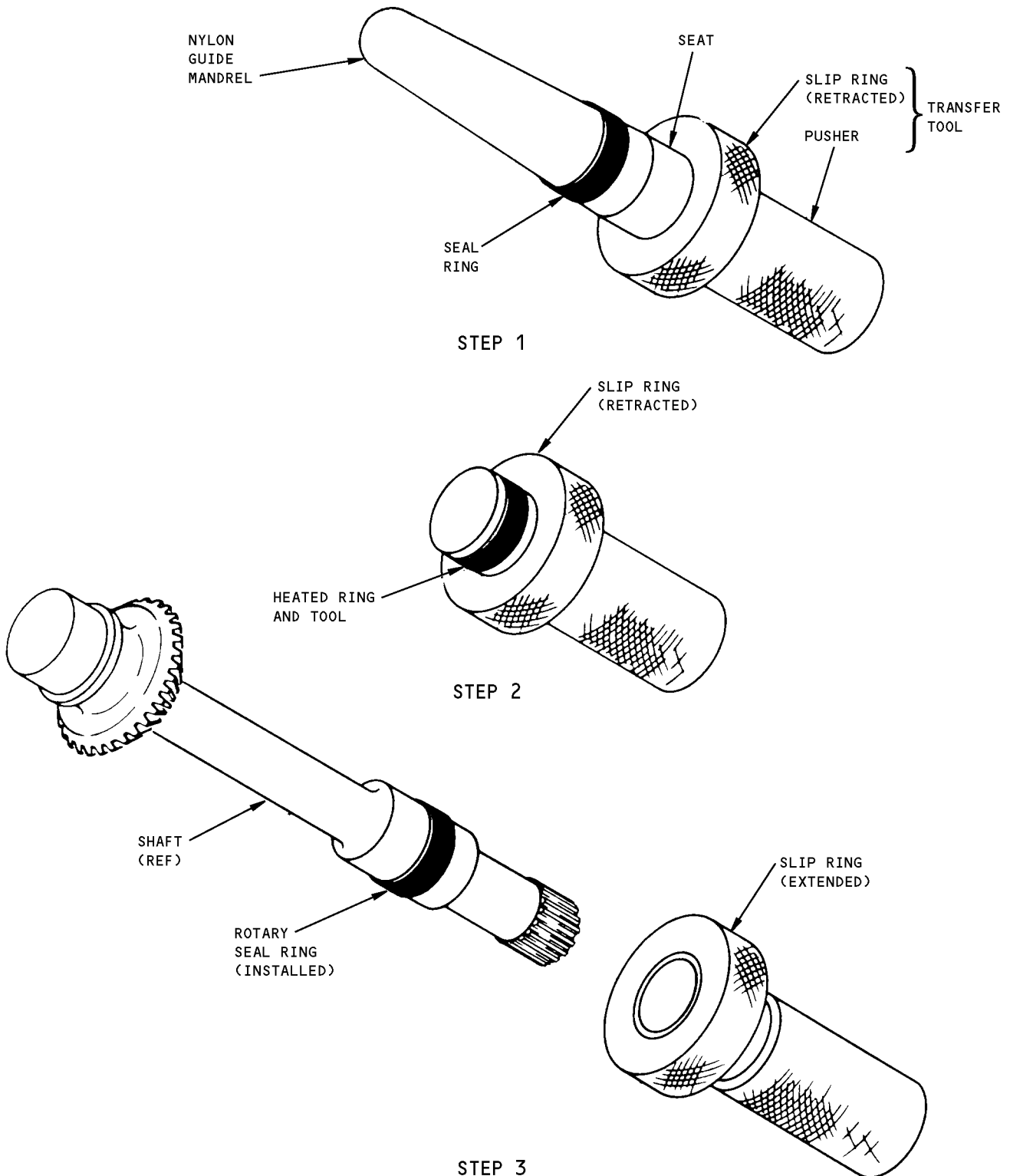
- A. Thin cylindrical rotary seal rings of teflon for 85% teflon and 15% molybdenum disulfide such as Boeing 69-27219 are used on some shafts to make a low-friction surface between the shaft and the O-ring seal, which is installed over the rotary seal ring. This procedure uses a special tool and a heat-shrink method.
- B. Use a suitable F72789 tool or equivalent.
- C. Slide the rotary seal ring on the nylon guide mandrel as shown in step 1 of Figure 3.
- D. Move the seal ring to the transfer tool as shown in step 2 of Figure 3, then remove the nylon guide mandrel.
- E. Heat the mating shaft in an oven for a minimum of 15 minutes.

WARNING: DO NOT HEAT THE SEAL OVER 400°F, BECAUSE POISONOUS GASES COULD BE RELEASED. USE CLEAN, HEAT-RESISTANT GLOVES TO HOLD THE HEATED PARTS. THEY WILL BE TOO HOT TO TOUCH WITHOUT HAND PROTECTION.

- F. Heat the transfer tool and the seal ring to 260-300°F (molybdenum disulfide-Teflon rings) or 315-335°F (Teflon rings).
- G. Put the tool on the shaft.
- H. Move the slip ring to push the seal ring off the tool and on the shaft, as shown in step 3 of Figure 3.
- I. Let the shaft and the seal ring slowly get cool. Do not let too much air flow around the parts, to let the seal ring cool as slowly as the shaft.

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Teflon Rotary Seal Installation
Figure 3

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8. INSTALLATION OF TEFLON CHANNEL SEALS (ID)

- A. In some pressure conditions, cap or channel seals can change their shape and cause a malfunction of the unit in which they are installed (Figure 4). A seal that fits tightly against the two sides of the groove can partially be pulled down by suction into the groove and permit fluid leakage (Figure 5). If notched seals can make the pressure equal inside the groove and decrease the risk of this problem, we recommend you use notched seals as replacements if permitted by the overhaul instructions as optional or preferred to the seals without notches.

- B. Install Teflon channel seals into the bore of the part as follows:

- (1) Clean the seal groove and the bore of the part.

WARNING: IF TEFLON SEALS ARE HEATED ABOVE 400°F, THEY COULD GIVE OFF POISONOUS GAS.

- (2) Heat the Teflon channel seal to 100-200°F with an incandescent heat lamp or hot water. If you use hot water, dry the seal with clean gauze before installation.

NOTE: Teflon material will not absorb water, thus will not keep water inside which could come out later to cause corrosion in the part.

- (3) Heat to 125-175°F the component to get the seal. Make sure the component is not too hot to touch by hand.

CAUTION: DO NOT USE METAL TOOLS TO INSTALL TEFLON CHANNEL SEALS OR DAMAGE TO SEALS WILL OCCUR. USE TOOLS OF NYLON OR EQUIVALENT MATERIAL.

- (4) Get a nylon plug or rod which can fit into the bore and which will stop the seal at the groove.

- (5) Lubricate the O-ring with the lubricant specified in Figure 1, then install it into the channel seal.

- (6) Bend the Teflon channel seal into an elliptical shape and slide it into the channel as shown. With a rod approximately 1/4 inch in diameter, push the remaining sections of the seal into the groove.

- (7) Smooth out the wrinkles, creases or waves which could occur in the installed Teflon channel seal with your fingers or a small smooth nylon rod or an equivalent tool.

NOTE: Tools to install Teflon channel seals are available from Busak & Shamban (V09257).

- C. Install the shaft through the Teflon channel seals.

- (1) Lubricate the shaft per Figure 1.

- (2) If the shaft has external threads, give the channel seal protection from the sharp threads at the shaft end (Figure 6) as by the following:

- (a) Get a piece of Teflon or plastic tubing with an ID slightly smaller than the major diameter of the threads and an OD the same size as the shaft.

- (b) Chamfer the end of the tubing as shown.

- (c) Turn the tubing onto the threaded part of the shaft until the end is against the shoulder of the shaft, as shown.

- (d) Lubricate the tubing per Figure 1.

- (e) Push the end of the tubing through the channel seal as you twist the shaft. This will expand the channel seal into the groove and get the shaft through the channel seal.

- (f) Continue to push shaft through the gland until the shaft is in the correct final position.

- (g) Remove the plastic tubing protection.

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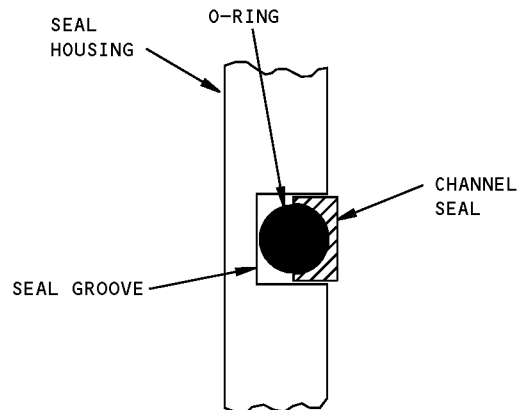
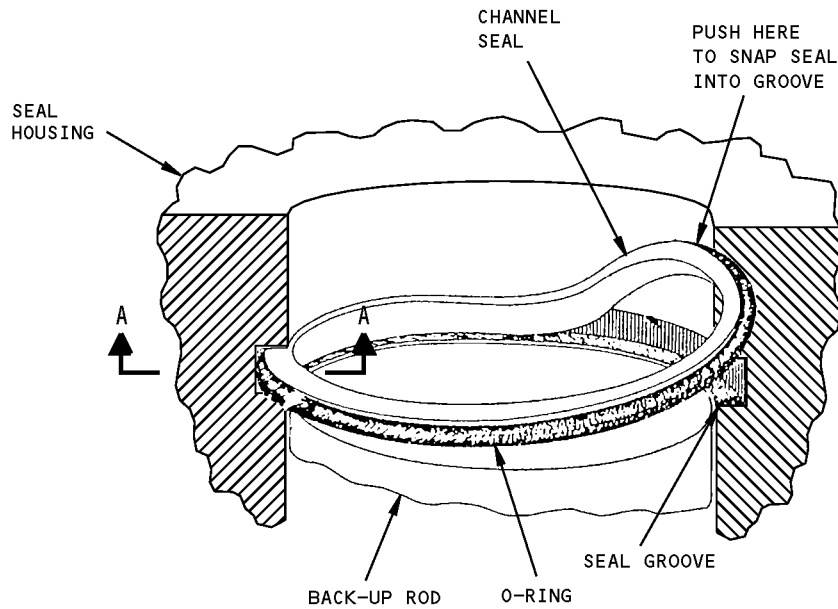
STANDARD OVERHAUL PRACTICES MANUAL

- (3) If the shaft has no threads on its end, carefully push and twist the shaft through the seal until the shaft end is completely through the seal. Then push the shaft straight through until it is in the correct final position.

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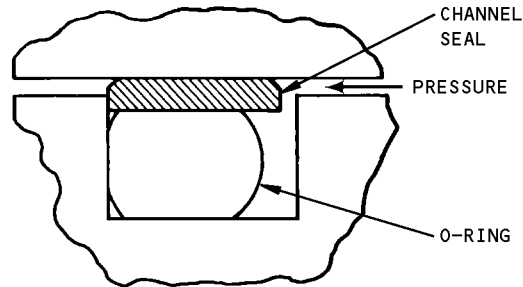
SEAL CORRECTLY INSTALLED
A-A

Installation of Teflon Channel Seals
Figure 4

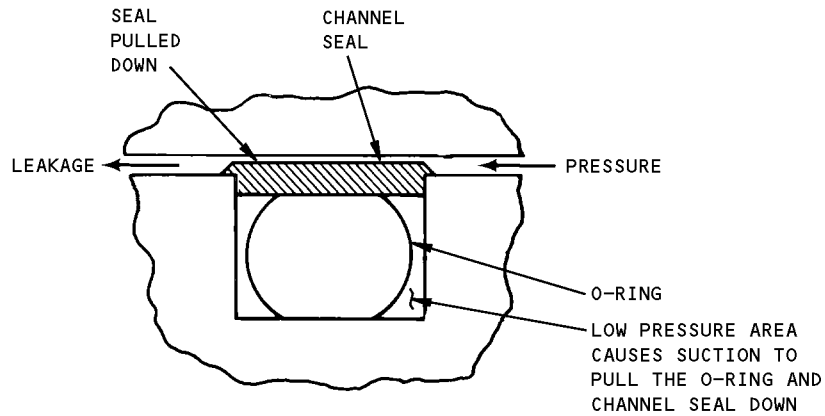
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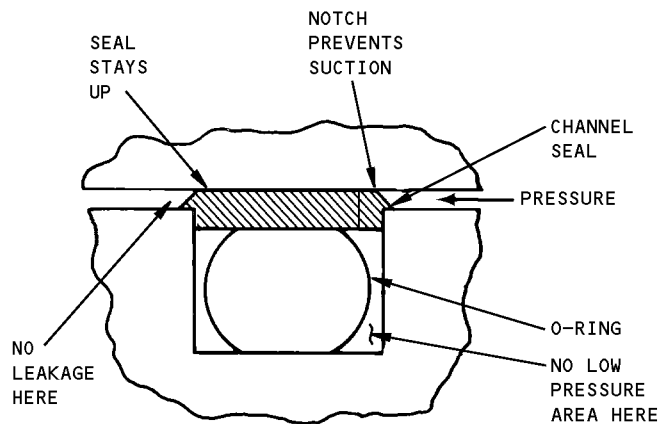
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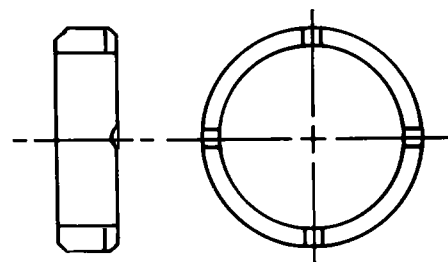
USUAL CORRECT SEAL OPERATION



SEAL MALFUNCTION CAUSED BY SUCTION



HOW NOTCHED SEALS PREVENT SUCTION

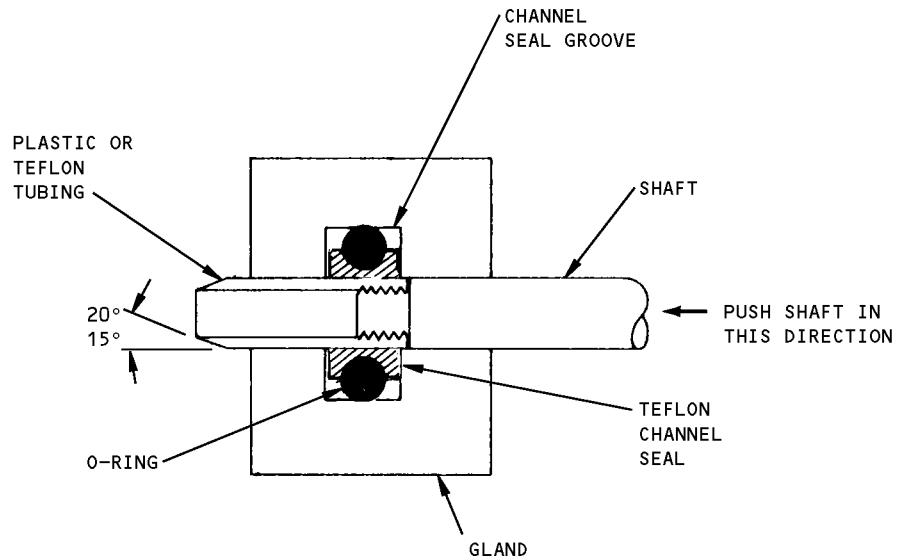


TYPICAL NOTCHED CHANNEL SEAL

Channel Seal Characteristics
Figure 5

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Threaded Shaft Installation Through Teflon Channel Seal
Figure 6

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**STANDARD OVERHAUL PRACTICES MANUAL****9. INSTALLATION OF TEFLON CHANNEL SEALS (OD)**

NOTE: Refer to Paragraph 8.A. for recommendations about notched seals.

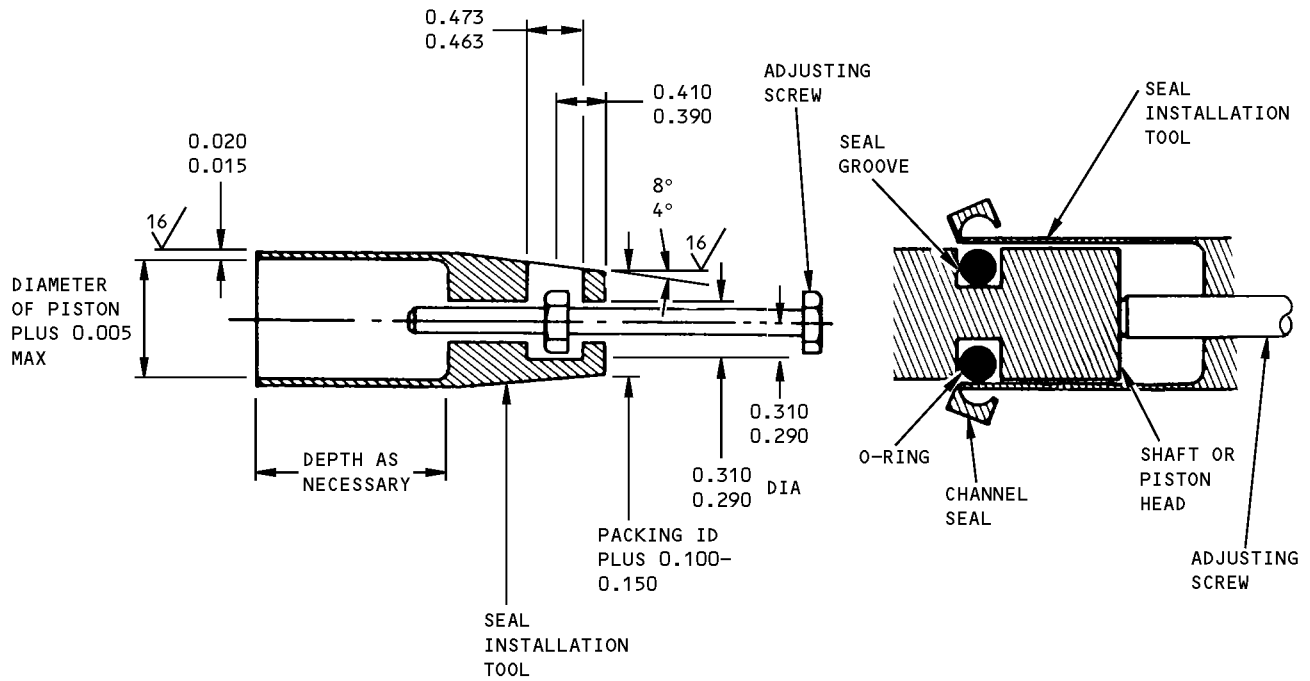
- A. Install the O-ring into the seal groove on the component (Figure 7).
- B. Heat the Teflon channel seal to 100-200°F with an incandescent lamp or hot water. If hot water is used, dry the seal with a clean sponge before installation.

NOTE: Teflon material will not absorb water, thus will not keep water inside which could come out later to cause corrosion in the part.

- C. Use a tool as shown. The tool can be locally made, or purchased from Busak & Shamban (V09257) as tool No. 16-130/OD.
- D. Lubricate the tool and the Teflon channel seal with lubricant per Figure 1.
- E. Put the tool over the end of the component with the end of the tool over the O-ring as shown. Adjust the screw to hold the tool in this position.
- F. Hold the tool with a clean, dry cloth to not let it slip. Hold the tool behind the channel seal and slide the channel seal over the tool until one leg of the channel seal goes into the seal groove, as shown.
- G. Turn the screw on the tool to pull the tool back, until the edge of the tool is aligned with the edge of the groove and the other leg of the channel seal drops into the groove. Make sure the O-ring is between the legs of the teflon channel seal.
- H. If the part is a large piston with a narrow rim between the seal groove and the piston end, you can put one edge of the seal in the groove and stretch the remaining part of the seal over the piston into the groove. (This is almost the same as how an automobile tire is installed on a wheel.)
- I. When two or more channel seals will be installed on a part, use a smoothing tool (Figure 8) to make it easier to put the seals in.
- J. Before you complete the assembly, slip the smoothing tool over the channel seals and press each seal against its O-ring. Twist and slide the tool at the same time to push on the seal surface until it is smooth. If there is only one teflon channel seal, you can do this by hand.

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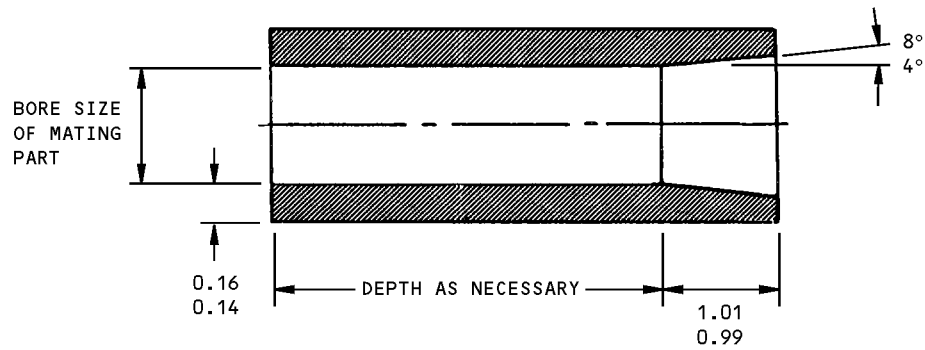


ALL DIMENSIONS ARE IN INCHES

OD Channel Seal Installation
Figure 7**20-50-06**



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ALL DIMENSIONS ARE IN INCHES

RECOMMENDED MATERIAL: NYLON

Seal Smoothing Tool
Figure 8

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**STANDARD OVERHAUL PRACTICES MANUAL****10. INSTALLATION OF TEFLON SQUARE RING AND CAP RING SEALS**

NOTE: Refer to Paragraph 8.A. for recommendations about notched seals.

A. Install square ring and cap ring seals (Figure 9) as follows:

- (1) Install the Teflon square ring in the seal groove.
- (2) Install the cap ring in with the same procedure as Teflon channel seals, steps 9.A. through J.

B. Assemble shaft or piston into mating part.

- (1) Get or make a seal pressing tool as shown in Figure 9. This tool is a nylon cylinder with its internal diameter equal to the bore size of the mating part. One wall of the cylinder has a slit longitudinally to permit installation over the seals, and the bore has a chamfer at each end to help prevent damage to the seals.
- (2) Install the tool over the seals as shown in Figure 9.
- (3) Install hose clamps around the cylinder. Carefully tighten the clamps to compress the seals, but do not pinch the cap rings.
- (4) Put the clamped assembly in an atmosphere colder than -70°F for 15-20 minutes.

WARNING: DO NOT TOUCH THE COLD ASSEMBLY WITH BARE HANDS. IT CAN CAUSE FROSTBITE AND DAMAGE TO HUMAN TISSUE.

- (5) Remove the pressing tool and immediately install the chilled assembly into its mating part.

11. INSTALLATION OF BACR12BD CAP RINGS (ID)

NOTE: Refer to Paragraph 8.A. for recommendations about notched seals.

A. Put the cap ring on the shaft as shown (Figure 10).

B. Stretch the O-ring onto the cap ring. Use the same size O-ring as the cap ring for cap rings BACR12BD110, BACR12BD210 and BACR12BD325. For all other cap ring sizes, use O-rings one size smaller than the cap ring.

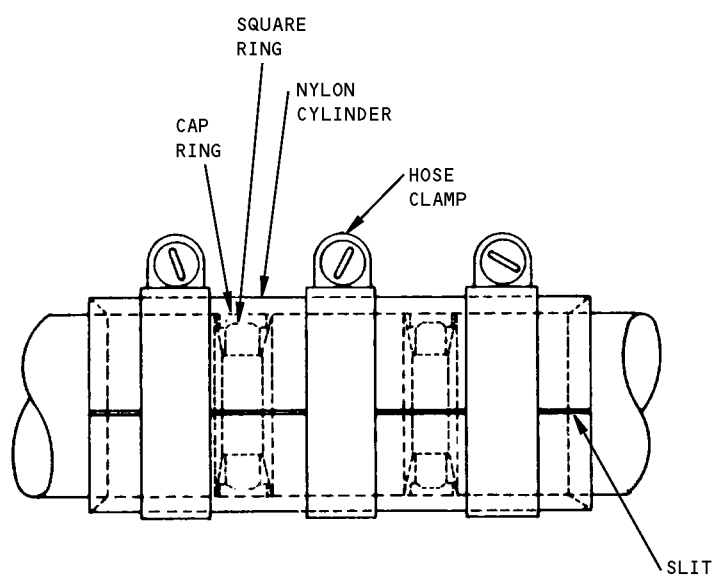
C. Slide the assembled O-ring and cap ring into the seal cavity.

D. Install the retainer.

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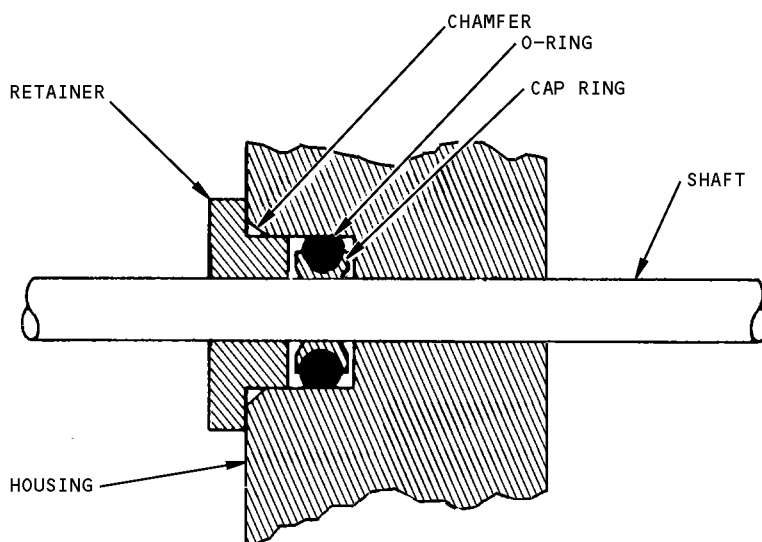


Seal Pressing Tool
Figure 9

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BACR12BD Packing Cap Ring (ID)
Figure 10

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**STANDARD OVERHAUL PRACTICES MANUAL****12. INSTALLATION OF BACR12BE CAP RINGS (OD)**

NOTE: Refer to Paragraph 8.A. for recommendations about notched seals.

- A. Put the O-ring into the seal groove as shown (Figure 11). Use the same size O-ring as the cap ring for cap rings BACR12BE110, BACR12BE210, and BACR12BE325. For all other cap rings, use O-rings one size smaller than the cap ring.
- B. Get or make an installation tool as shown in Figure 7.
- C. Put the installation tool on the shaft or piston head with the edge of the open end just covering over the O-ring. Adjust the screw to hold the tool in this position.
- D. Lubricate the cap ring, the O-ring seal and the installation tool with the lubricant specified in Figure 1.
- E. Hold the tool with a clean dry cloth, and slide the cap ring up the tool until one leg of the cap ring goes into the seal groove as shown in Figure 7.
- F. Adjust the screw to retract the tool until the open end starts to uncover the O-ring.
- G. Slide the remaining leg of the cap ring into the seal groove.
- H. Smooth the cap ring by hand and push and squeeze the seal assembly to remove all caught air, bumps, wrinkles or waves, until the cap is correctly in the groove. Use a smoothing tool as shown in Figure 8. This is important for the small packing cap ring sizes BACR12BE006 through BACR12BE012.
- I. Carefully push the shaft into the bore. Twist and turn the shaft as necessary.

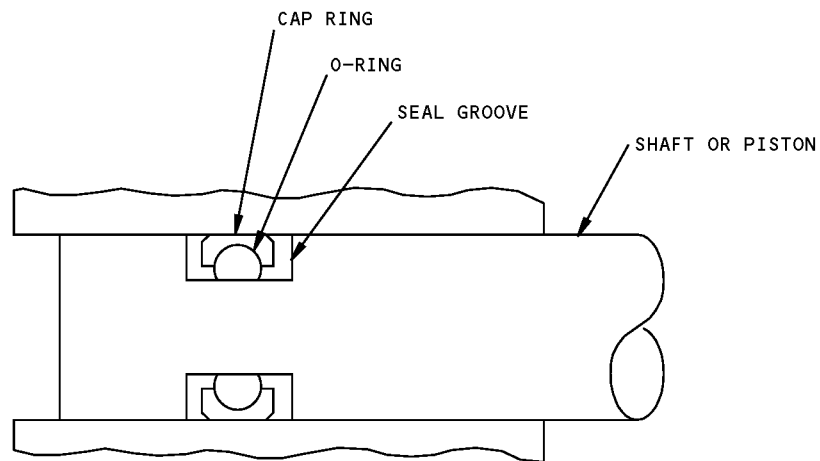
NOTE: To make installation and assembly easier, use an insertion tool as shown in Figure 6 if the shaft ends have external threads.

- J. Wipe off unwanted lubricant with clean lint-free cloth.

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BACR12BE Packing Cap Ring (OD)
Figure 11

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**STANDARD OVERHAUL PRACTICES MANUAL****13. INSTALLATION OF ROTARY SEAL RINGS (OD) – BONDING METHOD**

A. If seal rings are not already etched, etch them as follows:

CAUTION: THE TFE ETCHING SOLUTIONS CONTAIN SODIUM DISSOLVED IN A FLAMMABLE ORGANIC SOLVENT. BE CAREFUL WHEN YOU USE THEM. KEEP THEM AWAY FROM FLAMES. IF THERE IS A FIRE, USE ONLY A SODA-TYPE FIRE EXTINGUISHER.

- (1) Mask the outside diameter of the seal ring.
 - (2) Soak the ID of the ring in TFE etching solution until the surface becomes a light tan to a dark brown color. The time could be 5-30 seconds or more because of the different solution types or strengths. Use one of these or an equivalent:
 - (a) Bondaid S16943 Etchant, V09257
 - (b) Chemgrip Etchant, V18632
 - (c) Fluorobond, V00986
 - (d) Tetra-Etch, V17217 or V60622
 - (3) If the part does not become a dark brown color in 60 seconds, the etchant is too old or weak. Do the etch procedure again with new solution.
 - (4) Immediately after treatment, wash the etched surface with a 3 to 5% solution by volume of water in n-butyl alcohol to stop the etch process.
 - (5) Wash the part in clean water (180°F maximum). Remove masking. Wash the part with acetone or MEK. Dry it with a clean cloth, but do not rub it.
- B. With methyl ethyl ketone or methyl propyl ketone, clean the shaft and seal ring bonding surfaces, and all parts and tools which will touch the contact seal ring ID during installation. Bond surfaces must not have dust, lint, oil or other contamination.
- C. Install the seal ring on the expanding tool (Figure 7). Slide the tool over the shaft to put the seal ring adjacent to the grooves in the shaft.
- D. Apply a thin even coat of BMS 5-126, Type 1 or Type 2 adhesive per SOPM 20-50-12, Type 38.
- E. Slide the seal ring from the expanding tool onto the shaft groove and remove the tools. With the fingers only, immediately turn the seal ring approximately one turn to distribute the adhesive.
- F. If there is more than one seal on the shaft, do steps C., D., E. again.
- G. Wipe off unwanted adhesive with a lint-free cloth wet with methyl ethyl ketone or methyl propyl ketone.
- H. After 10 minutes try to turn each seal ring again with the fingers. If the adhesive is set, this will not be necessary.
- I. Let the adhesive cure 24 hours minimum at room temperature before you use the part. As an optional cure method, put the part in an oven preheated to 270-290°F. Remove the part from the oven after 2 minutes and turn each seal ring approximately one turn. Put the part back in the oven for 10-12 more minutes. Remove the part from the oven and let it air-cool to room temperature. Do not put the part in a coolant or a flow of air to make it cool faster.
- J. Remove unwanted cured adhesive with a cloth moistened with epoxy paint stripper per SOPM 20-30-02.
- K. Clean the shaft and the seal rings with methyl ethyl ketone or methyl propyl ketone. Let this air dry. Dip the complete shaft in MIL-H-5606 hydraulic fluid or a rust inhibitor.

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STANDARD OVERHAUL PRACTICES MANUAL

14. INSTALLATION OF OMNISEALS

CAUTION: BE VERY CAREFUL WHEN YOU USE AND INSTALL OMNISEALS TO PREVENT DAMAGE SUCH AS NICKS, CUTS, AND GROOVES ON THE SEALING SURFACES OF THE SEAL.

- A. Unless specified by the overhaul instructions, install the omniseal with the open side of the cover on the side of the pressure, as shown (Figure 12, Figure 13). In this position, the pressure will permit the seal to become internally pressurized.
- B. Omniseals in External Glands

CAUTION: THE INSTALLATION TOOL YOU USE MUST NOT STRETCH THE OMNISEAL TO MORE THAN A 30 PERCENT INCREASE IN INTERNAL DIAMETER OR DAMAGE TO THE SEAL WILL OCCUR.

- (1) Lubricate the expander tool (ST-848A-2-212) and the part to get the omniseal, with hydraulic fluid per Figure 1. Put the tool in position over the external gland of the part.
- (2) Put the seal on the expander tool in the correct direction as specified by the overhaul instructions. Lubricate with hydraulic fluid the end of collet tool ST848A-1-212 which will touch the seal. Put the collet over the expander tool ST848A-2-212 until it touches the omniseal (Figure 13).
- (3) Push the omniseal into position in the part with a good quick push on the collet. Then remove the collet and the expander tool.
- (4) Visually examine the omniseal for damage. Make sure the omniseal expander spring is not extruded from the seal, and that the omniseal is fully down in its groove in the correct direction. There must be no longitudinal marks on the sealing surface when examined under 10X magnification.
- (5) Lubricate the compressor tool ST848A-3-212 with the filtered hydraulic fluid specified in Figure 1.
- (6) Lubricate the seal again, then put the compressor tool over the part as shown in Figure 14, with the larger diameter of the tool on the omniseal first.
- (7) Push the compressor tool over the part, and make sure you put a constant pressure on the omniseal. Make sure the omniseal is fully inside the cylindrical opening of the compressor tool. Let the part stay inside the compressor tool for 10-15 minutes to let the seal get back to approximate original dimensions.

CAUTION: DO NOT BACK OFF THE COMPRESSOR TOOL FROM THE OMNISEAL OR YOU WILL DAMAGE THE SEAL.

- (8) Push the compressor tool through, over the omniseal, and onwards off the part, only in this same direction. Remove unwanted hydraulic fluid with solvent per Figure 1.
- (9) Examine the omniseal per step 14.B (4).
- C. Omniseals in Internal Glands
 - (1) Get the installation tools as shown in Figure 15. Clean all tools before you use them, with solvent per Figure 1.
 - (2) Install a plug in the bore of the part to stop the omniseal at the internal gland.
 - (3) Put the omniseal on the bevelled surface of the tool. Place the tool against the bore of the part, then carefully push on the handle until the seal goes into the gland.
 - (4) Turn the handle of the tool to put the omniseal completely in its groove, as shown.

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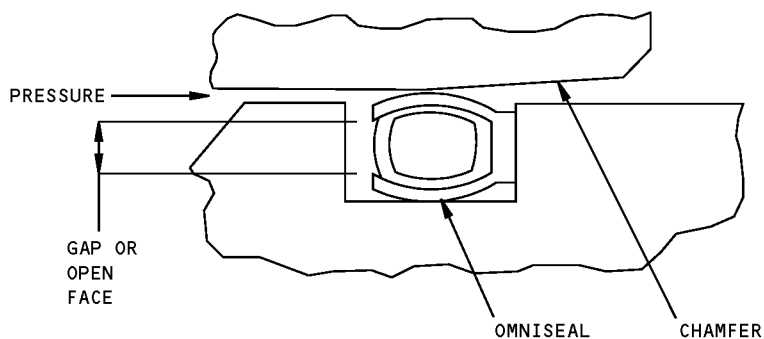
- (5) Visually examine the omniseal per step 14.B (4).

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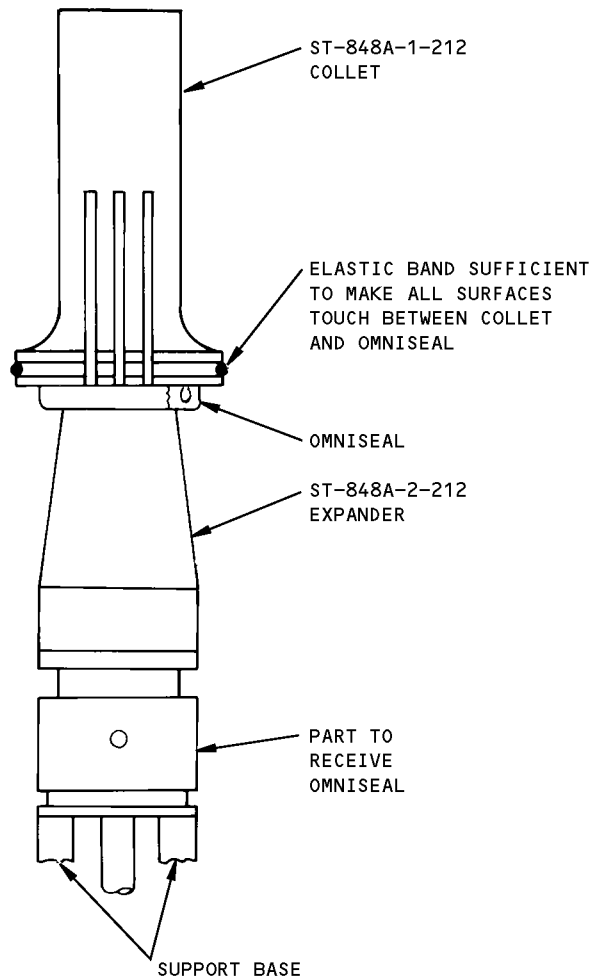
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Typcial Omniseal Installation
Figure 12

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Omniseal Installation in External Gland
Figure 13

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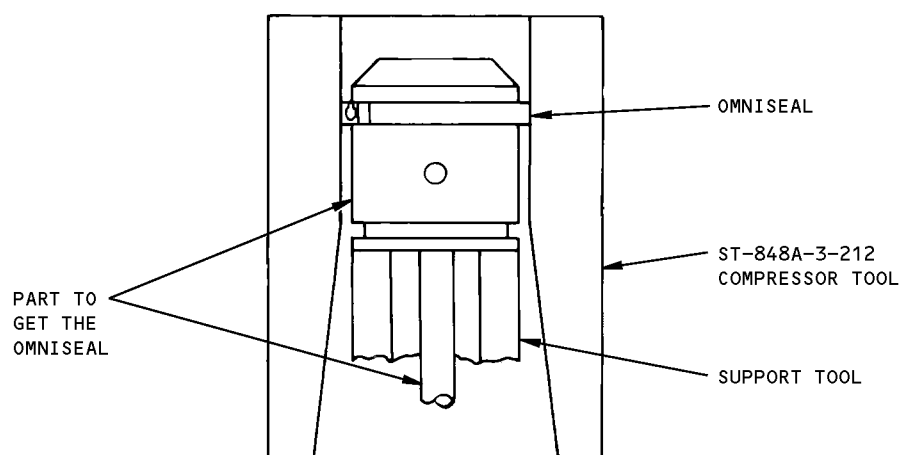
15. T-SEALS

- A. When you install T-seals, such as those made by Greene Tweed (V5F573), be sure to install the backup rings with the radius against the T-seal (Figure 16). Decreased T-seal life could occur if the backup rings are installed with the sharp square edge against the T-seal.

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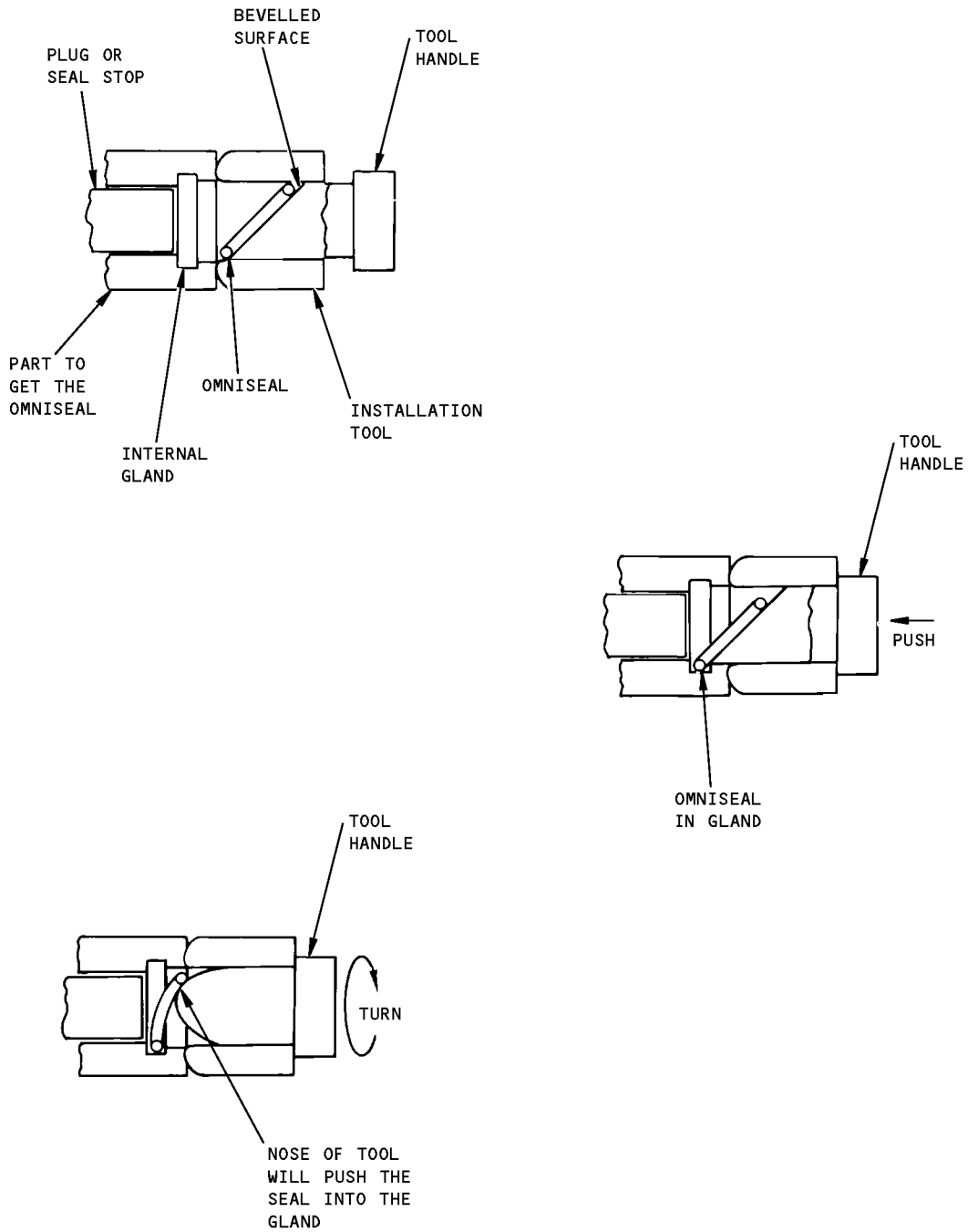
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Compressor Tool Operation
Figure 14

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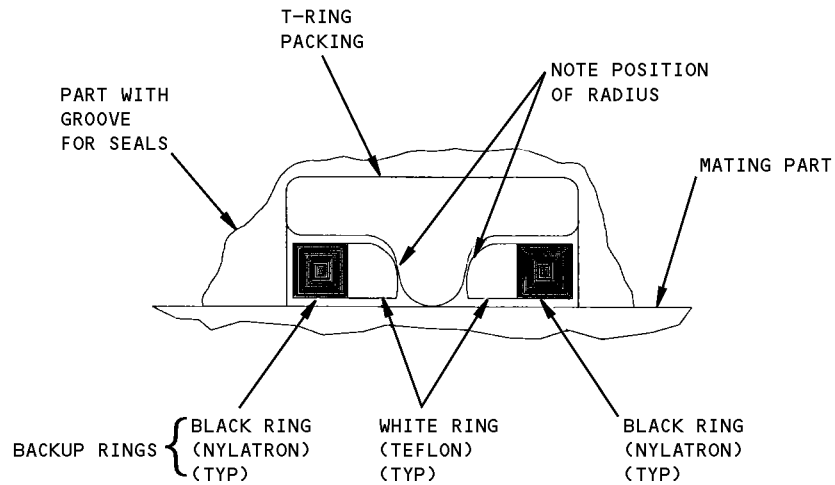


Omniseal Installation in Internal Gland
Figure 15

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Typical T-Seal Installation
Figure 16

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**STANDARD OVERHAUL PRACTICES MANUAL****16. NYLON BACKUP RINGS**

- A. These rings are usually installed in pairs, one on each side of an O-ring in an ID seal groove. The backup rings are usually made of nylon, usually nylon 6/6.
- B. Install the backup rings, with the O-ring in between, by a procedure equivalent to that shown for teflon channel seals, Paragraph 8.
- C. The nylon material will absorb water, but only if kept in water a long time. If you use hot water to make the backup rings warm and soft before installation, do not let them stay in the hot water more than 8 hours. After this long a soak, the nylon will start to change dimensions which could cause fit problems. But the amount of water absorbed by the nylon is not sufficiently large to cause corrosion problems. Hot vegetable oil can be used as an alternative to hot water if the rings must stay in the bath longer than 8 hours. Nylon will not absorb oil.

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