

#### 4-10. PF/VIP Valves

The "PF/VIP" valve is a high speed plate valve designed specifically for the Dresser-Rand VIP compressor cylinder. The valve is furnished in several styles, depending on valve size. All valve styles contain a seat, guard, guide ring, springs and valve plate. The smallest valve is furnished without a damping plate (Figure 4-8), valves from 4.250" through 10" have a stainless steel damping plate and a separate guide ring (Figure 4-9), and valves larger than 10" have a valve guide ring integral to the seat (Figure 4-10).

Piston rings are mounted on the valve seats of the inlet and discharge valves where they seat in the cylinder bore, preventing gas leakage past the valve.

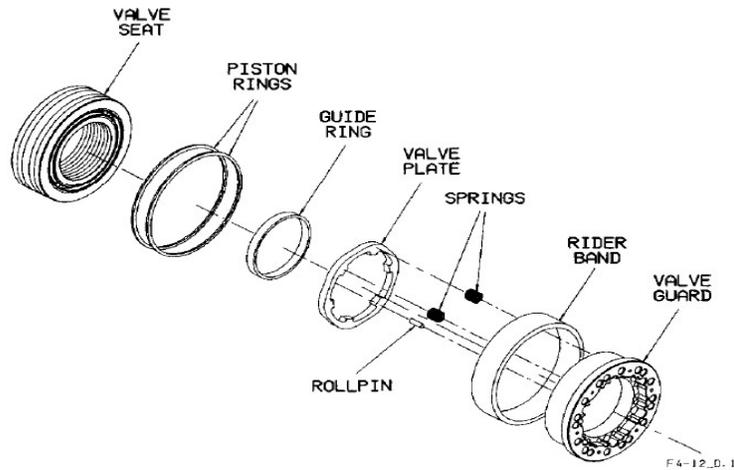


Figure 4-8. Small Bore "PF/VIP" Valve w/o Damping Plate

4-29

#### 4-15. Piston Ring Replacement

When the piston ring gap opening exceeds twice the original end gap, new rings should be fitted to the valve. Replacement rings from Dresser-Rand will be tagged. These tags will contain the proper side clearance and ring gap clearance to permit proper fitting of the rings to the piston and in the cylinder bores.

Whenever new rings are installed they should first be fitted into the cylinder bore and the end gap clearance of the ring established. These clearances should be checked before installing the rings on the valve. If necessary, the ends of the compression rings should be sanded or filed to establish the minimum end gap clearance indicated on the tag. Ensure that the ring fits freely in the piston ring groove and has the proper side clearance.

Keep in mind that Teflon expands considerably under operating temperatures; therefore extra precautions must be taken in fitting these rings. Piston rings can be readily slipped over the end of the valve into their respective grooves.

1. Remove the valves from the cylinder bore and remove the old rings. (Refer to Section 4-11.)
2. Position the new piston rings squarely into the cylinder bore. The cylinder bore is tapered on the head end for ease of installing piston assembly. When measuring end gap ensure rings are positioned in the bore past the tapered area. Check the end gap (See Figure 4-21). Refer to the data in Table 4-4 for correct end gap.

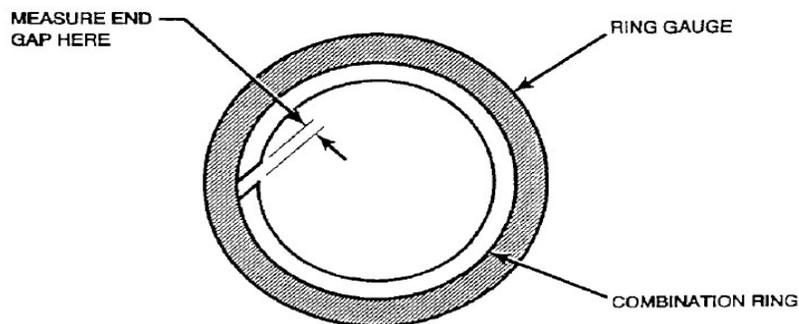


Figure 4-21. Taking End Gap Clearance

- If necessary, file the ends of the rings until the proper end gap is obtained.

### ▲ CAUTION

If there is insufficient end gap clearance, the rings will break or wear excessively during operation.

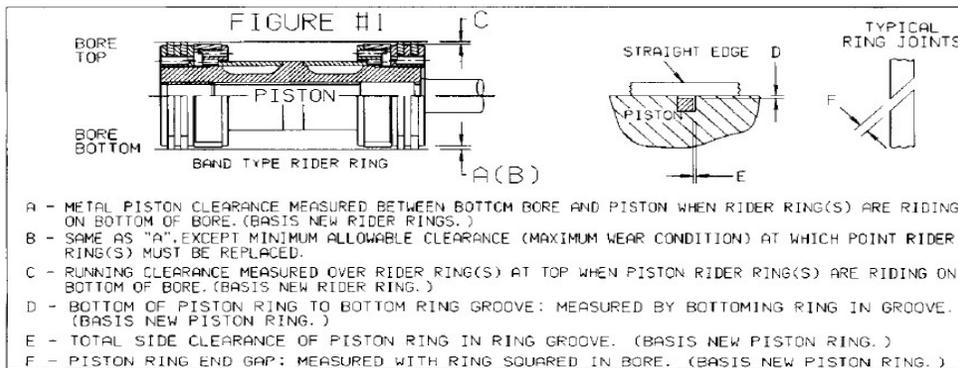
- File off all sharp edges or burrs on the rings. Wipe the rings to remove any excess filings. The rings must be assembled in the piston grooves prior to the piston being installed into the bore. These rings will extend beyond the pistons outside diameter when installed. After the piston is installed, measure the bottom clearance between the piston and cylinder bore (See Figure 4-22).
- The rings should fit fairly loose in the grooves. (If a ring is pulled up and out of its groove, it should drop by its own weight, without binding, back into the groove if clearance is sufficient.) See data in Table 4-4 for the proper clearance.

### NOTE

The metal strips allow the new rings to be slipped over the valve and into the grooves without overstressing or distorting them.

**CYLINDER SIZES 10.00" AND BELOW HAVE THE FOLLOWING:  
(PISTON RING MATERIAL AND TYPE OF CARBON FILLED TEFLON SINGLE PIECE, BUTTCUT)  
(RIDER RING MATERIAL AND TYPE OF CARBON FILLED TEFLON BAND TYPE)**

**CYLINDER SIZES 11.25" AND ABOVE HAVE THE FOLLOWING:  
(COMBO RINGS MATERIAL AND TYPE OF GRADE 12 THERMOPLASTIC 3 OR 4 SEPARATE PIECES)**



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(See Table 4-4 for Dimensions)  
Figure 4-22. Points for Checking Clearance

Table 4-4. Piston Ring/Rider Ring Clearance

Nominal Cylinder Size (Inches)	Groove Width (Inches) (+0.001/-0.000)	"A" Piston Clear. New Rings (Inches)	"C" Running Clear. Top - New Rings (Inches)	"D" Ring Bot. to Groove Bot. New Rings (Inches)	"E" Side Clear. Between Ring and Groove (Inches)	"F" "Total" Ring End Gap - New (In.)
3.50	.250	.017 - .022	.021	.065 - .081	.005 - .010	.035 - .055
4.25	.250	.015 - .021	.023	.065 - .082	.005 - .010	.045 - .065
5.00	.250	.019 - .026	.014	.066 - .087	.005 - .010	.055 - .075
5.50	.250	.031 - .038	.017	.023 - .044	.005 - .010	.061 - .081
6.00	.250	.043 - .049	.019	.023 - .044	.005 - .010	.068 - .088
6.50	.250	.051 - .057	.022	.023 - .044	.005 - .010	.075 - .095
7.125	.250	.058 - .064	.026	.023 - .044	.005 - .010	.083 - .103
7.75	.250	.058 - .064	.027	.023 - .044	.005 - .010	.091 - .111
8.50	.250	.058 - .064	.027	.023 - .044	.005 - .010	.101 - .121
9.25	.375	.054 - .060	.035	.023 - .044	.005 - .010	.110 - .130
10.00	.375	.055 - .061	.035	.023 - .044	.010 - .015	.115 - .145
11.25	.500	.025 - .033	.039	*	.009 - .013	.079 - .113
12.50	.500	.025 - .033	.042	*	.009 - .013	.088 - .125
13.75	.625	.025 - .033	.043	*	.009 - .013	.096 - .138
15.00	.625	.025 - .034	.045	*	.011 - .015	.105 - .150

NOTE: Inch-to-millimeter conversion - Multiply inches by 25.4 to obtain millimeters.

\* = These bore sizes utilize combination piston rings/rider rings intended to bottom in the groove, projecting above the surface of the piston.

#### 4-16. RIDER RING INSTALLATION

When the rider ring has worn so that any part of the valve is within 0.010 inch (0.25 mm) of the cylinder bore at "B", the rider ring should be replaced. Note that the valve must be disassembled as described in 4-11 before removing old rings or installing new rings (Figure 4-23).

The rider rings are directional and must be installed in the proper manner as shown in Figure 4-23.

#### NOTE

If sufficient material is left on a worn rider ring, the piston can be rotated 90° to present a new wearing surface to the bore. The constraints of piston end clearance must be adhered to, however, as rotating the piston will alter the end clearance figure.

#### To install rider rings:

1. Heat the rider ring in oil or an oven to at least 350° F (177° C) for one hour, or until ring becomes pliable. Heating is necessary to prevent breakage when stretching the ring. Take care not to overheat the material, and to fully support the ring on its rim while heating.
2. Position rider ring on the valve guard and tap or press evenly with a piece of wood into groove.
3. After installation, measure and record the rider band projection and piston rod runout for future use in determining the wear rate.

#### A. Handling Instructions

These piston rings are fragile (when compared to metallic parts) and can be easily damaged by careless handling. Always use care during storage, handling, installation and removal.

During long shutdowns (over six months), the pistons and rods should be removed from the compressor; coat the piston and rod assembly with a rust preventative that meets Military Specification MIL-C-16173 latest revision. The rings are to be removed from the piston and stored flat. No special covering or rust preventative is required. Do not lay the piston and rod assembly down with rings installed.

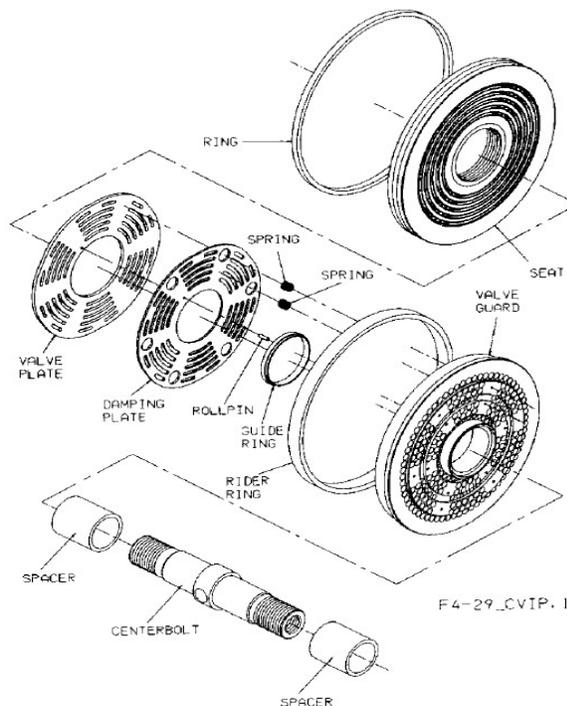


Figure 4-23. Rider Ring Installation

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## B. Establishing Ring Wear Rate

The combination piston/rider rings may wear more rapidly than other rings because of the functions they are designed to perform. (These are sealing of the cylinder bore, and the prevention of piston to cylinder bore contact.) Operating and maintenance personnel must take this factor into consideration when scheduling inspections and normal part replacement.

As wear occurs, piston rod runout will eventually exceed allowable limits. If oversized rings are installed in an oversized bore the ring wear factor is more critical because the rod drop will be increased by one-half the total oversize. For example, if the bore is 0.026-inch oversize (0.66 mm) the rod will drop an additional 0.013-inch (0.33 mm) before the bottom clearance or ring radial thickness indicates replacement is required. Therefore, the operator must keep in mind that the rings must be replaced when their original radial thickness is reduced by one-half of the original (new radial) thickness. Also, note the clearance between the piston rod and packing housing. DO NOT allow these items to come into contact with each other.

Because of the many variables involved, it is impossible to accurately predict the rate of wear. (Some of the variables are pressure, temperature, lubrication or lack thereof, piston weight, gas type, gas wetness, gas cleanliness and cylinder bore finish.)

### **▲ CAUTION**

**To prevent scoring of the cylinder bore, piston or the piston rod, the amount of ring wear (clearance between the piston and cylinder bore) must be checked on a regular basis. This action will tell the operator if wear is excessive, allowing replacement before damage is done.**

The importance of frequently checking ring wear rate cannot be over-emphasized. The rate of wear must be determined so that a replacement schedule can be established. Measurement of the piston to cylinder bore clearance ("A", Figure 4-22) should be taken at intervals of 10, 100, 250, 500 and 1000 hours. Record these numbers for future reference, or plot a simple wear versus time curve that will indicate both the rate of wear and the approximate number of hours running time before the combination rings need to be replaced.

### **NOTE**

When plotted, the wear rate curve will usually show a relatively rapid rate of wear during the first few hours of operation. As the rings wear, the curve should flatten out.

## C. Replacing Rings

Rings are replaced when the bottom piston to cylinder bore clearance ("A" Figure 4-22) has been reduced to the minimum allowable clearance or if the original radial thickness of the rings has been reduced by one-half.

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