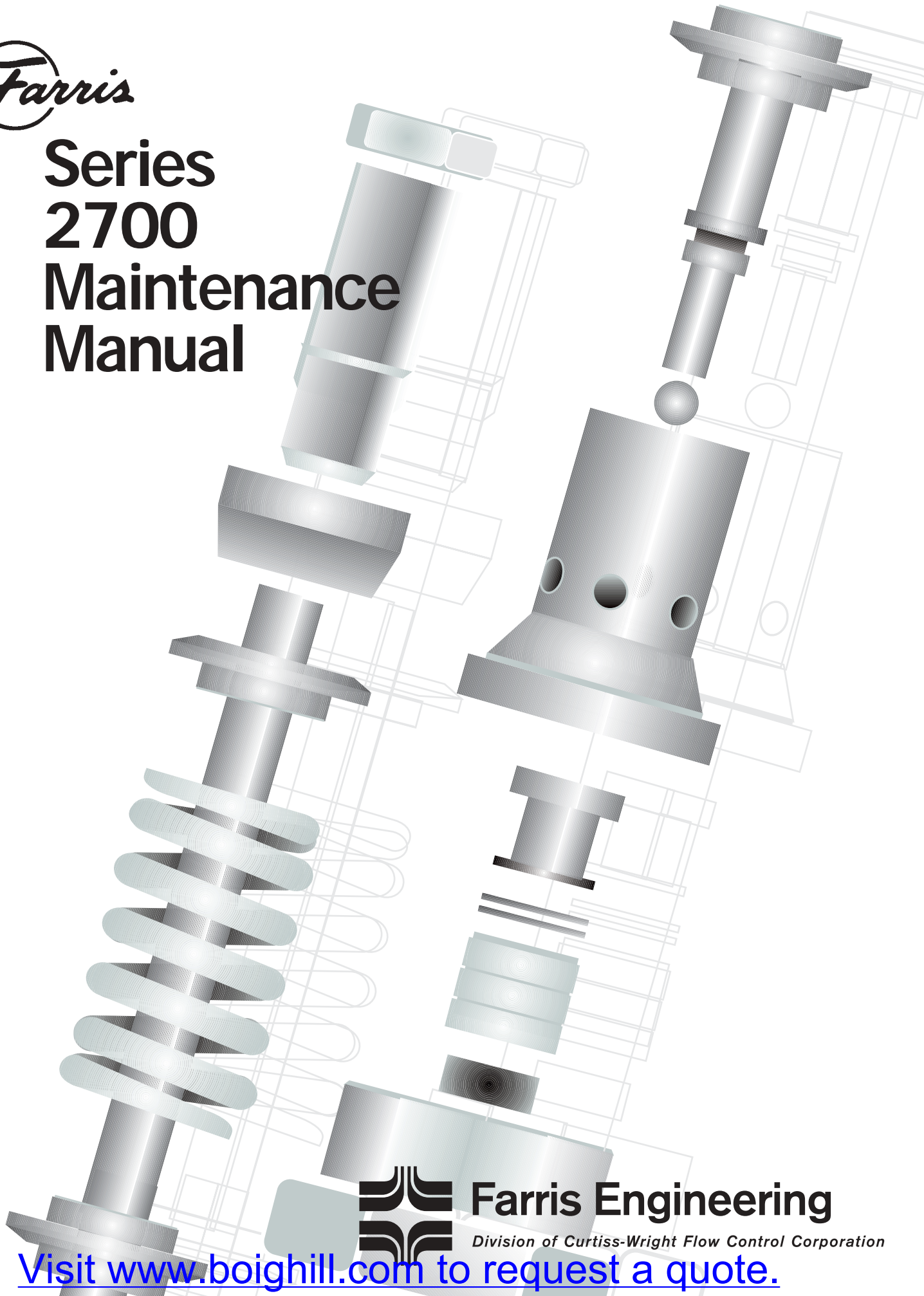




Series 2700 Maintenance Manual



Farris Engineering

Division of Curtiss-Wright Flow Control Corporation

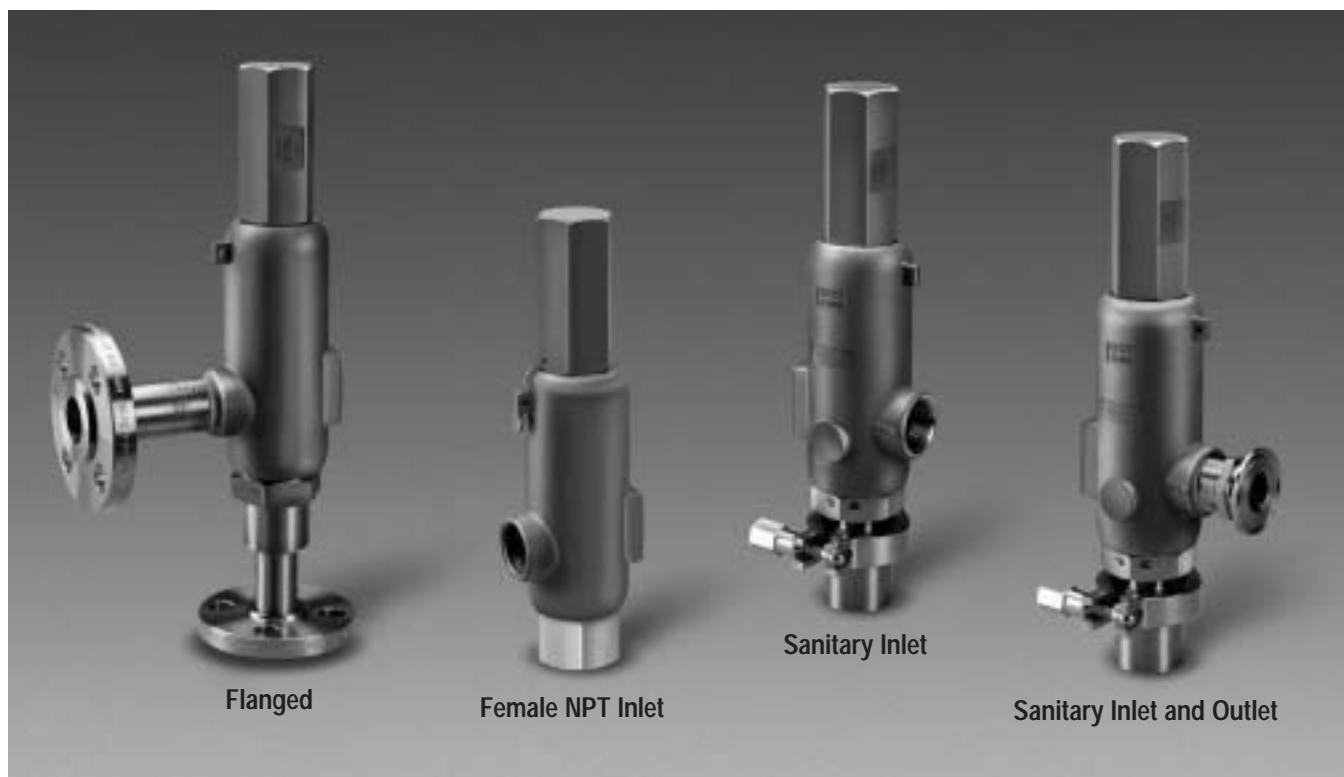


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1. Introduction

Numbering System

The chart below illustrates the Farris Series 2700 valve type numbering system. The type number is imprinted on the nameplate of every Farris Series 2700 valve and describes its construction and metallurgy. Valve types with numbers ending

in "SP" are special valves. Example: 27DA23-120/SP. Contact the Farris Factory for assistance when replacement parts or maintenance are required on these valves.

27	D	A	2	3	H -	M	2	0	S4
Series Number	Orifice Area	Seat Construction	Inlet Size	Outlet Size	Special Variations	Inlet Connections	Cap Construction	Test Gag	Special Materials
27	C 0.068	A Metal Seat	1 1/2"	3 1"	H High pressure variations of standard types	O Special	2 Plain	0 No Gag	S4 Complete 316 St. St.
	D 0.125	C Soft Seat	2 3/4"	4 1 1/2"		M MNPT	4 Packed Lever	1 Test Gag	S7 NACE Trim
	E 0.223	T Teflon® Seat	3 1"	5 2"		F FNPT	7 Open Lever		M1 Monel® Body & Disc
	F 0.350		4 1 1/2"	6 2 1/2"		1 Flanged-150RF			M2 Monel Trim
	G 0.573					2 Flanged-300RF			M4 Complete Monel
					3 Flanged-600RF			H1 Hastelloy® C Body & Disc	
					4 Flanged-900RF			H2 Hastelloy C Trim	
					5 Flanged-1500RF			H4 Complete Hastelloy C	
					6 Flanged-2500RF				
					S Socket Weld				
					T Sanitary				
					V VCR				
					W Welding Nipple				

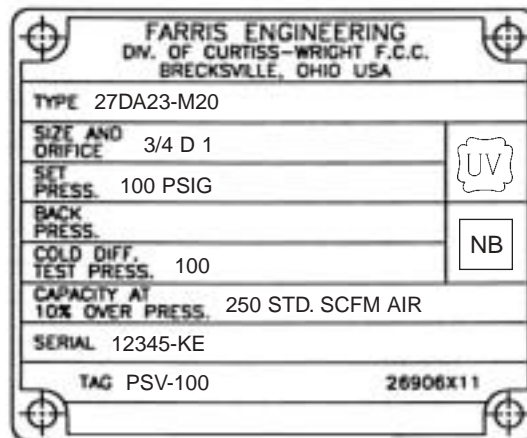


Figure 1.1 Nameplate for 2700 Series

Telfon is a registered trademark of the DuPont Company.
 Monel is a registered trademark of Inco Alloys International Inc.
 Hastelloy and Hastelloy C are registered trademarks of Haynes International Inc.



Bill of Materials

Item No.	Part Name	Standard Material
1	Body	SA-351, Gr. CF8M St. St. or SA-479 Type 316 St. St.
2	Bonnet	SA-216, Gr. WCB, Carb. St.
3	Disc	316 St. St.
4	Guide	316 St. St.
5	Disc Holder	316 St. St.
6	Stem	316 St. St.
7	Spring Adj. Screw	316 St. St.
8	Jam Nut	316 St. St.
9	Cap, Plain Screwed	Carbon Steel
10	Cap Gasket	316 St. St.
11	Body Gasket	316 St. St.
12	Guide Gasket	316 St. St.
13	Spring (-20° to +750°F)	Chrome Alloy, Rust Proofed
14	Spring Buttons	316 St. St.
15	Wire Seal	St. St. Wire / Lead Seal
16	Nameplate (Not Shown)	Stainless Steel
17	Welding Nipple (Inlet)	316 St. St.
18	Welding Nipple (Outlet)	Carbon Steel
19	Lap Joint Stub End (Inlet)	316 St. St.
20	Lap Joint Stub End (Outlet)	Carbon Steel
21	Lap Joint Flange (Inlet)	Carbon Steel
22	Lap Joint Flange (Outlet)	Carbon Steel

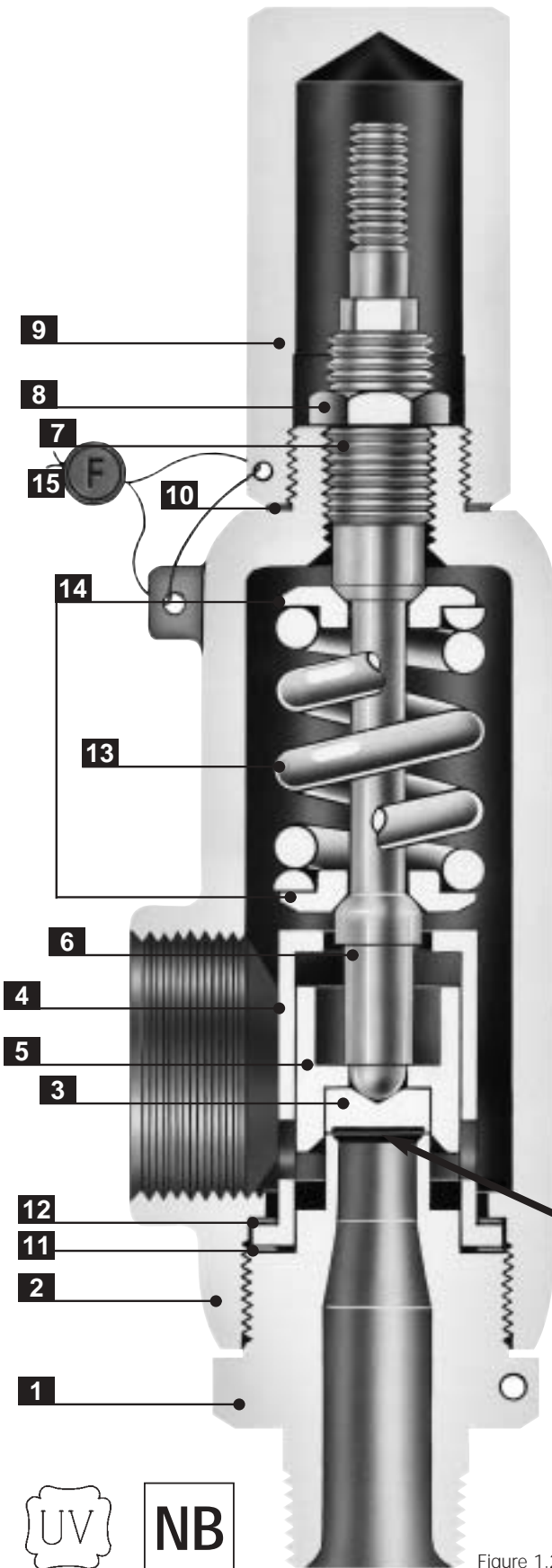


Figure 1.2

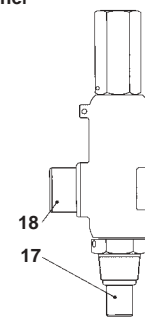


Figure 1.3

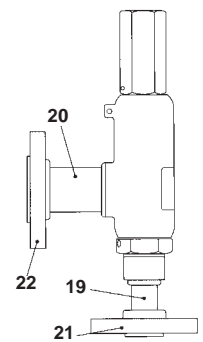


Figure 1.4



Built in conformance to ASME Code Section VIII, capacity certified by National Board for air, gas, steam and liquid.

Accessories

Cap Construction: M70 Open Lever, M40 Packed Lever

Cap Construction	Item No.	Part Name	Standard Materials	316 St. St.		Monel		Hastelloy C	
				S4	S7	M1 & M2	M4	H1 & H2	H4
M70 Open Lever	1	Test Lever	Iron	---	---	---	---	---	---
	2	Cap, Open Lever	Iron	---	---	---	---	---	---
	3	Stem Test Washer	St. St.	316 St. St.	---	---	Monel	---	Hast. C
	4	Stem Jam Nut	St. St.	316 St. St.	---	---	Monel	---	Hast. C
	5	Button Head Rivet	Steel	---	---	---	---	---	---
	6	Set Screw	Steel	---	---	---	---	---	---
M40 Packed Lever	7	Test Lever	Steel	---	---	---	---	---	---
	8	Cap, Packed Lever	Steel	316 St. St.	---	---	Monel	---	Hast. C
	9	Stem Test Washer	St. St.	316 St. St.	---	---	Monel	---	Hast. C
	10	Stem Jam Nut	St. St.	316 St. St.	---	---	Monel	---	Hast. C
	11	Cam	St. St.	316 St. St.	---	---	Monel	---	Hast. C
	12	Gland	St. St.	316 St. St.	---	---	Monel	---	Hast. C
	13	Gland Nut	St. St.	316 St. St.	---	---	Monel	---	Hast. C
	14	Packing Ring	Graphite	---	---	---	---	---	---
	15	Gland Nut Gasket	Flexible Graphite	Teflon Coated Ceramic Fiber	Teflon Coated Ceramic Fiber	---	Teflon Coated Ceramic Fiber	---	Teflon Coated Ceramic Fiber
	16	Groove Pin	Steel Pl't'd	---	---	---	---	---	---

General Notes:

- Any part denoted with a dash is standard material.
- S4 trim is suitable for cryogenic service.

2. Disassembly of Valves

Dismantling

- Place the valve at a suitable height. The work surface should be clean, and strong enough to handle the weight of the parts and the forces required during disassembly and assembly.
- Mount valve vertically in a vise using the flats on the valve body.
- Remove wire seal. Unscrew cap by turning counterclockwise. (For packed and open lever cap construction, refer to the section on Lifting Lever Assemblies.) Remove the cap gasket.
- Using a smooth jaw wrench, hold the spring adjusting screw and remove the jam nut (spring adjusting screw).
- Measure the distance from the top of the spring adjusting screw to the top of the bonnet, or count the number of turns of the spring adjusting screw. Use this measurement when reassembling the valve to approximately duplicate the original set pressure.
- Remove the spring adjusting screw by turning counterclockwise.
- Thread a pipe into the outlet and turn the bonnet counterclockwise, removing it from the body. Alternatively, the bonnet can be held in a vise and a wrench can be used on the body to loosen it.
- Lift out the stem with spring and buttons attached. Remove upper button, spring and lower button from stem.
- Remove the guide gasket.
- Remove the body and trim assembly from the vise. Place one hand on top of the guide and invert the assembly, allowing the guide which contains the disc holder and disc to drop free of the body. Turn the guide upright and allow the disc holder to slide out of the guide, being careful not to drop either piece. Remove disc from disc holder and body gasket from the body.
- Clean all parts and threaded surfaces thoroughly. Replace all gaskets.
- Lap the body seat and disc surfaces. See Section 3 for lapping procedure and Appendix A for critical dimensions.

Lifting Lever Assemblies

A. Open Lifting Lever (Figure 1.5)

1. Remove wire seal and slide out button head rivet, releasing lever from cap. Pull lever free of cap.
2. Remove set screw from base of cap and lift cap off bonnet.
3. Holding the stem with pliers (wrap the jaws to avoid marring), remove stem jam nut and stem test washer.
4. Clean all parts and reassemble in reverse order.

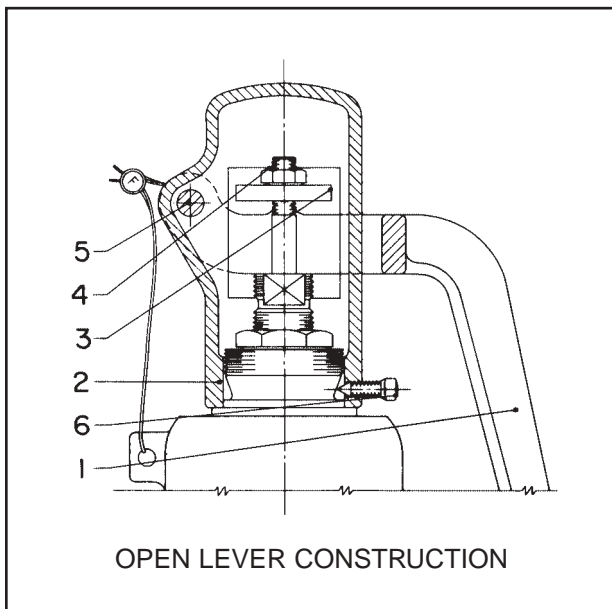


Figure 1.5

B. Packed Lifting Lever (Figure 1.6)

1. Remove groove pin from lever and slide lever off the cam.
2. Remove gland from gland nut. Unscrew gland nut from cap and remove packing ring and cam. If any signs of leakage exist, replace packing ring.
3. Break wire seal and unscrew cap from bonnet. Holding stem with smooth jaw pliers, remove stem jam nut and stem test washer.
4. Reassemble in reverse order, making sure the cam lobe is pointing down. Stem test washer should be adjusted to ensure the cam will make contact with stem test washer and lift stem when lever is actuated.

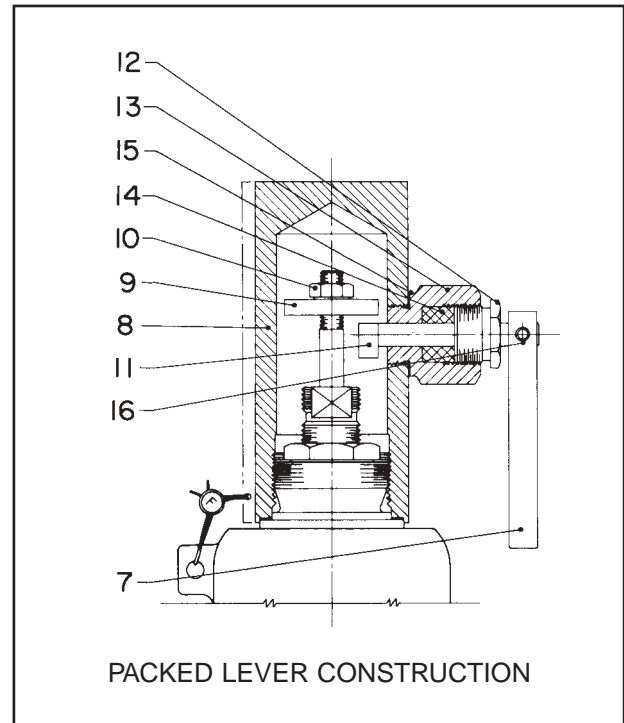


Figure 1.6

3. Refacing and Lapping

Body Refacing (when necessary)

1. True up body by means of an indicator, ensuring that body bore and outside diameter are concentric with each other within 0.002" full indicator reading.
2. Machine a light cut across the seat until damaged areas are removed. The seat should be machined to the smoothest possible finish. Rigidity of the cutting tool is critical.
3. Relap to a mirror finish.
4. Discard and replace the body when the minimum requirement on dimension B, listed in Appendix A, is not met.
5. Bodies on O-ring seat valves do not require refacing. Contact surfaces should be cleaned of any dirt or scale and lightly lapped.

Disc Relapping (metal and Teflon discs)

1. The disc should not be refaced, only relapped.
2. Discard and replace the disc when disc thickness becomes less than dimension A, listed in Appendix A.

Lapping Compounds

The three grades of Farris Lapping Compounds are prepared especially for the requirements of pressure relief valves. These are the only compounds recommended for achieving extreme valve tightness.

FARRIS LAPPING COMPOUNDS			
PART NO.	GRADE	FINISH	SIZE
18632X1(055)	3F	Roughing	1/2-oz. tube
18633X1(075)	38-500	Medium	1/2-oz. tube
18634X1(105)	38-1200	Final	1/2-oz. tube

Table 1 Farris Lapping Compounds

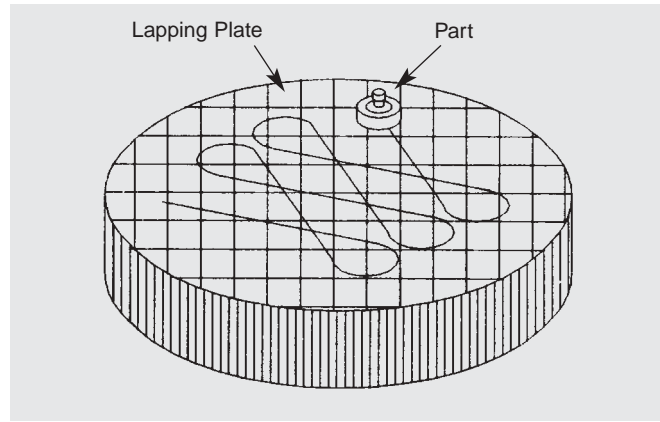


Figure 1.7

Lapping Procedures (manual)

1. Use a cast iron lapping block or Pyrex lapping glass which is known to have a perfectly flat face.

Pyrex Lapping Plates

Part No.	Material Code	Size	Thickness
7688	164	1 1/2"	1/4"
7689	164	2 1/4"	3/8"

2. Select the appropriate lapping compound. When lapping the disc, operate with a light figure eight motion over entire block surface for complete contact. See Figure 1.7. With this motion, the complete surface of the part will be evenly lapped and you will avoid wearing a groove in the block.
3. Lap disc until all blemishes and score marks have been removed. As you execute the figure eight motion, frequently lift disc away from the block to get a fresh bite on the compound. Most important, do not contaminate compounds with dirt. Keep the lid on the lapping compound when not in use. Use only clean applicators to transfer the lapping compound from jar to lapping glass. Store lapping blocks and lapping glass in clean, dust-free area.
4. Follow the same procedure for lapping body seat. Place the body on a table and a lapping block on the body. Be sure that lapping block does not tip over the side of the body (this would cause rounding of the edges). Use a light, rapid figure eight stroke, lifting the block from the body occasionally.
5. Carefully clean compound from all parts. Failure to do this may foul seat and disc surfaces. When reinstalling parts in the valve and assembling disc in the guide, be careful not to scratch either surface.
6. Clean the lapping glass.

4. Assembly

1. Refer to Figure 1.2 for construction details, and Figures 1.5 and 1.6 for open lever and packed lever cap construction details.
2. Verify that all parts required are grouped for assembly. Visually inspect all parts, paying close attention so that the body and disc seats are clear of imperfections and all parts are clean. Special attention should also be given to the guide, checking for any dirt or scale in exit holes and undercuts, and making sure that guide surface is in good condition.

3. All threaded surfaces should be lubricated with Bostik Never-Seez or equivalent. Sealing surfaces, such as body and cap gasket, should be lightly coated with a sealant such as Rectorseal pipe thread sealant. Use Bostik Never-Seez or equivalent on valves for steam service.

Sliding and bearing surfaces such as disc holder/guide and disc-to-disc holder contact surfaces should be left clean and assembled without lubricants.

4. Place disc in disc holder, making sure V-notch is facing the stem radius. Insert assembly into guide. Install body and lower guide gasket on the body.
5. Hold guide/disc holder assembly horizontally in your left hand and insert body, being careful not to damage disc or body seating surfaces.
6. Mount body/guide assembly vertically in a vise, gripping body securely by the flats. Install guide gasket on top of guide flange.
7. Place spring and spring buttons onto stem assembly and insert into disc holder. Hold in place in vertical position.
8. Place bonnet over assembled parts and screw down handtight onto the body. For C and D orifices, torque the bonnet to the body to 140-160 ft. lbs. For E, F, and G orifices, torque should be 180-200 ft. lbs.
9. Thread the jam nut onto the spring adjusting screw. Place spring adjusting screw over stem and into bonnet. Hand tighten spring adjusting screw until it contacts spring and lightly compresses it. Compress spring to the same point as in disassembly, if same set pressure is required. Install cap gasket.
10. Test the valve according to the procedure described in Section 5. After testing, install the appropriate cap or lever assembly.

5. Setting & Testing

Testing Procedures

Testing consists of adjusting the valve set pressure, performing a seat leakage test and a backpressure test. The set pressure test is always performed first.

Set Pressure Test

1. Set pressure testing must always be performed using the appropriate test fluid shown in Table 2.

PRESSURE RELIEF VALVE TEST FLUIDS	
Service Fluid	Test Fluid
Air, gas & vapor	Air or gas
Steam	Steam*
Liquid	Water

Table 2

*air may be used for ASME Code Section VIII valves.

2. Mount valve on test stand, making a note of set pressure and cold differential test pressure (CDTP). The valve will be set at the CDTP.
 3. Hold the stem tightly and tighten (clockwise) spring adjusting screw to increase the set pressure. Make sure stem does not rotate while tightening the adjusting screw as this can damage seat and disc.
 4. Slowly raise test drum pressure and observe the opening (set) pressure. The set pressure on air and steam is the point at which it makes an audible pop. For water, the set pressure is the first continuous flow of liquid that forms a stream approximately 1/16" thick perpendicular to the outlet.
 5. If necessary, reduce test drum pressure 25% below the opening pressure and adjust the spring adjusting screw. Repeat until the valve opens at the required pressure, designated as the cold differential test pressure (CDTP). The set pressure tolerance is equal to +/-3% of set pressure.
- ⚠ CAUTION:** *Never adjust the spring when the pressure under the valve is near its popping point as the body seat and disc may score and/or gall. Always lower the pressure in the test vessel at least 25% below popping pressure before making adjustments. This will put a loading on the seating surfaces and prevent rotation and damage.*
6. Lock the jam nut in place and pop valve once more to ensure set pressure adjustment was not disturbed.

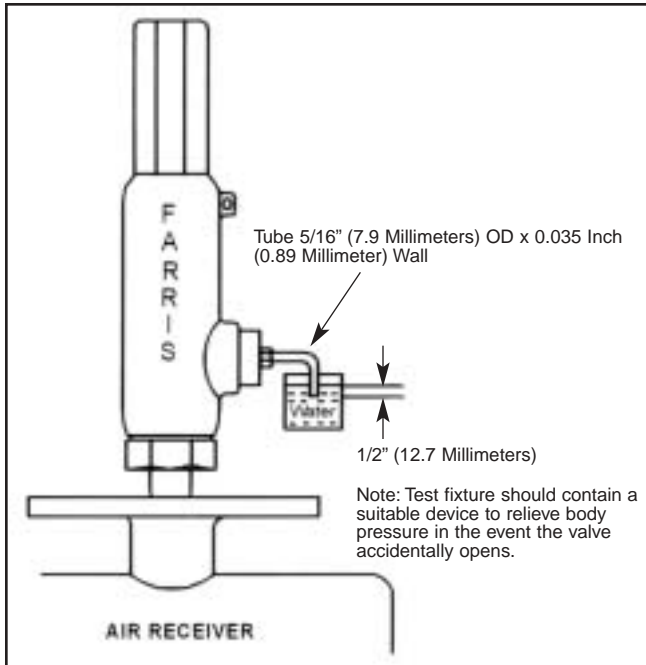


Figure 1.8

Seat Leakage Test

1. After the set pressure test, perform the seat leakage test. With the valve mounted on the test stand, attach a blind test fixture as shown in Figure 1.8 (air, gas & vapor service valves only). For steam and water seat leakage testing, see #4-5.
2. For metal and soft seated valves, the pressure is held at 90% of cold differential test pressure (CDTP) when CDTP is greater than 50 psig. For CDTP of 50 psig and below, the pressure should be held 5 psig below CDTP.
3. Bring the pressure up and hold it for one minute for valves up to 2" inlet size, two minutes for valves from 2 1/2"-4" inlet size, and five minutes for valves with inlet sizes 6" and larger. Count the number of bubbles for one minute. See Table 3 for acceptance criteria for metal seat valves. For O-ring and soft seat valves, there should be no leakage (zero bubbles per minute).

SEAT LEAKAGE RATES FOR AIR, GAS & VAPOR SERVICE		
Set Pressure (psig)	Leakage Rate Bubbles per Minute	Std. Cubic Feet per 24 Hours
15-1000	40	0.60
1500	60	0.90
2000	80	1.20
6500	100	1.50

Table 3

4. **Steam:** Apply test pressure as per #2 for three minutes before seat tightness test. Observe the valve for leakage for at least one minute. There should be no audible or visible sign of leakage at the valve outlet when viewed against a black background.

Where the Code allows ASME Section VIII steam valves to be tested on air, seat leakage may be verified using the procedure for air, gas & vapor service as listed in #1-3.

5. **Water:** Liquid valves are tested on water. Apply test pressure as per #2 for two minutes. There should be no visible sign of leakage.

Note: When performing the seat leakage test on valves with open levers, a plain screwed test cap must be used to prevent venting of the test pressure through the top of the bonnet.

Backpressure Test

1. The backpressure test applies to all valves designed to discharge to a closed system, including valves with plain caps and packed lever assemblies. Open lever valves and valves with exposed springs (open bonnet) do not require this test.
2. Test the secondary pressure zone of all valves exceeding 1" inlet size with air or other suitable gas at a pressure of at least 30 psi. Use a suitable leak detection solution to verify tightness of all gasket joints and vent/drain plugs.
3. If leakage is detected at any location, rework the valve to eliminate the leak path.

Final Notes

Once your valve has been assembled and tested, make sure you have completed all necessary records before placing it back in service. These records are important for the effective future use of the valve. They provide guidance as to when to retire valves and replace components as well as offer a historical record of the conditions and services under which the valve operated.

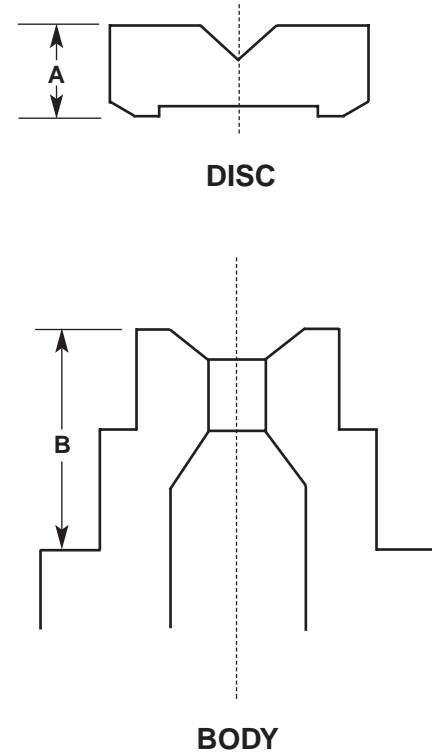
The valve should be properly installed in service or prepared for storage. If the valve is to be stored, the inlet and outlet should be covered to protect against any foreign matter entering the valve.

Appendix A

Critical Seat and Disc Dimensions

Use these dimensions when lapping and/or refacing is required. Parts must be replaced if the minimum dimension is reached as indicated in the drawings.

ORIFICE	SIZE	A	B
C	1/2 x 1 3/4 x 1 1 x 1	0.344	0.985
C (High Pressure)	1/2 x 1 3/4 x 1 1 x 1	0.344	0.985
D	1/2 x 1 3/4 x 1 1 x 1	0.344	0.985
D (High Pressure)	1/2 x 1 3/4 x 1 1 x 1	0.344	0.985
E	1 x 1 1/2	0.363	0.821
F	1 1/2 x 2	0.734	0.950
G	1 1/2 x 2 1/2	0.738	0.910



General Notes:

1. All dimensions are in inches.
2. Minimum dimension for body applies to both metal and O-ring seat designs.

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