

Consolidated^{*} **3900 MPV Series**

Pilot Operated Safety Relief Valve

Maintenance Manual (Rev.B)



THESE INSTRUCTIONS PROVIDE THE CUSTOMER/OPERATOR WITH IMPORTANT PROJECT-SPECIFIC REFERENCE INFORMATION IN ADDITION TO THE CUSTOMER/OPERATOR'S NORMAL OPERATION AND MAINTENANCE PROCEDURES. SINCE OPERATION AND MAINTENANCE PHILOSOPHIES VARY, BHGE (BAKER HUGHES, A GE COMPANY AND ITS SUBSIDIARIES AND AFFILIATES) DOES NOT ATTEMPT TO DICTATE SPECIFIC PROCEDURES, BUT TO PROVIDE BASIC LIMITATIONS AND REQUIREMENTS CREATED BY THE TYPE OF EQUIPMENT PROVIDED.

THESE INSTRUCTIONS ASSUME THAT OPERATORS ALREADY HAVE A GENERAL UNDERSTANDING OF THE REQUIREMENTS FOR SAFE OPERATION OF MECHANICAL AND ELECTRICAL EQUIPMENT IN POTENTIALLY HAZARDOUS ENVIRONMENTS. THEREFORE, THESE INSTRUCTIONS SHOULD BE INTERPRETED AND APPLIED IN CONJUNCTION WITH THE SAFETY RULES AND REGULATIONS APPLICABLE AT THE SITE AND THE PARTICULAR REQUIREMENTS FOR OPERATION OF OTHER EQUIPMENT AT THE SITE.

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Conversion Table

All the United States Customary System (USCM) values in the Manual is converted to Metric values using following conversion factors:

USCS Unit	Conversion Factor	Metric Unit
in.	25.4	mm
lb.	0.4535924	kg
in ²	6.4516	cm ²
ft ³ /min	0.2831685	m ³ /min
gal/min	3.785412	L/min
lb/hr	0.4535924	kg/hr
psig	0.6894757	barg
ft lb	1.3558181	Nm
°F	5/9 (°F-32)	°C

Note: Multiply USCS value with Conversion Factor to get Metric value.

NOTICE

For valve configurations not listed in this manual, please contact your local Green Tag* Center for assistance.

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I. Product Safety Sign and Label System

If and when required, appropriate safety labels have been included in the rectangular margin blocks throughout this manual. Safety labels are vertically oriented rectangles as shown in the *representative examples* (below), consisting of three panels encircled by a narrow border. The panels can contain four messages which communicate:

- The level of hazard seriousness
- The nature of the hazard
- The consequence of human, or product, interaction with the hazard.
- The instructions, if necessary, on how to avoid the hazard.

The top panel of the format contains a signal word (DANGER, WARNING, CAUTION or ATTENTION) which communicates the level of hazard seriousness.

The center panel contains a pictorial which communicates the nature of the hazard, and the possible consequence of human or product interaction with the hazard. In some instances of human hazards the pictorial may, instead, depict what preventive measures to take, such as wearing protective equipment.

The bottom panel may contain an instruction message on how to avoid the hazard. In the case of human hazard, this message may also contain a more precise definition of the hazard, and the consequences of human interaction with the hazard, than can be communicated solely by the pictorial.

①
DANGER – Immediate hazards which **WILL** result in severe personal injury or death.

②
WARNING – Hazards or unsafe practices which **COULD** result in severe personal injury or death.

③
CAUTION – Hazards or unsafe practices which **COULD** result in minor personal injury.

④
ATTENTION – Hazards or unsafe practices which **COULD** result in product or property damage.



II. Safety Alerts

⚠ DANGER



Do not remove bolts if pressure in line, as this will result in severe personal injury or death.

⚠ WARNING



Improper use or repair of pressurized device may result in severe personal injury or death.

⚠ WARNING



Heed all container label warnings.

⚠ WARNING



Provide and use guarding to prevent contact with heated and/or pressurized parts.

⚠ WARNING



Do not work with valves while under influence of intoxicants or narcotics.

Read - Understand - Practice

1. DANGER: High temperature/pressure can cause injury. Be sure all system pressure is absent before repairing or removing valves.
2. DANGER: Don't stand in front of valve outlet when discharging. STAND CLEAR OF VALVE to prevent exposure to trapped, corrosive media.
3. DANGER: When inspecting a pressure relief valve for leakage. BE VERY CAREFUL!

1. WARNING: Allow the system to cool to room temperature before cleaning servicing or repairing the system. Hot components or fluids can cause severe personal injury or death.
2. WARNING: Always read and comply with safety labels on all containers. Do not remove or deface the container. Do not remove or deface the container labels. Improper handling or misuse could result in severe personal injury or death.
3. WARNING: Never use pressurized fluids/gas/air to clean clothing or body parts. Never use body parts to check for leakage or discharge rates of areas. Pressurized fluids/gas/air injected into or near the body can cause severe personal injury or death.
4. WARNING: It is the responsibility of the owner to specify and provide guarding to protect persons from pressurized or heated parts. Contact with pressurized or heated parts can result in severe personal injury or death.
5. WARNING: Do not allow anyone under the influence or intoxicants or narcotics to work on or around pressurized systems. Workers under the influence intoxicants or narcotics are a hazard both to themselves and other employees and can cause severe personal injury or death to themselves or others.
6. WARNING: Incorrect service and repair could result in product or property damage or severe personal injury or death.

Note: Any Service questions not covered in this manual should be referred to your local Green Tag Center or BHGE's Service Department. Phone: +1 (281) 542-3646.

II. Safety Alerts (Contd.)

⚠ WARNING



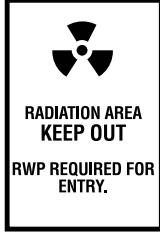
All potential hazards may not be covered in this manual.

⚠ WARNING




Improper tools or improper use of right tools could result in personal injury or product damage.

⚠ WARNING



Know nuclear "health physics" procedures, if applicable, to avoid possible severe personal injury or death.

⚠ CAUTION



Heed all service manual warnings. Read installation instructions before installing valve(s).

⚠ CAUTION



Wear necessary protective equipment to prevent possible injury.

⚠ CAUTION



Always use appropriate restoration procedures.

7. **WARNING:** These WARNINGS are as complete as possible but not all conceivable service methods not evaluate all potential hazards.
8. **WARNING:** Use of improper tools or improper use of right tools could result in personal injury or product or property damage.
9. **WARNING:** This valve product line is not intended for radioactive nuclear applications. Some valve products Manufactured by BHGE may be used in radioactive environments. Consequently, prior to starting any operation in a radioactive environment, the proper "health physics" procedures should be followed, if applicable.

1. **CAUTION:** Heed all service manual warnings. Read installation instructions before installing valve(s).
2. **CAUTION:** Wear hearing protection when testing or operating valves.
3. **CAUTION:** Wear appropriate eye and clothing protection.
4. **CAUTION:** Wear protective breathing apparatus to protect against toxic media.

Note: Any Service questions not covered in this manual should be referred to your local Green Tag Center or BHGE's Service Department. Phone: +1 (281) 542-3646

Restoring Safety

Appropriate service and repair important to safe, reliable operation of all valve products. Restoration to original quality and manufacturing specifications will accomplish the desired results. Procedures developed by BHGE as described in the applicable installation and Maintenance Manual, when correctly applied, will be effective.

III. Safety Notice

Proper installation and start-up is essential to the safe and reliable operation of all BHGE valve products. The relevant procedures recommended by BHGE, and described in these instructions, are effective methods of performing the required tasks.

It is important to note that these instructions contain various “safety messages” which should be carefully read in order to minimize the risk of personal injury, or the possibility that improper procedures will be followed which may damage the involved BHGE product, or render it unsafe. It is also important to understand that these “safety messages” are not exhaustive. BHGE can not possibly know, evaluate, and advise any customer of all of the conceivable ways in which tasks might be performed, or of the possible hazardous consequences of each way. Consequently, BHGE has not undertaken any such broad evaluation and, thus, anyone who uses a procedure and/or tool, which is not recommended by BHGE, or deviates from BHGE recommendations, must be thoroughly satisfied that neither personal safety, nor valve safety, will be jeopardized by the method and/or tools selected. Please, contact your local Green Tag Center or BHGE at +1 (281) 542-3646 if there are any questions relative to tools/methods.

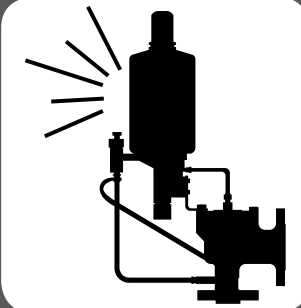
The installation and start-up of valves and/or valve products may involve proximity to fluids at extremely high pressure and/or temperature. Consequently, every precaution should be taken to prevent injury to personnel during the performance of any procedure. These precautions should consist of, but are not limited to, ear drum protection, eye protection, and the use of protective clothing, (i.e., gloves, etc.) when personnel are in, or around, a valve work area. Due to the various circumstances and conditions in which these operations may be performed on BHGE products, and the possible hazardous consequences of each way, BHGE can not possibly evaluate all conditions that might injure personnel or equipment. Nevertheless, BHGE does offer certain Safety Precautions for customer information only.

It is the responsibility of the purchaser or user of BHGE valves/equipment to adequately train all personnel who will be working with the involved valves/equipment. For more information on training schedules, please contact your local Green Tag Center or the BHGE Consolidated Training Manager at +1 (281) 542-3646. Further, prior to working with the involved valves/equipment, personnel who are to perform such work should become thoroughly familiar with the contents of these instructions.



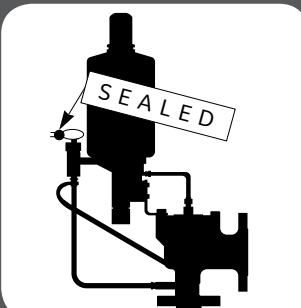
IV. Warranty Information

CAUTION



Defective and nonconforming items must be inspected by BHGE

CAUTION



Removal and/or breakage of seal will negate our warranty.

Warranty Statement

Warranty Statement¹- BHGE warrants that its products and work will meet all applicable specifications and other specific product and work requirements (including those of performance), if any, and will be free from defects in material and workmanship.

CAUTION: Defective and nonconforming items must be held for BHGE's inspection and returned to the original F.O.B point upon request.

Incorrect Selection or Misapplication of Products – BHGE cannot be responsible for customer's incorrect selection or misapplication of our products.

Unauthorized Repair work – BHGE has not authorized any non-BHGE affiliated repair companies, contractors or individuals to perform warranty repair service on new products or field repaired products of its manufacture. Therefore, customers contracting such repair service on new products or field repaired products of its manufacture. Therefore customers contracting such repair services from unauthorized sources must do at their own risk.

Unauthorized Removal of Seals – All new valves and valves repaired in the field by BHGE Field Service are sealed to assure the customer of our guarantee against defective workmanship. Unauthorized removal and/or breakage of this seal will negate our warranty.

Note 1: Refer to BHGE's Standard Terms of Sale for complete details on warranty and limitation of remedy and liability.

V. Terminology for Pilot Operated Safety Relief Valves

- **Accumulation:** The pressure increase over the maximum allowable working pressure of the vessel during discharge through the POSRV, expressed as a percentage of that pressure or in actual pressure units.
- **Backpressure:** The pressure on the discharge side of the POSRV:
 - **Built-up Backpressure:** Pressure that develops at the valve outlet as a result of flow, after the POSRV has been opened.
 - **Superimposed Backpressure:** Pressure in the discharge header before the POSRV opens.
 - **Constant Backpressure:** Superimposed backpressure that is constant with time.
 - **Variable Backpressure:** Superimposed backpressure that will vary with time.
- **Blowdown:** The difference between set pressure and reseating pressure of the POSRV, expressed as a percentage of the set pressure or in actual pressure units.
- **Cold Differential Set Pressure:** The pressure at which the valve is adjusted to open on the test stand. This pressure corrects for backpressure when a pop action pilot's vent is piped to the main valve outlet.
- **Differential Between Operating and Set Pressures:** Valves in process service will generally give best results if the operating pressure does not exceed 90% of the set pressure. However, on pump and compressor discharge lines, the differential required between the operating and set pressures may be greater because of pressure pulsations coming from a reciprocating piston. The valve should be set as far above the operating pressure as possible.
- **Lift:** The actual travel of the disc away from the closed position when a valve is relieving.
- **Maximum Allowable Working Pressure:** The maximum gauge pressure permissible in a vessel at a designated temperature. A vessel may not be operated above this pressure or its equivalent at any metal temperature other than that used in its design. Consequently, for that metal temperature, it is the highest pressure at which the primary pressure POSRV is set to open.
- **Operating Pressure:** The gauge pressure to which the vessel is normally subjected in service. A suitable margin is provided between operating pressure and maximum allowable working pressure. For assured safe operation, the operating pressure should be at least 10% under the maximum allowable working pressure or 5 psig (0.34 bar), whichever is greater.
- **Overpressure:** A pressure increase over the set pressure of the primary relieving device. Overpressure is similar to accumulation when the relieving device is set at the maximum allowable working pressure of the vessel. Normally, overpressure is expressed as a percentage of set pressure.
- **Pilot Operated Safety Relief Valve (POSRV):** A pressure relief valve in which the major relieving device is combined with, and is controlled by, a self-actuated auxiliary pressure relief valve.
- **Rated Capacity:** The percentage of measured flow at an authorized percent overpressure permitted by the applicable code. Rated capacity is generally expressed in pounds per hour (lb/hr) or kg/hr for vapors, standard cubic feet per minute (SCFM) or m³ /min for gases, and in gallons per minute (GPM) or Liter/min (L/min) for liquids.
- **Safety Relief Valve (SRV):** An automatic pressure-relieving device used as either a safety or relief valve, depending upon application. The SRV is used to protect personnel and equipment by preventing excessive overpressure.
- **Set Pressure:** The gauge pressure at the valve inlet, for which the relief valve has been adjusted to open under service conditions. In liquid service, the inlet pressure at which the valve starts to discharge determines set pressure. In gas or vapor service, the inlet pressure at which the valve pops determines the set pressure.

VI. Handling and Storage

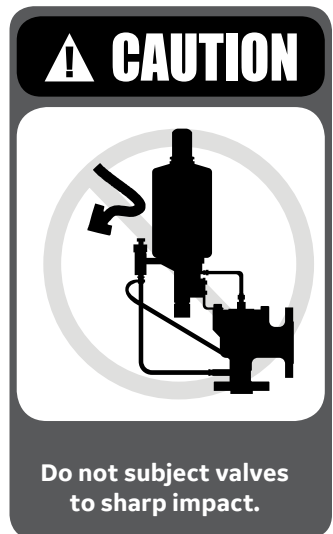
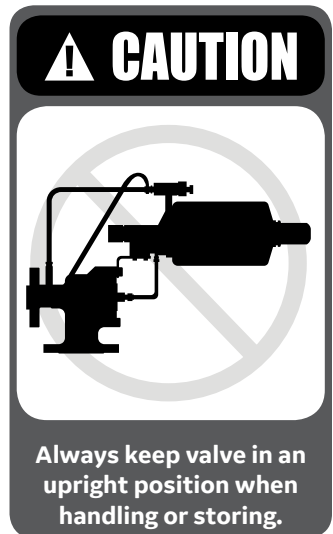
Handling

1. CAUTION: Flanged valves, either crated or uncrated, should always be kept with the inlet flange down, in the normal installation position to prevent misalignment and damage to internal parts.
2. CAUTION: Pressure relief valves, either crated or uncrated. Should never be subjected to sharp impact. Particular care should never be subjected to sharp impact. Particular care should be exercised when the valve is being loaded onto or unloaded from a truck, and when it is being hoisted into position for installation.
3. CAUTION: Never attempt to lift the full weight of the valve by the pilot assembly, external devices or tubing. Lift the valve by the eyebolts shown on figure safety sign.

Storage

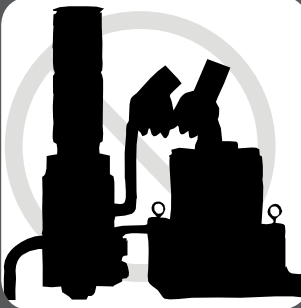
Pressure relief valves should be stored in a dry environment and protected from the weather. They should not be removed from the weather. They should not be removed from the skids or crates until immediately prior to installation on the system.

Flange protectors and sealing plugs should not be removed until the valve is to be installed on the system. This includes both inlet and outlet protectors.



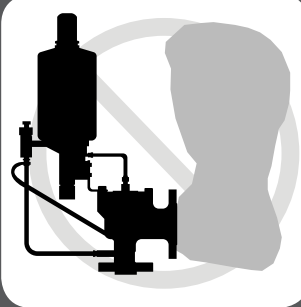
VII. Pre-Installation and Installation Instructions

CAUTION




Never attempt to lift the valve by anything other than the eyebolts.

CAUTION



Prevent dirt from entering outlet or inlet port.

CAUTION



Always install valve in a vertical, upright position.

Pre-Installation and Installation

CAUTION: After the valve is uncrated and protective devices removed, exercise care to prevent dirt and other foreign matter from entering either the inlet or the outlet port.

Mounting Instructions

CAUTION: Pressure relief valves should be mounted in a vertical, upright position. Installing a valve in any other position will adversely affect its operation in varying degrees as a result of induced misalignment of parts.

No stop valve should be placed between the pressure vessel and its relief valve except as permitted by Code regulations. If a stop valve located between the pressure vessel and pressure relief valve, its port area should equal or exceed the nominal internal area of the piping from the vessel to the relief valve must not exceed 3% of the valve set pressure when it is flowing at full capacity.

Flanges and gasket surfaces must be free from dirt and debris when valves are installed. Flange bolts should be tightened evenly to prevent distortion of the valve body and inlet nozzle. Before start-up be sure all threaded points are tight and secure.

Hydrostatic Testing

Prior to hydrostatic test of the pressure vessel system, the pilot-operated safety relief valve should be removed and the mounting flange for the valve blocked.

Service Considerations

For best performance, pressure relief valves should be serviced annually unless maintenance history dictates otherwise. They should be located for easy access and removal for service.

Remote Sensing

If the pressure drop between the source of pressure in the equipment to be protected and the pressure at the relief valve inlet exceeds 3%, the sensing line to the pilot valve should be connected directly to the equipment being protected rather than to the sensing connection on the main valve inlet neck. The main valve sensing port should be plugged with an appropriate sized NPT pipe plug. For remote sensing, .375 inch (9.53 mm) diameter tubing is adequate for distances up to 10 feet (3.048 m).

For block valve and other special installation features consult API 520 or the factory.

VIII. Introduction

A. General Introduction

A pilot operated pressure relief valve is a pressure relief valve in which the major relieving device is combined with and is controlled by a self actuated auxiliary pressure relief valve.

Note: Source: ASME Code, Section VIII-Div.1, Paragraph UG-126.

POSRV's are used on hundreds of different applications, including liquids and hydro carbons; therefore, the valve is designed to meet many requirements.

The 3900 Series valves included in this manual may be used to meet the requirements for ASME Section III and Section VIII. They cannot be used on ASME Section I steam boilers or superheaters, but may be used on process steam.

The Consolidated Modular Pilot Valve (MPV) is designed to provide reliable performance characteristics and stable operation within a pressure range of 15 to 6250 psig (1.03 to 430.92 barg)

B. Pilot Valve Introduction

Standard pilot construction consists of 316SS parts with nitrile O-Rings and nitrile diaphragms (only 07 classes) with Teflon® based seals throughout. Alternate materials can be provided by contacting the factory.

Pilot Valve Features

- One pilot fits all main valves
- Standard O-Ring seals
- Superior seat tightness
- Accurate adjustment of blowdown and set point
- Positive closure after blowdown
- Reduces icing and clogging
- Dual pilots
- Dual Fillers
- Field test connection
- Remote Sensing
- Optional sensing line filler
- Backflow preventer
- Manual blowdown
- Pressure differential switch
- External blowdown adjustments

Service and Applications

Main valve pressure and temperature limitations are combined in pressure class categories according to ANSI Standards. Conversely, the pressure and temperature limits of the Pilot Valve are presented separately.

Note: When Replacing or Repairing the main valve and pilot valve assembly, pay particular attention to the pressures and temperature limitations for both the main valve and pilot valve to ensure compatibility.

Table 1: Service and Applications

Model	Service	Pressure Range				Temperature Range			
		min.		max.		min.		max.	
		psig	barg	psig	barg	°F	°C	°F	°C
39PV07, GS, SS, or LA	Gas, Air, Steam or Liquid	15	1.03	750	51.71	-40	-40.0	505	262.8
39MV07 GS or SS	Gas, Air or Steam	15	1.03	750	51.71	-40	-40.0	505	262.8
39MV07 LS	Liquid	15	1.03	750	51.71	-40	-40.0	505	262.8
39PV37 GS, SS, or LA	Gas, Air, Steam or Liquid	751	51.78	3750	258.55	-40	-40.0	505	262.8
39MV22 GS or SS	Gas, Air or Steam	751	51.78	3750	258.55	-40	-40.0	505	262.8
39MV22 LA	Liquid	751	51.78	3750	258.55	-40	-40.0	505	262.8
39MV72 GS, SS or LA	Gas, Air, Steam or Liquid	3751	258.62	6250	430.92	-40	-40.0	505	262.8

Note: With the installation of the heat exchanger, temperature range may be expanded to -320°F to 650°F. (-195.6°C to 343.3°C)

VIII. Introduction (Contd.)

C. Main Valve Introduction

The Consolidated Pilot Operated Safety Relief Valve (POSRV) cast bodies are designed to meet the often specified inlet and outlet connection combinations. Sizes range from 1.00" - 12.00" (25.4 mm - 304.8 mm); pressure ratings from 150 - 2500 class. The main valve O-Ring dual seating principle is the same design that has been successfully utilized in the Consolidated SRV for over 30 years.

Capacities are certified by National Board of Boiler and Pressure Vessel Inspectors and published in their NB18 entitled "Pressure Relief Device Certifications".

Main Valve Features

- Orifice controlled capacity
- Nozzle guided disc
- Superior tightness
- Removable nozzles for replacement or remachining
- Standard O-Ring sizes: readily available, easily replaced
- Meets ASME Section VIII, Div. 1
- Multiple orifices per valve size
- National Board certified capacities

Main Valve Optional Seating Designs

1. Metal Seat (Figure 1):

Available with a solid metal disc that provides a metal to metal seat. This allows the temperature range capabilities of the valve to be expanded to -320°F to 650°F (-195.6°C to 343.3°C) with the appropriate heat exchanger.

2. Soft Seat (Figure 2):

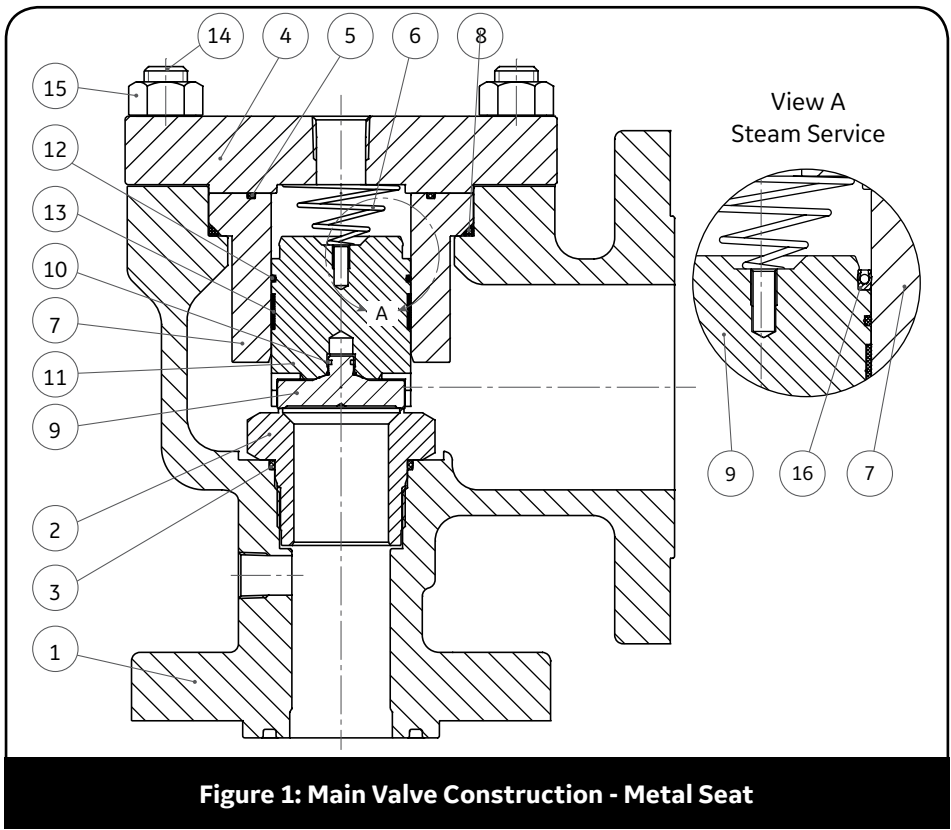
The O-Ring retainer has two machined slots in the upper beveled edge, allowing system pressure to reach the chamber behind the O-Ring. This exerts pressure against a specially curved metal seating surface on valve nozzle. The O-Ring seat seal design maintains a greater degree of tightness because the increasing operating pressure works to force the O-Ring against the metal seat.

When the valve opens, there is no pressure build-up in the O-Ring chamber as the slots vent the pressure to a lower pressure area.

This design features a secondary metal-to-metal seat which becomes effective if O-Ring integrity is lost. The beveled seat and disc guide the O-Ring into position eliminating rubbing and abrasion.

IX. Consolidated 3900 Series POSRV

A. Metal Seat Valve



Part No.	Nomenclature
1	Base
2	Nozzle
3	Nozzle O-Ring
4	Coverplate
5	Coverplate O-Ring
6	Spring
7	Guide
8	Guide O-Ring
9	Disc
10	Disc Retainer
11	Disc Holder
12	Disc Holder Seal
13	Guide Rings
14	Stud / Cap Screw
15	Nut
16	Disc Seal
17	O-Ring Retainer
18	Seat O-Ring
19	Lock Screw

Figure 1: Main Valve Construction - Metal Seat

B. Soft Seat Valve

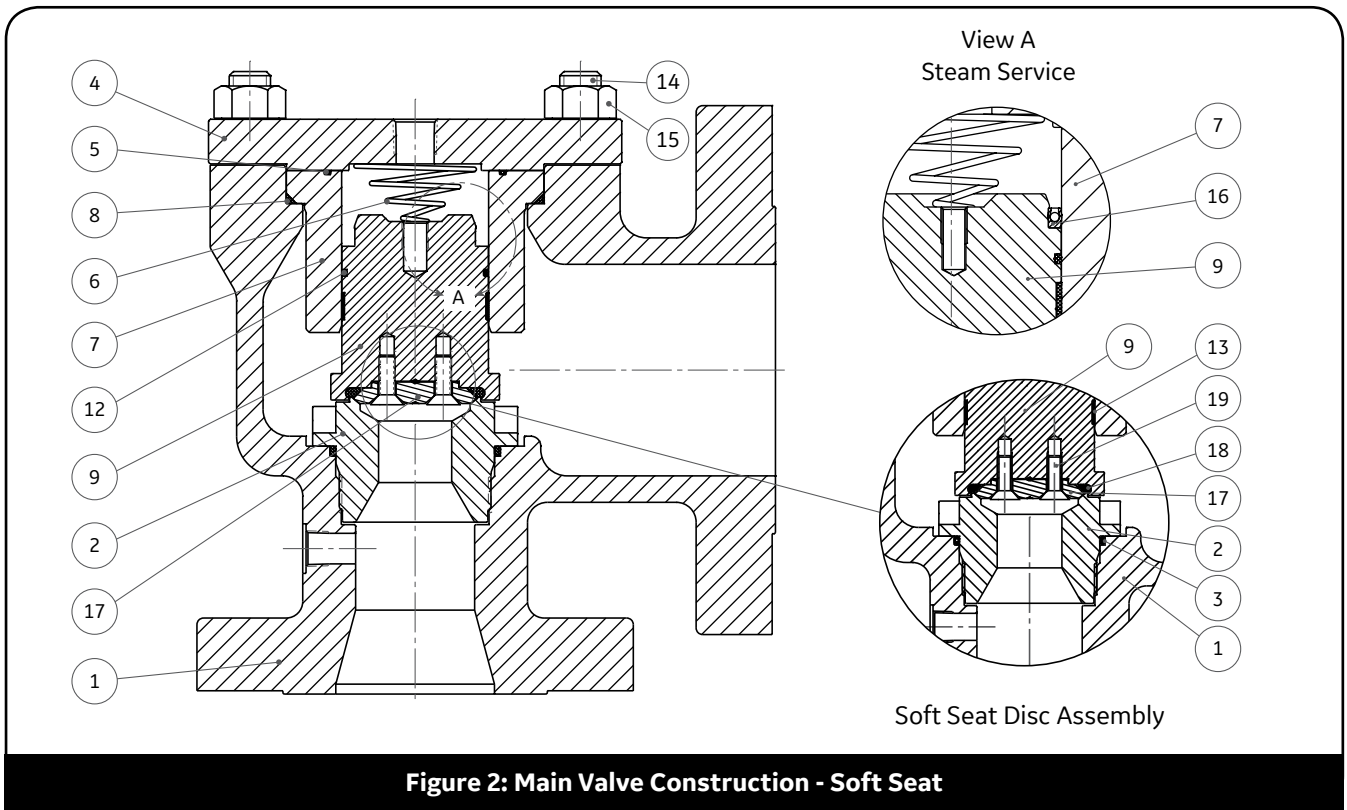
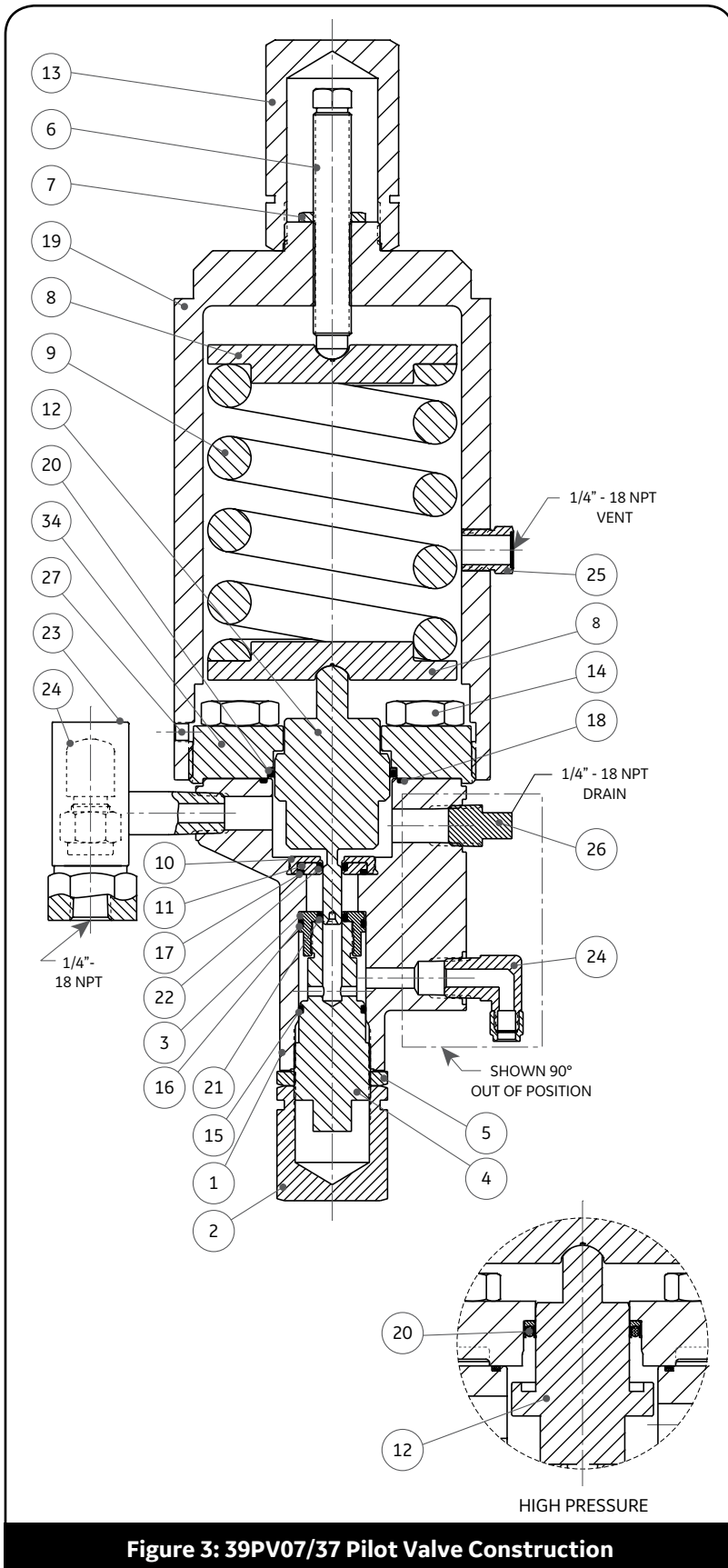


Figure 2: Main Valve Construction - Soft Seat

IX. Consolidated 3900 Series POSRV (Contd.)

C. 39PV07/37 Pilot Valve (Standard Service)



Part No.	Nomenclature
1	Main Base
2	Adjuster Cap
3	Adjuster Top
4	Adjuster Bottom
5	Adjuster Lock Nut
6	Compression Screw
7	Compression Screw Lock Nut
8	Spring Washer
9	Spring
10	Insert Top
11	Insert Bottom
12	Main Piston
13	Cap (Compression Screw)
14	Cap Screw (Top Plate)
15	O-Ring (Adjuster Bottom)
16	O-Ring (Adjuster Top)
17	O-Ring (Insert)
18	O-Ring (Top Plate)
19	Bonnet
20	Spring Seal (Main Piston)
21	Spring Seal (Adjuster Top)
22	Spring Seal (Insert)
23	Field Test Connector
24	Vent Assembly/Bug Screen (Field Test Connection)
25	Vent Assembly (Bonnet Vent) ¹
26	Pipe Plug (Pilot Valve)
27	Set Screw (Bonnet)
34	Top Plate

Note 1: Standard material is a filter plug. For special materials, vent assembly is supplied.

IX. Consolidated 3900 Series POSRV (Contd.)

D. 39MV07 Pilot Valve (Standard Service)

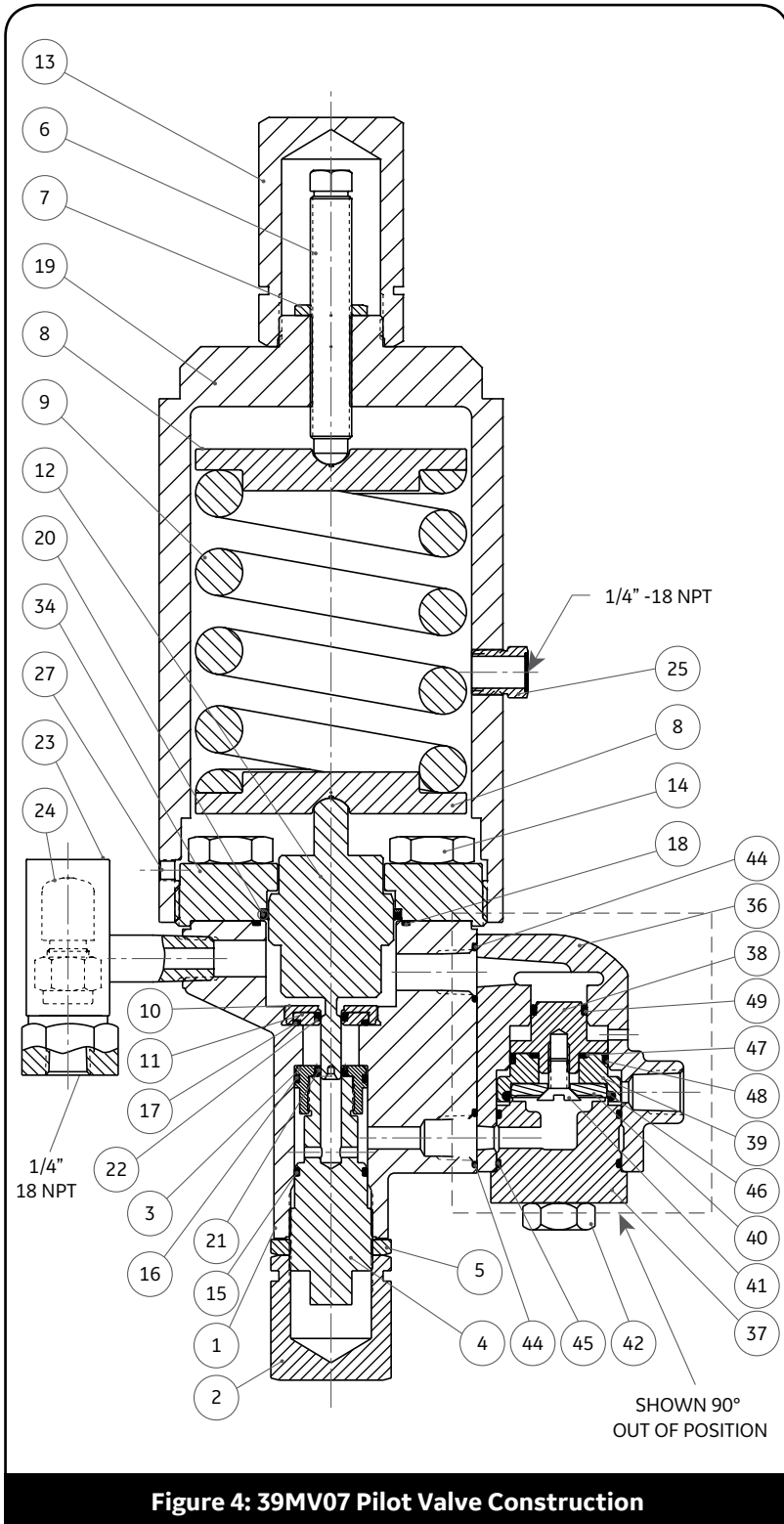


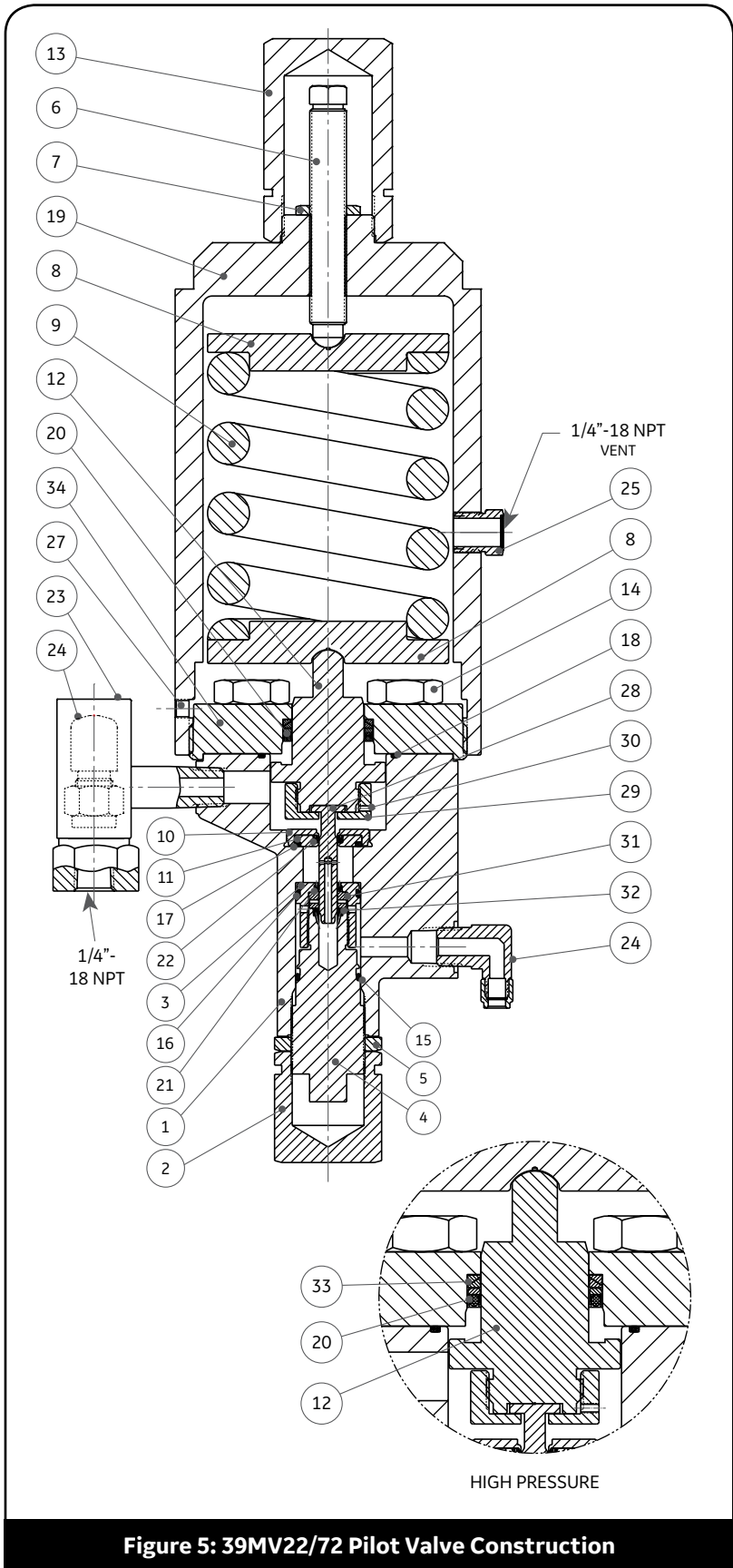
Figure 4: 39MV07 Pilot Valve Construction

Part No.	Nomenclature
1	Main Base
2	Adjuster Cap
3	Adjuster Top
4	Adjuster Bottom
5	Adjuster Lock Nut
6	Compression Screw
7	Compression Screw Lock Nut
8	Spring Washer
9	Spring
10	Insert Top
11	Insert Bottom
12	Main Piston
13	Cap (Compression Screw)
14	Cap Screw (Top Plate)
15	O-Ring (Adjuster Bottom)
16	O-Ring (Adjuster Top)
17	O-Ring (Insert)
18	O-Ring (Top Plate)
19	Bonnet
20	Spring Seal (Main Piston)
21	Spring Seal (Adjuster Top)
22	Spring Seal (Insert)
23	Field Test Connector
24	Vent Assembly/Bug Screen (Field Test Connection)
25	Vent Assembly (Bonnet Vent) ¹
27	Set Screw (Bonnet)
34	Top Plate
36	Modulator Base
37	Modulator Stop
38	Modulator Piston Top
39	Modulator Piston Bottom
40	O-Ring Retainer
41	Lock Screw (Retainer)
42	Cap Screw (Modulator)
43	Socket Head Cap Screw (Modulator)
44	O-Ring (Modulator Base)
45	O-Ring (Modulator Stop)
46	O-Ring (Modulator Seat)
47	O-Ring (Modulator Piston Bottom)
48	Spring Seal (Piston Bottom)
49	Spring Seal (Piston Top)

Note 1: Standard material is a filter plug. For special materials, vent assembly is supplied.

IX. Consolidated 3900 Series POSRV (Contd.)

E. 39MV22/MV72 Pilot Valve (Standard Service)



Part No.	Nomenclature
1	Main Base
2	Adjuster Cap
3	Adjuster Top
4	Adjuster Bottom
5	Adjuster Lock Nut
6	Compression Screw
7	Compression Screw Lock Nut
8	Spring Washer
9	Spring
10	Insert Top
11	Insert Bottom
12	Main Piston
13	Cap (Compression Screw)
14	Cap Screw (Top Plate)
15	O-Ring (Adjuster Bottom)
16	O-Ring (Adjuster Top)
17	O-Ring (Insert)
18	O-Ring (Top Plate)
19	Bonnet
20	Spring Seal (Main Piston)
21	Spring Seal (Adjuster Top)
22	Spring Seal (Insert)
23	Field Test Connector
24	Vent Assembly/Bug Screen (Field Test Connection)
25	Vent Assembly (Bonnet Vent) ¹
27	Set Screw (Bonnet)
28	Piston Nose
29	Piston Retainer Nut
30	Set Screw (Piston)
31	Vent Seal (Adaptor)
32	Spring Seal (Vent Seal Adaptor)
33	Back-up Ring (39MV72 Only)
34	Top Plate

Note 1: Standard material is a filter plug. For special materials, vent assembly is supplied.

Figure 5: 39MV22/72 Pilot Valve Construction

X. Operating Principles

A. 3900 Series Type 39PV Pilot - Operational Description

PV Valve Closed (Normal Position)

System pressure from the main valve inlet is led to the dome by the pilot through interconnecting tubing. This equalizes the pressure on the top of the disc. Since the area of the top

of the disc is larger than the area of the seating surface, the differential area results in a net download force keeping the main valve lightly closed.

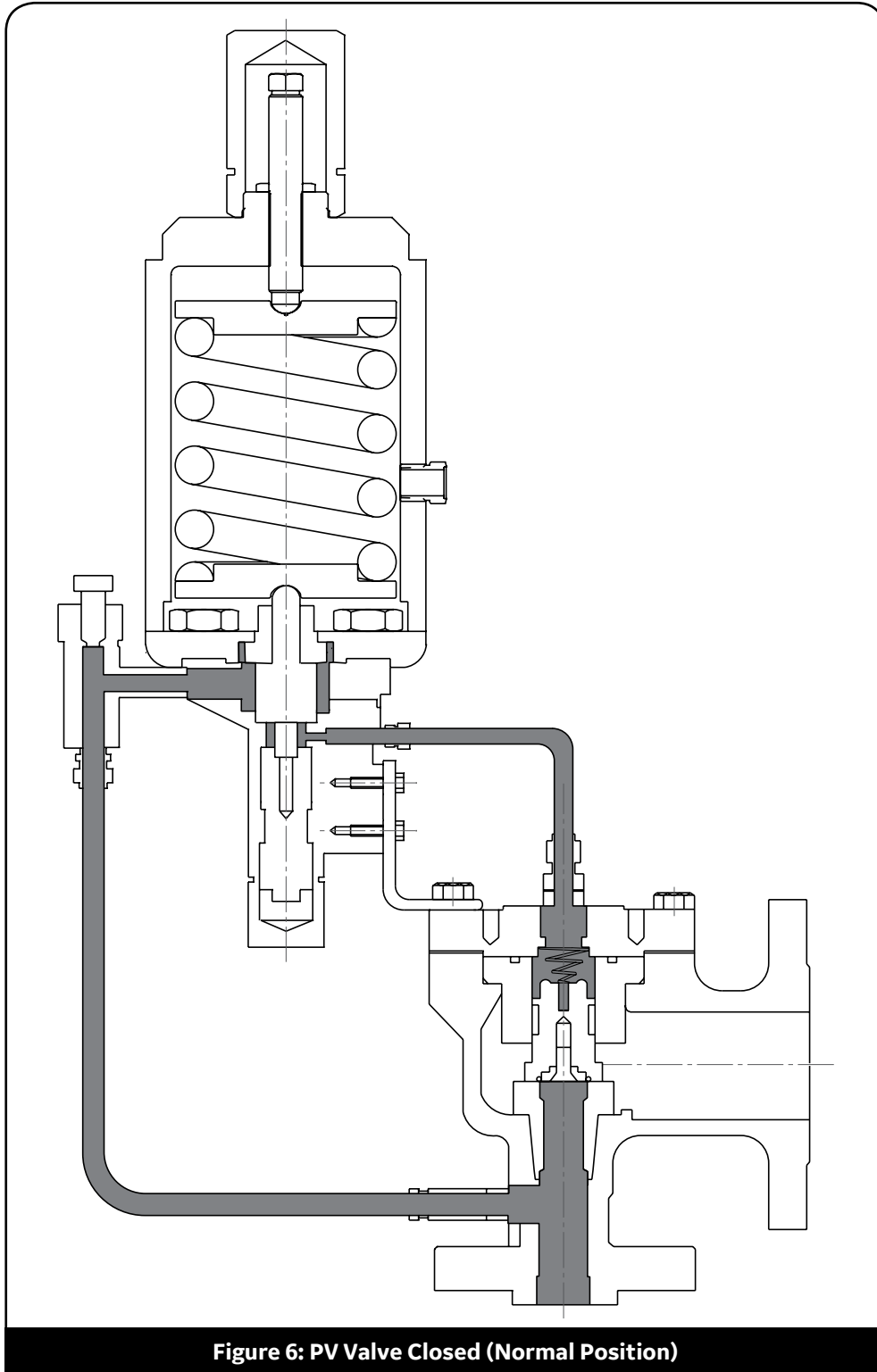


Figure 6: PV Valve Closed (Normal Position)

X. Operating Principles (Contd.)

PV Valve Open (Relieving Position)

As inlet pressure increases, the pilot position strokes and seals off the main valve inlet pressure from the dome pressure. The pilot simultaneously opens the vent seal to receive the dome pressure to atmospheric pressure. The Main valve disc is allowed to lift off the seat as the fluid force overcomes the now removed pressure load above the main valve disc. The valve discharges to relieve system pressure.

When the discharging main valve reduces the inlet pressure to the pre-set blow down pressure of the pilot, the pilot piston closes the vent seal. Simultaneously, the inlet seal is reopened in the pilot. The main valve inlet pressure is again allowed to enter the dome above the main valve disc. As the dome pressure equalizes with the inlet pressure, the downward force created by the differential areas of the disc closes the main valve.

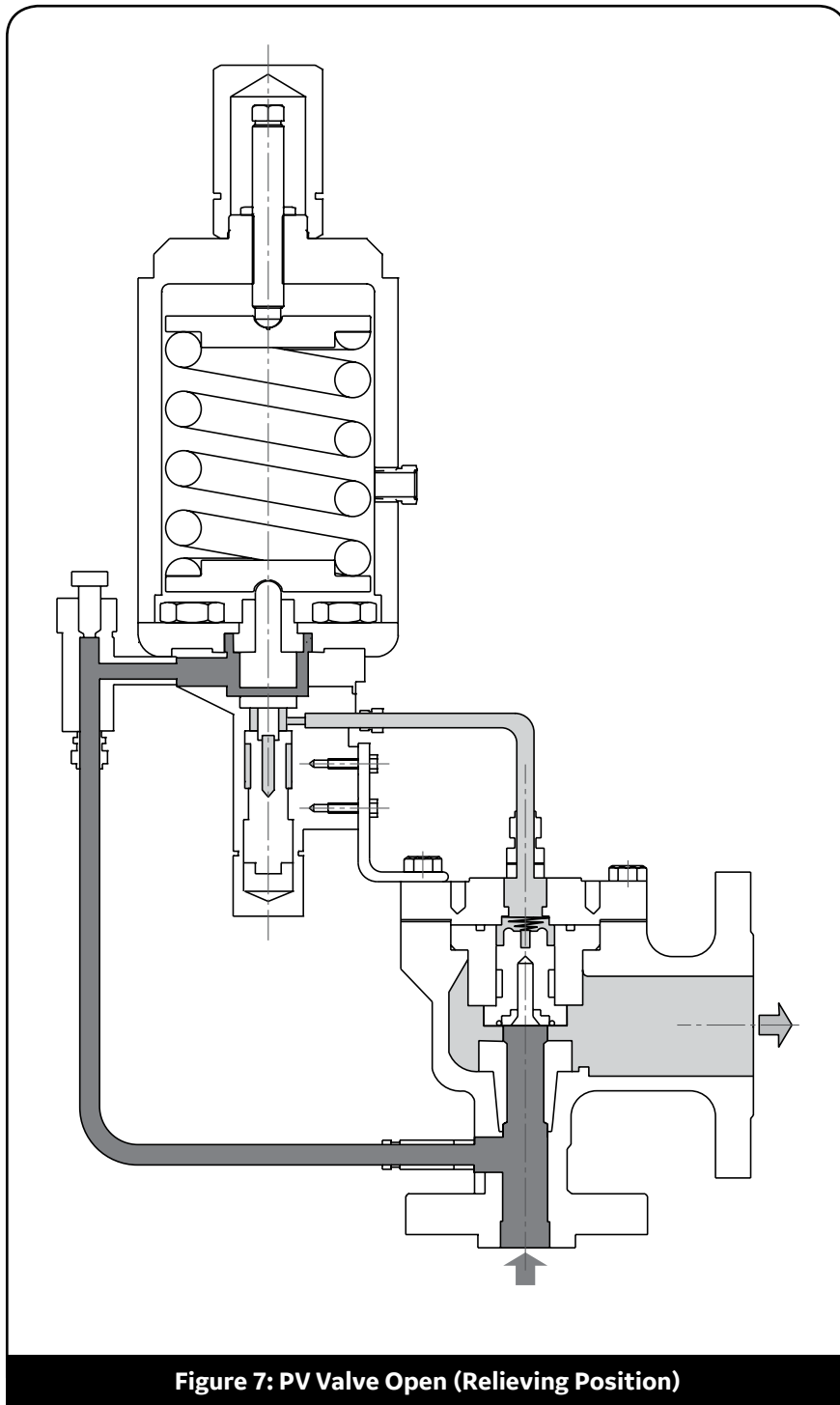


Figure 7: PV Valve Open (Relieving Position)

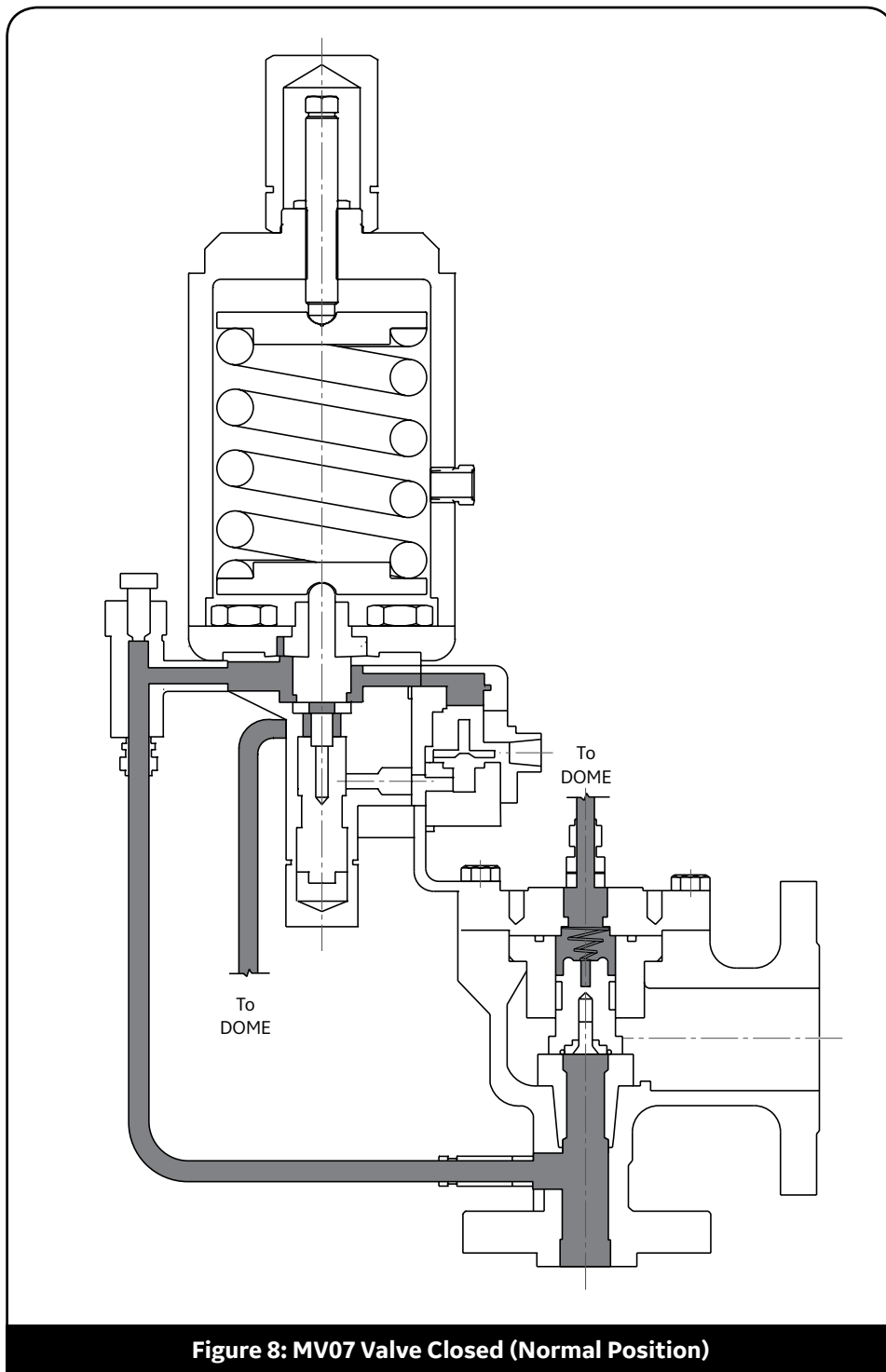
X. Operating Principles (Contd.)

B. 3900 Series Type 39MV07 (Modulating) Pilot - Operational Description

39MV07 Valve Closed (Normal Position)

System pressure from the main valve inlet is fed to the dome by the pilot through interconnecting tubing. This equalizes the pressure on the top of the disc with inlet pressure on the

seating surface (bottom) of the disc. Since the area on the top of the disc is larger than the area of the seating surface, the differential area results in a net download force keeping the main valve tightly closed.



X. Operating Principles (Contd.)

39MV07 Valve Modulating (Partial Relieving Position)

As the inlet pressure increases, the pilot piston strikes and stunts off the main valve inlet pressure from the drone pressure. The pilot simultaneously opens the vent seat to relieve the dome pressure to the bottom of the modulator piston. The modulator piston has a differential area with the smaller area being on top of the modulator piston. The top of

this always sees the main valve inlet pressure, when the dome pressure is applied to the bottom of the modulator piston, there is a net upward force. This is due to both pressures is being equal (at this point), and the lower area is larger than the upper area. The modulator relieves the pressure from the drone to the atmosphere until force from the inlet pressure on top of the modulator piston is sufficient to move it to the closed position. A certain amount of pressure remains in the dome. The pressure is controlled by the differential area in

the modulator. Since the dome pressure has not been dropped to atmospheric pressure, the main valve only partially opens at the set point. The modulator piston will remain closed until the main valve disc is forced into higher lift by increasing inlet pressure, as this occurs, the modulator piston may relieve further pressure from the dome as necessary to achieve the required main disc lift within 10% overpressure.

39MV07 Valve Fully Open (Full Relieving Position)

As inlet pressure increases further, the net upward force on the main valve disc increases, allowing the main valve to relieve more pressure. The disc obtains full lift (full capacity) within 10% of set pressure.

When the discharging valve reduces the inlet pressure to the pre-set blow down pressure of the pilot. The pilot piston closes the vent seal. Simultaneously, the inlet seal is reopened in the pilot. The main valve inlet pressure is again allowed to enter the dome above the main valve disc, As the dome pressure equalizes with the inlet pressure, the downward force created by the differential areas of the disc closes the main valve.

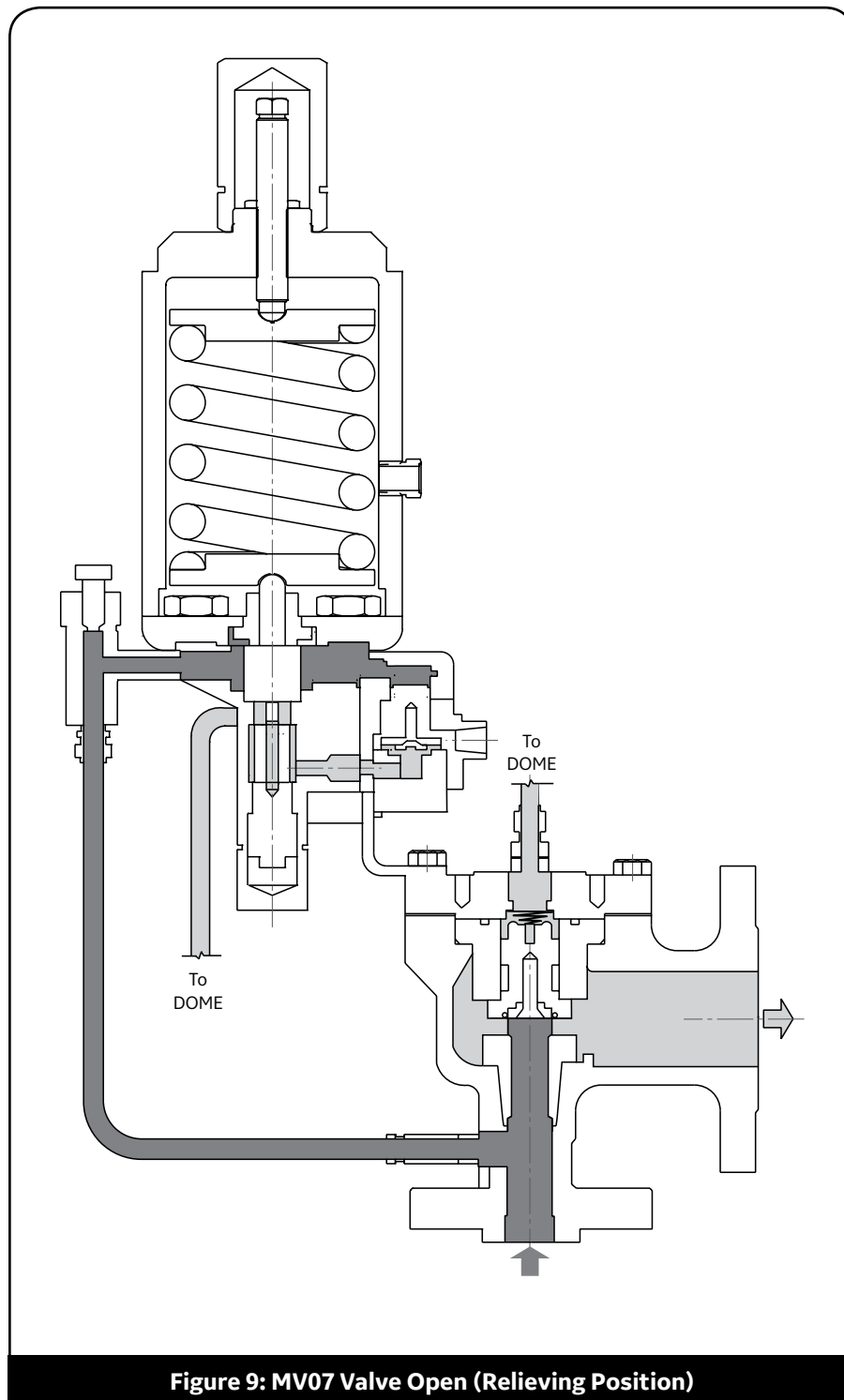


Figure 9: MV07 Valve Open (Relieving Position)

XI. General Planning for Maintenance

CAUTION



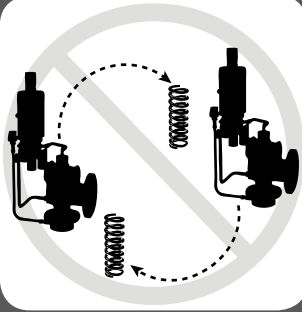
Always use appropriate restoration procedures.

A 12 month maintenance interval is recommended for general service conditions. For severe service applications, a 3 to 6 month inspection and testing interim may be more appropriate. The specific plant's operating and service history will better determine this frequency. BHGE encourages preventive maintenance.

The 3900 series Pilot Operated Safety Relief Valve (POSRV) is easily maintained. Normal maintenance usually involves:

- Removal of pilot valve from main valve
- Disassembly of both the pilot and main valve
- Cleaning
- Component Inspection
- Parts Replacement as Needed
- Reassembly
- Setting, Testing and Resealing the valve

CAUTION



Do not interchange parts from one valve to another.

Occasionally, remachining the seat bushing may be necessary to extend the service life of the valve. Keep all parts for each valve separated to ensure replacement in the same valve.

Note: Ensure there is no pressure in the inlet of the valve before attempting to remove it from the piping system.

DANGER



Decontaminate or clean if necessary before pretesting or disassembly. Safety and environmental precautions must be taken for the decontamination or cleaning method used.

XII. Disassembly of the 3900 POSRV

A. Removal of Pilot Valve From Main Valve

1. Make sure there is no media pressure in the vessel, in the valve inlet, in the main, or in the pilot valve.
2. Disconnect the Sensing Tube and Discharge Line from the pilot valve.
3. Disconnect the Filter and remove the Manual Blow down from the Pilot Valve if these options exist.
4. All other external attachments should be removed to free the Pilot Valve for Disassembly.
5. Loosen and remove the two cap bolts holding the pilot valve to the mounting bracket.
6. Place parts in the order they are disassembled to facilitate reassembly.



B. Disassembly of Main Valve

Note: If the pilot valve has not been removed, then refer to Section XII.A.

1. Remove Swagelok tube fitting from Sensing Tube.
2. Remove and discard Plug Filter from Sensing Tube (if applicable).
3. Loosen and remove the Nuts (or Cap Screws) on the Cover Plate.
4. Lift off the Cover Plate and Bracket.
5. Remove the Spring from the top of the Disc.
6. Install a lifting bolt into the drilled and tapped hole in the Disc's center and lift from the Base.

Note: The Guide may lift out of the Base with the Disc. If so, do not allow the Guide to fall and become damaged. Also, the D-orifice through 3" (76.20 mm) L-orifice will lift the Guide out with the Disc due to its design.

7. Remove the Guide from the Base if it did not come out with the Disc.
8. Metal Disc Disassembly
 - a. For D through T orifice valves and 1.5" (38.10 mm) through 6" (152.40 mm) Full Bore valve, remove the disc from the disc holder as follows:
 - i. Clamp the outside diameter of the disc holder, disc end up, firmly between two wooden V-blocks in a vise.

XII. Disassembly of the 3900 POSRV (Contd.)

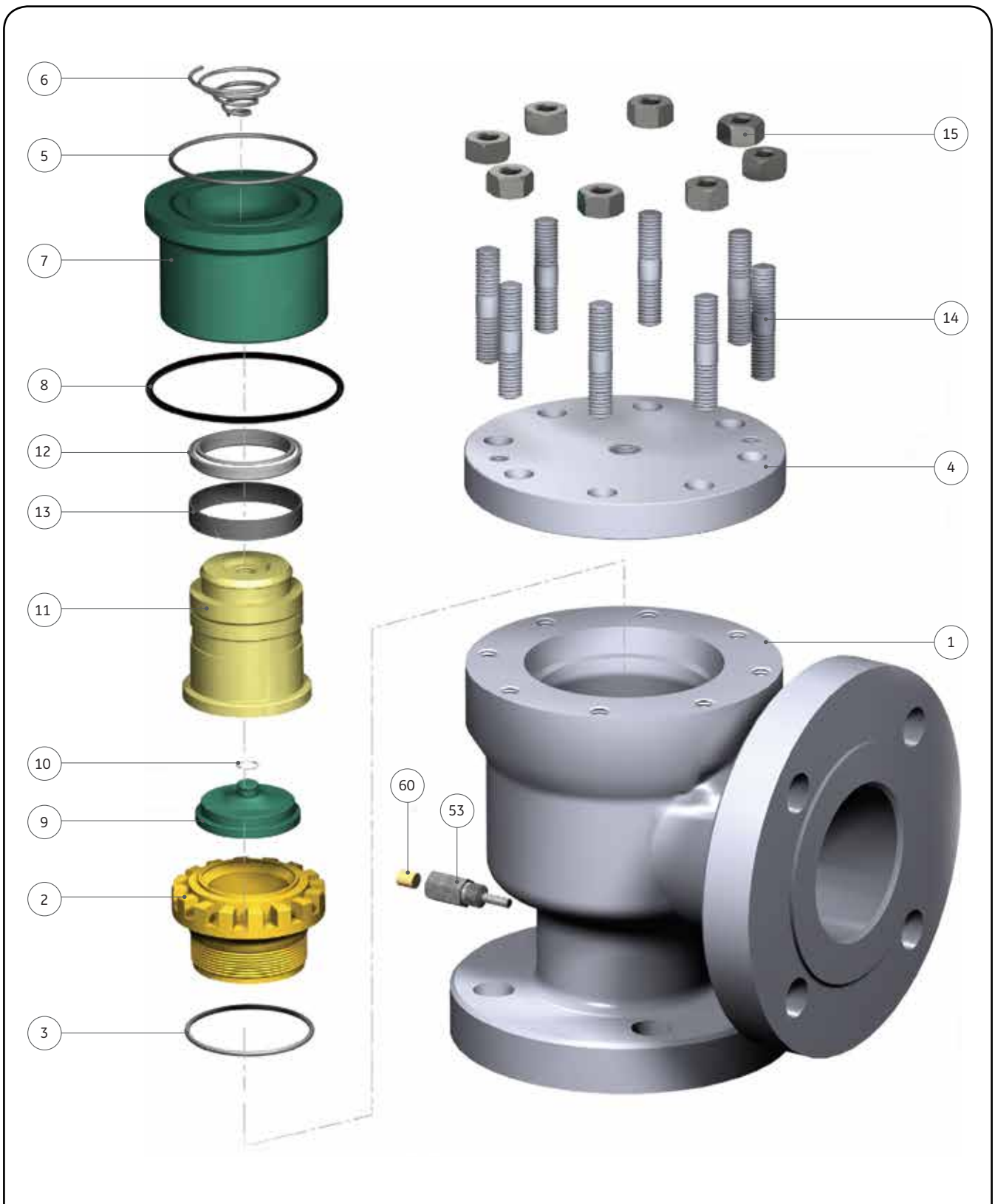


Figure 10: Metal Seat Valve Disassembly

XII. Disassembly of the 3900 POSRV (Contd.)

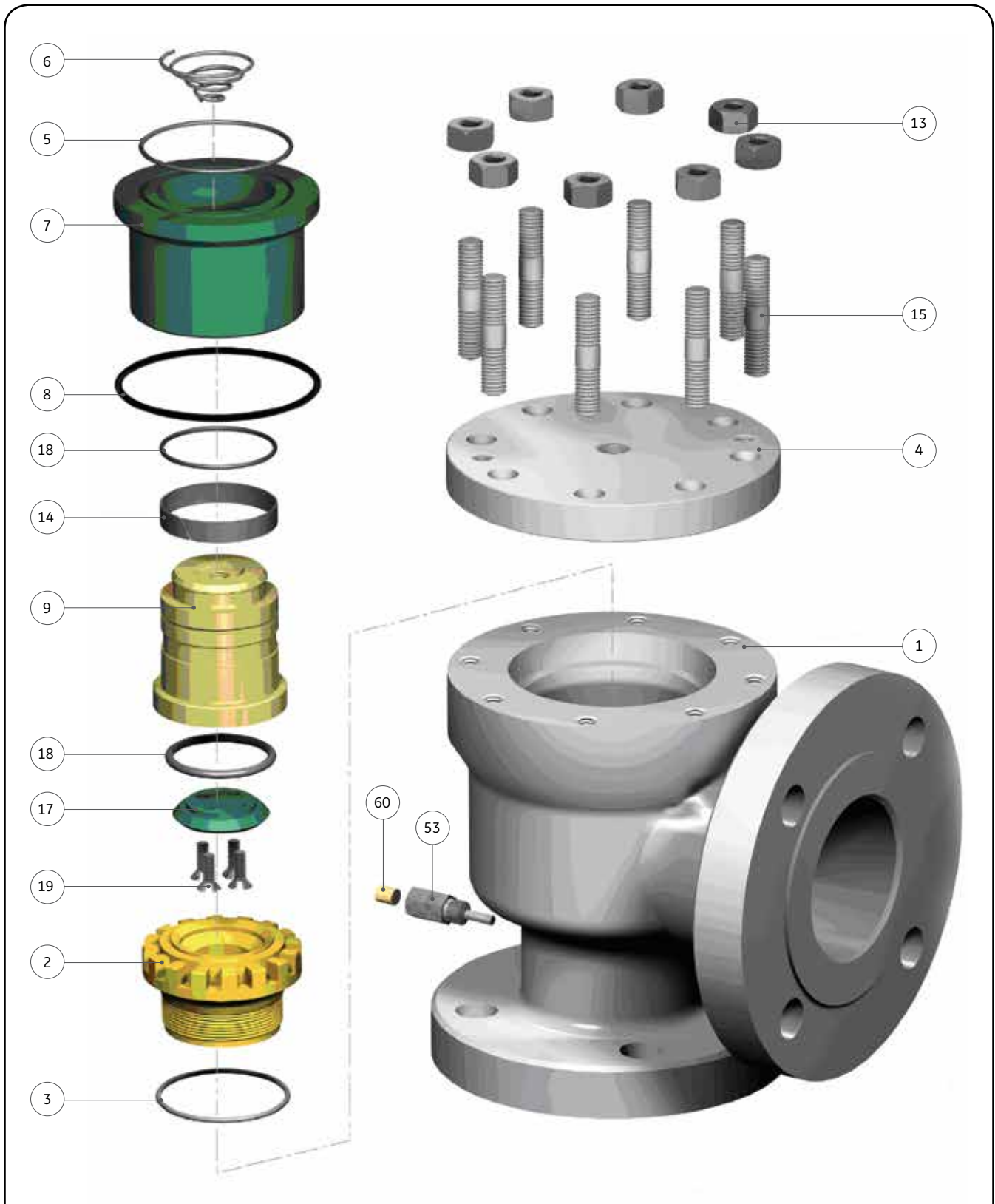


Figure 11: Soft Seat Valve Disassembly

XII. Disassembly of the 3900 POSRV (Contd.)

ii. Start inserting special drift pins into the holes in the disc holder (Figure 12) with the tapered portion of the pins working against the top of the disc, as indicated. See Figure 62 and Table 17 in the Maintenance Tools and Supplies section (Section XXII.D) for drift pin size.

iii. Use a light machinist hammer to tap each pin alternately until the disc snaps out of the recess in the disc holder.

b. For 8" and 10" Full Bore valves, remove the disc from the disc holder as follows:

i. Turn the disc holder on its side.

ii. Remove the retaining bolts.

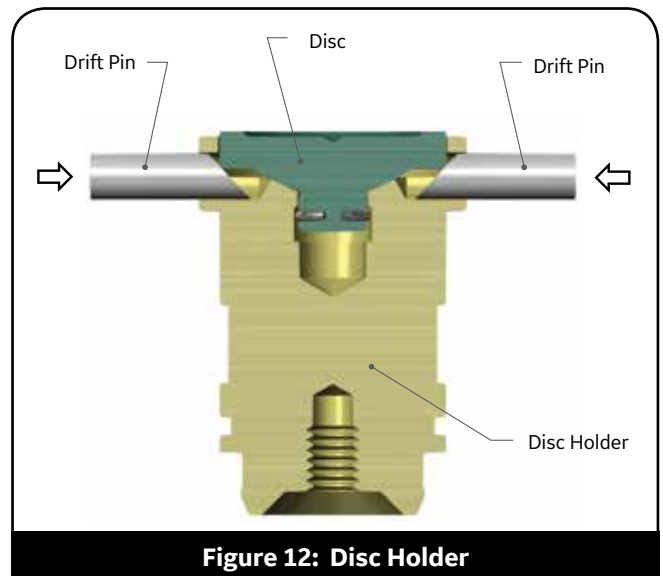
iii. Attach the lifting lug to the disc and lift out.

9. O-Ring Disc Disassembly: The O-Ring seat requires the Lock Screw(s) on the bottom of the Disc to be removed by turning counterclockwise so that the O-Ring Retainer and Seat O-Ring can be removed.

10. If the Nozzle requires rework or replacement, remove the Nozzle from the Base by unscrewing counterclockwise with the appropriate socket or spanner wrench shown in Figure 61 and Table 16 in the Maintenance Tools and Supplies section (Section XXII.C). This applies to all main

valve sizes except the 8", 10" and 12" full bore valves. The latter are disassembled by removing four Nozzle Cap Screws, inserting two eyebolts (5/8 - 11 UNC) 180° apart, and pulling the nozzle out.

11. Discard all O-Rings, guide rings, and seals.



C. Cleaning

1. Clean parts to remove all rust, burrs, scale, organic matter, and loose particles. Parts are to be free of any oil or grease except for lubrication as specified in this instruction.
2. Cleaning agents used shall be such that effective cleaning is assured without injuring the surface finishes or material properties of the part.
3. Acceptable cleaning agents include demineralized water, nonphosphate detergent, acetone, and isopropyl alcohol. Parts must be blown dry or wiped dry after cleaning.
4. If you are using cleaning solvents, take precautions to protect yourself from potential danger from breathing fumes, chemical burns, or explosion. See the solvent's Material Safety Data Sheet for safe handling recommendations and equipment.
5. Do not "sand blast" internal parts as it can reduce the dimensions of the parts.



XIII. Maintenance Instructions

A. General Information

After the valve has been disassembled, closely inspect the seating surfaces. Usually, a lapping of seats is all that is necessary to return a valve to working order. If an inspection shows badly damaged valve seating surfaces, machining will be required before lapping. O-Ring seat seal valve nozzles can only be reconditioned by machining, not lapping. (For specific information concerning the machining of nozzle and disc seating surfaces, see the Re-Machining Nozzle Seats and Bores and Re-Machining the Disc Seat sections.)

The seating surfaces of the metal-seated, Consolidated POSRV are flat. The nozzle seat is relieved by a 5° angle on the outside of the flat seat. The disc seat is wider than the nozzle seat; thus, the control of seat width is the nozzle seat (Figure 13).

A cast iron lap, coated with a lapping compound is used for reconditioning the seating surfaces of the nozzle and disc.

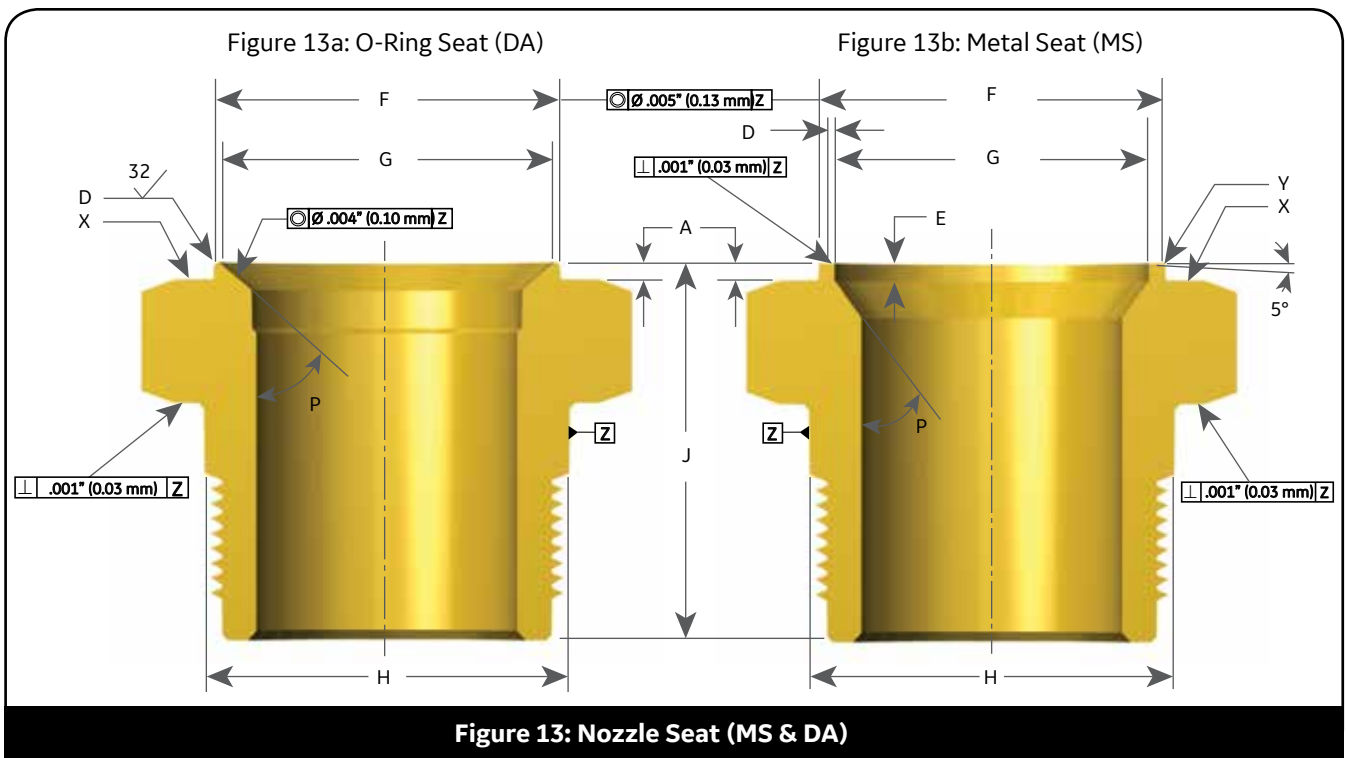
ATTENTION!

To establish leak-free valve seats, the nozzle seating surface and the disc seating surface must be lapped flat.

B. O-Ring Seat

The nozzle must not have any defects to prohibit the O-Ring from sealing properly, especially the OD of the seat where the surface must maintain a minimum of 32 RMS finish. See Figure 13a and Table 2b for reworking O-Ring Nozzle.

The O-Ring Retainer must also maintain a flat surface for it to sit on the Nozzle. Only polishing of surface can be done since material removal from this surface will cause the Nozzle to over engage O-Ring. Polishing paper or some other light abrasive can only be used since the part cannot function properly if its overall dimensions are changed significantly. If significant corrosion or damage has occurred on O-Ring retainer, discard and replace.



XIII. Maintenance Instructions (Contd.)

Table 2a: Nozzle Machined Dimensions (Metal-to-Metal)

Bore Type	Valve Inlet Size		Orifice	A ±.005" (±0.13 mm)		E ±.005" (±0.13 mm)		F		G		H ±.001" (±0.03 mm)		J min.		P ±0.5°
	in.	mm		in.	mm	in.	mm	in.	mm.	in.	mm	in.	mm	in.	mm	Angle
	Std. Bore	1.00		25.4	D, E, F	.092	2.34	.032	0.81	1.154 ± .001	29.31 ± 0.03	1.030 ± .001	26.16 ± 0.03	1.186	30.12	1.797
1.50		38.1	D, E, F	.092	2.34	.032	0.81	1.154 ± .001	29.31 ± 0.03	1.030 ± .001	26.16 ± 0.03	1.186	30.12	1.797	45.64	30°
1.50		38.1	G, H	.066	1.68	.066	1.68	1.836 ± .002	46.63 ± 0.05	1.711 ± .001	43.46 ± 0.03	1.936	49.17	1.984	50.39	45°
2.00		50.8	G, H, J	.066	1.68	.066	1.68	1.836 ± .002	46.63 ± 0.05	1.711 ± .001	43.46 ± 0.03	1.936	49.17	1.984	50.39	45°
3.00		76.2	J, K, L	.066	1.68	.066	1.68	2.525 ± .002	64.14 ± 0.05	2.400 ± .002	60.96 ± 0.05	2.999	76.17	2.359	59.92	45°
4.00		101.6	L, M, N, P	.095	2.41	.095	2.41	3.622 ± .002	92.00 ± 0.05	3.472 ± .002	88.19 ± 0.05	4.374	111.10	2.734	69.44	45°
6.00		152.4	Q, R	.096	2.44	.096	2.44	5.795 ± .003	147.19 ± 0.08	5.645 ± .003	143.38 ± 0.08	5.999	152.37	2.859	72.62	45°
8.00		203.2	T	.096	2.44	.096	2.44	6.510 ± .003	165.35 ± 0.08	6.315 ± .003	160.40 ± 0.08	7.249	184.12	3.484	88.49	45°
Full Bore	1.50	38.1	1.5"	.066	1.68	.066	1.68	1.836 ± .003	46.63 ± 0.08	1.711 ± .003	43.46 ± 0.08	1.936	49.17	1.984	50.39	45°
	2.00	50.8	2.0"	.066	1.68	.066	1.68	2.525 ± .003	64.14 ± 0.08	2.400 ± .003	60.96 ± 0.08	2.999	76.17	2.359	59.92	45°
	3.00	76.2	3.0"	.095	2.41	.095	2.41	3.622 ± .003	92.00 ± 0.08	3.472 ± .003	88.19 ± 0.08	4.374	111.10	2.734	69.44	45°
	4.00	101.6	4.0"	.095	2.41	.095	2.41	4.195 ± .003	106.55 ± 0.08	4.045 ± .003	102.74 ± 0.08	4.874	123.80	2.734	69.44	45°
	6.00	152.4	6.0"	.096	2.44	.096	2.44	6.510 ± .003	165.35 ± 0.08	6.315 ± .003	160.40 ± 0.08	7.249	184.12	3.484	88.49	45°
	8.00	203.2	8.0"	.127	3.23	.127	3.23	8.071 ± .003	205.00 ± 0.08	7.831 ± .003	198.91 ± 0.08	8.499	215.87	2.484	63.09	45°
	10.00	254.0	10.0"	.127	3.23	.127	3.23	10.260 ± .003	260.60 ± 0.08	10.018 ± .003	254.46 ± 0.08	10.499	266.67	2.859	72.62	45°
	12.00	304.8	12.0"	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	45°

XIII. Maintenance Instructions (Contd.)

Table 2b: Nozzle Machined Dimensions (O-Ring Seat Seal)

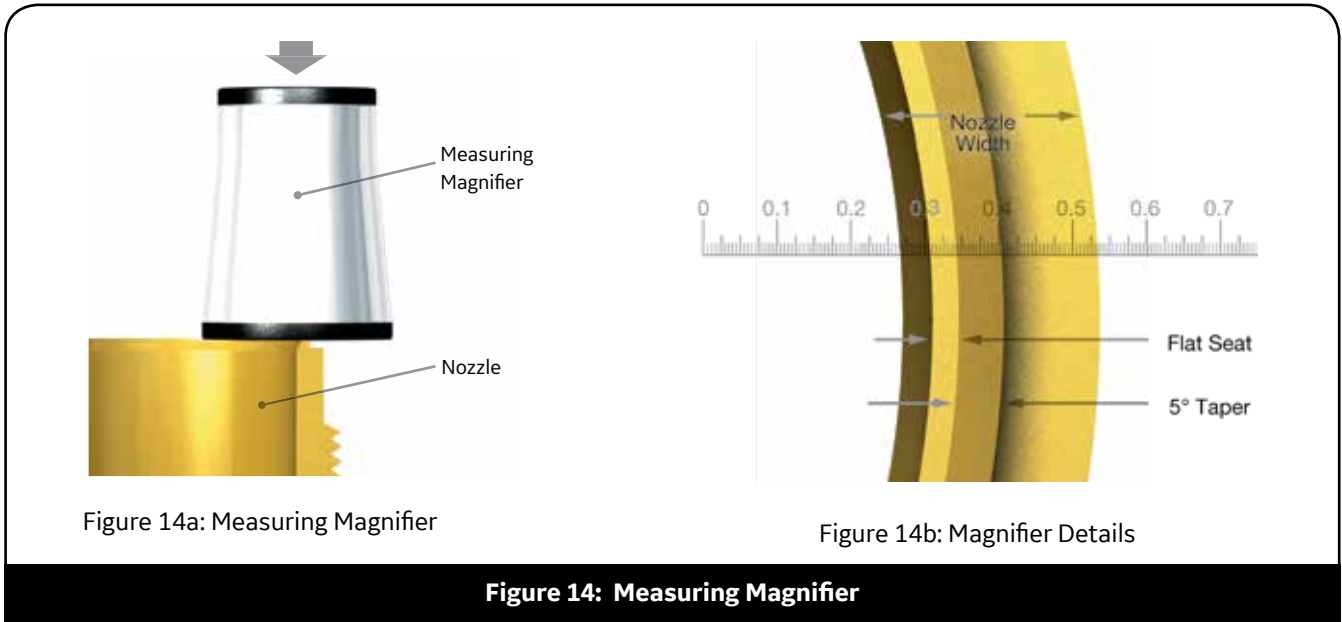
Bore Type	Valve Inlet		Orifice	A ±.005" (±0.13 mm)		D ±.001" (±0.03 mm)		F		G		H ±.001" (±0.03 mm)		J Min.		P ± 0.5°
	in.	mm		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	Angle
Std. Bore	1.00	25.4	D, E, F	.090	2.29	.022	0.56	1.087 ± .001	27.61 ± 0.03	1.041 ^{+.001} _{-.002}	26.44 ^{+0.03} _{-0.05}	1.186	30.12	1.797	45.64	50°
	1.50	38.1	D, E, F	.090	2.29	.022	0.56	1.087 ± .001	27.61 ± 0.03	1.041 ^{+.001} _{-.002}	26.44 ^{+0.03} _{-0.05}	1.186	30.12	1.797	45.64	50°
	1.50	38.1	G, H	.089	2.26	.022	0.56	1.836 ± .002	46.63 ± 0.05	1.780 ^{+.001} _{-.002}	45.21 ^{+0.03} _{-0.05}	1.936	49.17	1.984	50.39	50°
	2.00	50.8	G, H, J	.089	2.26	.022	0.56	1.836 ± .002	46.63 ± 0.05	1.780 ^{+.001} _{-.002}	45.21 ^{+0.03} _{-0.05}	1.936	49.17	1.984	50.39	50°
	3.00	76.2	J, K, L	.105	2.67	.022	0.56	2.479 ± .002	62.97 ± 0.05	2.423 ± .002	61.54 ± 0.05	2.999	76.17	2.359	59.92	50°
	4.00	101.6	L, M, N, P	.105	2.67	.022	0.56	3.476 ^{+.002} _{-.003}	88.29 ^{+0.05} _{-0.08}	3.420 ^{+.002} _{-.003}	86.87 ^{+0.05} _{-0.08}	4.374	111.10	2.734	69.44	50°
	6.00	152.4	Q, R	.125	3.18	.022	0.56	5.592 ± .003	142.04 ± 0.08	5.533 ± .003	140.54 ± 0.08	5.999	152.37	2.859	72.62	50°
	8.00	203.2	T	.125	3.18	.022	0.56	6.484 ^{+.003} _{-.004}	164.69 ^{+0.08} _{-0.10}	6.420 ^{+.004} _{-.003}	163.07 ^{+0.10} _{-0.08}	7.249	184.12	3.484	88.49	50°
Full Bore	1.50	38.1	1.5"	.089	2.26	.022	0.56	1.836 ± .002	46.63 ± 0.05	1.780 ^{+.001} _{-.002}	45.21 ^{+0.03} _{-0.05}	1.936	49.17	1.984	50.39	50°
	2.00	50.8	2.0"	.105	2.67	.022	0.56	2.479 ± .002	62.97 ± 0.05	2.423 ± .002	61.54 ± 0.05	2.999	76.17	2.359	59.92	50°
	3.00	76.2	3.0"	.105	2.67	.022	0.56	3.476 ^{+.002} _{-.003}	88.29 ^{+0.05} _{-0.08}	3.42 ^{+.002} _{-.003}	86.87 ^{+0.05} _{-0.08}	4.374	111.10	2.734	69.44	50°
	4.00	101.6	4.0"	.105	2.67	.022	0.56	4.101 ^{+.002} _{-.003}	104.17 ^{+0.05} _{-0.08}	4.045 ^{+.002} _{-.003}	102.74 ^{+0.05} _{-0.08}	4.874	123.80	2.734	69.44	50°
	6.00	152.4	6.0"	.125	3.18	.022	0.56	6.484 ^{+.003} _{-.004}	164.69 ^{+0.08} _{-0.10}	6.421 ^{+.003} _{-.004}	163.09 ^{+0.08} _{-0.10}	7.249	184.12	3.484	88.49	50°
	8.00	203.2	8.0"	.125	3.18	.022	0.56	7.984 ^{+.003} _{-.004}	202.79 ^{+0.08} _{-0.10}	7.921 ^{+.003} _{-.004}	201.19 ^{+0.08} _{-0.10}	8.499	215.87	2.484	63.09	50°
	10.00	254.0	10.0"	.125	3.18	.022	0.56	10.234 ^{+.003} _{-.004}	259.94 ^{+0.08} _{-0.10}	10.171 ^{+.003} _{-.004}	258.34 ^{+0.08} _{-0.10}	10.499	266.67	2.859	72.62	50°
	12.00	304.8	12.0"	.150	3.81	.022	0.56	12.551 ± .004	318.80 ± 0.10	12.305 ± .004	312.55 ± 0.10	12.999	330.17	3.359	85.32	45°

XIII. Maintenance Instructions (Contd.)

C. Lapped Nozzle Seat Widths

A wide nozzle seat will induce leakage, especially in the smaller-orifice, lower-pressure valves. For this reason, the seat of valves other than O-Ring valves should be as narrow as practical. Since the seat must be wide enough to carry the bearing load imposed upon it by the pressure force, the higher pressure valves must have wider seats than the lower pressure valves. The nozzle seat width should conform to the measurements in Tables 3 or 4.

To measure the seat width, use a Model S1-34- 35-37 Bausch and Lomb Optical Co. measuring magnifier or an equivalent seven-power glass with a .750" (19.05 mm) scale showing graduations of .005" (0.13 mm). Figures 14a & 14b illustrate the use of this tool in measuring the nozzle seat width. If additional lighting is required for measuring, use a gooseneck flashlight similar to the Type A Lamp Assembly (Standard Molding Corp.), or equivalent.



Valve	Set Pressure				Lapped Seat Width			
	min.		max.		min.		max.	
	psig	barg	psig	barg	in.	mm	in.	mm
1.00" (25.4 mm) D, E, F 1.50" (38.1 mm) D, E, F	15	1.03	50	3.45	.012	0.30	.018	0.46
	51	3.52	100	6.89	.018	0.46	.025	0.64
	101	6.96	250	17.24	.025	0.64	.032	0.81
	251	17.31	400	27.58	.032	0.81	.038	0.97
	401	27.65	800	55.16	.038	0.97	.045	1.14
	801	55.23	1000	68.95	.045	1.14	.055	1.40
	1001	69.02	Above		.055" + .005" (13.97 + 0.13 mm) per 100 psig (6.89 barg) (0.070" ± 0.005" (1.78 ± 0.13 mm) max)			
1.50" (38.1 mm) G, H 1.50" (38.1 mm) Full Bore 2.00" (50.8 mm) G, H, J	15	1.03	50	3.45	.019	0.48	.025	0.64
	51	3.52	100	6.89	.025	0.64	.029	0.74
	101	6.96	250	17.24	.029	0.74	.032	0.81
	251	17.31	400	27.58	.032	0.81	.038	0.97
	401	27.65	800	55.16	.038	0.97	.045	1.14
	801	55.23	1000	68.95	.045	1.14	.055	1.40
	1001	69.02	Above		.055" + .005" (13.97 + 0.13 mm) per 100 psig (6.89 barg) (0.070" ± 0.005" (1.78 ± 0.13 mm) max)			

XIII. Maintenance Instructions (Contd.)

Table 3: Approximate Nozzle Seat Width (Standard Metal Seat) Contd.

Valve	Set Pressure				Lapped Seat			
	min.		max.		min.		max.	
	psig	barg	psig	barg	in.	mm	in.	mm
2.00" (50.8 mm) Full Bore 3.00" (76.2 mm) J, K, L	15	1.03	50	3.45	.025	0.64	.030	0.76
	51	3.52	100	6.89	.030	0.76	.035	0.89
	101	6.96	250	17.24	.035	0.89	.040	1.02
	251	17.31	400	27.58	.040	1.02	.045	1.14
	401	27.65	800	55.16	.045	1.14	.050	1.27
	801	55.23	1000	68.95	.050	1.27	.058	1.47
	1001	69.02	Above		.058" + .005" (1.47 + 0.13mm) per 100 psig (6.89 barg) (.070" ± .005" (1.78 ± 0.13 mm)max)			
3.00" (76.2 mm) Full Bore 4.00" (101.6 mm) L, M, N,P	15	1.03	50	3.45	.030	0.76	0.037	0.94
	51	3.52	100	6.89	.037	0.94	0.045	1.14
	101	6.96	250	17.24	.045	1.14	0.052	1.32
	251	17.31	400	27.58	.052	1.32	0.059	1.50
	401	27.65	800	55.16	.059	1.50	0.064	1.63
	801	55.23	1000	68.95	.064	1.63	0.072	1.83
	1001	69.02	Above		Full Width			
4.00" (101.6 mm) Full Bore	15	1.03	50	3.45	.030	0.76	0.037	0.94
	51	3.52	100	6.89	.037	0.94	0.045	1.14
	101	6.96	250	17.24	.045	1.14	0.052	1.32
	251	17.31	400	27.58	.052	1.32	0.059	1.50
	401	27.65	800	55.16	.059	1.50	0.064	1.63
	801	55.23	1000	68.95	.064	1.63	0.072	1.83
	1001	69.02	Above		Full Width			
6.00" (152.4 mm) Q, R	15	1.03	50	3.45	.030	0.76	0.037	0.94
	51	3.52	100	6.89	.037	0.94	0.045	1.14
	101	6.96	250	17.24	.045	1.14	0.052	1.32
	251	17.31	400	27.58	.052	1.32	0.059	1.50
	401	27.65	800	55.16	.059	1.50	0.064	1.63
	801	55.23	1000	68.95	.064	1.63	0.072	1.83
	1001	69.02	Above		Full Width			
6.00" (152.4 mm) Full Bore 8.00" (203.2 mm) T	15	1.03	50	3.45	.040	1.02	.045	1.14
	51	3.52	100	6.89	.045	1.14	.053	1.35
	101	6.96	250	17.24	.053	1.35	.061	1.55
	251	17.31	400	27.58	.060	1.52	.068	1.73
	401	27.65	800	55.16	.068	1.73	.076	1.93
	801	55.23	1000	68.95	.076	1.93	.090	2.29
	1001	69.02	Above		Full Width			
8.00" (203.2 mm) Full Bore	15	1.03	50	3.45	.050	1.27	.060	1.52
	51	3.52	100	6.89	.060	1.52	.070	1.78
	101	6.96	250	17.24	.070	1.78	.080	2.03
	251	17.31	400	27.58	.080	2.03	.090	2.29
	401	27.65	800	55.16	.090	2.29	.100	2.54
	801	55.23	1000	68.95	.100	2.54	.110	2.79
	1001	69.02	Above		Full Width			
10.00" (254.0 mm) Full Bore	15	1.03	50	3.45	.065	1.65	.075	1.91
	51	3.52	100	6.89	.075	1.91	.085	2.16
	101	6.96	250	17.24	.085	2.16	.100	2.54
	251	17.31	400	27.58	.100	2.54	.110	2.79
	401	27.65	750	51.71	Full Width			

XIII. Maintenance Instructions (Contd.)

Table 4: Approximate Nozzle Seat Width (Thermodisc* Design)

Valve	Set Pressure				Lapped Seat Width			
	min.		max.		min.		max.	
	psig	barg	psig	barg	in.	mm	in.	mm
1.00" (25.4 mm) D, E, F 1.50" (38.1 mm) D, E, F	15	1.03	100	6.89	.020	0.51	.035	0.89
	101	6.96	300	20.68	.035	0.89	.045	1.14
	301	20.75	800	55.16	.045	1.14	.055	1.40
	801	55.23	Above		Full Width			
1.50" (38.1 mm) G, H 1.50" (38.1 mm) Full Bore 2.00" (50.8 mm) G, H, J	15	1.03	100	6.89	.025	0.64	.035	0.89
	101	6.96	300	20.68	.035	0.89	.045	1.14
	301	20.75	800	55.16	.045	1.14	.055	1.40
	801	55.23	Above		Full Width			
2.00" (50.8 mm) Full Bore 3.00" (76.2 mm) J, K, L	15	1.03	100	6.89	.030	0.76	.040	1.02
	101	6.96	300	20.68	.040	1.02	.050	1.27
	301	20.75	800	55.16	.050	1.27	.060	1.52
	801	55.23	Above		Full Width			
3.00" (76.2 mm) Full Bore 4.00" (101.6 mm) L, M, N,P	15	1.03	100	6.89	.040	1.02	.050	1.27
	101	6.96	300	20.68	.050	1.27	.060	1.52
	301	20.75	800	55.16	.060	1.52	.070	1.78
	801	55.23	Above		Full Width			
4.00" (101.6 mm) Full Bore	15	1.03	100	6.89	.040	1.02	.050	1.27
	101	6.96	300	20.68	.050	1.27	.060	1.52
	301	20.75	800	55.16	.060	1.52	.070	1.78
	801	55.23	Above		Full Width			
6.00" (152.4 mm) Q,R	15	1.03	100	6.89	.040	1.02	.050	1.27
	101	6.96	300	20.68	.050	1.27	.060	1.52
	301	20.75	800	55.16	.060	1.52	.070	1.78
	801	55.23	Above		Full Width			
6.00" (152.4 mm) Full Bore 8.00" (203.2 mm) T	15	1.03	100	6.89	.050	1.27	.060	1.52
	101	6.96	300	20.68	.060	1.52	.075	1.91
	301	20.75	800	55.16	.075	1.91	.085	2.16
	800	55.16	Above		Full Width			
8.00" (203.2 mm) Full Bore	15	1.03	100	6.89	.060	1.52	.075	1.91
	101	6.96	300	20.68	.075	1.91	.090	2.29
	301	20.75	800	55.16	.090	2.29	.105	2.67
	800	55.16	Above		Full Width			
10.00" (254.0 mm) Full Bore	15	1.03	100	6.89	.075	1.91	.090	2.29
	101	6.96	300	20.68	.090	2.29	.105	2.67
	301	20.75	750	51.71	Full Width			

XIII. Maintenance Instructions (Contd.)

D. Lapping Disc Seats

Use a ring lap or lapping plate to lap the disc in a circular motion, applying uniform pressure and slowly rotating the disc or lap.

- Apply 1000 lapping compound (see Table 16 in Lapping Tools Section - Section XXII.D). Lap disc to a polish finish.
- Remove lapping compound completely from Disc and Disc Holder.

E. Precautions and Hints for Lapping Seats

To ensure a quality lapping process, observe the following precautions and guidelines:

1. Keep work materials clean. Always use a fresh lap. If signs of wear (out of flatness) are evident, recondition the lap.
2. Apply a very thin layer of lapping compound to the lap to prevent rounding off the edges of the seat.
3. Keep the lap squarely on the flat surface, and avoid rocking the lap, which causes rounding of the seat.
4. When lapping, keep a firm grip on the lapped part to prevent dropping it and damaging the seat.
5. Lap in a circular motion while applying a uniform pressure. Slowly rotate the lap to evenly distribute the lapping compound. Wipe off the old compound and replace it with new compound frequently. Apply more pressure to speed the cutting action of the compound. To check the seating surfaces, remove all compound from the seat and the lap. Then, shine the seat with the same lap using the lapping method as described above. Low sections on the seating surface show up as shadow in contrast to the shiny portion. If shadows are present, further lapping is necessary. Only laps known to be flat can be used. It should take only a few minutes to remove the shadows.
6. When lapping is complete, any lines appearing as cross-scratches can be removed by rotating the lap on its axis (which has been wiped clean of compound) on the seat. Thoroughly clean the lapped seat using lint free cloth and a cleansing fluid.

ATTENTION!

Before assembly, grind the contact surfaces of the nozzle and O-Ring retainer to provide metal-to-metal seat tightness in the event of O-Ring failure.

F. Reconditioning of Laps

Ring laps are reconditioned by lapping them on a flat lapping plate in a figure-eight motion (Figure 15). To ensure the best results, recondition the ring laps after each use. Use an optical flat to check the quality of the lap.

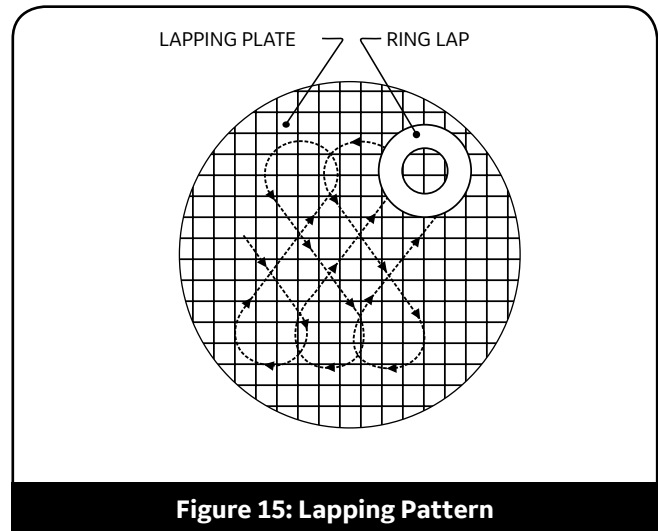


Figure 15: Lapping Pattern

G. Re-Machining Nozzle Seats

Remove the nozzle from the valve to be remachined. If it cannot be removed from the base (1), re-machine it inside the base.

Take the following steps to setup the lathe and nozzle:

1. Grip the nozzle in a four-jaw independent chuck (or collet, if appropriate), using a piece of soft material such as copper or fiber between the jaws and the nozzle as shown at A (Figure 16).
2. True up the nozzle so that the surfaces marked B and C run true within .001" (0.03 mm) on indicator (Figure 16).

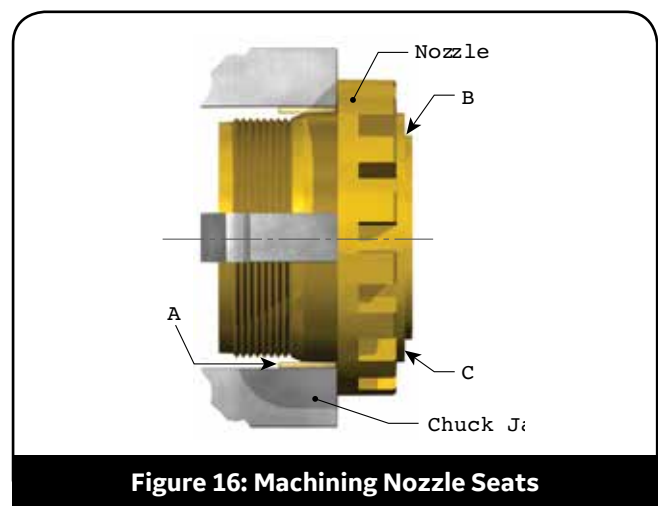


Figure 16: Machining Nozzle Seats

XIII. Maintenance Instructions (Contd.)

3. Machining Procedure: Metal Seat

See Figure 13b and Table 2a.

- a. Take light cuts across the surface Y at 5°, until the damaged areas are removed. Turn to the smoothest possible finish.
- b. Cut back the outside surface at X, until dimension A is obtained.
- c. Machine bore diameter G, until dimension E is obtained. Re-establish angle P.
- d. The nozzle is now ready for lapping.
- e. When the minimum dimension J is reached, the nozzle should be discarded.

4. Machining Procedure: O-Ring Seat

See Figure 13a and Table 2b.

- a. Take light cuts across Surface E [50° (45° for 12" fullbore)], until the damaged areas are removed. Turn to the smoothest possible finish.
- b. Cut back the outside surface X, until dimension A is obtained.
- c. Machine radius D.
- d. When the minimum dimension J is reached, the nozzle should be discarded.

H. Re-Machining the Disc Seat

Take the following steps to machine the standard disc seating surface (Figure 17):

1. Grip the disc in a four-jaw independent chuck (or collet, if appropriate), using a piece of soft material such as copper or fiber between the jaws and the disc as shown at A.

2. True up the disc so that the surface marked B and C run true within .001" (0.03 mm), TIR.
3. Make light cuts across the seating surface L until damaged areas are removed. Turn to the smoothest possible finish.
4. The disc is now ready for lapping.
5. Discard the disc if the minimum dimension N or T (Figure 18, Table 5) is reached. Do not reestablish surface C.

ATTENTION!
Do not remachine a Thermodisc or O-Ring Retainer..

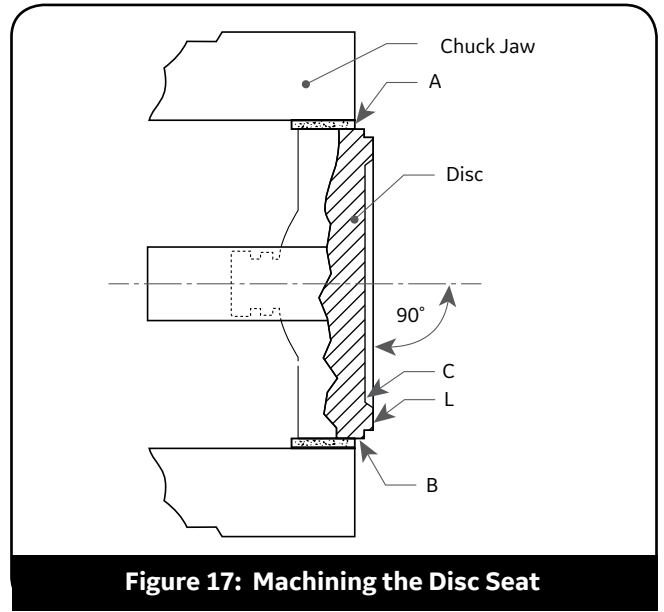


Figure 17: Machining the Disc Seat

XIII. Maintenance Instructions (Contd.)

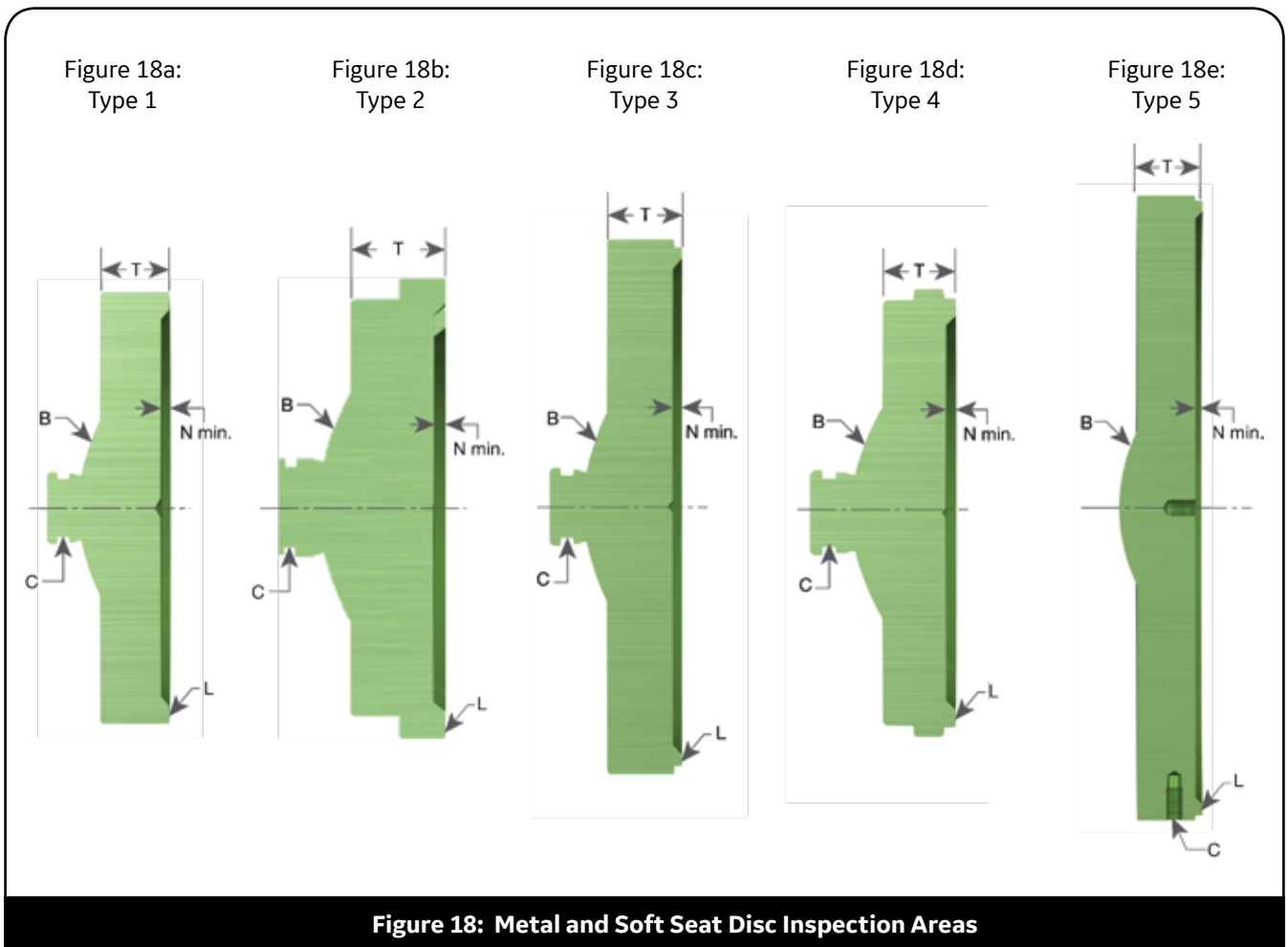


Figure 18: Metal and Soft Seat Disc Inspection Areas

Table 5: Minimum T and N Dimensions for Standard Disc							
Inlet Size		Orifice	Type	T min.		N min.	
in.	mm			in.	mm	in.	mm
1.00	25.4	D, E, F	1	.179	4.55	.010	0.25
1.50	38.1	D, E, F	1	.179	4.55	.010	0.25
1.50	38.1	G, H	1	.394	10.01	.020	0.51
2.00	50.8	G, H, J	1	.394	10.01	.020	0.51
3.00	76.2	J, K, L	2	.510	12.95	.038	0.97
4.00	101.6	L, M, N,P	1	.693	17.60	.068	1.73
6.00	152.4	Q,R	3	.693	17.60	.068	1.73
8.00	203.2	T	3	.905	22.99	.068	1.73
1.50	38.1	Full Bore	1	.394	10.01	.020	0.51
2.00	50.8	Full Bore	2	.510	12.95	.038	0.97
3.00	76.2	Full Bore	1	.693	17.60	.068	1.73
4.00	101.6	Full Bore	4	.693	17.60	.068	1.73
6.00	152.4	Full Bore	3	.905	22.99	.068	1.73
8.00	203.2	Full Bore	5	1.012	25.70	.068	1.73
10.00	254.0	Full Bore	5	1.012	25.70	.068	1.73
12.00	304.8	Full Bore	N/A	N/A	N/A	N/A	N/A

XIV. Inspection of Main Valve

1. Guide: Check ID for galling or scratch marks, especially around the guide and seal surface areas. Check O-Ring/energize seal contact area for any corrosion or scratched surfaces that might cause a leak.

Replace the guide if:

- a. Visible galling is present on the inside guiding surface.
 - b. Cover Plate O-Ring seating areas are pitted and cause the valve to leak between the Cover Plate and Base.
2. Base: Inspect general condition for cracks or holes. Look for any corrosion issues.
 3. Cover Plate: Inspect general condition for cracks or holes. Look for any corrosion issues.
 4. O-Ring Retainer: Inspect surface that sits on the disc for any corrosion on defects that might cause the disc not to sit flush with nozzle.
 5. Spring: Check for any corrosion issues that might cause the spring not to operate as designed.
 6. Nozzle should be replaced if:
 - a. Dimension from seat to shoulder after remachining and lapping is less than A min. on Table 2, 3 or 4.
 - b. Threads are damaged from pitting and/or corrosion.
 - c. Bottom of flange and intersecting surface are damaged from galling and/or tearing.
 - d. Seat Width is outside specification (Table 3 and Table 4).

Nozzle Seat Width for Metal Seated Valves:

Using a measuring magnifying glass, (see Lapped Nozzle Seat Widths), determine whether the finish lapped seat surface must be machined before lapping. If the seat can be lapped flat without exceeding the required seat width, as indicated in Table 3 or Table 4, it does not require machining.

To reduce the seat width, the 5° angle surface must be machined. The nozzle must be replaced if the H dimension is reduced below the minimum as indicated in Tables 2a or 2b.

7. Standard Metal Seated Disc: This disc (Figure 18) can be machined until the T dimension is reduced to the minimum, as listed in Table 5. The N min. dimension must be maintained as well.
8. Thermodisc Metal Seated Disc: This disc (Figure 19) cannot be machined. It can be lapped as long as the A min. dimension has been maintained. If lapping does not fix damaged area, part must be discarded.

Replace the Thermodisc if:

- a. Seat defects and damage cannot be lapped out without reducing the “A” dimension in Figure 19 and listed in Table 6. If the dimension cannot be measured, replace the Thermodisc.

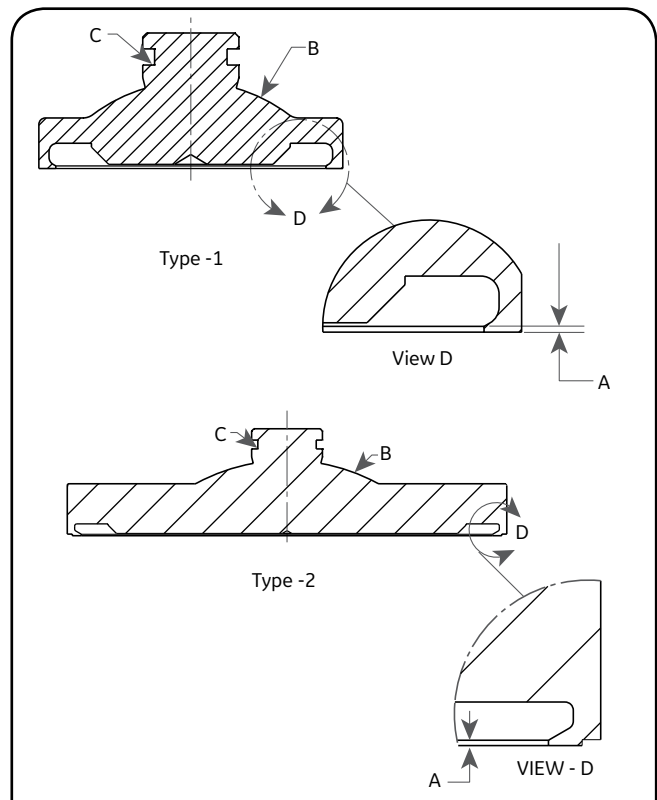


Figure 19: Thermodisc Design

Table 6: Minimum “A” Dimension for Thermodisc

Inlet Size		Orifice	Type	A min.	
in.	mm			in.	mm
1.00	25.4	D, E, F	1	.006	0.15
1.50	38.1	D, E, F	1	.006	0.15
1.50	38.1	G, H	2	.008	0.20
2.00	50.8	G, H, J	2	.008	0.20
3.00	76.2	J, K, L	1	.011	0.28
4.00	101.6	L, M, N,P	2	.012	0.30
6.00	152.4	Q,R	2	.016	0.41
8.00	203.2	T	2	.024	0.61
1.50	38.1	Full Bore	2	.008	0.20
2.00	50.8	Full Bore	2	.011	0.28
3.00	76.2	Full Bore	2	.012	0.30
4.00	101.6	Full Bore	2	.016	0.41
6.00	152.4	Full Bore	2	.024	0.61
8.00	203.2	Full Bore	2	.022	0.56
10.00	254.0	Full Bore	2	.022	0.56

XIV. Inspection of Main Valve (Contd.)

9. O-Ring Seated Disc: The O-Ring Retainer cannot be machined. It can be lapped for minor scratches. If lapping does not fix damaged area, part must be discarded.
10. Disc Holder: Should be replaced if the sliding surface is galled, pitted or scratched.

Replace all parts as needed. If any damage listed above is present, the part should be replaced or repaired per instruction. Other valve parts may be acceptable with light

corrosion, pitting, or minor damage of other types if it can be determined that it will not affect product performance. All O-Rings and seals should be replaced each time the valve is disassembled.

Refer to Table 18 for a list of recommended spare parts and Table 19 for a list of O-Ring repair kits.

XV. Reassembly of 3900 Main Valve

A. Lubricants and Sealants

1. Operating temperatures below -40°F (-40°C), consult the Factory.
2. Operating temperatures between -40 and 505°F (-40 and 262.7°C)
 - a. Lubricate all O-Rings, except silicone, spring energized seals, and back-up rings sparingly with silicone grease (BHGE P/N SP505).
 - b. Seal all pipe threads with Teflon tape or pipe sealant (BHGE P/N SP364-AB).
 - c. Lubricate standard threads and bearing points with Jet-Lube, BHGE non-metallic, product code #14613 (BHGE P/N 4114510 or 4114511).
3. Operating temperatures above +505°F (262.7°C)
 - a. Lubricate all O-Rings, except silicone, spring energized seals, and back-up rings sparingly with silicone grease (BHGE P/N SP505).
 - b. Seal all pipe threads with Teflon tape or pipe sealant (BHGE P/N SP364-AB).
 - c. Lubricate standard threads and bearing points with nickel graphite N5000 (BHGE P/N 4114507) or equivalent.

B. Assembly Procedure with Metal Seats

1. Thread Sensing Tube into the Main Valve (rear connection) making sure the wrench flat which reads "Up" is positioned upward after tightening.
2. Thread the tube fitting into the Sensing Tube and tighten.

Note: Install Plug Filter between tube fitting and Sensing Tube, if required.

3. Installation of Nozzle:
 - a. The nozzle seat must be lapped to a width corresponding to the valve set pressures. For seat widths, please refer to Table 3 for standard metal seats and Table 4 for Thermodisc seats.

- b. Check seat widths using a measuring magnifier such as Bausch & Lomb Model 81-34-3547, BHGE control number 8003688, or equivalent.
- c. Install Nozzle O-Ring over threads of Nozzle and slide until it hits the backside of the flange. Install Nozzle into Base with the appropriate wrench and torque to the value shown in Table 7. Refer to Figure 61 and Table 15 for specifications on appropriate spanner wrench.
4. Disc preparation:
 - a. Lap Disc to Disc Holder bearing surfaces using lapping compound 1A to lightly grey in.
 - b. Remove lapping compound, completely.
 - c. Install Disc Retainer into the groove in the Disc.
 - d. Lubricate bearing surfaces of Disc, Disc Holder and Retainer Ring.
 - e. Snap Disc into Disc Holder using only moderate hand force.
 - f. Check to make sure the Disc does not bind and is free to rock in Disc Holder.

C. Assembly Procedure for O-Ring Seats

1. Thread Sensing Tube into the Main Valve (rear connection) making sure the wrench flat which reads "Up" is positioned upward after tightening.
2. Thread the tube fitting into the Sensing Tube and tighten.

Note: Install Plug Filter between tube fitting and Sensing Tube, if required.

3. Installation of Nozzle.
4. Install Nozzle O-Ring over threads of Nozzle and slide until it hits the backside of the flange. Install Nozzle into Base with the appropriate wrench and

XV. Reassembly of 3900 Main Valve (Contd.)

Table 7: Nozzle Torque Values			
Valve Inlet Size		Nozzle Installation Torque	
in.	mm	ft-lbs ± 5%	N-m ± 5%
1.00	25.4	100	136
1.50	38.1	100	136
2.00	50.8	160	217
3.00	76.2	475	644
4.00	101.6	1070	1451
6.00	152.4	1445	1959
8.00	203.2	1865	2529
Bolted Nozzles		60	81

Table 8: O-Ring Retainer Screw(s) Torque Values						
Inlet Size		Orifice	No. of Bolts	Bolt Size	Torque Value ¹	
in.	mm				ft-lbs ±5	N-m ±0.5
1.00	25.4	D,E,F	1	5/16-18UNC	120	13.6
1.50	38.1	D,E,F	1	5/16-18UNC	120	13.6
1.50	38.1	G,H	1	3/8-24UNF	245	27.7
2.00	50.8	G,H,J	1	3/8-24UNF	245	27.7
3.00	76.2	J,K,L	4	5/16-18UNC	120	13.6
4.00	101.6	L,M,N,P	6	3/8-24UNF	245	27.7
6.00	152.4	Q,R	6	3/8-24UNF	245	27.7
8.00	203.2	T	6	3/8-24UNF	245	27.7
4.00	101.6	3" FB	6	3/8-24UNF	245	27.7
4.00	101.6	4" FB	4	3/8-24UNF	245	27.7
6.00	152.4	6" FB	6	3/8-24UNF	245	27.7
8.00	203.2	8" FB	8	3/8-24UNF	245	27.7
10.00	254.0	10" FB	8	3/8-24UNF	245	27.7
12.00	304.8	12.0" FB	8	3/8-24UNF	245	27.7

Note 1: For 1.5" and 2.0" FB, contact factory

torque to the value shown in Table 7. Refer to Figure 61 and Table 15 for specifications on appropriate spanner wrench.

- Install the Seat Seal O-Ring in the disc groove and position the O-Ring Retainer onto the Disc. Install the Lock Screw(s) and tighten to the torque values listed in Table 8.

Note: For Teflon seat O-Rings, heat to 300°F (149°C) for ten minutes before installation.

D. Disc to Guide seal

- For Teflon seals make sure of the integrity of the Teflon seal and seal spring. Install Disc Seal on Disc outside diameter on the opposite end of the disc seat as shown in Figure 20.
- If an O-Ring seal is used, it is installed in the groove between where the Guide Ring is installed and where a

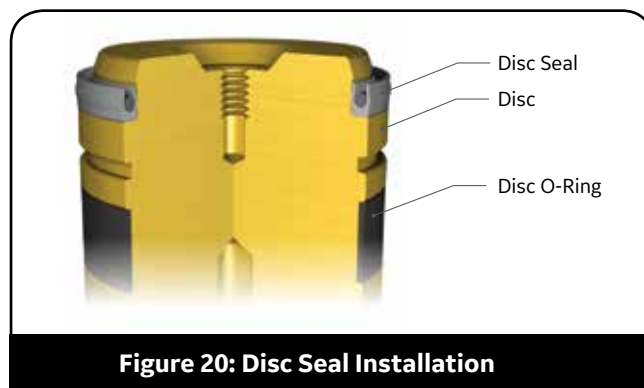


Figure 20: Disc Seal Installation

- Spring Energized Seal would be installed (Figure 10).
- Install the Guide Ring(s) on Disc outside diameter. If the valve is equipped with two guide rings, position the space where the guide ring ends meet 180° apart.

E. Guide and Disc Assembly

D, E, F, G, H, J, K, & 3" L

- Make sure the chamfer on the BOTTOM of the Guide is smooth. If any sharp edges exist, polish the chamfer, since the seal could be damaged during assembly.
- Insert Disc Seal (Disc O-Ring) into bottom of Guide first. Continue pushing Disc into Guide, being careful of not pinching the Guide Rings. Push Disc in until shoulder of Disc hits bottom of Guide.
- Drop Guide O-Ring into top of Base for outside diameter of Guide.
- Insert Guide/Disc assembly into top of Base. It will not fit flush. The Cover Plate will force it down during its installation. Push Disc in until the Disc is in contact with the Nozzle. Use threaded hole on top of disc if necessary to lift assembly.
- Install Cover Plate O-Ring into top groove on Guide.
- Install Spring into dome cavity with smaller coils on bottom. When installing the Cover Plate, make sure the spring coils remain in the groove and centered.
- Install Cover Plate on top of Base such that the pilot will be aligned for proper tubing connections. Make note of the length of the studs or Cap Screws. The two longer ones will straddle the vertical line of the inlet sensing port on the Main Base of the pilot valve. Install the bracket between the Cover Plate and the Nut or Cap Screw. Torque to the values shown in Table 9 in 15 lb (20 N-m) increments making sure there is a uniform gap between the Base and the Cover Plate. Torque in the sequence shown in Figure 21. Be sure that the bracket is aligned so that the two smaller pilot attachment holes are above the horizontal plane of the Cover Plate.

XV. Reassembly of 3900 Main Valve (Contd.)

Table 9: Coverplate Cap Screw / Nut Torque														
Inlet Size		Orifice	3905		3910		3912		3914		3916		3918	
in.	mm		ft-lb	N-m	ft-lb	N-m	ft-lb	N-m	ft-lb	N-m	ft-lb	N-m	ft-lb	N-m
1.00	25.4	D, E, F	40	54	40	54	40	54	40	54	40	54	90	122
1.50	38.1	D, E, F	40	54	40	54	40	54	40	54	40	54	340	461
1.50	38.1	G, H	120	163	120	163	120	163	120	163	120	163	510	691
2.00	50.8	G, H, J	120	163	120	163	120	163	120	163	120	163	720	976
3.00	76.2	J, K, L	210	285	210	285	210	285	210	285	210	285	1015	1376
4.00	101.6	L, M, N, P	340	461	340	461	340	461	340	461	340	461	N/A	N/A
6.00	152.4	Q, R	340	461	340	461	340	461	N/A	N/A	N/A	N/A	N/A	N/A
8.00	203.2	T	510	691	510	691	510	691	N/A	N/A	N/A	N/A	N/A	N/A
1.50	38.1	Full Bore	120	163	120	163	120	163	120	163	120	163	Note 1	Note 1
2.00	50.8	Full Bore	210	285	210	285	210	285	210	285	210	285	Note 1	Note 1
3.00	76.2	Full Bore	340	461	340	461	340	461	340	461	340	461	Note 1	Note 1
4.00	101.6	Full Bore	340	461	340	461	340	461	340	461	N/A	N/A	N/A	N/A
6.00	152.4	Full Bore	510	691	510	691	510	691	N/A	N/A	N/A	N/A	N/A	N/A
8.00	203.2	Full Bore	720	976	720	976	720	976	N/A	N/A	N/A	N/A	N/A	N/A
10.00	254.0	Full Bore	720	976	720	976	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
12.00	304.8	Full Bore	720	976	720	976	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note 1: Contact factory.

4" L, M, N, P, Q, R, T, 3" F.B., 4" F.B., 6" F.B., 8" F.B., 10" F. B. and 12" F. B.

1. Make sure the chamfer on the TOP of the Guide is smooth. If any sharp edges exist, polish the chamfer, since the seal could be damaged during assembly.

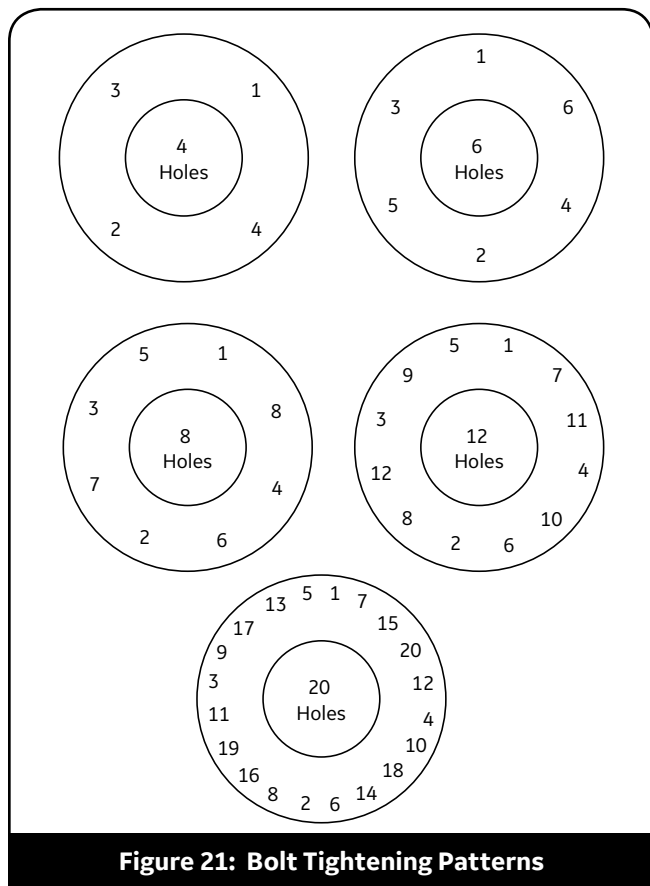


Table 10: Torque Required for Each Round of Pattern	
Round	Percentage of Required Torque
1	Wrench Tight
2	25
3	60
4	100
5	100

2. Drop Guide O-Ring into top of Base for outside diameter of Guide.
3. Insert Guide into top of Base. It will not fit flush. The Cover Plate will force it down during its installation.
4. Insert Disc Assembly into Guide with the Disc seat going in first. Continue pushing Disc into Guide, being careful of not pinching the Guide Rings. Push Disc in until the Disc is in contact with the Nozzle.
5. Install Cover Plate O-Ring into top groove on Guide.
6. Install Spring into dome cavity with smaller coils on bottom. When installing the Cover Plate, make sure the spring coils remain in the groove and centered.
7. Install Cover Plate on top of Base such that the pilot will be aligned for proper tubing connections. Make note of the length of the studs or Cap Screws. The two longer ones will straddle the vertical line of the inlet sensing port on the Main Base of the pilot valve. Install the bracket between the Cover Plate and the Nut or Cap Screw. Torque to the values found in Table 9 using the torque patterns in Figure 21 and Table 10. Be sure that the bracket is aligned so that the two smaller pilot attachment holes are above the horizontal plane of the Cover Plate.

XVI. Disassembly of Pilot Valve

A. 39PV07/37 Disassembly

Figures 22 and 23

1. Remove and discard the aluminum seals and sealing wire.
 2. Remove Cap (Compression Screw) by turning counterclockwise.
 3. If a lifting lever is installed, also use Figure 23 to remove the Lifting Lever assembly. Then return to Figure 22 to continue disassembly.
 - a. The Lifting Lever Assembly consists of:
 - 1 – Lever
 - 1 – Drive Pin
 - 1 – Cam Shaft
 - 1 – Bushing
 - b. Remove Lifting Lever Assembly by turning Bushing counterclockwise.
 - c. Turn Cap (Compression Screw) counterclockwise.
 - d. Measure distance from Release Lock Nut to the top of the Lifting Stem for reassembly later.
 - e. Remove the Release Lock Nut and Release Nut by turning counterclockwise.
 4. Measure and record Compression Screw height for later use when resetting.
 5. Turn Compression Screw Lock Nut counterclockwise to loosen.
 6. Turn Compression Screw counterclockwise to remove the load on the Spring.
 7. Turn Set Screw counterclockwise to loosen.
 8. Bonnet can now be removed by turning counterclockwise.
 9. Spring and Spring Washers can now be removed.
- Note: If Lifting Lever option is equipped, there is no need to remove Drive Pin from Bottom Spring Washer assembly.
10. Remove the four Cap Screws (Top Plate) holding the Top Plate to the Pilot Base. Remove and discard the Spring Seal (Main Piston) and O-Ring (Top Plate).
 11. Remove Main Piston from Pilot Base.

Note: For Dirty Service Option, please refer to “Dirty Service Option” (Section XXI.B) for disassembly instructions.

12. Removing the Insert Assembly.

The Insert Assembly consists of:

- 1 - Insert Top
- 1 - Insert Bottom
- 1 - Spring Seal (Insert)
- 1 - O-Ring (Insert)

Remove Insert Assembly from the top of the Pilot Base with tool #4995401 as shown in Figure 60. Remove and discard the O-Ring (Insert) on the bottom of the Insert Assembly. Disassemble Insert Assembly by removing the Insert Bottom from the Insert Top. Discard Spring Seal (Insert).

13. Remove Adjuster Cap from the bottom of the Pilot Base by turning counterclockwise.
14. Loosen Adjuster Lock Nut by turning counterclockwise.
15. Removing the Adjuster Assembly.

The Adjuster Assembly consists of:

- 1 – Adjuster Top
- 1 – Adjuster Bottom
- 1 – O-Ring (Adjuster Top)
- 1 – O-Ring (Adjuster Bottom)
- 1 – Spring Seal (Adjuster Top)

16. Turn Adjuster Assembly clockwise counting the number of flats until assembly stops. Record number of flats for reassembly.
17. Remove Adjuster Assembly from the Pilot Base by turning counterclockwise. Remove O-Ring (Adjuster Top) and O-Ring (Adjuster Bottom) from adjuster assembly and discard. Disassemble Adjuster Top from the Adjuster Bottom by turning Adjuster Top counterclockwise. Remove Spring Seal (Adjuster Top) from Adjuster Top and discard.
18. Refer to Field Test Connection / Backflow Preventer Option (Section XXI.A) for disassembly of Field Test Connection

XVI. Disassembly of Pilot Valve (Contd.)

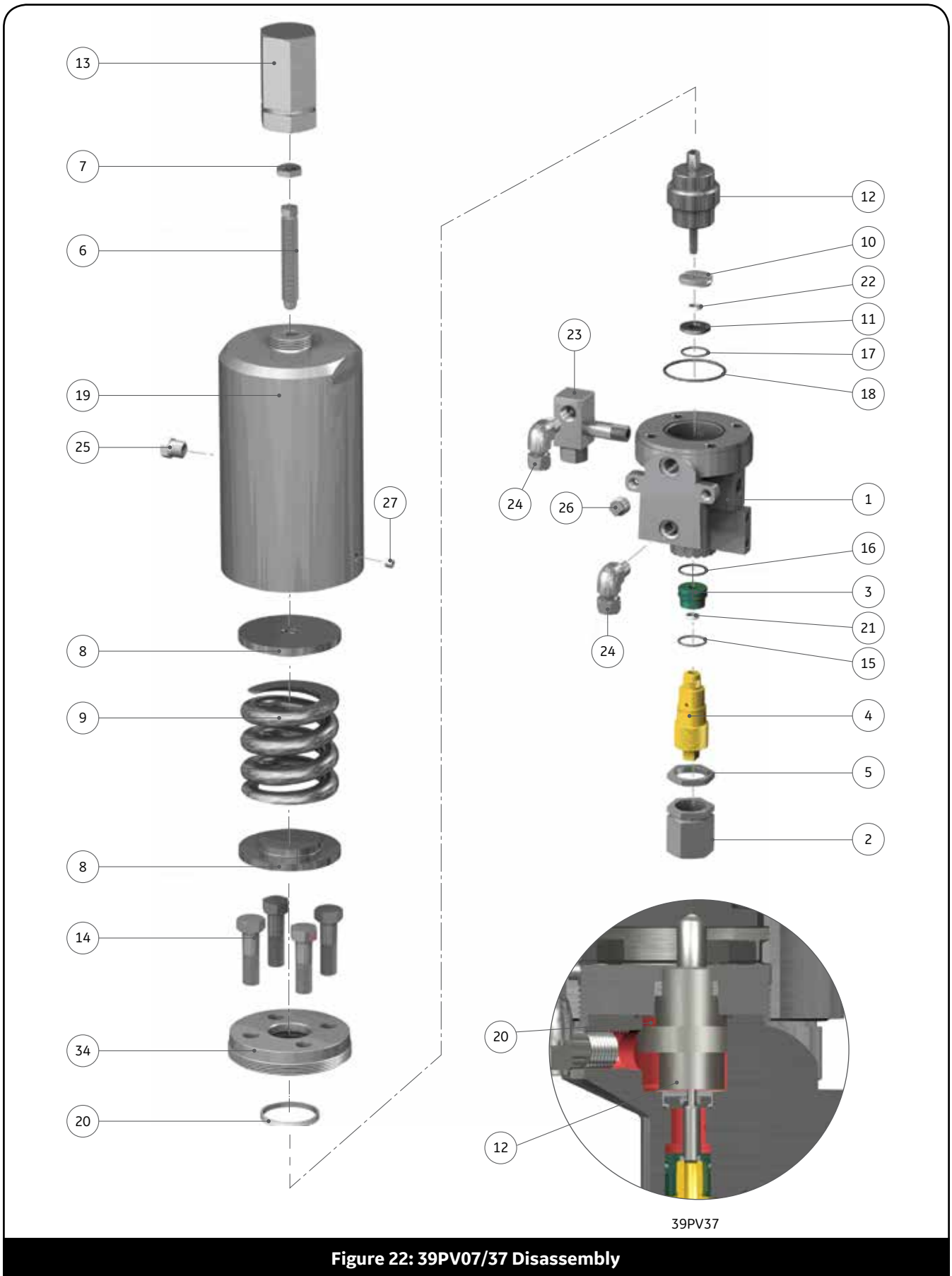


Figure 22: 39PV07/37 Disassembly

XVI. Disassembly of Pilot Valve (Contd.)

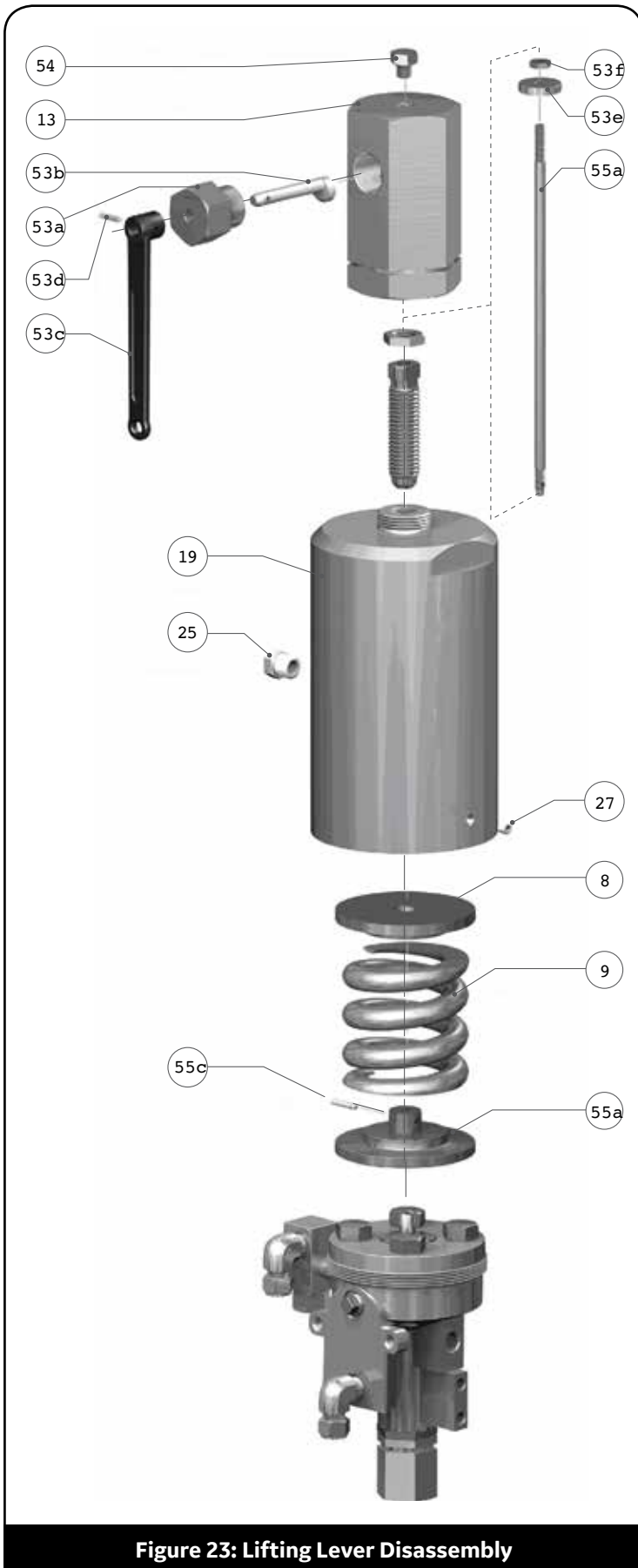


Figure 23: Lifting Lever Disassembly

Part No.	Nomenclature
53	Lifting Lever Assembly
53a	Cam Bushing
53b	Cam Shaft
53c	Lifting Lever
53d	Drive Pin
53e	Release Nut
53f	Release Locknut
54	Gag Bolt
55	Lower Spring Washer Assembly
55a	Lower Spring Washer
55b	Lifting Stem
55c	Drive Pin

B. 39MV07 Disassembly

Figures 23 and 24

1. Remove and discard the aluminum seals and sealing wire.
2. Remove Cap (Compression Screw) by turning counterclockwise.
3. If a lifting lever is installed, also use Figure 23 to remove the Lifting Lever assembly. Then return to Figure 24 to continue disassembly.
 - a. The Lifting Lever Assembly consists of:
 - 1 - Lever
 - 1 - Drive Pin
 - 1 - Cam Shaft
 - 1 - Bushing
 - b. Remove Lifting Lever Assembly by turning Bushing counterclockwise.
 - c. Turn Cap (Compression Screw) counterclockwise.
 - d. Measure distance from Release Lock Nut to the top of the Lifting Stem for reassembly later.
 - e. Remove the Release Lock Nut and Release Nut by turning counterclockwise.
4. Measure and record Compression Screw height for later use when resetting.
5. Turn Compression Screw Lock Nut counterclockwise to loosen.

XVI. Disassembly of Pilot Valve (Contd.)

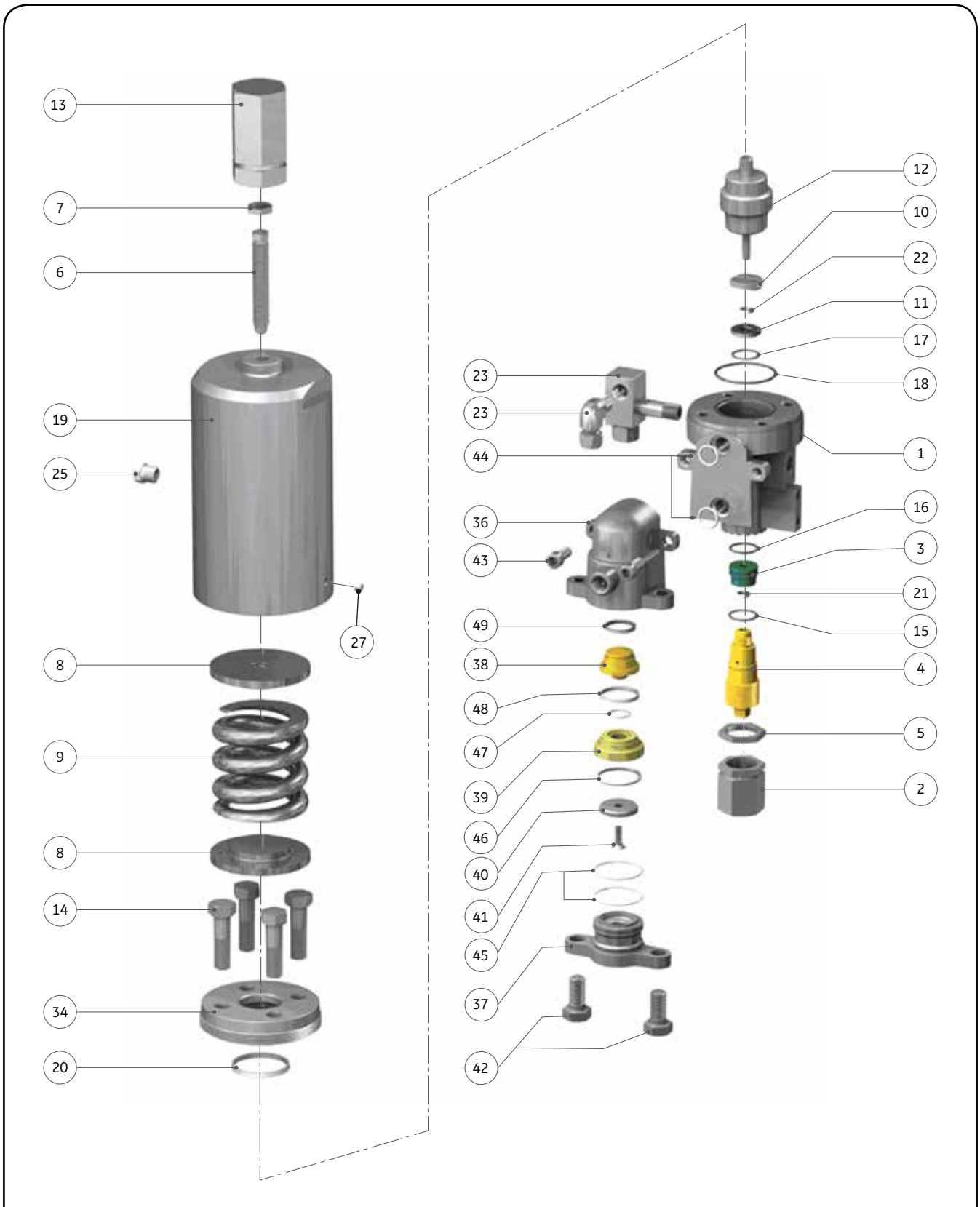


Figure 24: 39MV07 Disassembly

XVI. Disassembly of Pilot Valve (Contd.)

6. Turn Compression Screw counterclockwise to remove the load on the Spring.
 7. Turn Set Screw counterclockwise to loosen.
 8. Bonnet can now be removed by turning counterclockwise.
 9. Spring and Spring Washers can now be removed.
- Note: If Lifting Lever option is equipped, there is no need to remove Drive Pin from Bottom Spring Washer assembly.
10. Remove the four Cap Screws (Top Plate) holding the Top Plate to the Pilot Base. Remove and discard the Spring Seal (Main Piston) and O-Ring (Top Plate).
 11. Remove Main Piston from Pilot Base.
- Note: For Dirty Service Option, please refer to Dirty Service Option (Section XXI.B) for disassembly instructions.
12. Removing the Insert Assembly.
The Insert Assembly consists of:
 - 1 - Insert Top
 - 1 - Insert Bottom
 - 1 - Spring Seal (Insert)
 - 1 - O-Ring (Insert)Remove Insert Assembly from the top of the Pilot Base with tool #4995401 as shown in Figure 60. Remove and discard the O-Ring (Insert) on the bottom of the Insert Assembly. Disassemble Insert Assembly by removing the Insert Bottom from the Insert Top. Discard Spring Seal (Insert).
 13. Remove Adjuster Cap from the bottom of the Pilot Base by turning counterclockwise.
 14. Loosen Adjuster Lock Nut by turning counterclockwise.
 15. Removing the Adjuster Assembly.
The Adjuster Assembly consists of:
 - 1 – Adjuster Top
 - 1 – Adjuster Bottom
 - 1 – O-Ring (Adjuster Top)
 - 1 – O-Ring (Adjuster Bottom)
 - 1 – Spring Seal (Adjuster Top)
 16. Turn Adjuster Assembly clockwise counting the number of flats until assembly stops. Record number of flats for reassembly.
 17. Remove Adjuster Assembly from the Pilot Base by turning counterclockwise. Remove O-Ring (Adjuster Top) and O-Ring (Adjuster Bottom) from adjuster assembly and discard. Disassemble Adjuster Top from the Adjuster Bottom by turning Adjuster Top counterclockwise. Remove Spring Seal (Adjuster Top) from Adjuster Top and discard.
 18. Refer to Field Test Connection / Backflow Preventer Option (Section XXI.A) for disassembly of Field Test Connection
 19. Remove Socket Head Cap Screw (2 Nos.) to remove Modulator Assembly from Pilot Base. Remove and discard both O-Rings (Modulator Base).
The Modulator Assembly consists of:
 - 1 – Modulator Base
 - 1 – Modulator Stop
 - 1 – Modulator Piston AssemblyThe Modulator Piston Assembly consists of:
 - 1 – Modulator Piston Top
 - 1 – Modulator Piston Bottom
 - 1 – O-Ring Retainer
 - 1 – Lock Screw
 - 1 – O-Ring Modulator Piston Bottom
 - 1 – Spring Seal (Piston Top)
 - 1 – Spring Seal (Piston Bottom)
 - 1 – O-Ring (Modulator Seat)
 20. Remove Cap Screws (Modulator) holding Modulator Stop to Modulator Base.
 21. Modulator Base can now be removed by rotating the Modulator Stop enough to be able to push against the ears on the Modulator Base to remove the Modulator Stop.
 22. Remove both O-Rings (Modulator Stop) and discard.
 23. Disassemble the Modulator Piston Assembly by removing the Lock Screw.
 24. Remove and discard O-Ring (Modulator Piston Bottom) and O-Ring (Modulator Seat). Be careful not to bend the lip enclosing the O-Ring (Modulator Seat) during its removal.
 25. Discard Spring Seal (Piston Bottom) and Spring Seal (Piston Top).

XVI. Disassembly of Pilot Valve (Contd.)

C. 39MV22/72 Disassembly

Figures 25, 26 and 23

1. Remove and discard the aluminum seals and sealing wire.
2. Remove Cap (Compression Screw) by turning counterclockwise.
3. If a lifting lever is installed, also use Figure 23 to remove the Lifting Lever assembly. Then return to Figure 25 or 26 to continue disassembly.
 - a. The Lifting Lever Assembly consists of:
 - 1 – Lever
 - 1 – Drive Pin
 - 1 – Cam Shaft
 - 1 – Bushing
 - b. Remove Lifting Lever Assembly by turning Bushing counterclockwise.
 - c. Turn Cap (Compression Screw) counterclockwise.
 - d. Measure distance from Release Lock Nut to the top of the Lifting Stem for reassembly later.
 - e. Remove the Release Lock Nut and Release Nut by turning counterclockwise.
4. Measure and record Compression Screw height for later use when resetting.
5. Turn Compression Screw Lock Nut counterclockwise to loosen.
6. Turn Compression Screw counterclockwise to remove the load on the Spring.
7. Turn Set Screw counterclockwise to loosen.
8. Bonnet can now be removed by turning counterclockwise.
9. Spring and Spring Washers can now be removed.

Note: If Lifting Lever option is equipped, there is no need to remove Drive Pin from Bottom Spring Washer assembly.

10. Remove the four Cap Screws (Top Plate) holding the Top Plate to the Pilot Base. Remove and discard the Spring Seal (Main Piston), O-Ring (Top Plate) and back-up rings (if applicable).
11. Remove Main Piston Assembly from Pilot Base.
12. Main Piston Assembly consists of:
 - 1 – Main Piston
 - 1 – Piston Nose
 - 1 – Piston Retainer Nut
 - 1 – Set ScrewRemove Set Screw. Turn Piston Retainer Nut

counterclockwise to remove. Remove Piston Nose.

Note: For Dirty Service Option, please refer to “Dirty Service Option” (Section XXI.B) for disassembly instructions.

13. Remove Spring Seal (Main Piston) and Backup Ring (if applicable) and discard.

14. Removing the Insert Assembly.

The Insert Assembly consists of:

- 1 - Insert Top
- 1 - Insert Bottom
- 1 - Spring Seal (Insert)
- 1 - O-Ring (Insert)

Remove Insert Assembly from the top of the Pilot Base with tool #4995401 as shown in Figure 60. Remove and discard the O-Ring (Insert) on the bottom of the Insert Assembly. Disassemble Insert Assembly by removing the Insert Bottom from the Insert Top. Discard Spring Seal (Insert).

15. Remove Adjuster Cap from the bottom of the Pilot Base by turning counterclockwise.

16. Loosen Adjuster Lock Nut by turning counterclockwise.

17. Removing the Adjuster Assembly.

The Adjuster Assembly consists of:

- 1 – Adjuster Top
- 1 – Adjuster Bottom
- 1 – Balance Seal Adaptor
- 1 – O-Ring (Adjuster Top)
- 1 – O-Ring (Adjuster Bottom)
- 1 – Spring Seal (Adjuster Top)
- 1 – Spring Seal (Adjuster Bottom)

18. Turn Adjuster Assembly clockwise counting the number of flats until assembly stops. Record number of flats for reassembly.

19. Remove Adjuster Assembly from the Pilot Base by turning counterclockwise. Remove O-Ring (Adjuster Top) and O-Ring (Adjuster Bottom) from adjuster assembly and discard. Disassemble Adjuster Top from the Adjuster Bottom by turning Adjuster Top counterclockwise. Remove the Balance Seal Adaptor from the Adjuster Top. Remove and discard the Spring Seal (Adjuster Top) and Spring Seal (Adjuster Bottom).

20. Refer to Field Test Connection / Backflow Preventer Option (Section XXI.A) for disassembly of Field Test Connection

XVI. Disassembly of Pilot Valve (Contd.)

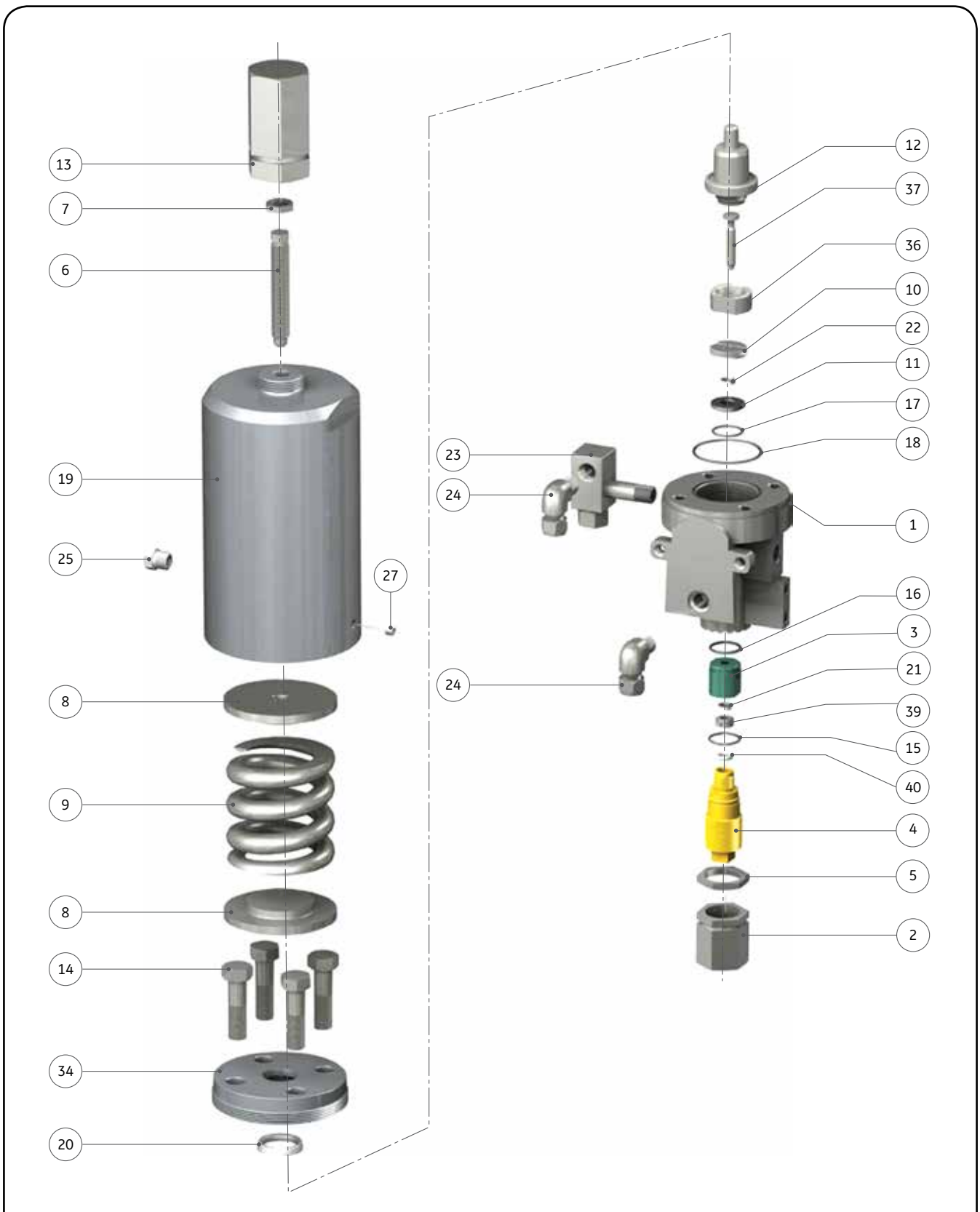


Figure 25: 39MV22 Disassembly

XVI. Disassembly of Pilot Valve (Contd.)

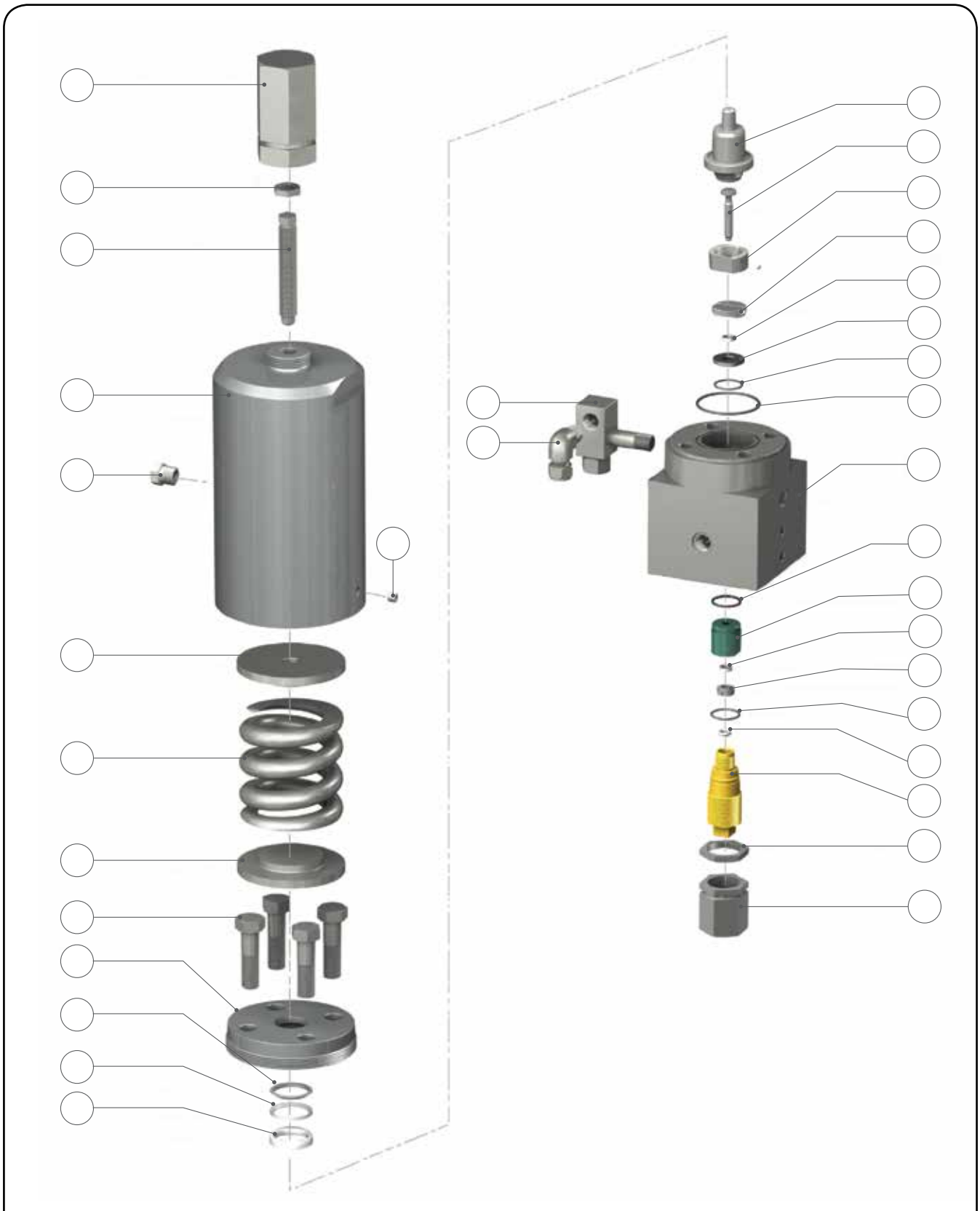


Figure 26: 39MV72 Disassembly

XVI. Disassembly of Pilot Valve (Contd.)



D. Cleaning

1. Clean parts to remove all rust, burrs, scale, organic matter, and loose particles. Parts are to be free of any oil or grease except for lubrication as specified in this instruction.
2. Cleaning agents used shall be such that effective cleaning is assured without injuring the surface finishes or material properties of the part.
3. Acceptable cleaning agents include demineralized water, nonphosphate detergent, acetone, and isopropyl alcohol. Parts must be blown dry or wiped dry after cleaning.
4. If you are using cleaning solvents, take precautions to protect yourself from potential danger from breathing fumes, chemical burns, or explosion. See the solvent's Material Safety Data Sheet for safe handling recommendations and equipment.
5. Do not "sand blast" internal parts as it can reduce the dimensions of the parts.

XVII. Part Inspection of Pilot Valve

After the valve has been disassembled, all parts should be given a visual inspection. Some key areas to check with the boundaries for reworking parts are listed below.

A. 39PV07/37

1. Main Piston: Galling or excessive wear on the small diameter end where it engages the spring seals or on the spherical bearing surface. Any corrosion or pitting that appears detrimental to the function of the valve. The part can be polished as long as the outside diameter of the stem remains at $.243 \pm .001$ " (6.18 ± 0.03 mm). The stem itself must have a T.I.R of $.001$ " (0.03 mm) along its length. The upper diameter where the Spring Seal (Main Piston) rides must be $1.495 \pm .001$ (37.97 ± 0.03 mm) on 39PV07 model or $.970 \pm .001$ " (24.64 ± 0.03 mm) on 39PV37. A surface finish of 8 RMS must be maintained for proper sealing on these surfaces.
2. Insert Top: Galling or excessive wear on the inside diameter that guides the Main Piston. Check for any corrosion or pitting. Also, check for galling of threads.
3. Insert Bottom: Galling or excessive wear on the inside diameter that guides the Main Piston. Check for any corrosion or pitting.
4. Adjuster Top: Galling or excessive wear on the inside diameter that guides the Main Piston. Check for any corrosion or pitting. Also, check for galling of threads.
5. Adjuster Bottom: Galling or excessive wear on the inside diameter that guides the Main Piston. Check for any corrosion or pitting. Also, check for galling of threads.
6. Top Plate: Galling or excessive wear on the inside diameter that guides the Main Piston. Check for any corrosion or pitting. Also, check for galling of threads.
7. Bonnet: Check for any corrosion or pitting. Also, check for galling of threads for the compression screw and where it attaches to the Pilot Base.
8. Compression Screw: Galling at the spherical bearing surface or in the thread. Check for any corrosion or pitting.
9. Spring Washer(s): Galling at the spherical bearing surface. Check for any corrosion or pitting.
10. Pilot Base: Check for any corrosion or pitting. Also, check for galling of threads.
11. Spring: Check for any corrosion or pitting.

B. 39MV07

1. Main Piston: Galling or excessive wear on the small diameter end where it engages the spring seals or on the spherical bearing surface. Any corrosion or pitting that

appears detrimental to the function of the valve. The part can be polished as long as the outside diameter of the stem remains at $.243 \pm .001$ " (6.17 ± 0.03 mm). The stem itself must have a T.I.R of $.001$ " (0.03 mm) along its length. The upper diameter where the Spring Seal (Main Piston) rides must be $1.495 \pm .001$ (37.97 ± 0.03 mm) on 39PV07 model or $.970 \pm .001$ " (24.64 ± 0.03 mm) on 39PV37. A surface finish of 8 RMS must be maintained for proper sealing on these surfaces.

2. Insert Top: Galling or excessive wear on the inside diameter that guides the Main Piston. Check for any corrosion or pitting. Also, check for galling of threads.
3. Insert Bottom: Galling or excessive wear on the inside diameter that guides the Main Piston. Check for any corrosion or pitting.
4. Adjuster Top: Galling or excessive wear on the inside diameter that guides the Main Piston. Check for any corrosion or pitting. Also, check for galling of threads.
5. Adjuster Bottom: Galling or excessive wear on the inside diameter that guides the Main Piston. Check for any corrosion or pitting. Also, check for galling of threads.
6. Top Plate: Galling or excessive wear on the inside diameter that guides the Main Piston. Check for any corrosion or pitting. Also, check for galling of threads.
7. Bonnet: Check for any corrosion or pitting. Also, check for galling of threads for the compression screw and where it attaches to the Pilot Base.
8. Compression Screw: Galling at the spherical bearing surface or in the thread. Check for any corrosion or pitting.
9. Spring Washer(s): Galling at the spherical bearing surface. Check for any corrosion or pitting.
10. Pilot Base: Check for any corrosion or pitting. Also, check for galling of threads.
11. Spring: Check for any corrosion or pitting.
12. Modulator Stop: Top seating surface for cuts or deformities. The surface can be lapped if the distance from the seat to the outside shoulder does not reduce to less than $.086$ " (2.18 mm).
13. O-Ring Retainer: Seating surface for cuts or deformities. The surface can be lapped if the overall height of the part does not reduce to less than $.160$ " (4.06 mm). Also, check the outside diameter for any scratches that might prevent the O-Ring (Modulator Seat) from sealing.

XVII. Part Inspection of Pilot Valve (Contd.)

14. Modulator Piston Bottom: Galling or excessive wear on the outside diameter that rubs against the Modulator Base. Make sure that the lip holding the O-Ring (Modulator Seat) is not deformed. Also, check the outside diameter of the O-Ring groove for scratches that might cause the O-Ring (Modulator Seat) not to seal. Check for any corrosion or pitting.
15. Modulator Base: Galling or excessive wear on any inside diameter. Any corrosion or pitting.
5. Adjuster Top: Galling or excessive wear on the inside diameter that guides the Main Piston. Check for any corrosion or pitting. Also, check for galling of threads.
6. Adjuster Bottom: Galling or excessive wear on the inside diameter that guides the Main Piston. Check for any corrosion or pitting. Also, check for galling of threads.
7. Balance Seal Adaptor: Check for any corrosion or pitting.
8. Top Plate: Galling or excessive wear on the inside diameter that guides the Main Piston. Check for any corrosion or pitting. Also, check for galling of threads.

C. 39MV22/72

1. Main Piston: Galling or excessive wear on the diameter where the Spring Seal (Main Piston) engages or on the spherical bearing surface. Any corrosion or pitting that appears detrimental to the function of the valve. The part can be polished as long as the outside diameter of the where the Spring Seal (Main Piston) rides must be $.970 \pm .001$ " (24.64 ± 0.03 mm) on 39MV22 model or $.812 \pm .001$ " (20.63 ± 0.03 mm) on 39MV72. A surface finish of 8 RMS must be maintained for proper sealing on these surfaces.
2. Piston Nose: Galling or excessive wear on the diameter where the spring seals engage. Any corrosion or pitting that appears detrimental to the function of the valve. The part can be polished as long as the outside diameter of the stem remains at $.243 \pm .001$ " (6.17 ± 0.03 mm). The stem itself must have a T.I.R of $.001$ " (0.03 mm) along its length.
3. Insert Top: Galling or excessive wear on the inside diameter that guides the Main Piston. Check for any corrosion or pitting. Also, check for galling of threads.
4. Insert Bottom: Galling or excessive wear on the inside diameter that guides the Main Piston. Check for any corrosion or pitting.
9. Bonnet: Check for any corrosion or pitting. Also, check for galling of threads for the compression screw and where it attaches to the Pilot Base.
10. Compression Screw: Galling at the spherical bearing surface or in the thread. Check for any corrosion or pitting.
11. Spring Washer(s): Galling at the spherical bearing surface. Check for any corrosion or pitting.
12. Pilot Base: Check for any corrosion or pitting. Also, check for galling of threads.
13. Spring: Check for any corrosion or pitting.

If any damage listed above is present, the part should be replaced or repaired per instruction. Other valve parts may be acceptable with light corrosion, pitting, or minor damage of other types if it can be determined that it will not affect product performance. All O-Rings and spring seals should be replaced each time the valve is disassembled.

Refer to Tables 20 and 21 for O-Ring/Spring Seal repair kits. Recommended spare parts are listed in Table 18.

XVIII. Reassembly of Pilot Valve

A. Lubricants and Sealants

1. Lubricate all O-Rings, except those made from silicone, and spring seals sparingly with silicone grease BHGE P/N SP505.
2. Seal all pipe threads with Teflon tape or pipe sealant (BHGE P/N SP364-AB).
3. Lubricate standard threads and bearing points with Flourolube GR362 (BHGE P/N 4668601) or equivalent.

B. Assembly of 39PV07/37

1. Making the Main Pilot.
2. Making the Adjuster Assembly,

This assembly consists of:

- 1 – Adjuster Bottom
- 1 – Adjuster Top
- 1 – Spring Seal (Adjuster Top)
- 1 – O-Ring (Adjuster Top)
- 1 – O-Ring (Adjuster Bottom)

- a. Check the Adjuster Top for burrs at the spring seal lead in chamfer. Remove any burrs using a polishing cloth.
- b. Install Spring Seal (Adjuster Top) into Adjuster Top using insertion tool as shown in Figure 59.
 - i. Lubricate Spring Seal (Adjuster Top) with silicone grease.
 - ii. Install Spring Seal (Adjuster Top) onto Plunger Cylinder with spring facing away from Plunger Cylinder.
 - iii. Insert Plunger into Plunger Cylinder until Plunger lightly contacts Spring Seal (Adjuster Top).
 - iv. Insert Funnel Tube, chamfer side first, over the Plunger and Spring Seal (Adjuster Top). Stop when Spring Seal (Adjuster Top) is about half way inside the Funnel Tube as shown in Figure 27.

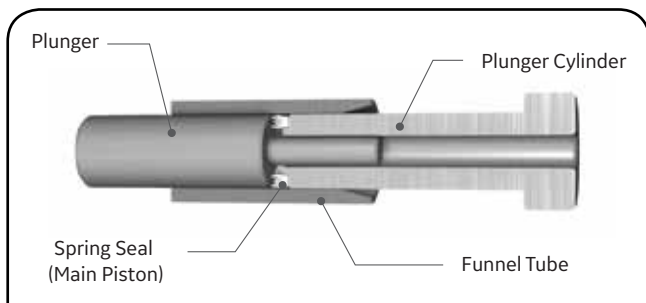


Figure 27: Funnel Tube

- v. Remove Plunger.
- vi. Insert Funnel Tube Assembly into Adjuster Top until Funnel Tube contacts Spring Seal (Adjuster Top) gland.
- viii. Push down on Plunger cylinder to insert Spring Seal (Adjuster Top) into Adjuster Top as shown in Figure 28.

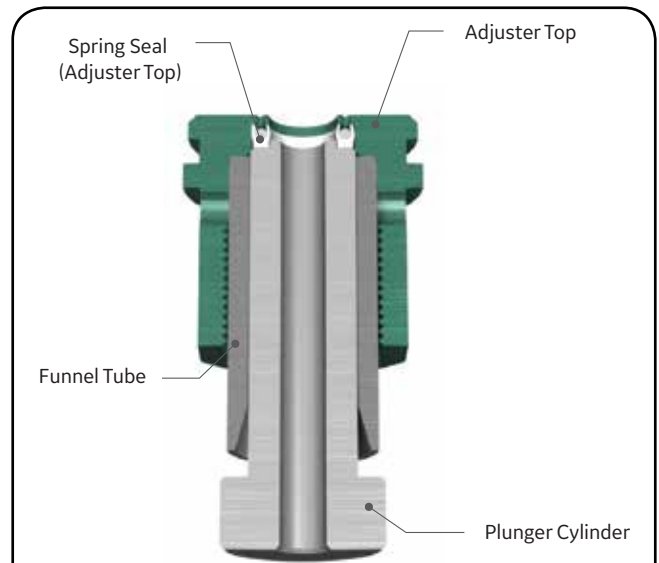


Figure 28: Plunger Cylinder

- viii. Remove Funnel Tube Assembly.
- ix. Inspect Adjuster Top to make sure that Spring Seal (Adjuster Top) did not flare out during installation and that the Spring Seal (Adjuster Top) is oriented as shown in Figure 29.

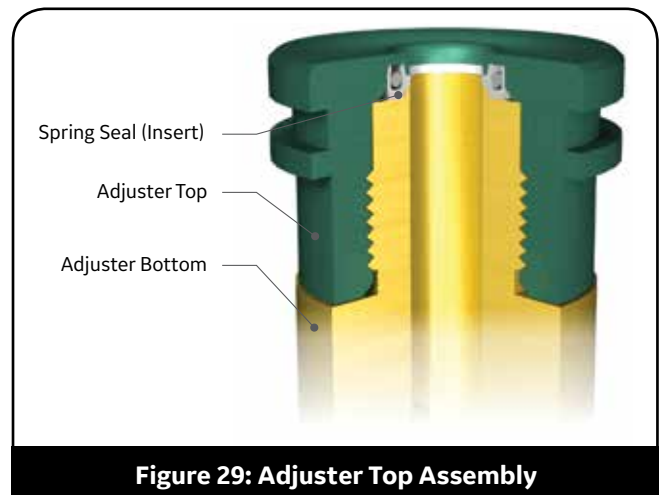


Figure 29: Adjuster Top Assembly

XVIII. Reassembly of Pilot Valve (Contd.)

- c. Thread Adjuster Top clockwise onto Adjuster bottom and torque to 27 ± 2 ft-lbs (37 ± 2.7 N-m).
- d. Lubricate Main Piston stem and cycle Main Piston through Spring Seal (Adjuster Top) five times.

Note: Do not install adjuster assembly into Pilot Base with O-Rings installed without wrench tightening Adjuster Top to Adjuster Bottom together. Adjuster Top can get stuck in Pilot Base if the Adjuster Top is not tighten properly.

- e. Install O-Ring (Adjuster Top) into groove on Adjuster Top.
- f. Install O-Ring (Adjuster Bottom) into groove on Adjuster Bottom. Install from the opposite end of the square wrenching flats.
- g. Lightly lubricate both external O-Rings on Adjuster Assembly. Install Adjuster Assembly into Pilot Base with the Adjuster Top going in first. Rotate the assembly clockwise during installation until the threads are engaged. This helps the O-Rings get by chamfers and holes.
- h. Continue to turn Adjuster Assembly clockwise into Pilot Base until it stops.
- i. Turn Adjuster Assembly counterclockwise the number of flats that was recorded in Disassembly Instructions (Section XVI.A), step 16.
- j. Thread the Adjuster Lock Nut clockwise onto the Adjuster Assembly hand tight.
- k. Thread Adjuster Cap clockwise onto Adjuster Assembly hand tight.

Note: Make sure Adjuster Cap and Adjuster Lock Nut threads freely on Adjuster Bottom. Adjuster Assembly may be inadvertently rotated if these two parts do not fit loosely.

3. The Insert Assembly of the pilot consists of:

- 1 – Insert Top
 - 1 – Insert Bottom
 - 1 – Spring Seal (Insert)
 - 1 – O-Ring (Insert)
- a. Press Spring Seal (Insert) into groove on the Insert Bottom. Make sure spring is facing upwards.
 - b. Install Insert Top over Insert Bottom with the spring seal side going in first.
 - c. Lightly lubricate O-Ring groove now formed by the two insert parts. This lubrication is used to hold the O-Ring in place when it is being inserted into Pilot Base.
 - d. Place O-Ring (Insert) into groove.
 - e. Final Insert Assembly is shown in Figure 30.

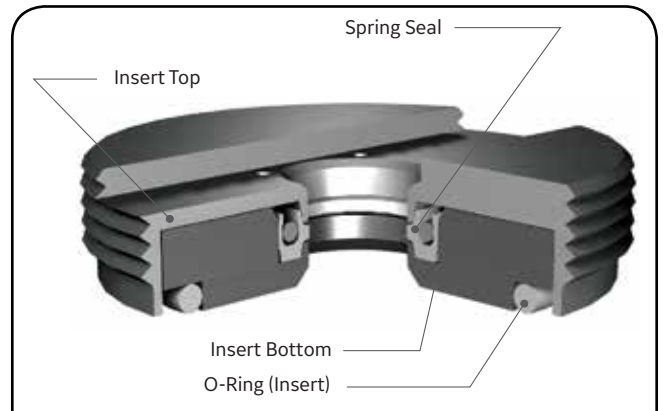


Figure 30: Insert Assembly

- f. Turn Insert Assembly over and thread into Pilot Base with T-handle groove wrench (Part #4995401 Figure 60). Tighten wrench tight. Make sure milled slot is facing up.
- g. Lubricate Main Piston stem and cycle Main Piston through Spring Seal (Insert) five times.

Note: For Dirty Service Option, please refer to assembly instructions included in the Dirty Service Option section (Section XXI.B.4).

4. Install O-Ring (Top Plate) into groove on top of Pilot Base.

Note: For Dirty Service Option, O-Ring (Top Plate) is installed into groove on top of the Dirty Service Insert.

- a. Lubricate the Spring Seal (Main Piston) and Top Plate gland. Install the Spring Seal (Main Piston) into Top Plate. The spring should be oriented as shown in Figure 31 or 32.

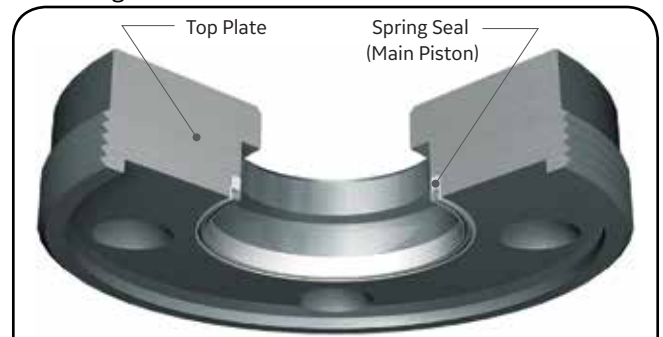


Figure 31: Top Plate (39PV07)

- b. Lubricate Main Piston before installing. Install the Main Piston into the Top Plate with the Spring Washer bearing point going in first. Be careful not to damage the Spring Seal (Main Piston).

5. Install Main Piston / Top Plate Assembly into Pilot

XVIII. Reassembly of Pilot Valve (Contd.)



Figure 32: Top Plate (39PV37)

Base by inserting small diameter end of Main Piston through Insert Assembly.

Note: For Dirty Service Option, install Main Piston / Top Plate Assembly into Dirty Service Insert instead of Pilot Base.

6. Insert the four Cap Screws (Top Plate) through the Top Plate and thread into the Pilot Base. Tighten to 25 ± 2 ft-lbs (34 ± 2.7 N-m).
 - a. If removed, thread Compression Screw Lock Nut clockwise onto Compression Screw.
7. Thread Compression Screw into top of Bonnet until the bearing point begins to protrude through Bonnet.
8. Place Spring Washers on the ends of the Spring. There is not a top or bottom Spring Washer unless the Lifting Lever option is installed.
9. If pilot has Lifting Lever Option:
 - a. Place Spring over Lifting Stem and place on Bottom Spring Washer.
 - b. Place Top Spring Washer on top of Spring and then place the entire assembly on top of Pilot Base assembly ensuring that the spherical radius located on the Bottom Spring Washer engages with spherical nose on Main Piston.
10. Install the Bonnet over the Spring and Spring Washer Assembly. Thread the Bonnet onto the Top Plate. Tighten wrench tight. Install and tighten Set Screw.
11. Turn Compression Screw clockwise until dimension has been reached that was noted during disassembly.
12. Tighten Compression Screw Lock Nut wrench tight.
13. For Lifting Lever Option, reinstall Release Nut and Release Lock Nut onto Lifting Stem. Turn clockwise until it matches the dimension noted during disassembly.
14. Install Filter Plug into Bonnet vent hole (if removed).
15. Install Pipe Plug (Pilot Valve) in port above vent hole (if removed).
16. Refer to Field Test Connection / Backflow Preventer Option (Section XXI.A) for reassembly of Field Test Connection.

C. Assembly of 39MV07

1. Making the Main Pilot.
2. Making the Adjuster Assembly,
This assembly consists of:
 - 1 – Adjuster Bottom
 - 1 – Adjuster Top
 - 1 – Spring Seal (Adjuster Top)
 - 1 – O-Ring (Adjuster Top)
 - 1 – O-Ring (Adjuster Bottom)
 - a. Check the Adjuster Top for burrs at the spring seal lead in chamfer. Remove any burrs using a polishing cloth.
 - b. Install Spring Seal (Adjuster Top) into Adjuster Top using insertion tool as shown in Figure 59.
 - i. Lubricate Spring Seal (Adjuster Top) with silicone grease.
 - ii. Install Spring Seal (Adjuster Top) onto Plunger Cylinder with spring facing away from Plunger Cylinder.
 - iii. Insert Plunger into Plunger Cylinder until Plunger lightly contacts Spring Seal (Adjuster Top).
 - iv. Insert Funnel Tube, chamfer side first, over the Plunger and Spring Seal (Adjuster Top). Stop when Spring Seal (Adjuster Top) is about half way inside the Funnel Tube as shown in Figure 27.
 - v. Remove Plunger.
 - vi. Insert Funnel Tube Assembly into Adjuster Top until Funnel Tube contacts Spring Seal (Adjuster Top) gland.
 - viii. Push down on Plunger cylinder to insert Spring Seal (Adjuster Top) into Adjuster Top as shown in Figure 28.
 - viii. Remove Funnel Tube Assembly.
 - ix. Inspect Adjuster Top to make sure that Spring Seal (Adjuster Top) did not flare out during installation and that the Spring Seal (Adjuster Top) is oriented as shown in Figure 29.
 - c. Thread Adjuster Top clockwise onto Adjuster bottom and torque to 27 ± 2 ft-lbs (37 ± 2.7 N-m).

XVIII. Reassembly of Pilot Valve (Contd.)

- d. Lubricate Main Piston stem and cycle Main Piston through Spring Seal (Adjuster Top) five times.

Note: Do not install adjuster assembly into Pilot Base with O-Rings installed without wrench tightening Adjuster Top to Adjuster Bottom together. Adjuster Top can get stuck in Pilot Base if Adjuster Top is not tighten properly.

- e. Install O-Ring (Adjuster Top) into groove on Adjuster Top.
- f. Install O-Ring (Adjuster Bottom) into groove on Adjuster Bottom. Install from the opposite end of the square wrenching flats.
- g. Lightly lubricate both external O-Rings on Adjuster Assembly. Install Adjuster Assembly into Pilot Base with the Adjuster Top going in first. Rotate the assembly clockwise during installation until the threads are engaged. This helps the O-Rings get by chamfers and holes.
- h. Continue to turn Adjuster Assembly clockwise into Pilot Base until it stops.
- i. Turn Adjuster Assembly counterclockwise the number of flats that was recorded in Disassembly Instructions (Section XVI.B), step 16.
- j. Thread the Adjuster Lock Nut clockwise onto the Adjuster Assembly hand tight.
- k. Thread Adjuster Cap clockwise onto Adjuster Assembly hand tight.

Note: Make sure Adjuster Cap and Adjuster Lock Nut threads freely on Adjuster Bottom. Adjuster Assembly may be inadvertently rotated if these two parts do not fit loosely.

3. The Insert Assembly of the pilot consists of:

- 1 – Insert Top
- 1 – Insert Bottom
- 1 – Spring Seal (Insert)
- 1 – O-Ring (Insert)
- a. Press Spring Seal (Insert) into groove on the Insert Bottom. Make sure spring is facing upwards.
- b. Install Insert Top over Insert Bottom with the spring seal side going in first.
- c. Lightly lubricate O-Ring groove now formed by the two insert parts. This lubrication is used to hold the O-Ring in place when it is being inserted into Pilot Base.
- d. Place O-Ring (Insert) into groove.
- e. Final Insert Assembly is shown in Figure 30.
- f. Turn Insert Assembly over and thread into Pilot Base with T-handle groove wrench (Part #4995401, Figure 60). Tighten wrench tight. Make sure milled slot is facing up.

- g. Lubricate Main Piston stem and cycle Main Piston through Spring Seal (Insert) five times.

Note: For Dirty Service Option, please refer to assembly instructions included in the Dirty Service Option section.

4. Install O-Ring (Top Plate) into groove on top of Pilot Base.

Note: For Dirty Service Option, O-Ring (Top Plate) is installed into groove on top of the Dirty Service Insert.

- a. Lubricate the Spring Seal (Main Piston) and Top Plate gland. Install the Spring Seal (Main Piston) into Top Plate. The spring should be oriented as shown in Figure 31.
- b. Lubricate Main Piston before installing. Install the Main Piston into the Top Plate with the Spring Washer bearing point going in first. Be careful not to damage the Spring Seal (Main Piston).

5. Install Main Piston / Top Plate Assembly into Pilot Base by inserting small diameter end of Main Piston through Insert Assembly.

Note: For Dirty Service Option, install Main Piston / Top Plate Assembly into Dirty Service Insert instead of Pilot Base.

6. Insert the four Cap Screws (Top Plate) through the Top Plate and thread into the Pilot Base. Tighten to 25 ± 2 ft-lbs (34 ± 2.7 N-m).

Note: If removed, thread Compression Screw Lock Nut clockwise onto Compression Screw.

7. Thread Compression Screw Lock Nut clockwise onto Compression Screw.

8. Thread Compression Screw into top of Bonnet until the bearing point begins to protrude through Bonnet.

9. Place Spring Washers on the ends of the Spring. There is not a top or bottom Spring Washer unless the Lifting Lever option is installed.

10. If pilot has Lifting Lever Option:

- a. Place Spring over Lifting Stem and place on Bottom Spring Washer.
- b. Place Top Spring Washer on top of Spring and then place the entire assembly on top of Pilot Base assembly ensuring that the spherical radius located on the Bottom Spring Washer engages with spherical nose on Main Piston.

11. Install the Bonnet over the Spring and Spring Washer Assembly. Thread the Bonnet onto the Top Plate. Tighten wrench tight. Install and tighten Set Screw.

12. Turn Compression Screw clockwise until dimension has been reached that was noted during disassembly.

13. Tighten Compression Screw Lock Nut wrench tight.

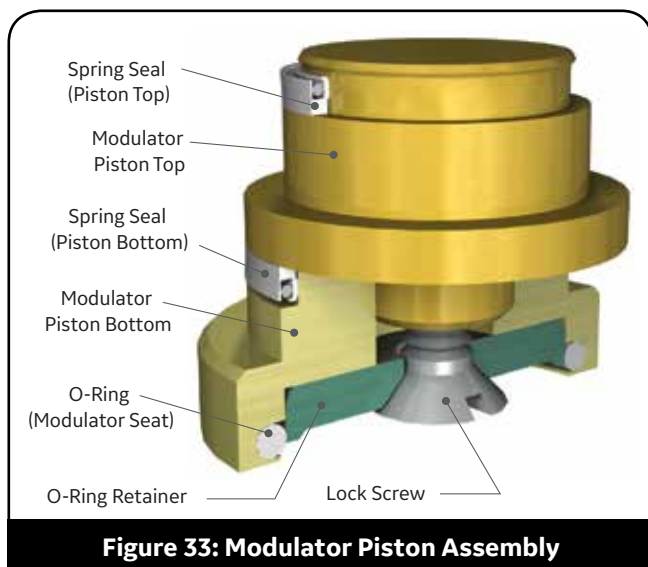
XVIII. Reassembly of Pilot Valve (Contd.)

14. For Lifting Lever Option, reinstall Release Nut and Release Lock Nut onto Lifting Stem. Turn clockwise until it matches the dimension noted during disassembly.
 - a. Install Filter Plug into Bonnet vent hole (if removed).
 15. Install Pipe Plug (Pilot Valve) in port above vent hole.
 16. Refer to Field Test Connection / Backflow Preventer Option for reassembly of Field Test Connection
 17. Making The Modulator Piston Assembly:
 - a. Install Spring Seal (Piston Top) into groove on Modulator Piston Top. Be sure to have the spring in the seal facing up.
 - b. Install O-Ring (Modulator Seat) into groove on Modulator Piston Bottom.
 - c. Turn Modulator Piston Bottom over and place O-Ring (Modulator Piston Bottom) into inner groove.
 - d. Install Spring Seal (Piston Bottom) onto Modulator Piston Bottom in outer groove. Make sure spring is facing down.
 - e. Insert Modulator Piston Top into Modulator Piston Bottom through the side with the O-Ring (Modulator Piston Bottom) and the Spring Seal (Piston Bottom).
 - f. Turn assembly over and install O-Ring Retainer. The chamfered outside diameter goes in first.
 - g. Thread Lock Screw through the O-Ring Retainer into Modulator Piston Top. Tighten 40 ± 5 in-lbs (4.5 ± 0.6 N-m).
 - h. Final Modulator Piston Assembly is shown in Figure 33.
 15. Lubricate Spring Seals before inserting into Modulator Base.
16. Insert Modulator Piston Assembly into Modulator Base with the Modulator Piston Top going in first. Push piston in with thumbs until it stops. There will be some resistance due to the Spring Seals compressing to fit into the bore of the Modulator Base. If necessary for installation, insert the proper wrench into the Lock Screw. Lightly tapping the wrench with a hammer will force the Modulator Piston Assembly into the Modulator base.
 17. Install both O-Rings (Modulator Stop) into grooves on Modulator Piston Stop.
 18. Insert Modulator Stop into Modulator Base with the seat going in first. Make sure the side hole in the Modulator Stop is facing towards the flat side of the Modulator Base.
 19. Thread the Cap Screws (Modulator) through the Modulator Stop into the Modulator Base. Tighten to 365 ± 30 in-lbs (41.2 ± 3.4 N-m).
 20. Do not install Modulator Assembly at this time.

D. Assembly of 39MV22/72

Making the Main Pilot.

1. Making the Main Piston Assembly
 - a. Insert the Piston Nose into the recess at the threaded end of the Piston Top.
 - b. Slide the Piston Nut over the Piston Nose and thread it onto the Piston Top. Place the assembly in a vice with soft jaws and torque the Piston Nut to 30 ± 3 ft-lbs (40.6 ± 4 N-m).
 - c. Install the Set Screw into the threaded hole of the Piston Nut and hand tighten.
2. Making the Adjuster Assembly,
This assembly consists of:
 - 1 – Adjuster Bottom
 - 1 – Adjuster Top
 - 1 – Balance Seal Adaptor
 - 1 – Spring Seal (Adjuster Top)
 - 1 – Spring Seal (Adjuster Bottom)
 - 1 – O-Ring (Adjuster Top)
 - 1 – O-Ring (Adjuster Bottom)
 - a. Check the Adjuster Top for burrs at the spring seal lead in chamfer. Remove any burrs using a polishing cloth.
 - b. Install Spring Seal (Adjuster Top) into Adjuster Top using insertion tool as shown in Figure 59.



XVIII. Reassembly of Pilot Valve (Contd.)

- i. Lubricate Spring Seal (Adjuster Top) with silicone grease.
 - ii. Install Spring Seal (Adjuster Top) onto Plunger Cylinder with spring facing away from Plunger Cylinder.
 - iii. Insert Plunger into Plunger Cylinder until Plunger lightly contacts Spring Seal (Adjuster Top).
 - iv. Insert Funnel Tube, chamfer side first, over the Plunger and Spring Seal (Adjuster Top). Stop when Spring Seal (Adjuster Top) is about half way inside the Funnel Tube as shown in Figure 27.
 - v. Remove Plunger.
 - vi. Insert Funnel Tube Assembly into Adjuster Top until Funnel Tube contacts Spring Seal (Adjuster Top) gland.
 - vii. Push down on Plunger cylinder to insert Spring Seal (Adjuster Top) into Adjuster Top as shown in Figure 28.
 - viii. Remove Funnel Tube Assembly.
 - ix. Inspect Adjuster Top to make sure that Spring Seal (Adjuster Top) did not flare out during installation and that the Spring Seal (Adjuster Top) is oriented as shown in Figure 29.
- c. Install the Spring Seal (Adjuster Bottom) onto the Adjuster Bottom with spring side down as shown in Figure 29.
 - d. Place the Balance Seal Adaptor onto the Spring Seal (Adjuster Bottom) with flat side up.
 - e. Thread Adjuster Top clockwise onto Adjuster bottom and torque to 27 ± 2 ft-lbs (37 ± 2.7 N-m).
 - f. Lubricate Main Piston stem and cycle Main Piston through Spring Seal (Adjuster Top) and Spring Seal (Vent Seal Adaptor) five times.

Note: Do not install adjuster assembly into Pilot Base with O-Rings installed without wrench tightening Adjuster Top to Adjuster Bottom together. Adjuster Top can get stuck in Pilot Base if Adjuster Top is not tightened properly.

- g. Install O-Ring (Adjuster Top) into groove on Adjuster Top.
- h. Install O-Ring (Adjuster Bottom) into groove on Adjuster Bottom. Install from the opposite end of the square.
- i. Lightly lubricate both external O-Rings on Adjuster Assembly. Install Adjuster Assembly into Pilot Base with the Adjuster Top going in first. Rotate the assembly clockwise during installation until the threads are engaged. This helps the O-Rings get by chamfers and holes.

- j. Continue to turn Adjuster Assembly clockwise into Pilot Base until it stops.
- k. Turn Adjuster Assembly counterclockwise the number of flats that was recorded in Disassembly Instructions (Section XVI.C), step 16.
- l. Thread the Adjuster Lock Nut clockwise onto the Adjuster Assembly hand tight.
- m. Thread Adjuster Cap clockwise onto Adjuster Assembly hand tight.

Note: Make sure Adjuster Cap and Adjuster Lock Nut threads freely on Adjuster Bottom. Adjuster Assembly may be inadvertently rotated if these two parts do not fit loosely.

3. The Insert Assembly of the pilot consists of:
 - 1 – Insert Top
 - 1 – Insert Bottom
 - 1 – Spring Seal (Insert)
 - 1 – O-Ring (Insert)
 - a. Press Spring Seal (Insert) into groove on the Insert Bottom. Make sure spring is facing upwards.
 - b. Install Insert Top over Insert Bottom with the spring seal side going in first.
 - c. Lightly lubricate O-Ring groove now formed by the two insert parts. This lubrication is used to hold the O-Ring in place when it is being inserted into Pilot Base.
 - d. Place O-Ring (Insert) into groove.
 - e. Final Insert Assembly is shown in Figure 30.
 - f. Turn Insert Assembly over and thread into Pilot Base with T-handle groove wrench (Part #4995401 Figure 60). Tighten wrench tight. Make sure milled slot is facing up.
 - g. Lubricate Main Piston stem and cycle Main Piston through Spring Seal (Insert) five times.

Note: For Dirty Service Option, please refer to Dirty Service Option section (Section XXI.B) for assembly instructions.

4. Install O-Ring (Top Plate) into groove on top of Pilot Base.

Note: For Dirty Service Option, O-Ring (Top Plate) is installed into groove on top of the Dirty Service Insert.

- a. 39MV22
 - i. Lubricate the Spring Seal (Main Piston) and Top Plate gland. Install the Spring Seal (Main Piston) into Top Plate. The spring should be oriented as shown in Figure 32.
 - ii. Lubricate Main Piston before installing. Install the Main Piston into the Top Plate with the Spring Washer bearing point going in first. Be careful

XVIII. Reassembly of Pilot Valve (Contd.)

not to damage the Spring Seal (Main Piston).

- b. 39MV72
 - i. Lubricate the backup rings. Back-up Ring (Upper) should be installed first with angle surface facing you when installed.
 - ii. Back-up Ring (Lower) should be installed second with angle facing away from you when installed.
 - iii. Lubricate Spring Seal (Main Piston) and Top Plate gland. Install Spring Seal (Main Piston) into the Top Plate. The spring and back-up rings should be oriented as shown in Figure 32.
 - iv. Lubricate Main Piston Assembly before installing. Install Main Piston into the Top Plate with Spring Washer bearing point going in first. Be careful not to damage Spring Seal (Main Piston).
5. Install Main Piston / Top Plate Assembly into Pilot Base by inserting small diameter end of Main Piston through Insert Assembly.

Note: For Dirty Service Option, install Main Piston / Top Plate Assembly into Dirty Service Insert instead of Pilot Base.
6. Insert the four Cap Screws (Top Plate) through the Top Plate and thread into the Pilot Base. Tighten to 25 ± 2 ft-lbs (34 ± 2.7 N-m).
7. If removed, thread Compression Screw Lock Nut clockwise onto Compression Screw.
8. Thread Compression Screw into top of Bonnet until the bearing point begins to protrude through Bonnet.
9. Place Spring Washers on the ends of the Spring. There is not a top or bottom Spring Washer unless the Lifting Lever option is installed.
10. If pilot has Lifting Lever Option:
 - a. Place Spring over Lifting Stem and place on Bottom Spring Washer.
 - b. Place Top Spring Washer on top of Spring and then place the entire assembly on top of Pilot Base assembly ensuring that the spherical radius located on the Bottom Spring Washer engages with spherical nose on Main Piston.
10. Install the Bonnet over the Spring and Spring Washer Assembly. Thread the Bonnet onto the Top Plate. Tighten wrench tight. Install and tighten Set Screw.
11. Turn Compression Screw clockwise until dimension has been reached that was noted during disassembly.
12. Tighten Compression Screw Lock Nut wrench tight.
13. For Lifting Lever Option, reinstall Release Nut and Release Lock Nut onto Lifting Stem. Turn clockwise until it matches the dimension noted during disassembly.
14. Install Filter Plug into Bonnet vent hole (if removed).
15. Install Pipe Plug (Pilot Valve) in port above vent hole (if removed).
16. Refer to Field Test Connection / Backflow Preventer Option (Section XXI.A) for reassembly of Field Test Connection.

XIX. Setting and Testing

A. 39PV07/37



Figure 34: 39PV07/37

1. Attach pilot to main valve using two Socket Head Cap Screws (Bracket).
2. Install the .375" (9.53 mm) O.D. tubes (Refer to Table 12 for sizing of tubing) into the fittings for the inlet and dome ports. Make sure the tube ends are fully inserted before torquing. Begin torquing the fitting, about midway down, verify that Swagelok Gap Inspection Gauge (Swagelok P/N MS-IG-468) will go. Continue to torque down fitting until Swagelok Gap Inspection Gauge will not go. After torquing, remove to assure the ferrule is in good contact with the tubing. Refer to Table 11 and Figure 35 to determine if ferrule has seated itself properly. Reinstall the tubing.

Table 11: Ferrule Wall Thickness		
Pressure Class	Wall Thickness (min.)	
	in.	mm
150# to 900#	.035	0.89
1500#	.049	1.24
2500#	.065	1.65

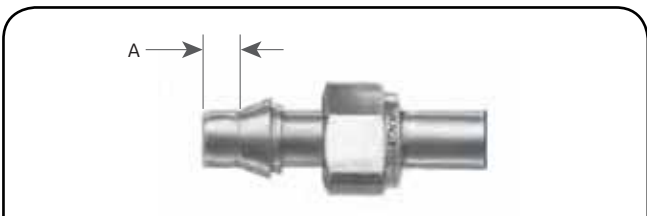


Figure 35: Tubing Dimensions

Table 12: Tubing Dimensions			
Tubing Diameter		Tubing Length (A)	
in.	mm	in.	mm
.250	6.35	.190	4.83
.375	9.53	.250	6.35
.500	12.70	.340	8.64

3. The vent port of the pilot valve is vented to atmosphere in standard configuration.
4. Final standard configuration for a 39PV07 or 39PV37 without any options is shown in Figure 34.

B. 39MV07, 39MV22/72

1. Attach Pilot to Main Valve using two Socket Head Cap Screws (Bracket).
2. Install the tubes into the fittings for the inlet and dome ports. Make sure the tube ends are fully inserted before torquing. Begin torquing the fitting, about midway down, verify that Swagelok Gap Inspection Gauge (Swagelok P/N MS-IG-468) will go. Continue to torque down fitting until Swagelok Gap Inspection Gauge will not go. After torquing, remove to assure the ferrule is in good contact with the tubing. Reinstall the tubing.
3. Install tubing to connect the vent port of the Pilot to the outlet of the Main Valve in the standard configuration.
4. Final standard configuration for the modulation pilot valves without any options is shown in Figures 36 through 38.
5. Reasons for failure:



Figure 36: 39MV07

XIX. Setting and Testing (Contd.)



Figure 37: 39MV22



Figure 38: 39MV72

- a. Any leakage from Pilot at 4% below valve set pressure or 2 psig (0.14 barg), whichever is greater. The 39MV22 and 39MV72 may have 50 bubbles per minute at 5% below the set pressures at or above 2251 psig (155.2 barg) and none at pressures below 2250 psig (155.1 barg).
- b. Main Valve equipped with soft seats.
 - i. For Main Valve equipped with 39MV22 and 39MV72, no leakage (0 bpm) is acceptable at 5% below valve set pressure or 2 psig (0.14 barg), whichever is greater. For set pressures 2250 psig (155.10 barg) and above, 50 bpm is acceptable for both Pilot and Main Valve.

- ii. For all other valve types, no leakage (0 bpm) is acceptable at 4% below valve set pressure or 2 psig (0.14 psig), whichever is greater.
- c. Main Valve equipped with metal seats and air as test media.
 - i. An initial leakage test of the Main Valve shall be made using a piece of wet paper placed over the outlet of the valve for one minute with pressure held at 4% below valve set pressure or 2 psig (0.14 barg), whichever is greater.
 - ii. If leakage from Main Valve is indicated by a bulging of the wet paper, the standard test fixture (as described in c.iii) shall be installed on the outlet flange to determine the extent of the leakage. The test fixture is to be connected to the valve outlet in such a manner that no leakage may occur in the connection.
 - iii. Per API standard 527 (ANSI B147.1-72) a standard test fixture consists of a piece of tubing .313" (7.94 mm) O.D. x .032" (0.81 mm) wall, where one end is joined to an adaptor on the valve outlet and other end is immersed .5" (12.7 mm) below the surface of a reservoir of water.

C. Troubleshooting Leakage

1. To isolate leakage that may be coming from the pilot, disconnect the pilot vent line (if applicable) from the main base outlet and plug the main valve outlet connection. If wet paper still bulges, then leakage is occurring from main valve.
2. Leakage from main valve can come from either the main valve seat, nozzle seal or dome seal. To determine if the leakage is from either the main valve seat or nozzle seal, the outlet must be filled with water to above the seat line and checked for bubbles. If no bubbles are present, then leakage is coming from the dome seal.
3. The leakage rate shall be determined with the valve mounted vertically and using a standard test fixture as described in XIX.B.c.iii. The leakage rate in bubbles per minute shall be determined with pressure held at 4% below valve set pressure or 2 psig (0.14 barg), whichever is greater. The test pressure shall be applied for 1 minute for valves of inlet sizes through 2" (50.8 mm); 2 minutes for sizes 2.50" (63.5 mm), 3" (76.2 mm) & 4" (101.6 mm); 5 minutes for sizes 6" (152.4 mm) and 8" (203.2 mm).
4. The leakage rate in bubbles per minute shall not exceed the values in Table 13.

XIX. Setting and Testing (Contd.)

Table 13: Leakage Rate					
Set Pressure at 60°F (15.6°C)		Effective Orifice Sizes ≤ 0.307 in ² (1.981 cm ²)		Effective Orifice Sizes > 0.307 in ² (1.981 cm ²)	
		D & E Orifice Only		F Orifice & Larger	
		Approximate Leakage per 24 Hours		Approximate Leakage per 24 Hours	
psig	barg	Bubbles per minute	Standard Cubic Feet	Bubbles per minute	Standard Cubic Feet
15-1000	1.03-68.95	40	0.60	20	0.30
1500	103.42	60	0.90	30	0.45
2000	137.90	80	1.20	40	0.60
2500	172.37	100	1.50	50	0.75
3000	206.84	100	1.50	60	0.90
4000	275.79	100	1.50	80	1.20
5000	344.74	100	1.50	100	1.50
6000	413.69	100	1.50	100	1.50

- a. Main Valve equipped with metal seats and water as the test media.
 - i. No leakage shall be detected by sight or feel for one minute, when pressure is held at 4% below valve set pressure or 2 psig (0.14 barg), whichever is greater.
 - b. Media valve equipped with metal seats and steam as the test media.
 - i. Leak tightness shall be checked visually using a black background. There shall be no visual or audible leakage after the interior or the valve is allowed to dry after popping. The leak test pressure shall be when pressure is held at 4% below valve set pressure or 2 psig (0.14 barg), whichever is greater.
 - c. Blowdown is long (only consider if system is capable of flowing valve at 10% overpressure).
 - d. Set point cannot be adjusted to consistently release at ±2% of unit ticket set pressure or 2 psig (0.14 barg), whichever is greater.
5. Repeat set point verification tests 3 times.
- a. Inlet pressure ramp guidelines.
 - i. When set pressure is below or equal to 750 psig (51.7 barg), the inlet pressure ramp should not exceed 0.5 psig (0.03 barg), per second, when test pressure is within 90% of set pressure.
 - ii. When set pressure is above 750 psig (51.7 barg), the inlet pressure ramp should not exceed 1.0 psig (0.07 barg) per second, when test pressure is within 90% of set pressure.

- b. For the 39MV22 and 39MV72 pilots, venting will and must begin before the set point. The 39MV22 begins venting at 98% of set pressure and the 39MV72 begins venting at 97% of set pressure.
- c. Drop system to 90% of set pressure between cycles.
- d. The 3 tests should be within ±2% of unit ticket set pressure or 2 psig (0.14 barg), whichever is greater.
- e. If blowdown is being checked, the following guidelines are to be followed.

Note: Blowdown can be set and checked on the main valve only if the system can achieve 10% over pressure.

- i. 39PV model (gas/steam): Less than or equal to 5% or 3 psig (0.20 barg), whichever is greater.
- ii. 39PV model (liquid): Between 7% and 4%. If set pressure is less than 30 psig (2.1 barg), 3psig (0.20 barg), or less.
- iii. 39MV model (gas/steam): Less than or equal to 4% or 2 psig (0.14 barg), whichever is greater.
- iv. 39MV model (liquid): Between 7% and 4%. If set pressure is less than 30 psig (2.1 barg), 3 psig (0.20 barg), or less.

Note: Customer requirements may note a variation to the standard blowdown. Customers request takes priority.

6. If adjustments are necessary, adjust Compression Screw or Adjuster and retighten corresponding lock nut. Retest beginning at Step 5.
7. Increase pressure from 90% of set pressure to 4% below set pressure or 2 psig (0.14 barg), whichever is greater, and check all ports and connections for leakage on Pilot and Main Valve.
8. Backpressure testing for leakage
 - a. Backpressure is the pressure measured at the valve outlet, in pounds per square inch gage (psig or barg).
 - b. Backpressure tests are to be performed after adjustment of set pressure and blowdown on each valve designed for use in a closed system having an inlet size greater than 1" (24.5 mm) NPS.
 - c. The pressure, at which the valve is to be backpressure tested, shall be 30 psig (2.1 barg)(minimum) or system backpressure, whichever is higher. Air or nitrogen shall be used as the test medium for applying backpressure.
 - d. Backpressure tests are to be performed by applying pressure with air or nitrogen to the valve outlet. Leakage may be detected by application of soap solution, or equivalent, at points of possible leakage. Pressure is to be held constant at the test pressure while the valve is being examined for leakage.

Note: The letter designation BP designates backflow preventer.

XIX. Setting and Testing (Contd.)

2900 bellows, 3900-5-MS without backflow preventer backpressure test are to be performed by applying pressure with air or nitrogen to the valve inlet and valve outlet. The pressure being applied to the valve inlet should be equal to the pressure being applied to the valve outlet. Leakage may be detected by application of soap solution, or equivalent, at points of possible leakage. Pressure is to be held constant at the test pressure while the valve is being examined for leakage.

Note: The purpose of applying pressure to the valve inlet and outlet is to prevent the disc and disc holder from separating during the backpressure test.

- e. The following points shall be examined for leakage during backpressure testing:
 - i. Coverplate, inlet and outlet joints.
 - ii. All tube fittings and connections.
 - iii. Possible point of leakage on the pilot valve.

When testing steam valves, pressure is to be applied through field test connection equal to or greater than the back pressure. This is to simulate inlet pressure after valve is taken off of the steam test stand.

- f. Repair of valves which show leaks in backpressure testing may be attempted by tightening the joint involved to normal tightness, while the valve is in the testing area. If such procedure does not correct the leak, the valve is to be returned to the assembly department with a notation as to cause for rejection. The valve is to be examined for cause of failure.

D. Field Testing of POSRV Assembly

1. Field Test Connection (Figure 39):

A .250" (6.35 mm) FNPT field test connection is standard on all pilot valve types. This allows the stroking of the valve with an auxiliary media, e.g. air or nitrogen. An internal check valve is present in the field test connection isolating the inlet media from the test media and at the same time, allowing the valve to open normally in the event of a system overpressurization during a field test.

2. Pilot Valve Tester (Figure 40):

The pilot valve test indicator is available for the modulating and pop action pilot valves. The valve test indicator measures the set pressure of the pilot, while maintaining pressure on the main valve dome area; thereby, allowing only the pilot to actuate. The system shown below is available for remote or local testing.



Figure 40: Pilot Valve Tester

Ref. No.	Part
1	Shuttle Ball
2	O-Ring
3	Shuttle Base
4	Shuttle Plug
5	Tube Filter

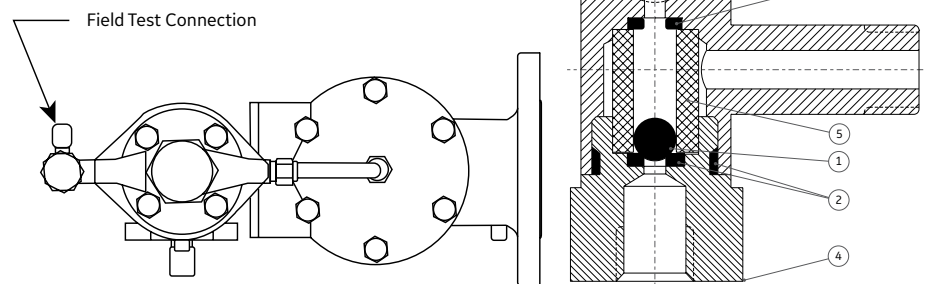
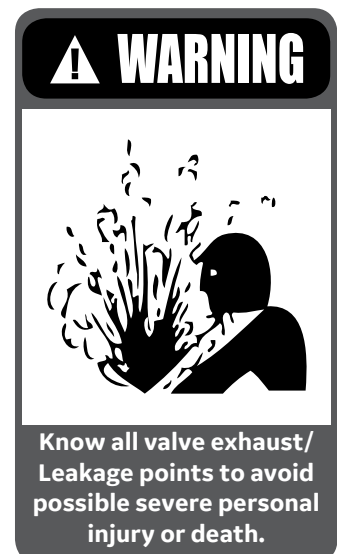


Figure 39: Field Test Connector

XX. Trouble Shooting

Table 14: Trouble Shooting Chart

Problem	Possible Cause	Corrective Action
Blowdown incorrect	A. Incorrect Adjuster Assembly setting	A. Re-set Adjuster Assembly (See Pilot Valve Setting)
Leakage around fittings	A. Fittings are not tightened or are cross threaded. B. Did not install Teflon tape or pipe sealant.	A. Re-install fittings correctly B. Re-install fittings with Teflon tape or pipe sealant.
Leakage under the Cover Plate when valve is open.	A. Cover Plate O-Ring is damaged. B. Cap Screws or Stud Nuts on Cover Plate are loose.	A. Disassemble valve and replace Cover Plate O-Ring. B. Tighten as required.
Main Valve leaks through the Seat	A. Damaged Seat O-Ring B. Damaged Metal Seat C. Metal Seat is not lapped in properly to Disc Holder D. Seat too wide	A. Disassemble valve and replace Seat O-Ring. B. Disassemble valve and lap Metal Disc and/or Nozzle. C. Disassemble Disc and Disc Holder to lap two together properly D. Recheck Tables 3 & 4
Main Valve leaks under the Nozzle Seat	A. Damaged Nozzle O-Ring	A. Disassemble Main Valve and replace damaged Nozzle O-Ring.
Pilot Valve is not opening at set pressure and Main Valve will not open	A. Wrong set pressure	A. Readjust the set pressure of the valve.
Main Valve does not close upon start up. P2 chamber does not load with system pressure.	A. Start-up procedures pressurize the valve too rapidly. B. Sensing Tube is installed upside down. C. Closed Filter D. Spring not installed.	A. Slowly increase the inlet pressure. B. Re-install Sensing Tube correctly. C. Clear or replace Filter. D. Install Spring.
Leakage through the Pilot Valve	A. Operating pressure too high B. O-Ring or Spring Seal degradation	A. Adjust operating pressure B. Disassemble and replace O-Ring or Spring Seals
Main Valve opens and allows the discharge media to flow back into the pressure vessel	A. Backpressure is greater than set pressure and forces the Main Disc up, and the media flows backward into the vessel. B. Discharging into a closed container or not enough capacity in the discharge system.	A. Install Backflow Preventer B. Install Backflow Preventer.



XXI. 3900 Series POSRV Options

A. Backflow Preventer

When the pilot operated safety relief valve is not vented directly to atmosphere, it is possible to build up backpressure in the discharge line. This is typical in situations where several valves manifold into a common discharge header. Should the discharge line pressure exceed the valve inlet pressure, it could cause the disc to lift and allow reverse flow through the main valve. This situation can be eliminated through the use of the Backflow Preventer.

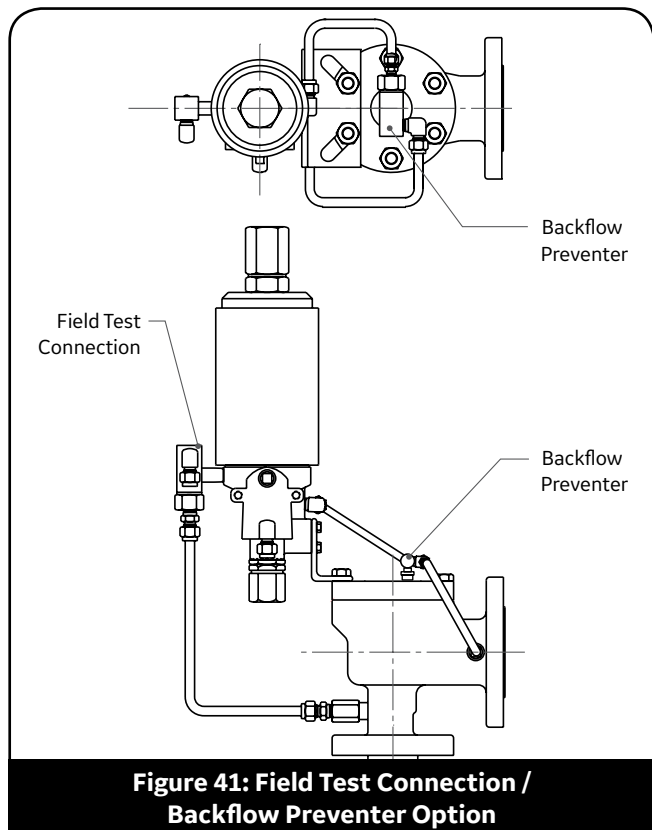


Figure 41: Field Test Connection / Backflow Preventer Option

Note: Item #23 in Figures 3, 4 and 5 is the same Field Test Connection shown here in Figure 41. Shuttle Base (23c) can be square or octagon bar stock.

A.1 Disassembly Instructions

1. Remove Shuttle Plug from Shuttle Base by unscrewing counterclockwise.
2. Remove Shuttle Ball, Tube Filter, and O-Rings and discard.

A.2 Cleaning

1. If required, clean parts to remove all rust, burrs, scale, organic matter, and loose particles. Parts are to be free of any oil or grease except for lubrication as specified in this instruction.
2. Cleaning agents used shall be such that effective cleaning is assured without injuring the surface finishes or material properties of the part.

3. Acceptable cleaning agents include demineralized water, nonphosphate detergent, acetone, and isopropyl alcohol. Parts must be blown dry or wiped dry after cleaning.
4. If you are using cleaning solvents, take precautions to protect yourself from potential danger from breathing fumes, chemical burns, or explosion. See the solvent's Material Safety Data Sheet for safe handling recommendations and equipment.
5. It is not recommended to "sand blast" internal parts as it can reduce the dimensions of the parts.

A.3 Parts Inspection

1. Shuttle Base: Galling or excessive wear on the threads. Check for any corrosion or pitting.
2. Shuttle Plug: Galling or excessive wear on the threads. Check for any corrosion or pitting.

A.4 Reassembly Instructions

Lubricate O-Rings with silicone grease BHGE P/N SP505.

1. Assembly of Field Test Connection / Backflow Preventer Assembly.
 - a. Insert one of the Small O-Rings into the Shuttle Base counter bore.
 - b. Insert the Tube Filter into the Shuttle Base.
 - c. Insert Shuttle Ball inside of Tube Filter.
 - d. Insert the other Small O-Ring into the Shuttle Plug counter bore. Install Larger O-Ring into groove located on OD of Shuttle Plug.
 - e. Thread Shuttle Plug into Shuttle Base, wrench tighten.

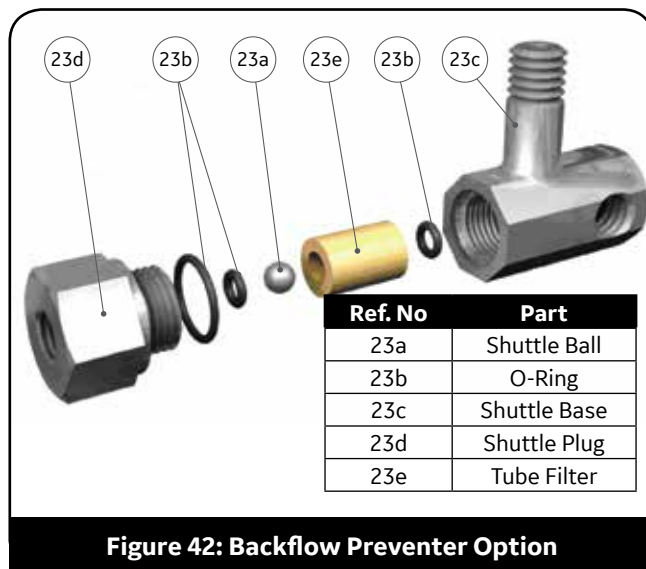


Figure 42: Backflow Preventer Option

XXI. 3900 Series POSRV Options (Contd.)

B. Dirty Service Option

Severe dirty service, precipitation and viscous fluid problems can be solved using the dirty service option offered on the 3900 POSRV. A dirty service option can be added to the standard pilot valve. The kit contains a 316 SS chamber, an isolation seal and an extended pilot piston. The module is positioned at the top of the pilot valve body and below the pilot valve bonnet. Crucial valve components such as the modulator, dome assembly, vent, and inlet seals never come in contact with the dirty system media. The process media pressure still controls the set pressure and blowdown of the POSRV.

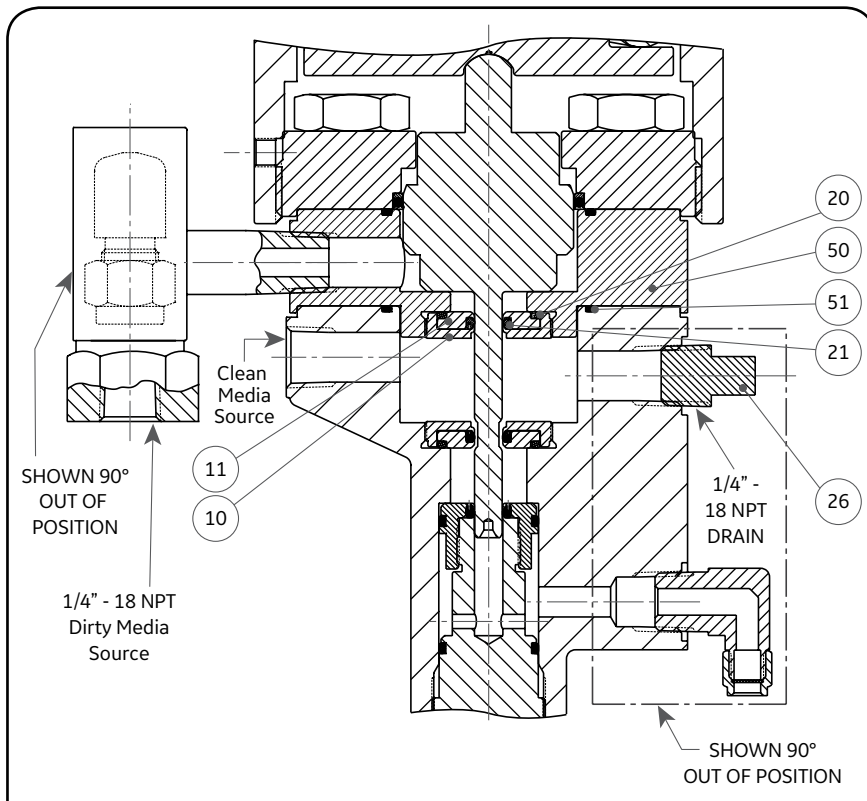


Figure 43: 39PV07/37 Dirty Service

Part No.	Nomenclature
1	Main Base
2	Adjuster Cap
3	Adjuster Top
10	Insert Top
11	Insert Bottom
12	Main Piston
14	Cap Screw (Top Plate)
16	O-Ring (Adjuster Top)
17	O-Ring (Insert)
18	O-Ring (Top Plate)
20	Spring Seal (Main Piston)
21	Spring Seal (Adjuster Top)
22	Spring Seal (Insert)
26	Pipe Plug (Pilot Valve)
29	Piston Retainer Nut
30	Set Screw (Piston)
31	Vent Seal (Adaptor)
32	Spring Seal (Vent Seal Adaptor)
50	Dirty Insert
51	Omni Plug
52	Breather Filer Vent

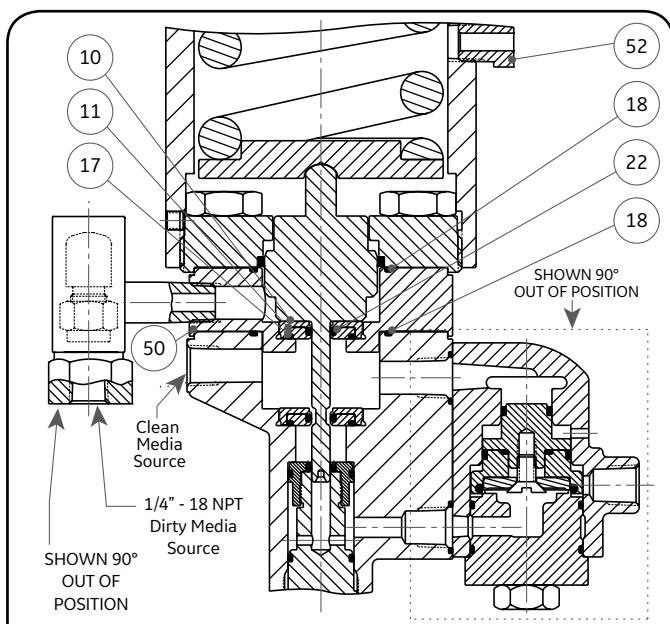


Figure 44: 39MV07 Dirty Service

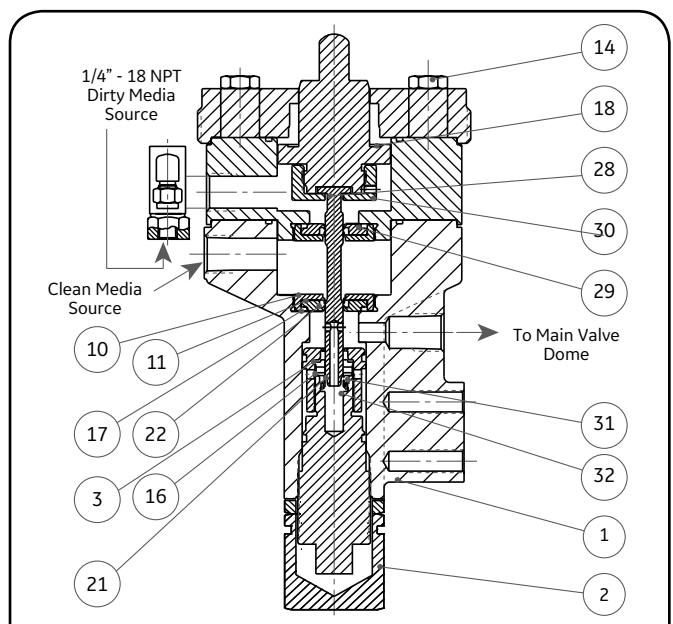


Figure 45: 39MV22/72 Dirty service

XXI. 3900 Series POSRV Options (Contd.)

B. Dirty Service Option (Contd.)

B.1 Disassembly Instructions

1. The Dirty Service Option consists of:
 - 1 – Insert Assembly
 - 1 – Dirty Service Insert
 - 1 – O-Ring (Dirty Service Insert)
 - 1 - Regulator
2. The Insert Assembly consists of:
 - 1 – Insert Top
 - 1 – Insert Bottom
 - 1 – Spring Seal (Insert)
 - 1 – O-Ring (Insert)
3. Remove Dirty Service Insert and discard O-Ring (Dirty Service Insert).
4. Remove Insert Assembly from the Dirty Service Insert with tool #4995401. Remove and discard the O-Ring (Insert) on the bottom of the Insert Assembly. Disassemble Insert Assembly by removing the Insert Bottom from the Insert Top. Discard Spring Seal (Insert).
5. Return to Disassembly Instructions for pilot (Section XVI).

B.2 Cleaning

1. Clean parts to remove all rust, burrs, scale, organic matter, and loose particles. Parts are to be free of any oil or grease except for lubrication as specified in this instruction.
2. Cleaning agents used shall be such that effective cleaning is assured without injuring the surface finishes or material properties of the part.
3. Acceptable cleaning agents include demineralized water, nonphosphate detergent, acetone, and isopropyl alcohol. Parts must be blown dry or wiped dry after cleaning.
4. If you are using cleaning solvents, take precautions to protect yourself from potential danger from breathing fumes, chemical burns, or explosion. See the solvent's Material Safety Data Sheet for safe handling recommendations and equipment.
5. Do not "sand blast" internal parts as it can reduce the dimensions of the parts.

B.3 Parts Inspection

1. Insert Top: Galling or excessive wear on the inside diameter that guides the Main Piston. Check for any corrosion or pitting. Also, check for galling of threads.
2. Insert Bottom: Galling or excessive wear on the inside diameter that guides the Main Piston. Check for any

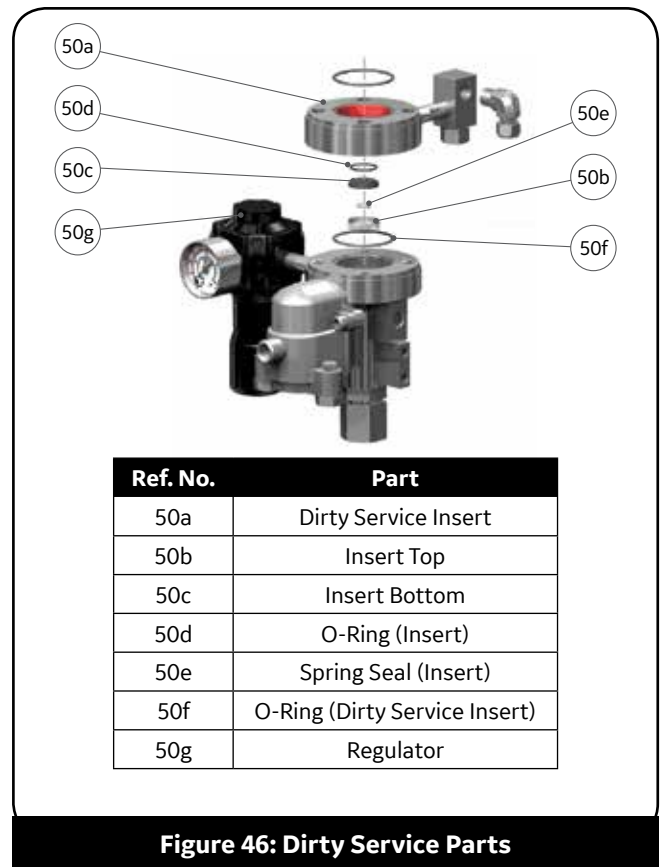


Figure 46: Dirty Service Parts
corrosion or pitting.

B.4 Reassembly Instructions

Making the Insert Assembly for Dirty Service Option:

1. Press Spring Seal (Insert) into groove on the Insert Bottom. Make sure spring is facing upwards.
2. Install Insert Top over Insert Bottom with the seal side going in first.
3. Lightly lubricate O-Ring groove now formed by the two insert parts. This lubrication is used to hold the O-Ring (Insert) in place when it is being inserted into Dirty Service Insert.
4. Place O-Ring (Insert) into groove.
5. The Insert Assembly is threaded into the Dirty Service Insert. Tighten assembly wrench tight. Make sure milled slot is facing up.
6. Install O-Ring (Top-Plate) onto groove in Pilot Base.
7. Install Dirty Service Insert Assembly on top of Pilot Base with inlet port facing opposite of vent port on Pilot Base. Then install Main Piston / Top Plate Assembly onto Base/ Dirty Insert by inserting small diameter end of Main Piston through Insert Assemblies.

XXI. 3900 Series POSRV Options (Contd.)

C. Dual Pilots

A dual pilot arrangement (Figure 47) is available for applications in which the pilot valve soft goods require monitoring and/or maintenance more often than the main valve. In this installation, the pilot valves may be alternated for maintenance, without bringing the system down.



Figure 47: Dual Pilots

ATTENTION!

When servicing dual pilots, procedures need to be in place to perform a tag out / lock out of pilots under pressure if they are in service.

D. Field Test Connection

A field test connection is standard on all pilot valve types. This allows the stroking of the valve with an auxiliary media, e.g. air or nitrogen. An internal check valve is present in the field test connection isolating the inlet media from the test media and at the same time, allowing the valve to open normally in the event of a system over pressurization during a field test. The test port connection is a .375" (9.53 mm) tube fitting equipped with a bug screen.

For all applications on air, water over 140°F (60 °C), or steam service, ASME Section VIII - Division 1 requires each pressure relief valve to have a lifting device such as a field test connection or a means of connecting or applying pressure to the pilot to verify that the moving parts essential to good

operation are free to move. (Reference UG 136(a)(3)). The lifting lever or field test connection may be omitted under Code Case 2203. All orders for pressure relief valves without levers or field test connection for steam, air and water over 140°F (60°C) must state specifically that the valves are being purchased per Code Case 2203. The purchaser is responsible for obtaining jurisdictional authorization for use of Code Case 2203.

E. Filter (Single, Dual, or High Capacity)



Figure 48: Sensing Line Filter

Filter options are available for dirty applications. These filters are installed in the pilot inlet sensing line. For the 39PV and 39MV, an optional sensing line filter is available (Figure 48). This filter has a 316 stainless steel body, Teflon® seals, and a 40-50 micron stainless steel filter element. Other high capacity filter options (Figure 49) include:

1. A carbon steel cadmium coated filter body with a 35 micron stainless steel element; and
2. An entirely stainless steel filter arrangement. These filters may be equipped with a manually operated needle valve which allows for purging the filtered material while the valve is in operation. All filter elements are stainless steel, and all filters, including carbon steel, conform to NACE Standard MR0103 and MR0175. A dual filter arrangement (Figure 50) is available for applications in which the customer is unsure of the filter maintenance requirements. In these cases, a preventive maintenance

XXI. 3900 Series POSRV Options (Contd.)

program may be developed by monitoring the filters, without taking the valve off line.



Figure 49: High Capacity Filter



Figure 50: Dual Filter

ATTENTION!

When servicing dual filters, procedures need to be in place to perform a tag out / lock out of pilots under pressure if they are in service.

F. Gag

A manual method of locking a pilot operated relief valve in the closed position for system hydrostatic test. 39MV72 limited to 4800 psig (330.9 barg) with gag option (Figure 51).

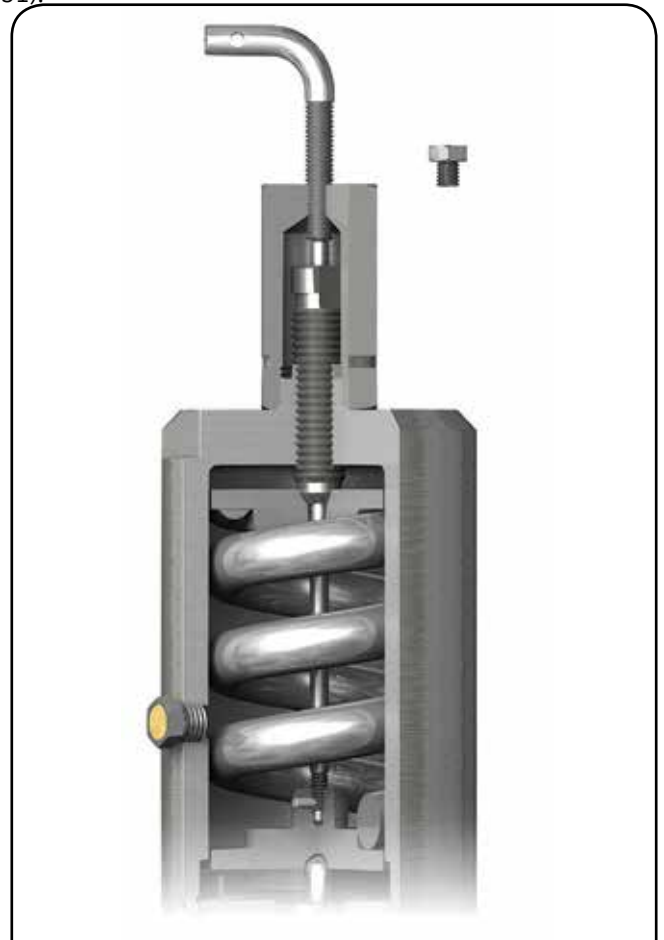


Figure 51: Gag

G. Heat Exchanger

This allows the temperature range for the 3900 POSRV with metal seats to be extended to -320°F to 650°F (-195.5°C to 343.3°C). Not available above 3750 psig (258.5 barg). When the heat exchanger is selected, the POSRV shall be piped so that the media enters the heat exchanger first to condition the media's temperature. Option(s) such as line filter, canister filter, 5-way manifold valve, pressure differential switch, pressure spike snubber, etc. shall be piped downstream of the heat exchanger

XXI. 3900 Series POSRV Options (Contd.)



(Figures 52 & 53).

H. Lifting Lever

This is an external, physical means of allowing the pilot valve to relieve dome pressure so that the main valve can open.

I. Manual, Electrical, or Pneumatic Blowdown Valve

(Figures 54 & 55)



An optional manual blowdown valve is available for relieving the pilot operated safety relief valve. Consult factory for applications requiring a pneumatic or electrical solenoid blowdown valve which may be connected to a distant location, such as an operator station, for remote actuation. The blowdown valve is ported directly to the main dome area, so that the media in the dome is vented when the blowdown valve is actuated, thus allowing the main valve to open.



XXI. 3900 Series POSRV Options (Contd.)

J. Pilot Valve Tester

The pilot valve test indicator (Figure 55) is available for the modulating and pop action pilot valves. The valve test indicator measures the set pressure of the pilot, while maintaining pressure on the main valve dome area; thereby, allowing only the pilot to actuate.

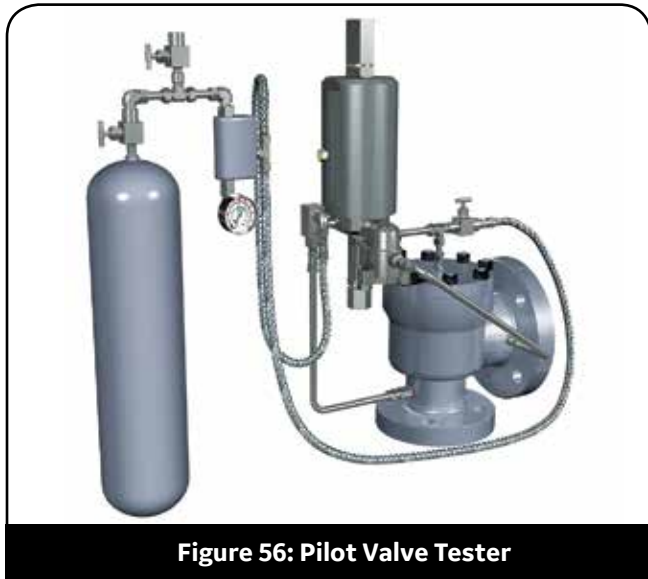


Figure 56: Pilot Valve Tester

K. Pressure Differential Switch

Electrical: A pressure differential switch (Figure 57) is available which may be wired to an operator station or some other remote location. The switch will provide a signal that indicates when the main valve is opening. The standard pressure differential switch is a single pole, double throw, rated at 5 amps and 30 volts DC with a NEMA 4 enclosure. (For other configurations, consult the factory.)

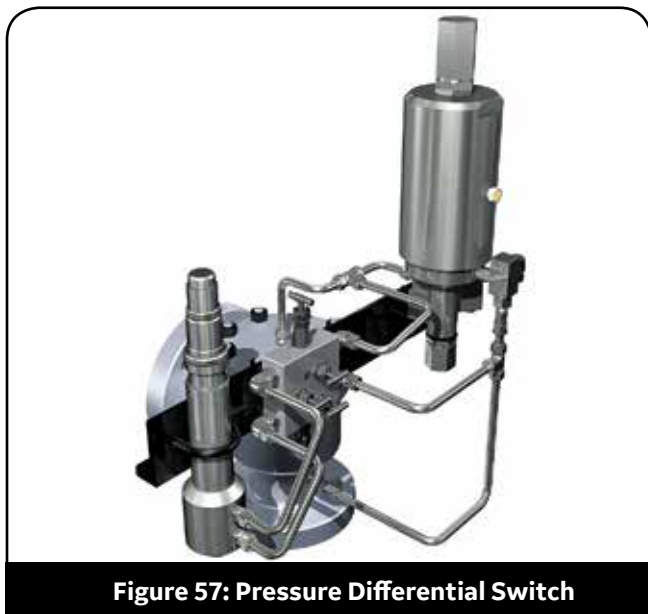


Figure 57: Pressure Differential Switch

Pneumatic: For applications that do not permit an electrical differential switch, an option is available to provide pneumatic signal to indicate when the main valve opens.

L. Pressure Spike Snubber

BHGE recommends the use of a pressure spike snubber (Figure 58) for all applications which may have high frequency pressure spikes. The pressure spike snubber is designed to dampen the pressure spikes which could cause unnecessary parts wear or premature valve opening.



Figure 58: Pressure Spike Snubber

M. Remote Pilot Mounting

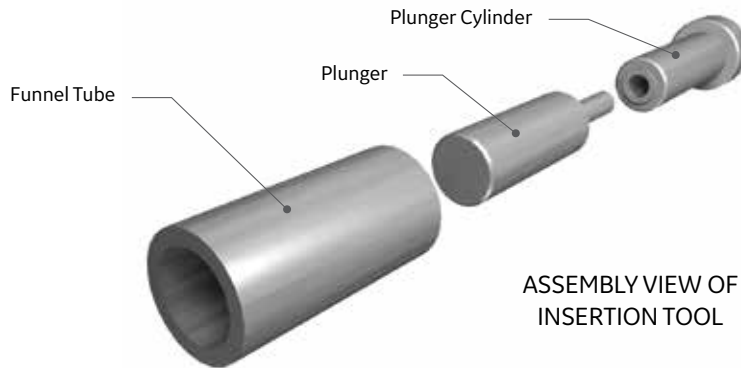
The 39PV and 39MV pilots can be mounted separately from the main valve. Remote pilot mounting will allow heating or cooling the pilot in case ambient conditions are outside the scope of the pilot. It will also enable the user to group several pilots together for control of ambient conditions in a smaller space. In addition, this promotes easier maintenance.

N. Remote Sensing

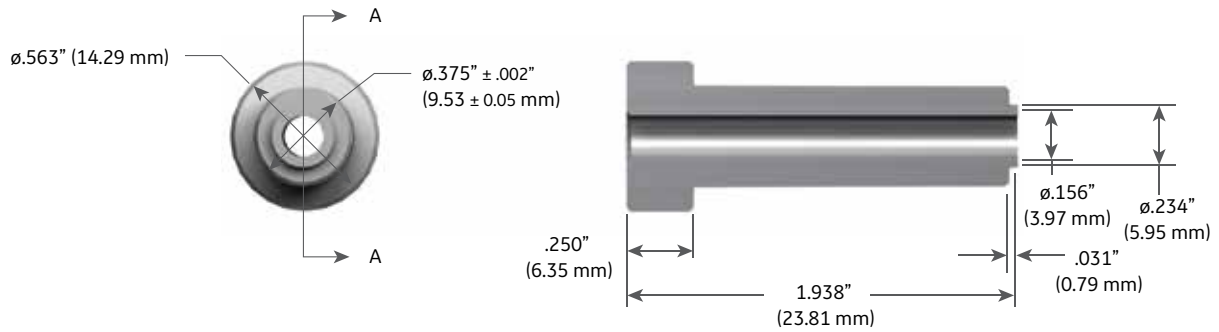
The pilot valve inlet may be piped to a location remote from the main valve. In this application, the customer may pipe the inlet sensing line to some location other than where the main valve is located and where the pressure will be relieved (for tubing size and maximum length, consult factory for recommendations).

XXII. Maintenance Tools and Supplies

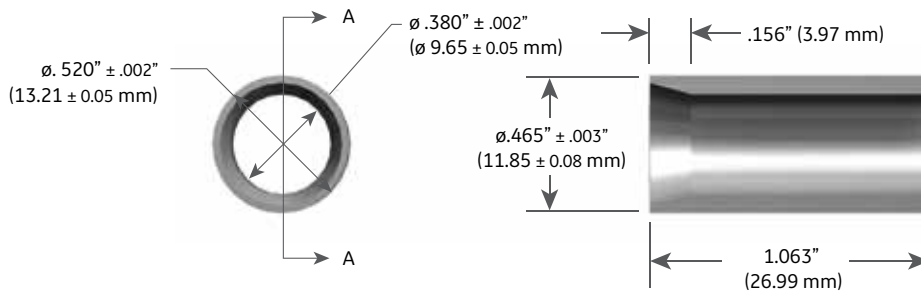
A. Adjuster Top Seal Insertion Tool



DETAIL OF PLUNGER CYLINDER



DETAIL OF FUNNEL TUBE



DETAIL OF PLUNGER

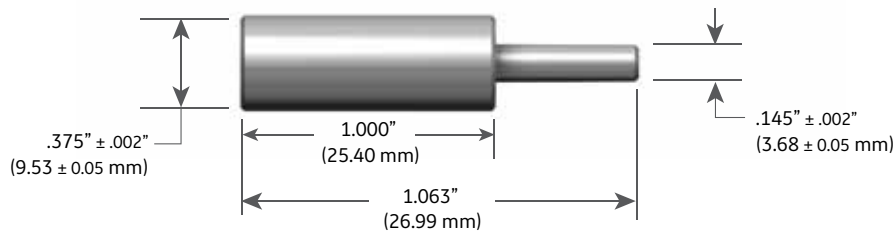


Figure 59: Adjuster Top Seal Insertion Tool

XXII. Maintenance Tools and Supplies (Contd.)

B. Insert Installation Tool

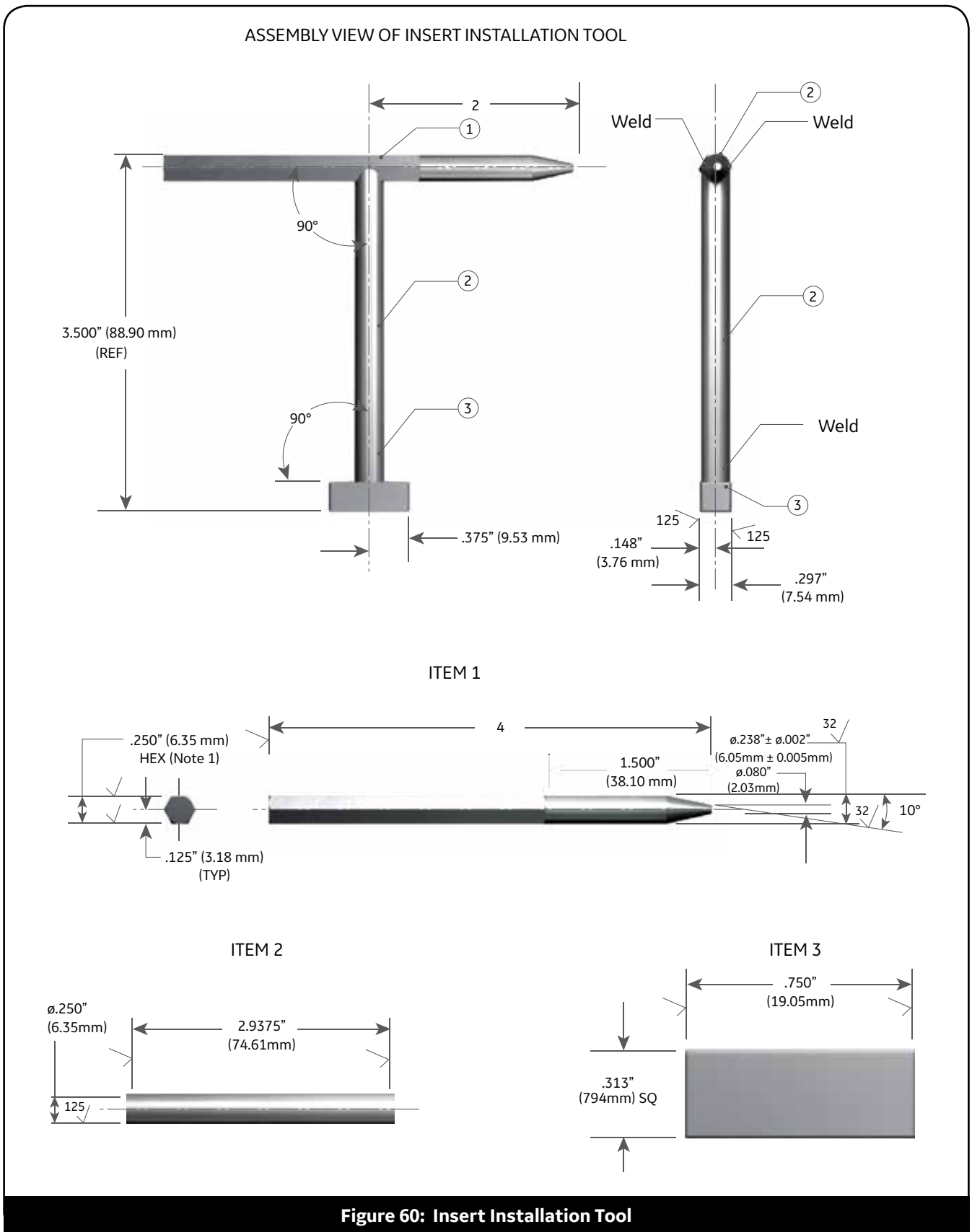


Figure 60: Insert Installation Tool

XXII. Maintenance Tools and Supplies (Contd.)

C. Main Valve Nozzle Wrench

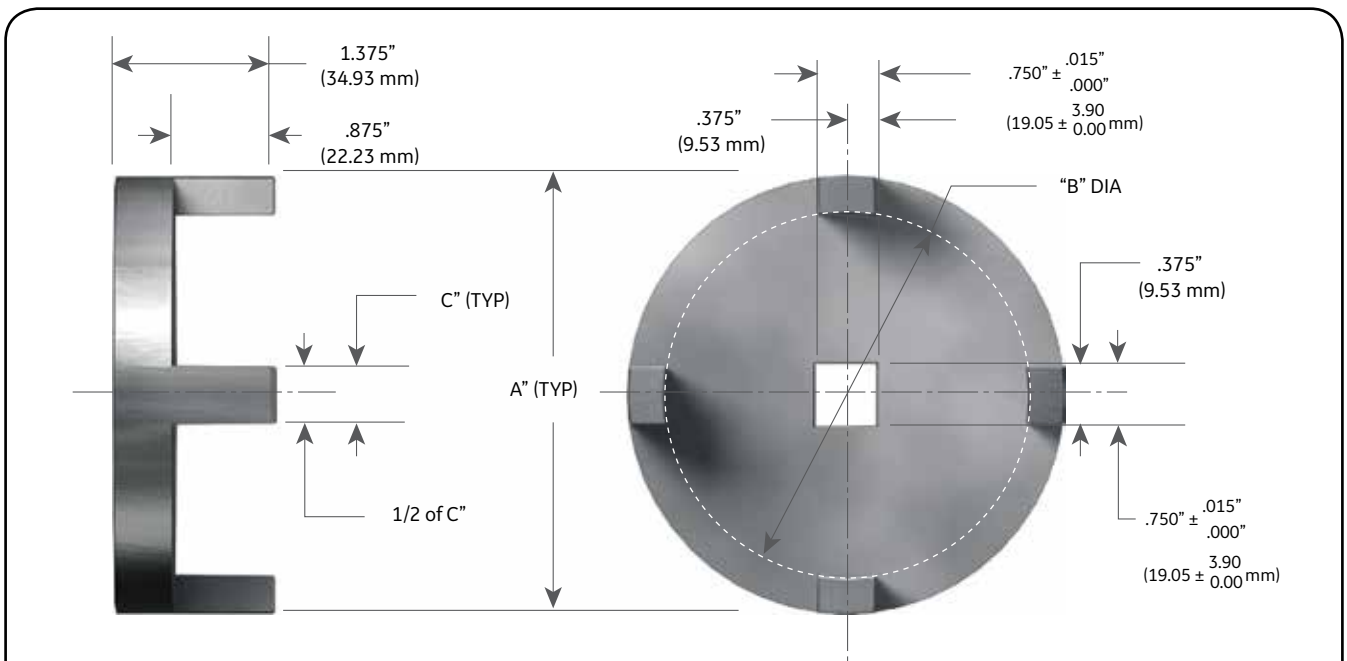


Figure 61: Main Valve Nozzle Wrench

Table 15: Main Valve Nozzle Wrench

Valve Size		Tool	Tool Dimension					
			A		B		C	
in.	mm		in.	mm	in.	mm	in.	mm
1.00	25.4	1.625" (41.28 mm) Socket Wrench	-	-	-	-	-	-
1.50, 2.00	38.1, 50.8	1.250" (31.75 mm) Socket Wrench	-	-	-	-	-	-
3.00	76.2	Spanner Wrench	3.870	98.30	3.250	82.55	.500	12.7
4.00	101.6		5.250	133.35	4.375	111.13	.750	19.05
6.00	152.4		7.500	190.50	6.500	165.10	1.000	25.4
8.00	203.2		8.500	215.90	6.500	165.10	1.000	25.4
6.00 x 8.00 x 8.00	152.4 x 203.2 x 203.2	.375" (9.53 mm) Hex Key (Allen) Wrench	-	-	-	-	-	-
8.00 x 10.00 x 10.00	203.2 x 254.0 x 254.0		-	-	-	-	-	-
10.00 x 10.00 x 10.00	254.0 x 254.0 x 254.0		-	-	-	-	-	-
10.00 x 14.00	254.0 x 355.6		-	-	-	-	-	-
12.00 x 16.00	304.8 x 406.4		-	-	-	-	-	-

XXII. Maintenance Tools and Supplies (Contd.)

D. Lapping Tools

The following tools are required for proper maintenance of Pilot Operated Safety Relief Valve metal seats, and may be purchased from BHGE.

1. Ring Lap: The ring lap is used for lapping the disc seat and finish lapping of the nozzle seat.
2. Lapping Plate: The lapping plate is used for reconditioning the ring lap. It may also be used for lapping the disc. One 11" (279.40 mm) diameter plate is required for the entire line of valves (Part No. 0439004).
3. Lapping Compound: Lapping compound is used as a cutting medium when lapping the valve seats, as specified in Table 16.

4. Drift Pins: Two drift pins are required for the removal of the disc from the disc holder. Refer Figure 62 and Table 17 for Drift Pin specifications.

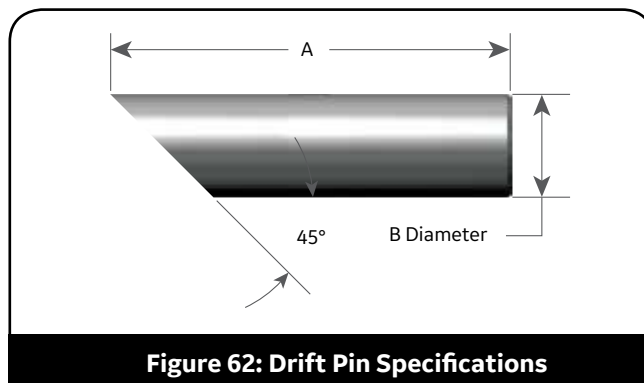


Table 16: Lapping Compound Types

Brand	Grade	Grit	Lapping Function	Size Container	Part No.
Clover	1A	320	General	4 oz	199-3
Clover	3A	500	Finishing	4 oz	199-4
Kwik-Ak-Shun	-	1000	Polishing	1 lb	199-11
				2 lb	199-12

Table 17: Drift Pin Types

Orifice	A		B		Part No.
	in.	mm	in.	mm	
D, E, F, G, H, J - 2" (50.8 mm), 1.5" (38.1 mm) FB	1.750	44.45	0.219	5.56	430401
J - 3" (76.2 mm), 2" (50.8 mm) FB, K, L-3" (76.2 mm), 8" (203.2 mm) FB, 10" (254.0 mm) FB	2.500	63.50	0.313	7.94	
3" (76.2 mm) FB, L, M, N, P, 4" (101.6 mm) FB, Q, R, 6" (152.4 mm) FB, T	2.500	63.50	0.438	11.11	

XXIII. Replacement Parts Planning

A. Basic Guidelines

The following guidelines should be of assistance in developing a meaningful replacement parts plan.

1. The total number of valves in service should be classified by size, type and temperature class.
2. The parts inventory should be classified by the tendency to require replacement.
Class I— Most frequently replaced
Class II— Less frequently replaced but critical in an emergency
3. Parts for the valve types covered by this manual are classified on Table 18. "Qty. parts" is the number of parts or sets which is recommended to achieve a desired need-probability, as it relates to the total number of valves in service by size and type. For example, a "Qty. parts" of 1 for "Valves in service" of 5 means that 1 part should be stocked for each 5 valves of the same type and size in service.
4. When ordering replacement parts, please specify in accordance with applicable nomenclature (see Figures 1 to 5). Be sure to state the size, type and serial number of the valve for which parts are required. When ordering pilot parts please state specific pilot type (39PV07, 37 etc.)

For ease of maintenance O-Ring kits are available for each main valve and pilot type. A stock of these kits should be kept on hand for maximum operating efficiency. See Tables 19, 20 and 21.

B. Identification and Ordering Essentials

When ordering service parts, please furnish the following information to ensure receiving the correct replacement parts.

Identify valve by the following nameplate data:

- a. Size
- b. Type
- c. Pressure/Temperature Class Rating
- d. Serial Numbers from both main valve and pilot valve

Example:

Main Valve:

3910R-3-CC-DA-RF-GS, TL1234M

Pilot Valve:

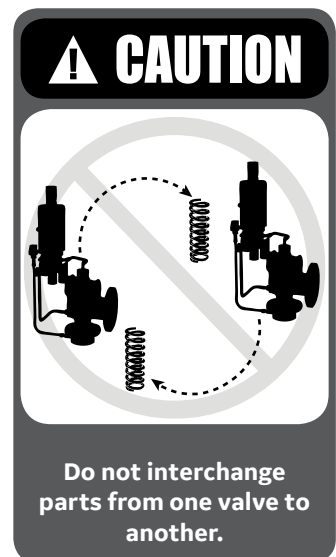
39PV07 -1-CC-B-GS, TL1234P

How to Verify Material of O-Rings and Seals

Kit coding indicates O-Ring and seals material.

Examples:

MORK-60T	T = Teflon®
	B=Buna-N
PORKF-34E	E = Ethylene/Propylene
PORKF-32V	V = Viton
	K = Kalrez



XXIII. Replacement Parts Planning (Contd.)

C. Positive Identification of Main Valve and Pilot Valve Combinations

POSRV's shipped direct from the factory to the end user probably have main valves and pilot valves with identical serial numbers (S/N's). Those shipped unconnected to the Green Tag network may have main valves and pilot valves with different S/N's. During service and repair, the following inspection steps will ensure the proper match of main valves to pilot valves:

1. Record main valve and pilot valve S/N's of original POSRV's in plant records.
2. Inspect S/N's for agreement with Step 1, after any disassembly involving removal of pilot valve from main valve.
3. Make sure the set pressures of the main valve and pilot valve are identical.

4. Check O-Ring and Seals Kit material code to ensure they are the same for main valve and pilot valve.

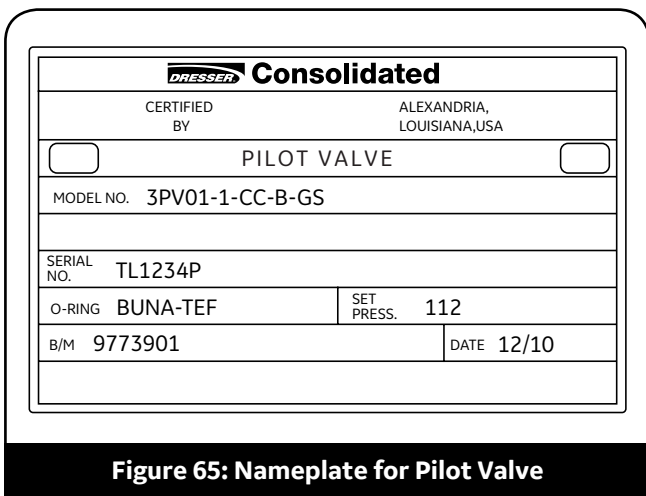
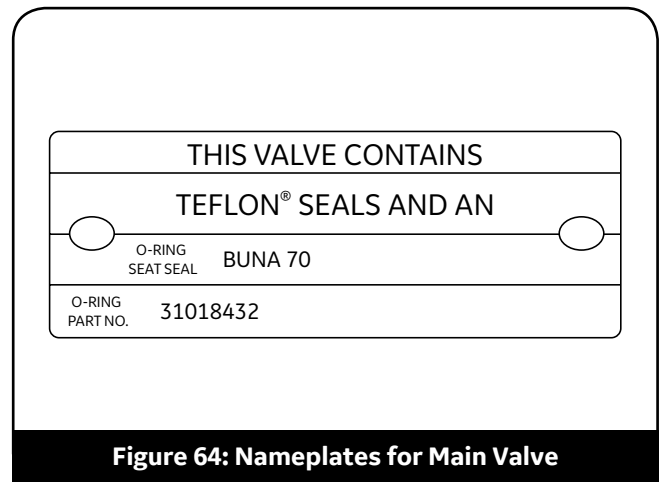
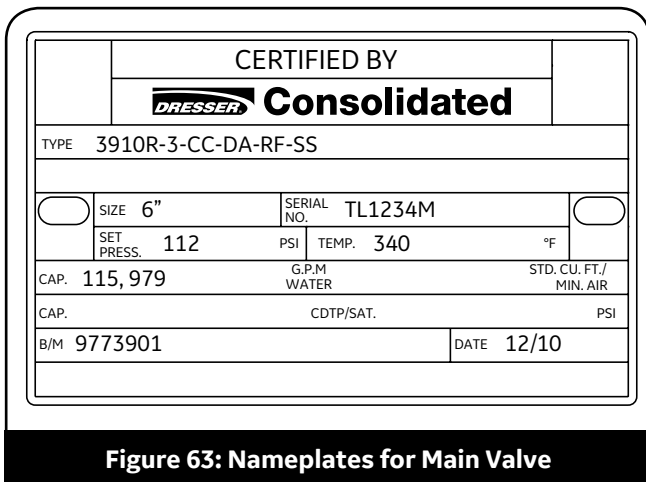
Any discrepancies should be promptly reported to the appropriate plant authority.

Specify parts required by:

1. Part Name (See Section IX, Figures 1, 2, 3, 4 & 5)
2. Part Number (if known)
3. Quantity

For further information please, contact your local Green Tag Center.

In addition, the main valve serial number is stamped on the top edge of the outlet flange. Be sure to include the one or two letters preceding the figures in the serial number. Typical valve nameplates are shown in Figures 63, 64 and 65.



XXIV. Genuine Consolidated Parts

The next time replacement parts are needed, keep these points in mind:

- BHGE designed the parts
- BHGE guarantees the parts
- Consolidated valve products have been in use since 1879
- BHGE has worldwide service
- BHGE has fast response availability for parts

XXV. Recommended Spare Parts

Table 18: Recommended Spare Parts for 3900 Series POSRV¹

	Class	Part Name	
Class I Parts should be stocked at the rate of one (1) per valve. Maintaining this level of spare parts will provide replacement parts for 70% of possible maintenance requirements	I	Pilot Valve	O-Ring Kit Plug Filter
		Main Valve	O-Ring Kit Metal Disc
Class II parts should be stocked at the rate of one (1) part per each five (5) valves in the population. Class II parts will provide replacement parts for an additional 15% of possible maintenance requirements.	II	Pilot Valve	Main Piston Tube Fittings (2) Modulator Stop O-Ring Retainer Backflow Preventer Seal Kit Piston Nose
		Main Valve	Nozzle O-Ring Retainer Tube Fittings (2)

Note 1: A combination of Class I and II parts will satisfy maintenance requirements 85% of the time.

XXV. Recommended Spare Parts (Contd.)

Table 19: Main Valve O-Ring Kits					
Buna N (Nitrile)					
Inlet Size		Orifice	Valve Type	Material	Part No.
in.	mm				
1.00	25.4	D, E, F	3905, 10, 12	Buna N (Nitrile 70)	MORK-70B018
1.50	38.1				
1.50	38.1	G, H	3905, 10, 12	Buna N (Nitrile 70)	MORK-71B018
1.50	38.1	G, H	3905, 10, 12	Buna N (Nitrile 90)	MORK-71B008
2.00	50.8	G, H, J	3905, 10, 12	Buna N (Nitrile 70)	MORK-71B018
3.00	76.2	J, K, L	3905, 10, 12	Buna N (Nitrile 70)	MORK-72B018
4.00	101.6	L, M, N, P	3905, 10, 12	Buna N (Nitrile 70)	MORK-73B018
6.00	152.4	Q, R	3905, 10, 12	Buna N (Nitrile 70)	MORK-74B018
8.00	203.2	T	3905, 10, 12	Buna N (Nitrile 70)	MORK-75B018
1.50	38.1	Full Bore	3905, 10, 12	Buna N (Nitrile 70)	MORK-71B018
1.50	38.1	Full Bore	3905, 10, 12	Buna N (Nitrile 90)	MORK-71B008
3.00	76.2	Full Bore	3905, 10, 12	Buna N (Nitrile 70)	MORK-73B018
4.00	101.6	Full Bore	3905, 10, 12	Buna N (Nitrile 70)	MORK-76B018
6.00	152.4	Full Bore	3905, 10, 12	Buna N (Nitrile 70)	MORK-75B018
8.00	203.2	Full Bore	3905, 10, 12	Buna N (Nitrile 70)	MORK-77B018
10.00	254.0	Full Bore	3905, 10, 12	Buna N (Nitrile 70)	MORK-78B018
1.00	25.4	D, E, F	3914, 16	Buna N (Nitrile 90)	MORK-79B008
1.50	38.1				
1.50	38.1	G, H	3914, 16	Buna N (Nitrile 90)	MORK-80B008
2.00	50.8	G, H, J	3914, 16	Buna N (Nitrile 90)	MORK-80B008
3.00	76.2	J, K, L	3914, 16	Buna N (Nitrile 90)	MORK-81B008
4.00	101.6	L, M, N, P	3914, 16	Buna N (Nitrile 90)	MORK-82B008

Note 1:Nitrile 70 (For Freon 134/Ester Oil Service), Neoprene, Silicon & Kalrez® Seals are available – POA.

Note 2:If repairing a 3900 Metal Seat Design, the seat O-Ring in the above kits will not be used.

XXV. Recommended Spare Parts (Contd.)

Table 19: Main Valve O-Ring Kits (Contd.)					
Viton® (Fluoro-Carbon)					
Inlet Size		Orifice	Valve Type	Material	Part No.
in.	mm				
1.00	25.4	D, E, F	3905, 10, 12	Viton (Fluoro-Carbon 75)	MORK-70V022
1.50	38.1				
1.00	25.4	D, E, F	3905, 10, 12	Viton (Fluoro-Carbon 90)	MORK-70V005
1.50	38.1				
1.50	38.1	G, H	3905, 10, 12	Viton (Fluoro-Carbon 75)	MORK-71V022
1.50	38.1	G, H	3905, 10, 12	Viton (Fluoro-Carbon 90)	MORK-71V005
2.00	50.8	G, H, J	3905, 10, 12	Viton (Fluoro-Carbon 75)	MORK-71V022
2.00	50.8				
3.00	76.2	J, K, L	3905, 10, 12	Viton (Fluoro-Carbon 75)	MORK-72V022
3.00	76.2				
4.00	101.6	L, M, N, P	3905, 10, 12	Viton (Fluoro-Carbon 75)	MORK-73V022
4.00	101.6				
6.00	152.4	Q, R	3905, 10, 12	Viton (Fluoro-Carbon 75)	MORK-74V022
6.00	152.4				
8.00	203.2	T	3905, 10, 12	Viton (Fluoro-Carbon 75)	MORK-75V022
8.00	203.2				
1.50	38.1	Full Bore	3905, 10, 12	Viton (Fluoro-Carbon 75)	MORK-71V022
1.50	38.1	Full Bore	3905, 10, 12	Viton (Fluoro-Carbon 90)	MORK-71V005
3.00	76.2	Full Bore	3905, 10, 12	Viton (Fluoro-Carbon 75)	MORK-73V022
4.00	101.6	Full Bore	3905, 10, 12	Viton (Fluoro-Carbon 75)	MORK-76V022
4.00	101.6	Full Bore	3905, 10, 12	Viton (Fluoro-Carbon 90)	MORK-76V005
6.00	152.4	Full Bore	3905, 10, 12	Viton (Fluoro-Carbon 75)	MORK-75V022
6.00	152.4	Full Bore	3905, 10, 12	Viton (Fluoro-Carbon 90)	MORK-75V005
8.00	203.2	Full Bore	3905, 10, 12	Viton (Fluoro-Carbon 75)	MORK-77V022
8.00	203.2	Full Bore	3905, 10, 12	Viton (Fluoro-Carbon 90)	MORK-77V005
10.00	254.0	Full Bore	3905, 10, 12	Viton (Fluoro-Carbon 75)	MORK-78V022
1.00	25.4	D, E, F	3914, 16	Viton (Fluoro-Carbon 90)	MORK-79V005
1.50	38.1				
1.50	38.1	G, H	3914, 16	Viton (Fluoro-Carbon 90)	MORK-80V005
2.00	50.8	G, H, J	3914, 16	Viton (Fluoro-Carbon 90)	MORK-80V005
3.00	76.2	J, K, L	3914, 16	Viton (Fluoro-Carbon 90)	MORK-81V005
4.00	101.6	L, M, N, P	3914, 16	Viton (Fluoro-Carbon 90)	MORK-82V005

Note 1:Nitrile 70 (For Freon 134/Ester Oil Service), Neoprene, Silicon & Kalrez® Seals are available – POA.

Note 2:If repairing a 3900 Metal Seat Design, the seat O-Ring in the above kits will not be used.

XXV. Recommended Spare Parts (Contd.)

Table 19: Main Valve O-Ring Kits (Contd.)

Ethylene Propylene					
Inlet Size		Orifice	Valve Type	Material	Part No.
in.	mm				
1.00	25.4	D, E, F	3905, 10, 12	EPR (Ethylene Propylene 90)	M0RK-70E002
1.50	38.1				
1.50	38.1	G, H	3905, 10, 12	EPR (Ethylene Propylene 90)	M0RK-71E002
2.00	50.8	G, H, J	3905, 10, 12	EPR (Ethylene Propylene 90)	M0RK-71E002
3.00	76.2	J, K, L	3905, 10, 12	EPR (Ethylene Propylene 90)	M0RK-72E002
4.00	101.6	L, M, N, P	3905, 10, 12	EPR (Ethylene Propylene 90)	M0RK-73E002
6.00	152.4	Q, R	3905, 10, 12	EPR (Ethylene Propylene 90)	M0RK-74E002
8.00	203.2	T	3905, 10, 12	EPR (Ethylene Propylene 90)	M0RK-75E002
1.50	38.1	Full Bore	3905, 10, 12	EPR (Ethylene Propylene 90)	M0RK-71E002
3.00	76.2	Full Bore	3905, 10, 12	EPR (Ethylene Propylene 90)	M0RK-73E002
4.00	101.6	Full Bore	3905, 10, 12	EPR (Ethylene Propylene 90)	M0RK-76E002
6.00	152.4	Full Bore	3905, 10, 12	EPR (Ethylene Propylene 90)	M0RK-75E002
8.00	203.2	Full Bore	3905, 10, 12	EPR (Ethylene Propylene 90)	M0RK-77E002
10.00	254.0	Full Bore	3905, 10, 12	EPR (Ethylene Propylene 90)	M0RK-78E002
1.00	25.4	D, E, F	3914, 16	EPR (Ethylene Propylene 90)	M0RK-70E002
1.50	38.1				
1.50	38.1	G, H	3914, 16	EPR (Ethylene Propylene 90)	M0RK-71E002
2.00	50.8	G, H, J	3914, 16	EPR (Ethylene Propylene 90)	M0RK-71E002
3.00	76.2	J, K, L	3914, 16	EPR (Ethylene Propylene 90)	M0RK-72E002
4.00	101.6	L, M, N, P	3914, 16	EPR (Ethylene Propylene 90)	M0RK-73E002

Note 1: Nitrile 70 (For Freon 134/Ester Oil Service), Neoprene, Silicon & Kalrez® Seals are available – POA.

Note 2: If repairing a 3900 Metal Seat Design, the seat O-Ring in the above kits will not be used.

XXV. Recommended Spare Parts (Contd.)

Table 19: Main Valve O-Ring Kits (Contd.)					
Teflon®					
Inlet Size		Orifice	Valve Type	Material	Part No.
in.	mm				
1.00	25.4	D, E, F	3905, 10, 12	Teflon	MORK-70T006
1.50	38.1				
1.50	38.1	G, H	3905, 10, 12	Teflon	MORK-71T006
2.00	50.8	G, H, J	3905, 10, 12	Teflon	MORK-71T006
3.00	76.2	J, K, L	3905, 10, 12	Teflon	MORK-72T006
4.00	101.6	L, M, N, P	3905, 10, 12	Teflon	MORK-73T006
6.00	152.4	Q, R	3905, 10, 12	Teflon	MORK-74T006
8.00	203.2	T	3905, 10, 12	Teflon	MORK-75T006
1.50	38.1	Full Bore	3905, 10, 12	Teflon	MORK-71T006
3.00	76.2	Full Bore	3905, 10, 12	Teflon	MORK-73T006
4.00	101.6	Full Bore	3905, 10, 12	Teflon	MORK-76T006
6.00	152.4	Full Bore	3905, 10, 12	Teflon	MORK-75T006
8.00	203.2	Full Bore	3905, 10, 12	Teflon	MORK-77T006
10.00	254.0	Full Bore	3905, 10, 12	Teflon	MORK-78T006
1.00	25.4	D, E, F	3914, 16	Teflon	MORK-70T006
1.50	38.1				
1.50	38.1	G, H	3914, 16	Teflon	MORK-71T006
2.00	50.8	G, H, J	3914, 16	Teflon	MORK-71T006
3.00	76.2	J, K, L	3914, 16	Teflon	MORK-72T006
4.00	101.6	L, M, N, P	3914, 16	Teflon	MORK-73T006

Note 1: Nitrile 70 (For Freon 134/Ester Oil Service), Neoprene, Silicon & Kalrez® Seals are available – POA.

Note 2: If repairing a 3900 Metal Seat Design, the seat O-Ring in the above kits will not be used.

XXV. Recommended Spare Parts (Contd.)

Table 20: Pilot Valve O-Ring Kit				
Pilot Type	Buna-N	Ethylene/ Propylene	Viton	Teflon
39PV01-1-GS & LS	PSGKF - 31B	PSGKF - 31E	PSGKF - 31V	N/A
39PV07-1-GS & LS	PSGKF - 33B	PSGKF - 33E	PSGKF - 33V	N/A
39PV07-2-GS & LA	PSGK - 38B018	PSGK - 38E019	PSGK - 38V022	Note 2
39PV07-2-SS	N/A	PSGK - 38E002 ¹	N/A	PSGK - 38T006
39PV37-1-GS & LS	PSGK - 35B018	PSGK - 35E019	PSGK - 35V022	N/A
39PV37-2-GS & LA	PSGK - 35B018	PSGK - 35E019	PSGK - 35V022	Note 2
39PV37-2-SS	N/A	N/A	N/A	PSGK - 35T006
39MV01, 07 & 37-GS ³	PSGK - 32B018	PSGK - 32E019	PSGK - 32V022	Note 2
39MV01, 07 & 37-LS ³	PSGK - 34B018	PSGK - 34E019	PSGK - 34V022	Note 2
39MV, 07 & 37-SS ³	N/A	PSGK - 34E002	N/A	PSGK - 34T006
39MV22-LA & GS	PSGK - 46B018	PSGK - 46E019	PSGK - 46V022	PSGK - 46T006
39MV72-LA & GS	PSGK - 47B008	PSGK - 47E002	PSGK - 47V005	PSGK - 47T005

Note 1: For steam service at pressures below 50 psig (3.45 barg) the 39PV07-2-SS or 39MV07-2-SS with EPR O-Rings should be used (E962-90).

Note 2: For services other than steam consult applications engineering.

Note 3: This kit contains modulator o rings only. In addition to this psgk kit, the Comparable PV PSGK kit is also required.
Example: A 39MV07-2-LS with Viton O-Rings would require a PSGK-34V022 and a PSGK-38V022.

Table 21: Pilot Valve O-Ring Kit Options ¹				
Options	Buna-N	Ethylene/ Propylene	Viton	Teflon
Field Test Connection / Backflow		PSGK - 37E019		
Preventer Seal Kit	PSGK - 37B018	PSGK - 37E002 ²	PSGK - 37V022	PSGK - 37T006
Line Filter Seal Kit				SP540-JKIT

Note 1: Contact factory for kit number for Dirty Service Option.

Note 2: For steam service at pressures below 50 psig (3.45 barg) the 39PV07-2-SS or 39MV07-2-SS with EPR O-Rings should be used (E962-90).

XXV. Recommended Spare Parts (Contd.)

Table 22: Miscellaneous Parts ¹		
Description	Size	Part Number
Manual Blowdown Valve	.250" (6.35 mm) MNPT	SP348-E
Male Connector	.375" (9.53 mm) T x .250" (6.35 mm) MNPT	6000609
Male Elbow	.375" (9.53 mm) T x .250" (6.35 mm) MNPT	6000608
Nut and Ferrule Set	.375" (9.53 mm) T	6000669
Plug Filter	N/A	4818801
Union Tee	.375" (9.53 mm) T x .375" (9.53 mm) T x .375" (9.53 mm) T	6000615

Note 1: The above part numbers are 316 stainless steel material. For other material options, please contact factory.

XXVI. Field Service, Training and Repair Program

A. Field Service

BHGE maintains the largest and most competent network of field service technicians in the Industry. Service technicians are located at strategic points throughout the United States to respond to customer's requirements for service, even in the event of extreme off-hour emergency situations. Each Service Technician is trained and experienced in servicing BHGE's Consolidated products.

It is highly recommended that the professional expertise of a field service technician be employed to make final field adjustments during the initial setting of all Consolidated valves.

For further information, please contact your local Green Tag Center.

B. Factory Repair Facilities

The BHGE Consolidated Repair Department, in conjunction with the manufacturing facilities, is equipped to perform specialized repairs and product modifications, e.g., butt-weld, bushing replacements, code welding, pilot replacement etc.

For further information, please contact your local Green Tag Center.

C. Maintenance Training

Rising costs of maintenance and repair in the Utility and Process Industries indicate the need for trained maintenance personnel. BHGE conducts service seminars that can help your maintenance and engineering personnel to reduce these costs.

Seminars, conducted either at your site, or at our manufacturing plant, provide participants with an introduction to the basics of preventive maintenance necessary to minimize downtime, reduce unplanned repairs and increase valve safety. While these seminars do not make "instant" experts, they do provide the participants with "Hands On" experience with Consolidated Valves. The seminar also includes valve terminology and nomenclature, component inspection, trouble shooting, setting and testing, with emphasis on the ASME Boiler and Pressure Vessel Code.

For further information, please contact your local Green Tag Center or the BHGE Consolidated Training Manager at +1 (281) 542-3646.

DIRECT SALES OFFICE LOCATIONS

AUSTRALIA

Brisbane:
Phone: +61-7-3001-4319
Fax: +61-7-3001-4399

Perth:
Phone: +61-8-6595-7018
Fax: +61-8-6595-7299

Melbourne:
Phone: +61-3-8807-6002
Fax: +61-3-8807-6577

BELGIUM
Phone: +32-2-344-0970
Fax: +32-2-344-1123

BRAZIL
Phone: +55-19-2104-6900

CHINA
Phone: +86-10-5738-8888
Fax: +86-10-5918-9707

FRANCE
Courbevoie
Phone: +33-1-4904-9000
Fax: +33-1-4904-9010

GERMANY
Ratingen
Phone: +49-2102-108-0
Fax: +49-2102-108-111

INDIA
Mumbai
Phone: +91-22-8354790
Fax: +91-22-8354791

New Delhi
Phone: +91-11-2-6164175
Fax: +91-11-5-1659635

ITALY

Phone: +39-081-7892-111
Fax: +39-081-7892-208

JAPAN

Tokyo
Phone: +81-03-6871-9008
Fax: +81-03-6890-4620

KOREA

Phone: +82-2-2274-0748
Fax: +82-2-2274-0794

MALAYSIA

Phone: +60-3-2161-0322
Fax: +60-3-2163-6312

MEXICO

Phone: +52-55-3640-5060

THE NETHERLANDS

Phone: +31-15-3808666

RUSSIA

Veliky Novgorod
Phone: +7-8162-55-7898
Fax: +7-8162-55-7921

Moscow

Phone: +7 495-585-1276
Fax: +7 495-585-1279

SAUDI ARABIA

Phone: +966-3-341-0278
Fax: +966-3-341-7624

SINGAPORE

Phone: +65-6861-6100
Fax: +65-6861-7172

SOUTH AFRICA

Phone: +27-11-452-1550
Fax: +27-11-452-6542

SOUTH & CENTRAL

AMERICA AND THE CARIBBEAN
Phone: +55-12-2134-1201
Fax: +55-12-2134-1238

SPAIN

Phone: +34-93-652-6430
Fax: +34-93-652-6444

UNITED ARAB EMIRATES

Phone: +971-4-8991-777
Fax: +971-4-8991-778

UNITED KINGDOM

Bracknell
Phone: +44-1344-460-500
Fax: +44-1344-460-537

Skelmersdale

Phone: +44-1695-526-00
Fax: +44-1695-526-01

UNITED STATES

Jacksonville, Florida
Phone: +1-904-570-3409

Deer Park, Texas

Phone: +1-281-884-1000
Fax: +1-281-884-1010

Houston, Texas

Phone: +1-281-671-1640
Fax: +1-281-671-1735

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