

4900 MPV Series

Pilot Operated Safety Relief Valve

Instruction Manual (Rev. C)



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, BAKER HUGHES (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.

THESE INSTRUCTIONS DO NOT PURPORT TO COVER ALL DETAILS OR VARIATIONS IN EQUIPMENT NOR TO PROVIDE FOR EVERY POSSIBLE CONTINGENCY TO BE MET IN CONNECTION WITH INSTALLATION, OPERATION OR MAINTENANCE. SHOULD FURTHER INFORMATION BE DESIRED OR SHOULD PARTICULAR PROBLEMS ARISE WHICH ARE NOT COVERED SUFFICIENTLY FOR THE CUSTOMER/OPERATOR'S PURPOSES THE MATTER SHOULD BE REFERRED TO BAKER HUGHES.

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THESE INSTRUCTIONS ARE FURNISHED TO THE CUSTOMER/OPERATOR SOLELY TO ASSIST IN THE INSTALLATION, TESTING, OPERATION, AND/OR MAINTENANCE OF THE EQUIPMENT DESCRIBED. THIS DOCUMENT SHALL NOT BE REPRODUCED IN WHOLE OR IN PART WITHOUT THE WRITTEN APPROVAL OF BAKER HUGHES.

Conversion Table

All the United States Customary System (USCS) values are converted to metric values using the 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	0.02831685	m ³ /min
gal/min	3.785412	L/min
lb/hr	0.4535924	kg/hr
psig	0.06894757	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 any service questions not covered in this manual, please contact your local **Green Tag™** Center (GTC).

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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 Precautions

⚠ 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 of intoxicants or narcotics to work on or around pressurized systems. Workers under the influence of 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 (GTC).

II. Safety Precautions (Cont.)

⚠ 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-inclusive. Baker Hughes cannot know all conceivable service methods nor 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 **Consolidated™** valve product line is not intended for radioactive nuclear applications. Some valve products manufactured by Baker Hughes 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 (GTC).

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 Baker Hughes 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 valve products. The relevant procedures recommended by Baker Hughes, 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 Baker Hughes product, or render it unsafe. It is also important to understand that these “safety messages” are not exhaustive. Baker Hughes 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, Baker Hughes has not undertaken any such broad evaluation and, thus, anyone who uses a procedure and/or tool, which is not recommended by Baker Hughes, or deviates from Baker Hughes recommendations, must be thoroughly satisfied that neither personal safety, nor valve safety, will be jeopardized by the method and/or tools selected. Contact your local Green Tag Center (GTC) 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 Baker Hughes products, and the possible hazardous consequences of each way, Baker Hughes can not possibly evaluate all conditions that might injure personnel or equipment. Nevertheless, Baker Hughes does offer certain Safety Precautions, listed in Section II, for customer information only.

It is the responsibility of the purchaser or user of Baker Hughes 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 (GTC). 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

Warranty Statement

Warranty Statement:⁽¹⁾ Baker Hughes 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 Baker Hughes's inspection and returned to the manufacturer upon request.

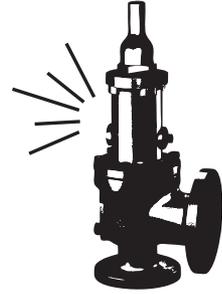
Incorrect Selection or Misapplication of Products: Baker Hughes cannot be responsible for customer's incorrect selection or misapplication of our products.

Unauthorized Repair Work: Baker Hughes has not authorized any non-Consolidated 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 services from unauthorized sources must do so at their own risk.

Unauthorized Removal of Seals: All new valves and valves repaired in the field by Baker Hughes 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.

1. **Refer to Baker Hughes's Standard Terms of Sale for complete details on warranty and limitation of remedy and liability.**

⚠ CAUTION



Defective and nonconforming items must be inspected by Baker Hughes.

⚠ CAUTION



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

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 barg), 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 kilograms per hour (kg/hr) for vapors, standard cubic feet per minute (SCFM) or cubic meters per minute (m. /min) for gases, and in gallons per minute (GPM) or Liter per minute (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

Always keep the inlet flange down on a crated or uncrated flange valve to prevent misalignment and damage to valve internals.

Pilot Operated Safety Relief Valves should be handled carefully. The internal parts of a pilot operated safety relief valve are precision machined and fitted together to maintain perfect alignment. Rough handling may damage the external tubing, pilot, and main valve seats or may cause misalignment sufficient to incur leakage or erratic operation. POSRVs are shipped with a protective covering over the inlet and the outlet flanges. This is to prevent damage to the flanged surfaces and to prevent entry of foreign material into the valve.

ATTENTION!

Never lift the full weight of the valve by the pilot assembly, external devices or tubing.

ATTENTION!

Do not rotate the valve horizontally or lift/carry using the pilot assembly.

ATTENTION!

Only lift the valve by the eyebolts inserted into the coverplate.

ATTENTION!

Handle carefully. Do not drop or strike the valve

Storage

Store POSRVs in a dry environment and protect them from the weather. Do not remove the valve from the skids or crates until immediately before installation. Do not remove flange protectors and seating plugs until the valve is ready to be bolted into place during the installation, i.e., both inlet and outlet.

VII. Pre-Installation and Installation Instructions

When POSRVs are uncrated and the flange protectors or sealing plugs are removed, exercise meticulous care to prevent dirt and other foreign materials from entering the inlet and outlet ports while bolting the POSRV in place.

CAUTION



Always install valve in a vertical, upright position.

VIII. Introduction

A pilot operated safety relief valve (POSRV) is a pressure relief valve in which the major relieving device is combined with and is controlled by a self-activated auxiliary pressure relief valve.

POSRV's are used on hundreds of different applications, including liquids and hydrocarbons, therefore, the valve is designed to meet any requirements.

CAUTION



Do not subject valves to sharp impact.

The 4900 Series valve included in this manual may be used to meet the requirements for ASME Section XIII (UV Designator). They cannot be used on ASME Section I steam boilers or superheaters, but may be used on process steam.

IX. Consolidated 4900 Series POSRV

A. 4900 Series Main Valve Construction

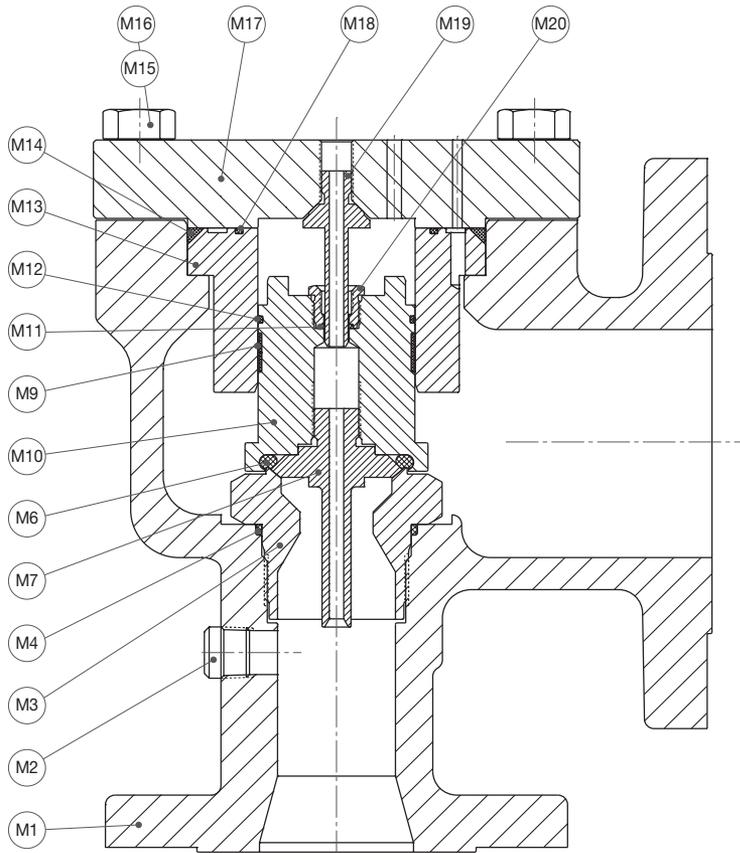


Figure 1: Main Valve Construction - Soft Seat

Part No.	Nomenclature
M1	Base
M2	Base Plug
M3	Nozzle
M4	O-Ring (Nozzle)
M5	Retainer Nose ¹
M6	O-Ring (Seat)
M7	O-Ring Retainer
M8	Lockscrew ¹
M9	Guide Ring
M10	Disc
M11	O-Ring (Retainer Nut)
M12	O-Ring (Disc)
M13	Guide
M14	O-Ring (Coverplate)
M15	Base Stud
M16	Base Stud Nut
M17	Coverplate
M18	O-Ring (Guide)
M19	Sensing Element
M20	Retainer Nut
M21	Coverplate Plug ¹
M22	Eye Bolt ¹

1. Not shown

IX. Consolidated 4900 Series POSRV (Cont.)

B. 49PV07/37 Pilot Valve Construction

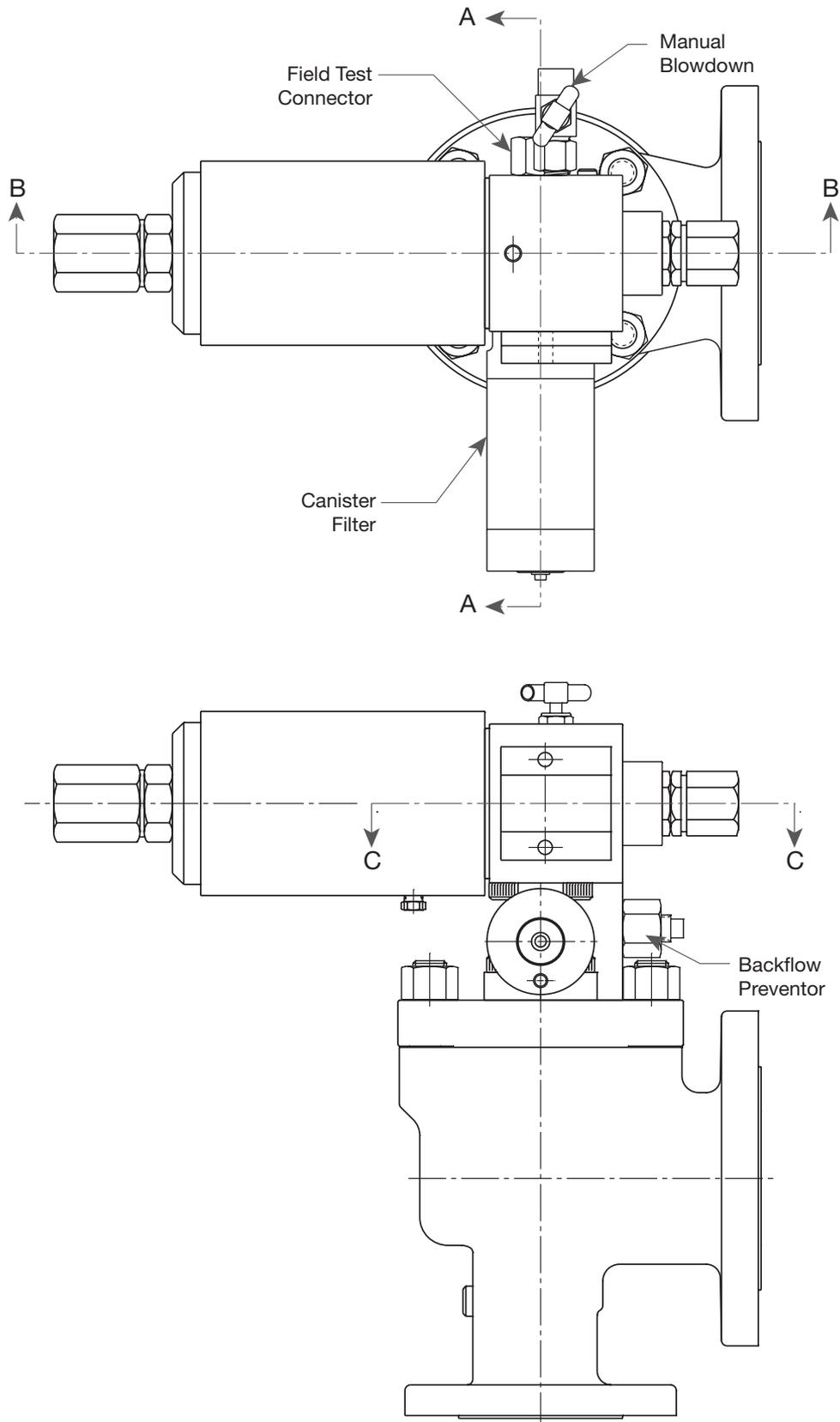


Figure 2: 4900 Series POSRV Assembly with 49PV07/37 Pilot

IX. Consolidated 4900 Series POSRV (Cont.)

B. 49PV07/37 Pilot Valve Construction (Cont.)

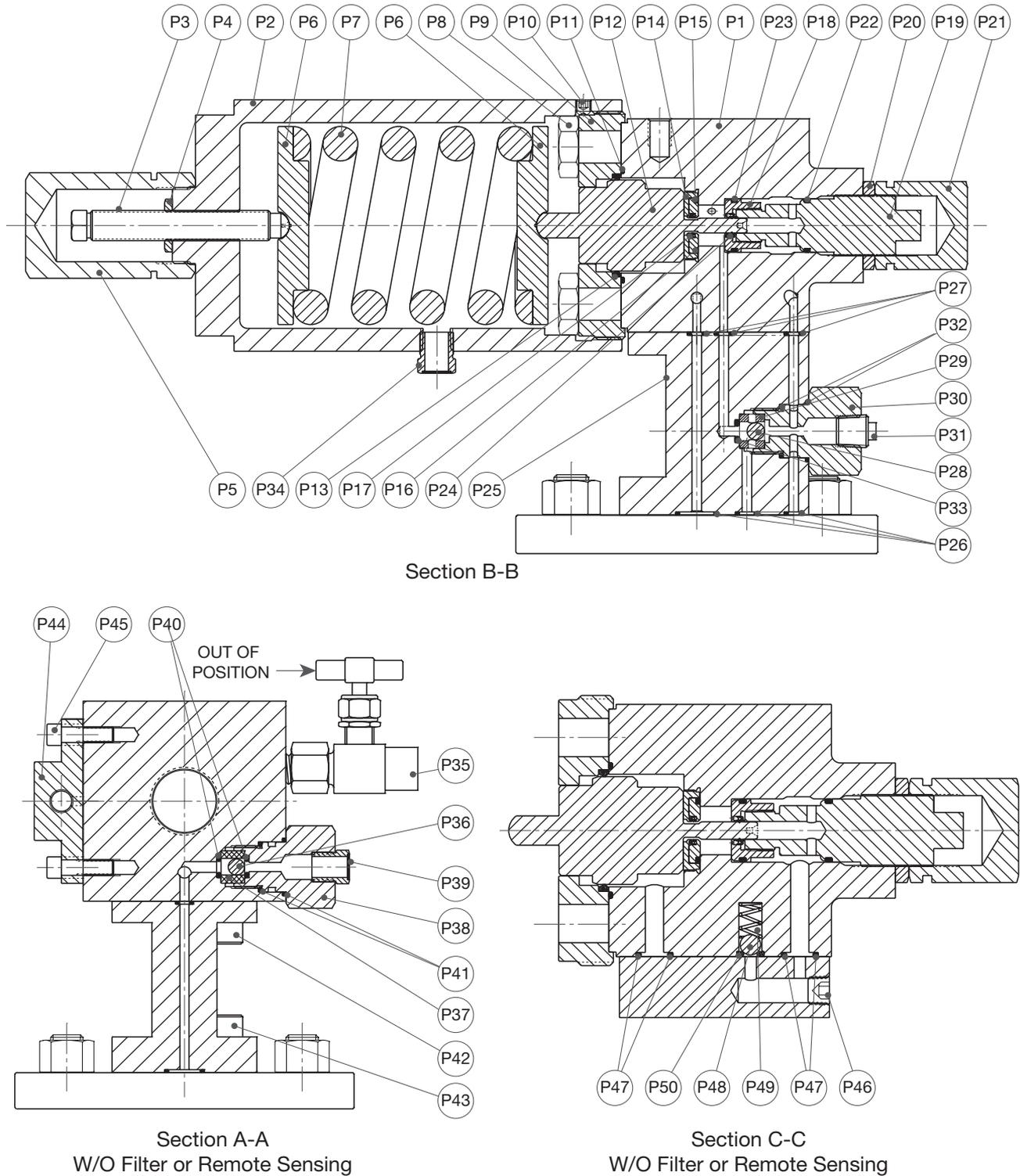


Figure 3: 49PV07/37 Pilot Valve Construction

IX. Consolidated 4900 Series POSRV (Cont.)

B. 49PV07/37 Pilot Valve Construction (Cont.)

Part No.	Nomenclature
P1	Main Base
P2	Bonnet
P3	Compression Screw
P4	Compression Screw Lock Nut
P5	Cap (Compression Screw)
P6	Spring Washer
P7	Spring
P8	Cap Screw (Top Plate)
P9	Top Plate
P10	Set Screw (Bonnet)
P11	O-Ring (Top Plate)
P12	Main Piston
P13	Spring Seal (Main Piston)
P14	Insert Top
P15	Insert Bottom
P16	O-Ring (Insert)
P17	Spring Seal (Insert)
P18	Adjuster Top
P19	Adjuster Bottom
P20	Adjuster Lock Nut
P21	Adjuster Cap
P22	O-Ring (Adjuster Bottom)
P23	O-Ring (Adjuster Top)
P24	Spring Seal (Adjuster Top)
P25	Inlet Adapter
P26	O-Ring (Pilot Base)
P27	O-Ring (Inlet Adapter)
P28	Ball (Backflow Preventer)
P29	Backflow Preventer Guide
P30	Backflow Preventer Body
P31	Pipe Plug (Backflow Preventer)

Part No.	Nomenclature
P32	O-Ring (Backflow Preventer)
P33	O-Ring (Ball Seat) (Backflow Preventer)
P34	Breather Filter Vent (Bonnet)
P35	Manual Blowdown (Needle Valve)
P36	Ball (Field Test)
P37	Tube Filter
P38	Field Test Body
P39	Breather Filter Vent (Field Test Body)
P40	O-Ring (Ball Seat) (Field Test)
P41	O-Ring (Field Test Body)
P42	Cap Screw (Pilot Base/Inlet Adapter)
P43	Cap Screw (Inlet Adapter/Coverplate)
P44	Port Adapter

Part No.	Nomenclature
P45	Cap Screw (Port Adapter/Pilot Base)
P46	Pipe Plug (Port Adapter)
P47	O-Ring (Port Adapter)
P48	Ball (Base)
P49	Spring (Base)
P50	O-Ring (Ball Seat)
Optional Canister Filter	
A1	Filter Base
A2	O-Ring (Filter Base)
A3	Filter Element
A4	Filter Spring
A5	Filter Sleeve
A6	O-Ring (Filter Sleeve)
A7	Filter End Cap
A8	Filter Tie Bolt
A9	O-Ring (Filter Tie Bolt)
A10	Locator Pin
A11	Cap Screw (Filter)
A12	O-Ring (Cap Screw)
A13	Pipe Plug (Filter)

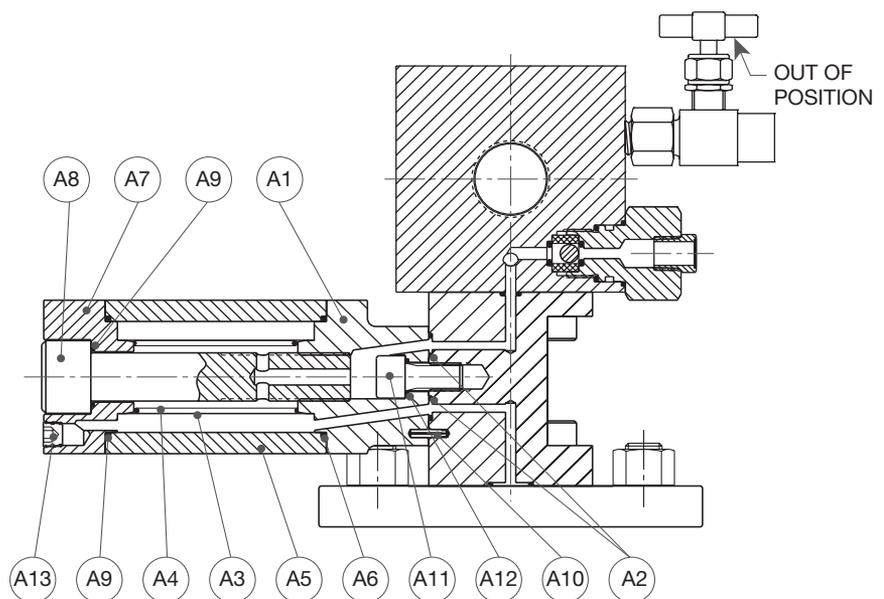


Figure 4: Canister Filter (Optional)

IX. Consolidated 4900 Series POSRV (Cont.)

C. 49MV07 Pilot Valve Construction

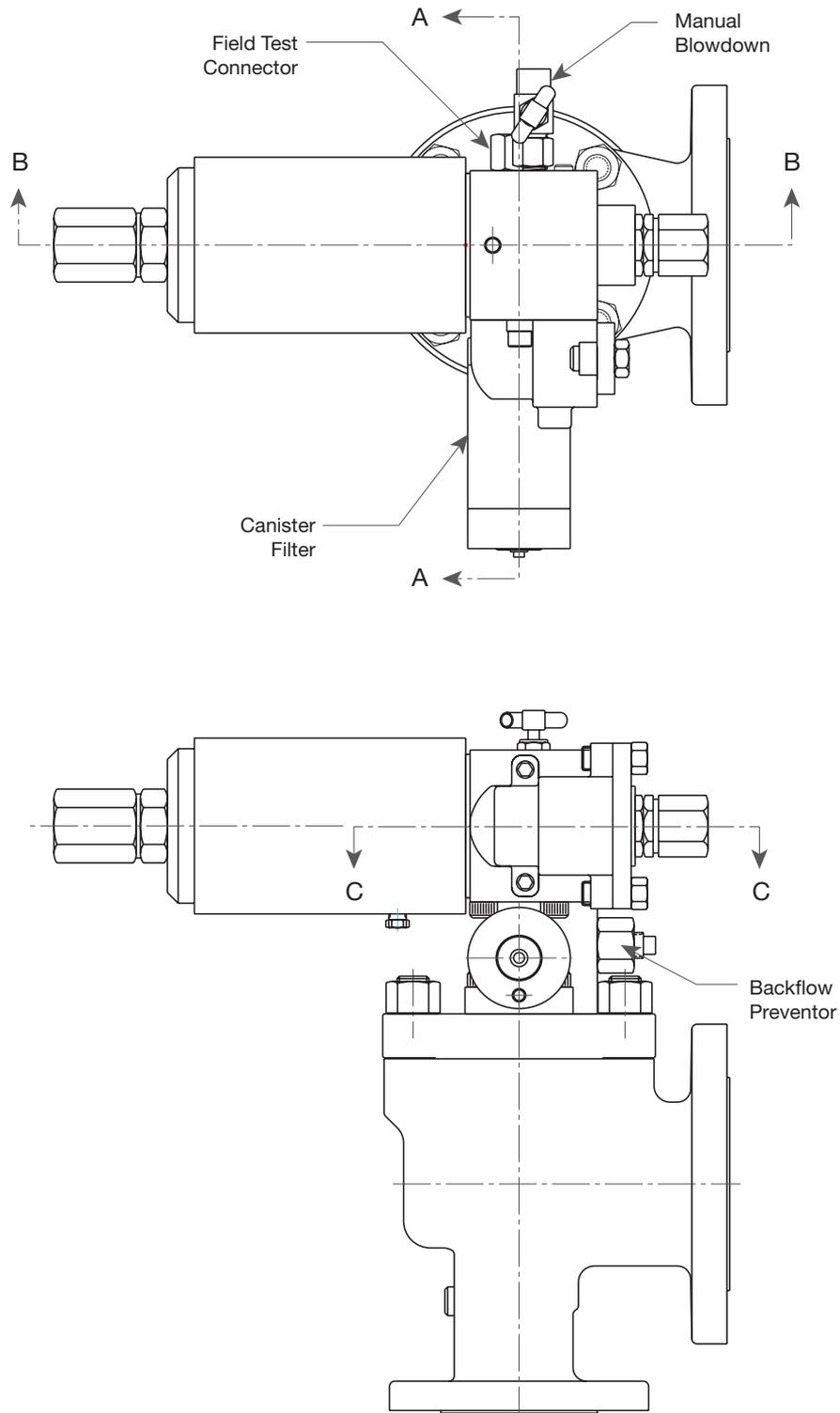


Figure 5: 4900 Series POSRV Assembly with 49MV07 Pilot

IX. Consolidated 4900 Series POSRV (Cont.)

C. 49PV07/37 Pilot Valve Construction (Cont.)

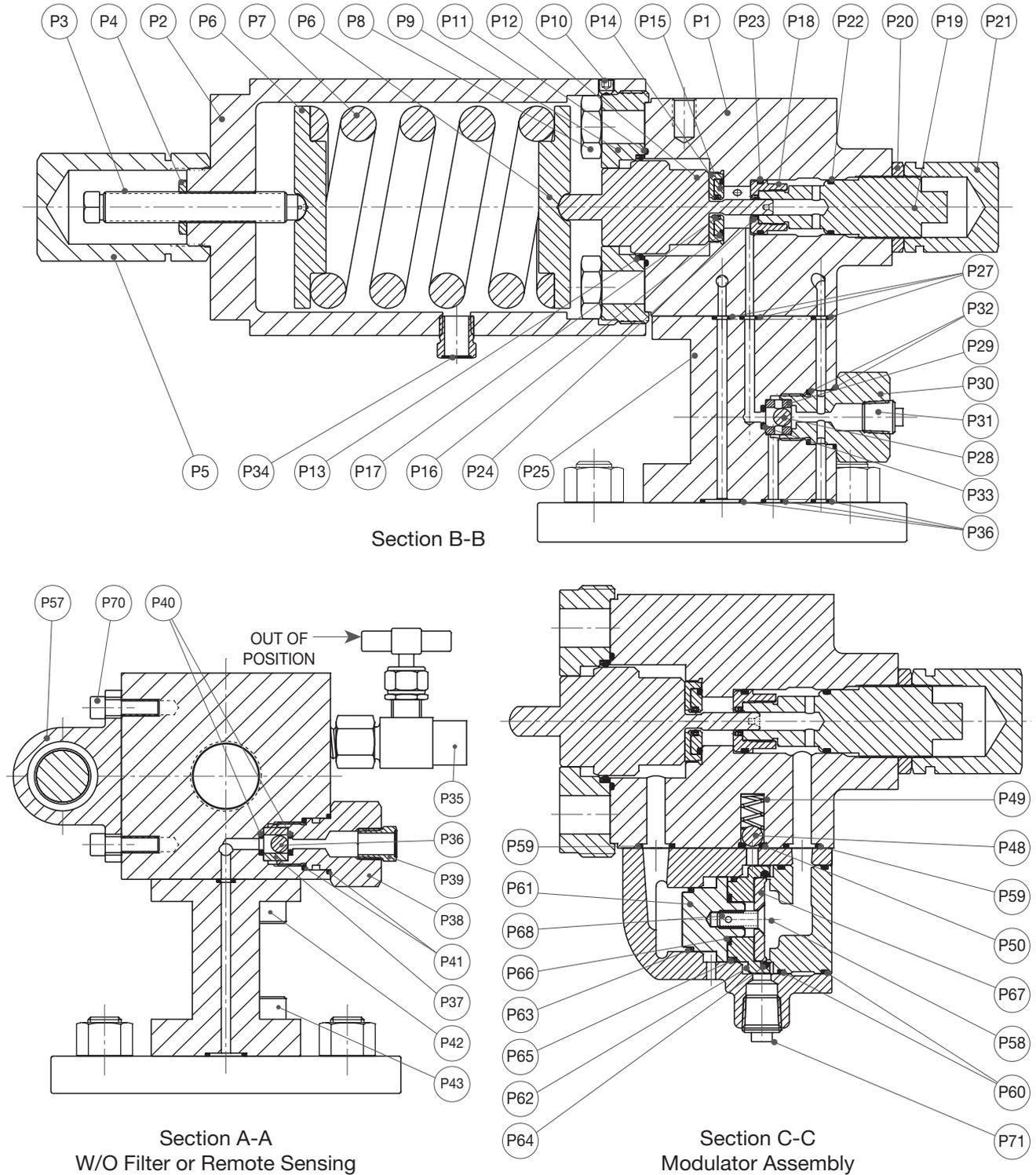


Figure 6: 49MV07 Pilot Valve Construction

IX. Consolidated 4900 Series POSRV (Cont.)

C. 49PV07/37 Pilot Valve Construction (Cont.)

Part No.	Nomenclature
P1	Main Base
P2	Bonnet
P3	Compression Screw
P4	Compression Screw Lock Nut
P5	Cap (Compression Screw)
P6	Spring Washer
P7	Spring
P8	Cap Screw (Top Plate)
P9	Top Plate
P10	Set Screw (Bonnet)
P11	O-Ring (Top Plate)
P12	Main Piston
P13	Spring Seal (Main Piston)
P14	Insert Top
P15	Insert Bottom
P16	O-Ring (Insert)
P17	Spring Seal (Insert)
P18	Adjuster Top
P19	Adjuster Bottom
P20	Adjuster Lock Nut
P21	Adjuster Cap
P22	O-Ring (Adjuster Bottom)
P23	O-Ring (Adjuster Top)
P24	Spring Seal (Adjuster Top)
P25	Inlet Adapter
P26	O-Ring (Pilot Base)
P27	O-Ring (Inlet Adapter)
P28	Ball (Backflow Preventer)
P29	Backflow Preventer Guide
P30	Backflow Preventer Body
P31	Pipe Plug (Backflow Preventer)
P32	O-Ring (Backflow Preventer)

Part No.	Nomenclature
P33	O-Ring (Ball Seat) (Backflow Preventer)
P34	Breather Filter Vent (Bonnet)
P35	Manual Blowdown (Needle Valve)
P36	Ball (Field Test)
P37	Tube Filter
P38	Field Test Body
P39	Breather Filter Vent (Field Test Body)
P40	O-Ring (Ball Seat) (Field Test)
P41	O-Ring (Field Test Body)
P42	Cap Screw (Pilot Base/Inlet Adapter)
P43	Cap Screw (Inlet Adapter/Coverplate)
P48	Ball (Base)
P49	Spring (Base)
P50	O-Ring (Ball Seat)
P57	Modulator Base
P58	Modulator Stop
P59	O-Ring (Modulator Base)
P60	O-Ring (Modulator Stop)
P61	Modulator Piston Top
P62	Modulator Piston Bottom
P63	Spring Seal (Piston Top)
P64	Spring Seal (Piston Bottom)
P65	Spring Seal (Modulator Piston Bottom)
P66	O-Ring (Modulator Seat)
P67	O-Ring Retainer
P68	Lock Screw (Retainer)
P69	Cap Screw (Modulator Stop) (Not Shown)
P70	Socket Head Cap Screw (Modulator)
P71	Pipe Plug (Modulator)

IX. Consolidated 4900 Series POSRV (Cont.)

D. 49MV22/72 Pilot Valve Construction

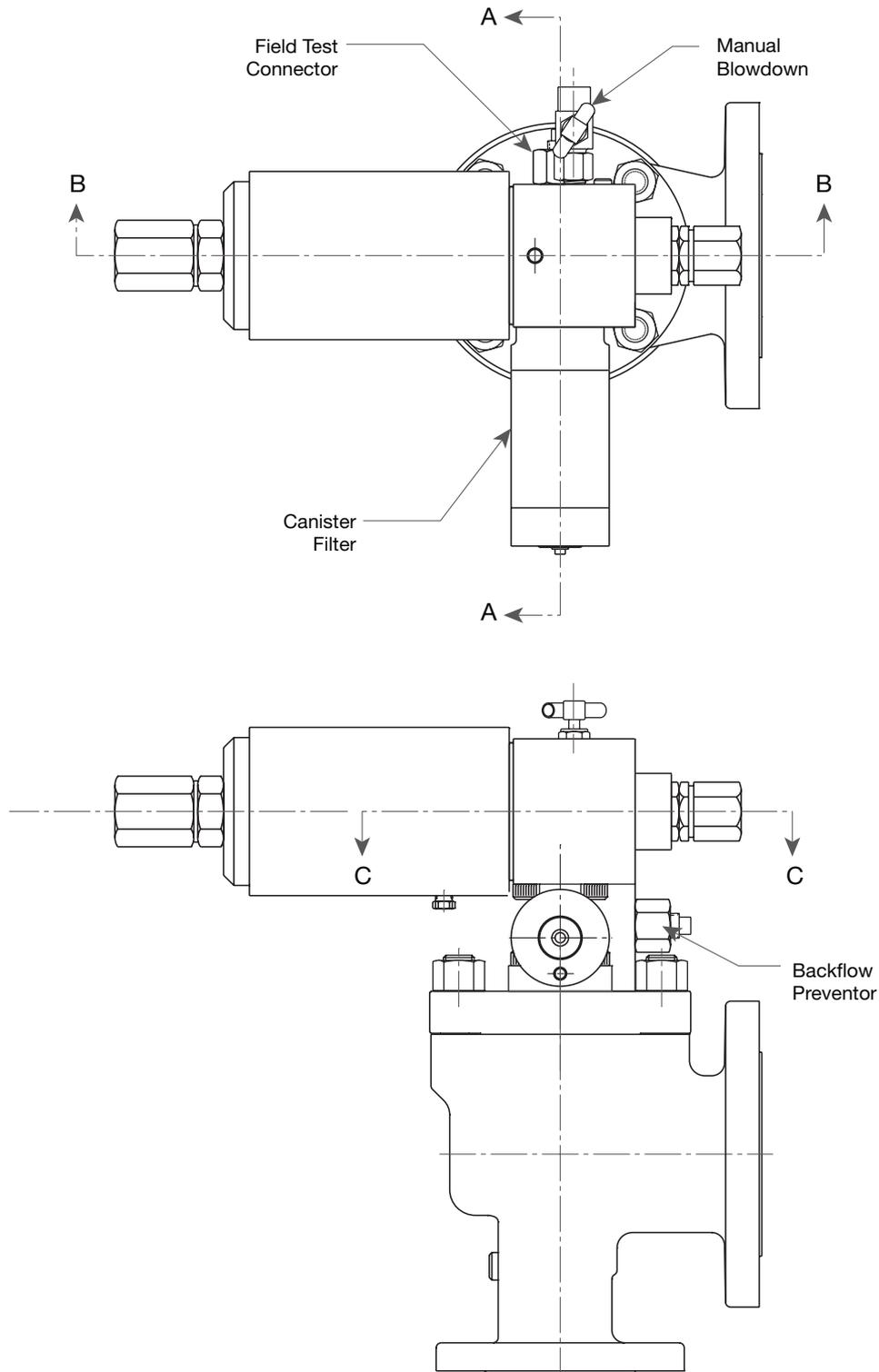


Figure 7: POSRV Assembly with MV22/72 Pilot

IX. Consolidated 4900 Series POSRV (Cont.)

D. 49MV22/72 Pilot Valve Construction (Cont.)

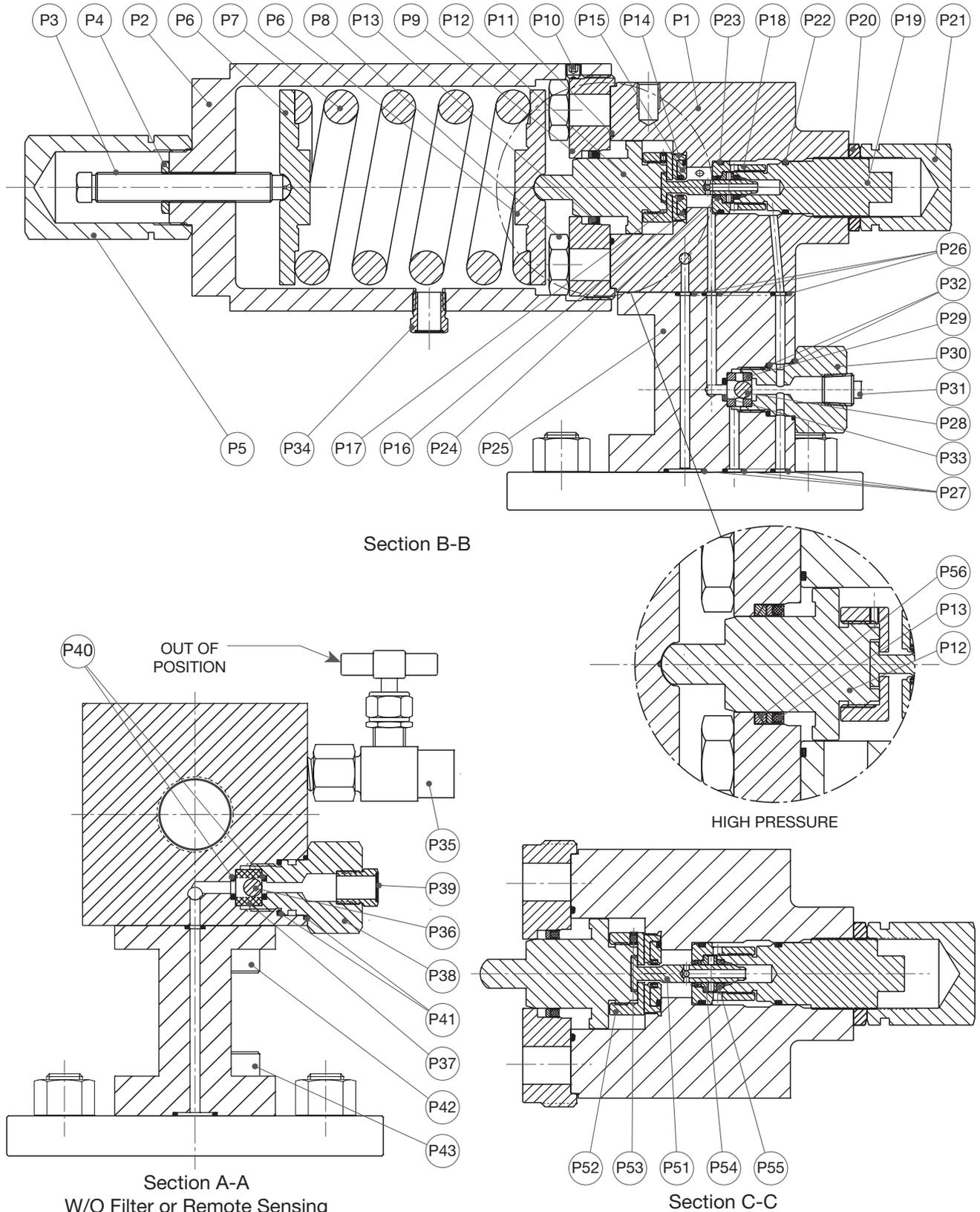


Figure 8: 49MV22/72 Pilot Valve Construction

IX. Consolidated 4900 Series POSRV (Cont.)

D. 49MV22/72 Pilot Valve Construction (Cont.)

Part No.	Nomenclature
P1	Main Base
P2	Bonnet
P3	Compression Screw
P4	Compression Screw Lock Nut
P5	Cap (Compression Screw)
P6	Spring Washer
P7	Spring
P8	Cap Screw (Top Plate)
P9	Top Plate
P10	Set Screw (Bonnet)
P11	O-Ring (Top Plate)
P12	Main Piston
P13	Spring Seal (Main Piston)
P14	Insert Top
P15	Insert Bottom
P16	O-Ring (Insert)
P17	Spring Seal (Insert)
P18	Adjuster Top
P19	Adjuster Bottom
P20	Adjuster Lock Nut
P21	Adjuster Cap
P22	O-Ring (Adjuster Bottom)
P23	O-Ring (Adjuster Top)
P24	Spring Seal (Adjuster Top)
P25	Inlet Adapter

Part No.	Nomenclature
P26	O-Ring (Pilot Base)
P27	O-Ring (Inlet Adapter)
P28	Ball (Backflow Preventer)
P29	Backflow Preventer Guide
P30	Backflow Preventer Body
P31	Pipe Plug (Backflow Preventer)
P32	O-Ring (Backflow Preventer)
P33	O-Ring (Ball Seat) (Backflow Preventer)
P34	Breather Filter Vent (Bonnet)
P35	Manual Blowdown (Needle Valve)
P36	Ball (Field Test)
P37	Tube Filter
P38	Field Test Body
P39	Breather Filter Vent (Field Test Body)
P40	O-Ring (Ball Seat) (Field Test)
P41	O-Ring (Field Test Body)
P42	Cap Screw (Pilot Base/Inlet Adapter)
P43	Cap Screw (Inlet Adapter/Coverplate)
P51	Piston Nose
P52	Piston Retainer Nut
P53	Set Screw (Piston)
P54	Vent Seal (Adaptor)
P55	Spring Seal (Vent Seal Adaptor)
P56	Back-up Ring (49MV72)

X. General Planning for Maintenance

A 12 month maintenance interval is recommended for general service conditions.

For severe service applications, a 3 to 6 month inspection and test interim may be more appropriate. The specific plant's operating and service history will better determine this frequency. Baker Hughes encourages preventive maintenance.

The 4900 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

Occasionally, remachining the nozzle 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.



XI. Recommended Installation Practices

A. Mounting Position

The POSRVs should be mounted in a vertical upright position (in accordance with API RP 520). Installing a pilot operated safety relief valve in any position other than vertical (± 1 degree) will adversely affect its operation as a result of induced misalignment of moving parts. A stop valve may be placed between the pressure vessel and its relief valve only as permitted by code regulations. If a stop valve is located between the pressure vessel and POSRV, the stop valve port area should equal or exceed the nominal internal area associated with the pipe size of the POSRV inlet. The pressure drop from the vessel to the POSRV shall not exceed 3% of the valve's set pressure, when flowing at full capacity.

Ensure the flanges and sealing faces of the valve and connective piping are free from dirt, sediment, and scale. Ensure all flange bolts are drawn evenly to prevent distortion of the valve body and the inlet nozzle. Position the POSRVs for easy access and/or removal so that servicing can be properly performed. Ensure sufficient working space is provided around and above the valve.

B. Inlet Piping

The inlet piping (Figure 9) to the valve should be short and direct from the vessel, or equipment, being protected. The radius of the connection to the vessel should permit smooth flow to the valve. Avoid sharp corners. If this is not practical, then the inlet should be at least one additional pipe diameter larger. The pressure drop from the vessel to the valve shall not exceed 3% of valve set pressure when the valve is allowing full capacity flow. The inlet piping should never be smaller in diameter than the inlet connection of the valve. Excessive pressure drop in gas, vapor, or flashing liquid service at the inlet of the POSRV will cause extremely rapid opening and closing of the valve, which is known as "chattering". Chattering will result in lowered capacity and damage to the seating surfaces. The most desirable installation is that in which the nominal size of the inlet piping is the same as, or greater than, the nominal size of the valve inlet flange; and in which the length does not exceed the face-to-face dimensions of a standard tee of the required pressure class.

Do not locate POSRV inlets where excessive turbulence is present, such as near elbows, tees, bends, orifice plates or throttling valves.

Section VIII of the ASME Boiler and Pressure Vessel Code requires the inlet connection design to consider stress conditions during valve operation, caused by external loading, vibration, and loads due to thermal expansion of the discharge piping.

The determination of reaction forces during valve discharge is the responsibility of the vessel and/or piping designer. Baker Hughes publishes certain technical information about reaction forces under various fluid flow conditions, but assumes no liability for the calculations and design of the inlet piping.

External loading, by poorly designed discharge piping and support systems, and forced alignment of discharge piping can cause excessive stresses and

⚠ CAUTION



Prevent dirt from entering outlet or inlet port.

⚠ CAUTION



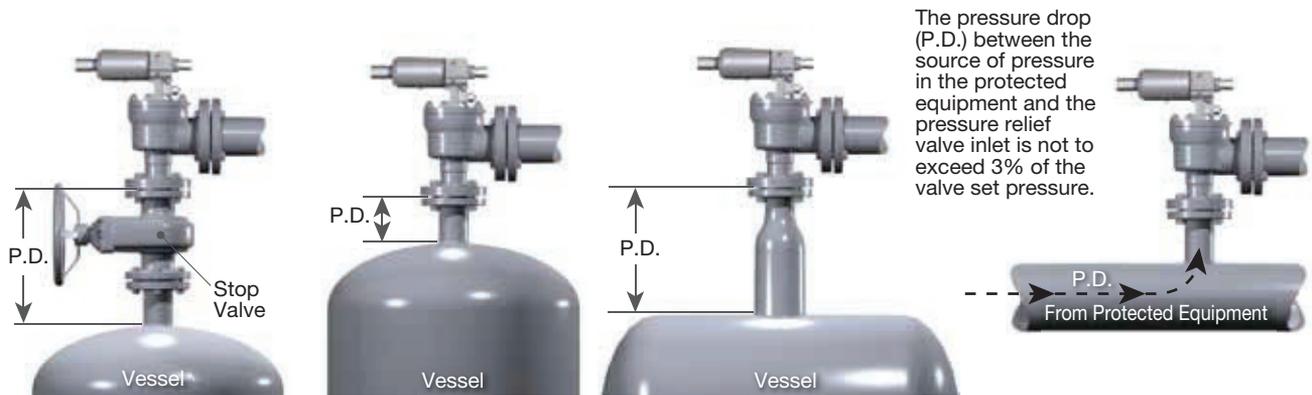
Always install valve in a vertical, upright position.

⚠ DANGER



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

XI. Recommended Installation Practices (Cont.)



The pressure drop (P.D.) between the source of pressure in the protected equipment and the pressure relief valve inlet is not to exceed 3% of the valve set pressure.

Figure 9: Pressure Drop on the Inlet Piping

distortions in the valve as well as the inlet piping. The stresses in the valve may cause a malfunction or leak. Therefore, discharge piping must be independently supported and carefully aligned.

Vibrations in the inlet piping systems may cause valve seat leakage and/or fatigue failure. These vibrations may cause the disc seat to slide back and forth across the nozzle seat and may result in damage to the seating surfaces. Also, vibration may cause separation of the seating surfaces and premature wear to valve parts. High-frequency vibrations are more detrimental to POSRV tightness than low-frequency vibrations. This effect can be minimized by providing a larger difference between the operating pressure of the system and the set pressure of the valve, particularly under high frequency conditions.

Temperature changes in the discharge piping may be caused by fluid flow in from the discharge of the valve or by prolonged exposure to the sun or heat radiated from nearby equipment. A change in the

discharge piping temperature will cause a change in the length of the piping, which may cause stresses to be transmitted to the POSRV and its inlet piping. Proper support, anchoring or provision for flexibility of the discharge piping can prevent stresses caused by thermal changes. Do not use fixed supports.

C. Outlet Piping

Alignment of the internal parts of the POSRV is important to ensure proper operation (see Figure 10). Although the valve body will withstand a considerable mechanical load, unsupported discharge piping consisting of more than a companion flange long-radius elbow, and a short vertical pipe is not recommended. Use spring supports to connect outlet piping to prevent thermal expansion from creating strains on the valve. The discharge piping should be designed to allow for vessel expansion as well as expansion of the discharge pipe itself. This is particularly important on long distance lines.

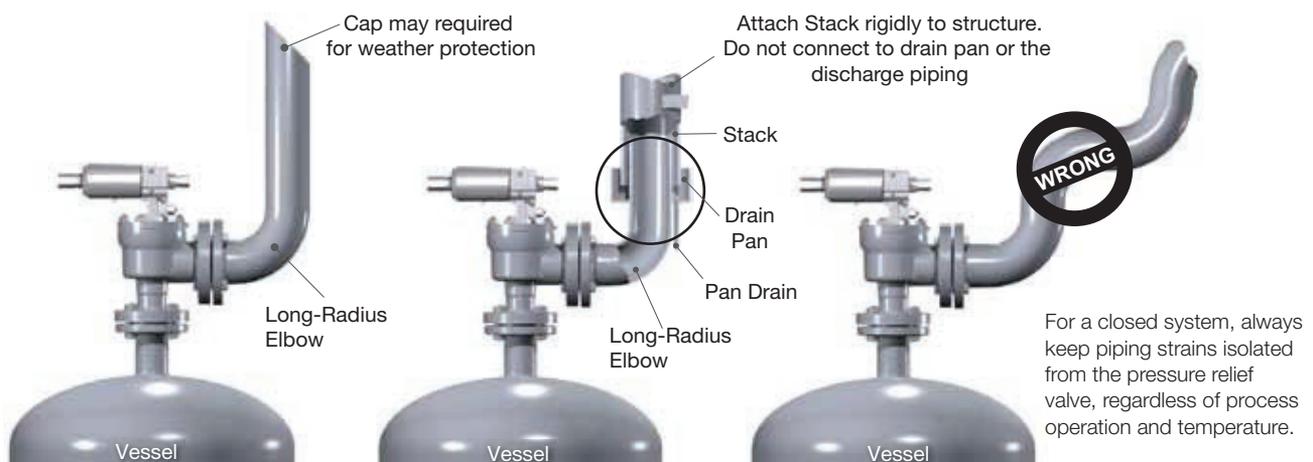


Figure 10: POSRV Parts Alignment

XI. Recommended Installation Practices (Cont.)

A continual oscillation of the discharge piping (wind loads) may induce stress distortion in the valve body. The resultant movement of the valve's internal parts may cause leakage.

The pressure drop (P.D.) between the source of pressure in the protected equipment and the pressure relief valve inlet is not to exceed 3% of the valve set pressure.

Where possible, use properly supported drainage piping to prevent the collection of water or corrosive liquid in the valve body.

In every case, the nominal discharge pipe size should be at least as large as the nominal size of the POSRV outlet flange. In the case of long discharge piping, the nominal discharge pipe size must sometimes be much larger.

D. 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. For remote sensing, .375" (9.53 mm) diameter tubing is adequate for distances up to 10 feet (3.048 m). If distance is longer than 10 feet (3.048 m), please contact Baker Hughes Application Engineering.

ATTENTION!

Change in elevation between relief valve and source of sensing line may cause set pressure changes.

E. Freeze Protection

Type of applications:

- Applications where the process media, in the liquid state, has a freezing point between the ambient temperature limits of the local region.
- Steam service applications where the pilot operated valve is exposed to the climate, extreme cold ambient temperatures.

Example: the condensed steam in the pilot and tubing may become frozen

- Applications where the process media is temperature sensitive to thick formations.

Example: hydrocarbon applications where the possibility of hydrate formation may occur.

Reasons for freeze protection:

- If the pilot sensing line becomes clogged or frozen, then system pressure can be isolated from the pilot valve. This will not allow the pilot to detect system pressure, open and relieve the overpressure situation.

Recommendations for insulating and heat tracing pilot operated safety relief valve:

Types of freeze protection:

- Insulation by fiber glass blankets or wrap.
- Heat tracing with electrical heat tape.
- Radiant heat sources, such as a heat lamp.

For applications where heat tracing or radiant heaters are used, the temperature should be limited to approximately 200.F (93.3°C) so that the elastomers are not damaged. Higher temperatures may be allowed upon review of the application.

- Valve illustrations showing acceptable locations for insulation are shown in Figure 11.

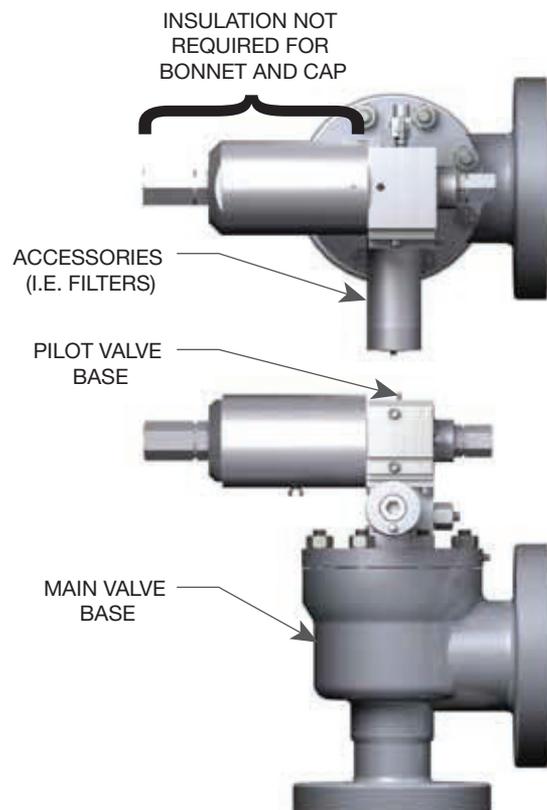


Figure 11: Valve Insulation

XII. Disassembly of the 4900 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 valve, or in the pilot valve.
2. Mark the Coverplate, Inlet Adaptor, and Main Base for ease of reassembly.
3. Loosen the four Socket Head Cap Screws (Main Valve) and remove the pilot assembly including the Inlet Adapter from the Coverplate.
4. Loosen and remove the four Socket Head Cap Screws (Pilot) to separate the pilot valve from the Inlet Adapter.
5. 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. Loosen and remove the Nuts (or Cap Screws) on the Coverplate.
2. Lift off the Coverplate
3. 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" L Orifice will lift the Guide out with the Disc due to its design.

4. Remove the Guide from the Base if it did not come out with the Disc.
5. Remove the Sensing Retainer Nut.

Note: For valves with separate retainer and sensing tube, remove the retainer from the disc and then remove the tube.

6. 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.

7. 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 45 and Table 9 in the Maintenance Tools and Supplies section. This applies to all main valve sizes except the 8" (203.2 mm) and 10" (254 mm) 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.



XII. Disassembly of the 4900 Series POSRV (Cont.)

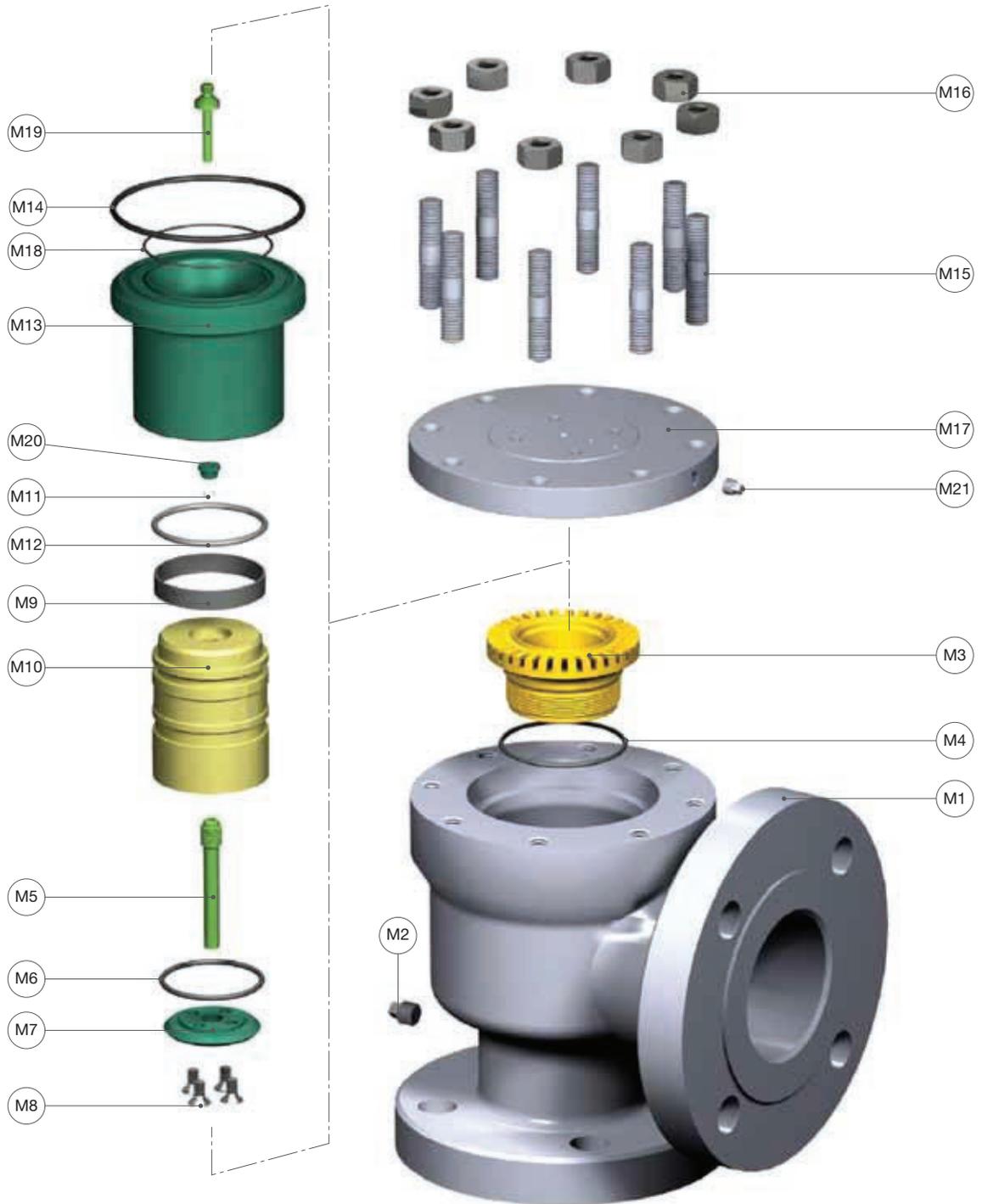


Figure 12: POSRV Assembly with MV22/72 Pilot

XII. Disassembly of the 4900 Series POSRV (Cont.)

Part No.	Nomenclature
M1	Base
M2	Base Plug
M3	Nozzle
M4	O-Ring (Nozzle)
M5	Retainer Nose
M6	O-Ring (Seat)
M7	O-Ring Retainer
M8	Lockscrew
M9	Guide Ring
M10	Disc
M11	O-Ring (Retainer Nut)
M12	O-Ring (Disc)
M13	Guide
M14	O-Ring (Coverplate)
M15	Base Stud
M16	Base Stud Nut
M17	Coverplate
M18	O-Ring (Guide)
M19	Sensing Element
M20	Retainer Nut
M21	Coverplate Plug

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. 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.)

B. O-Ring Seat

The nozzle must not have any defects to prohibit the O-Ring from sealing properly, especially the O.D. of the seat where the surface must maintain a minimum of 32 RMS finish. See Figure 13 and Table 1 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.

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.

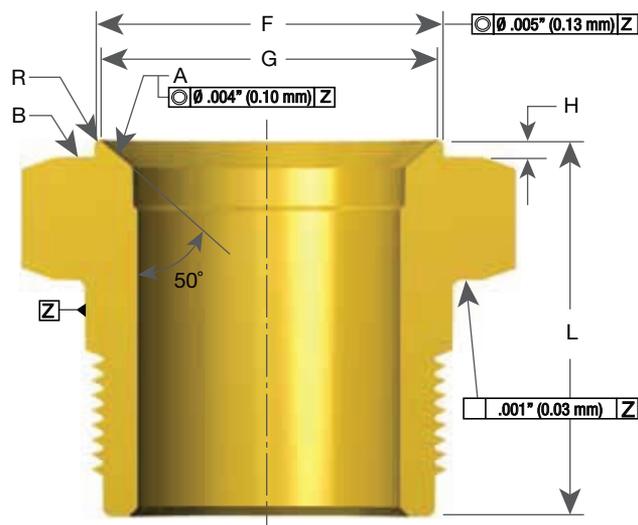


Figure 13: Nozzle O-Ring Seat (DA)

C. 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 14).
2. True up the nozzle so that the surfaces marked B and C run true within .001" (0.03 mm) on indicator (Figure 14).

D. Machining Procedure: O-Ring Seat

See Figure 13 and Table 1

1. Take light cuts across surface A (50°), until the damaged areas are removed. Turn to the smoothest possible finish.
2. Cut back the outside surface B, until dimension H is obtained.
3. Machine radius R.
4. When the minimum dimension L is reached, the nozzle should be discarded.

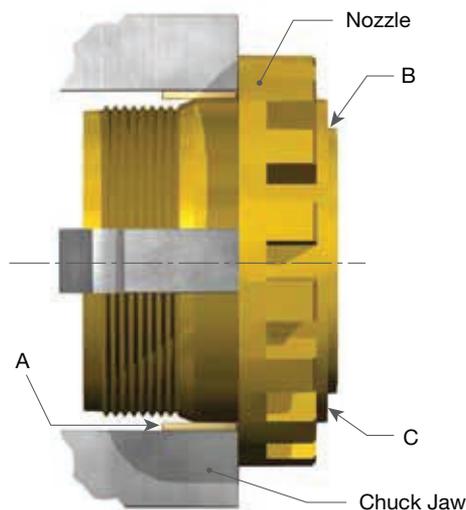


Figure 14: Machining Nozzle Seats

XIII. Maintenance Instructions (Cont.)

Table 1: Nozzle Machined Dimensions

Bore Type	Inlet		Orifice	F		G		H ±.005" (±0.13 mm)		L min.		R ±.001" (±0.03 mm)	
	in.	mm		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
	Standard Bore	1.00		25.4	D, E, F	1.087 ± .001	27.61 ± 0.03	1.040 + .002 - .001	26.42 + 0.05 - 0.03	.090	2.29	1.781	45.24
1.50		38.1	D, E, F	1.087 ± .001	27.61 ± 0.03	1.040 + .002 - .001	26.42 + 0.05 - 0.03	.090	2.29	1.781	45.24	.022	0.56
1.50		38.1	G, H	1.836 ± .002	46.63 ± 0.05	1.780 + .002 - .001	45.21 + 0.05 - 0.03	.089	2.26	1.969	50.01	.022	0.56
2.00		50.8	G, H, J	1.836 ± .002	46.63 ± 0.05	1.780 + .002 - .001	45.21 + 0.05 - 0.03	.089	2.26	1.969	50.01	.022	0.56
3.00		76.2	J, K, L	2.479 ± .002	62.97 ± 0.05	2.423 ± .002	61.54 ± 0.05	.105	2.67	2.344	59.54	.022	0.56
4.00		101.6	L, M, N, P	3.476 + .002 - .003	88.29 + 0.05 - 0.08	3.420 + .002 - .003	86.87 + 0.05 - 0.08	.105	2.67	2.719	69.06	.022	0.56
6.00		152.4	Q, R	5.592 ± .003	142.04 ± 0.08	5.533 ± .003	140.54 ± 0.08	.125	3.18	2.844	72.24	.022	0.56
8.00		203.2	T	6.484 + .003 - .004	142.04 + 0.08 - 0.10	6.420 + .003 - .004	163.07 + 0.08 - 0.10	.125	3.18	3.469	88.11	.022	0.56
Full Bore	1.50	38.1	1.5"	1.836 ± .002	164.69 ± 0.05	1.780 + .002 - .001	45.21 + 0.05 - 0.03	.089	2.26	1.969	50.01	.022	0.56
	2.00	50.8	2"	2.479 ± .002	46.63 ± 0.05	2.423 ± .002	61.54 ± 0.05	.105	2.67	2.344	59.54	.022	0.56
	3.00	76.2	3"	3.476 + .002 - .003	62.97 + 0.05 - 0.08	3.420 + .002 - .003	86.87 + 0.05 - 0.08	.105	2.67	2.719	69.06	.022	0.56
	4.00	101.6	4"	4.100 + .003 - .002	88.29 + 0.08 - 0.05	4.044 ± .002	102.72 + 0.08 - 0.05	.105	2.67	2.719	69.06	.022	0.56
	6.00	152.4	6"	6.484 + .003 - .004	104.14 + 0.08 - 0.10	6.420 + .003 - .004	163.07 + 0.08 - 0.10	.125	3.18	3.469	88.11	.022	0.56
	8.00	203.2	8"	7.984 + .003 - .004	202.79 + 0.08 - 0.10	7.920 + .004 - .003	201.17 + 0.10 - 0.08	.125	3.18	2.469	62.71	.022	0.56
	10.00	254.0	10"	10.234 + .003 - .004	259.94 + 0.08 - 0.10	10.170 + .004 - .003	258.32 + 0.10 - 0.08	.125	3.18	2.844	72.24	.022	0.56

XIV. Inspection and Part Replacement

Main Valve Parts Inspection

1. Guide:

Check I.D. 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. Coverplate O-Ring seating areas are pitted and cause the valve to leak between the Coverplate and Base.

2. Base:

Inspect general condition for cracks or holes. Look for any corrosion issues.

3. Coverplate:

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

Nozzle should be replaced if:

- a. Dimension from seat to shoulder after remachining and lapping is less than H min. on Table 1.
- 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 1).

7. 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.

8. Disc Holder:

Should be replaced if the sliding surface is galled, pitted, or scratched.

Refer to Table 10 for a list of recommended spare parts and Table 11 for a list of O-Ring repair kits.

XV. Reassembly of 4900 Series Main Valve

A. Lubricants and Sealants

1. Operating temperatures below -40°F (-40°C), consult Factory.
2. Operating temperatures between -40°F and +505°F (-40°C and 262.7°C)
 - a. Lubricate all O-Rings, except silicone, spring energized seals, and back-up rings sparingly with silicone grease (P/N SP505).
 - b. Seal all pipe threads with Teflon tape or pipe sealant (P/N SP364-AB).
 - c. Lubricate standard threads and bearing points with Jet-Lube, non-metallic, product code #14613 (P/N4114510 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 (P/N SP505).
 - b. Seal all pipe threads with Teflon tape or pipe sealant (P/N SP 364-AB).
 - c. Lubricate standard threads and bearing points with nickel graphite N5000 (P/N 4114507) or equivalent.

B. Assembly Procedure for O-Ring Seats

B.1 Installation of Nozzle

1. 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 2. Refer

Valve Inlet Size		Torque Specification	
in.	mm	ft-lbs ± 5%	Nm ± 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	81.4

to Figure 45 and Table 9 for specifications on appropriate spanner wrench.

2. 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 3.
3. For valves with separate retainer and sensing tube, assemble the tube to the retainer before attaching to the disc. Insert the tube through the retainer and attach using the hex nut. Torque to 25±5 ft-lbs (33.9±6.8 N-m).
4. Insert an O-Ring into the O-Ring groove of the Sensing Retainer Nut. Thread nut into the top of the disc, being careful not to dislodge the O-Ring. Torque to 25±5 ft-lbs (33.9±6.8 N-m).

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

Bore Type	Inlet Size		Orifice	No. of Bolts	Bolt Size	Torque Value	
	in.	mm				in-lbs ±5	N-m ±0.5
Standard Bore	1.00	25.4	D,E,F	N/A	5/8-24UNC	720	14.0
	1.50	38.1	D,E,F	N/A	5/8-24UNC	720	14.0
	1.50	38.1	G,H	N/A	5/8-24UNC	720	27.7
	2.00	50.8	G,H,J	N/A	5/8-24UNC	720	27.7
	3.00	76.2	J,K,L	4	5/16-24UNC	120	14.0
	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
Full Bore	3.00	76.2	3"	6	3/8-24UNF	245	27.7
	4.00	101.6	4"	4	3/8-24UNF	245	27.7
	6.00	152.4	6"	6	3/8-24UNF	245	27.7
	8.00	203.2	8"	8	3/8-24UNF	245	27.7
	10.00	254.0	10"	8	3/8-24UNF	245	27.7

XV. Reassembly of 4900 Series Main Valve (Cont.)

B.2 Disc to Guide seal

1. 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 12.
2. If an O-Ring seal is used, it is installed in the groove between where the Guide Ring is installed and where a Spring Energized Seal would be installed (Figure 12).
3. 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.

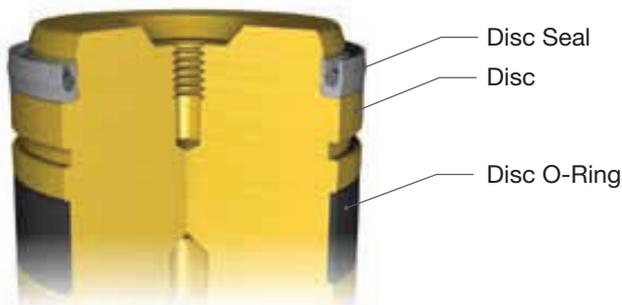


Figure 15: Disc Seal Installation

B.3 Guide and Disc Assembly (D, E, F, G, H, J, K, & 3”L)

1. 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.
2. 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.
3. Drop Guide O-Ring into top of Base for outside diameter of Guide.
4. Insert Guide/Disc assembly into top of Base. It will not fit flush. The Coverplate 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.
5. Install Coverplate O-Ring into top groove on Guide.
6. Thread the Sensing Element into the bottom of the Coverplate. Torque to 50±5 ft-lbs (67.8±6.8N-m).

Table 4: Coverplate Cap Screw/Nut Torque

Bore Type	Valve Size		Orifice	4905		4910		4912		4914		4916		4918	
	in.	mm		ft-lb.	Nm										
Standard Bore	1.00	25.40	D, E, F	40	54.23	40	54.23	40	54.23	40	54.23	40	54.23	90	122.02
	1.50	38.10	D, E, F	40	54.23	40	54.23	40	54.23	40	54.23	40	54.23	340	460.98
	1.50	38.10	G, H	120	162.70	120	162.70	120	162.70	120	162.70	120	162.70	510	691.47
	2.00	50.80	G, H, J	120	162.70	120	162.70	120	162.70	120	162.70	120	162.70	720	976.19
	3.00	76.20	J, K, L	210	284.72	210	284.72	210	284.72	210	284.72	210	284.72	1015	1376.16
	4.00	101.60	L, M, N, P	340	460.98	340	460.98	340	460.98	340	460.98	340	460.98	N/A	N/A
	6.00	152.40	Q, R	340	460.98	340	460.98	340	460.98	N/A	N/A	N/A	N/A	N/A	N/A
Full Bore	8.00	203.20	T	510	691.47	510	691.47	510	691.47	N/A	N/A	N/A	N/A	N/A	N/A
	1.50	38.10	Full Bore	120	162.70	120	162.70	120	162.70	120	162.70	120	162.70	Note 1	N/A
	2.00	50.80	Full Bore	210	284.72	210	284.72	210	284.72	210	284.72	210	284.72	Note 1	Note 1
	3.00	76.20	Full Bore	340	460.98	340	460.98	340	460.98	340	460.98	340	460.98	Note 1	Note 1
	4.00	101.60	Full Bore	340	460.98	340	460.98	340	460.98	340	460.98	N/A	N/A	N/A	N/A
	6.00	152.40	Full Bore	510	691.47	510	691.47	510	691.47	N/A	N/A	N/A	N/A	N/A	N/A
	8.00	203.20	Full Bore	720	976.19	720	976.19	720	976.19	N/A	N/A	N/A	N/A	N/A	N/A
10.00	254.00	Full Bore	720	976.19	720	976.19	N/A								

1. Contact factory.

XV. Reassembly of 4900 Series Main Valve (Cont.)

- Install Coverplate on top of Base such that the vent port and dome port is on the outlet side of the valve center line. Carefully lower the Coverplate bolting and torque uniformly, making sure that there is a uniform gap between the Base and the Coverplate. Torque to the values shown in Table 4 in 15 ft-lb (20 N-m) increments making sure there is a uniform gap between the Base and the Coverplate. Torque in the sequence shown in Figure 16.

- Install Coverplate on top of Base such that the vent port and dome port is on the outlet side of the valve center line. Carefully lower the Coverplate bolting and torque uniformly, making sure that there is a uniform gap between the Base and the Coverplate. Torque to the values found in Table 4 using the torque patterns in Figure 16 and Table 5.

B.4 Guide and Disc Assembly (4" L, M, N, P, Q, R, T, 3" F.B., 4" F.B., 6" F.B., 8" F.B., & 10" F.B.)

- 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.
- Drop Guide O-Ring into top of Base for outside diameter of Guide.
- Insert Guide into top of Base. It will not fit flush. The Coverplate will force it down during its installation.
- 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.
- Install Coverplate O-Ring into top groove on Guide.
- Thread the Sensing Element into the bottom of the coverplate. Torque to 50 ± 5 ft-lbs (67.8 ± 6.8 N-m).

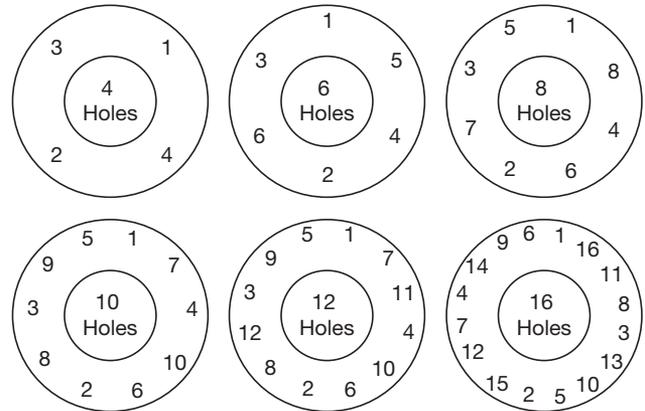


Figure 16: Bolt Tightening Patterns

Table 5: Torque Required per Round	
Round	Percentage of Torque per Pattern Round
1	Wrench Tight
2	25%
3	60%
4	100%
5	100%

XVI. Disassembly of 4900 Series Pilot Valve

A. 49PV07 and 49PV37 (Figures 17 and 18)

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 18 to remove the Lifting Lever assembly. Then return to Figure 17 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.
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 44.

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.
 - a. Disassemble Adjuster Top from the Adjuster Bottom by turning Adjuster Top counterclockwise. Remove Spring Seal (Adjuster Top) from Adjuster Top and discard.
 - b. Remove Cap Screws counter clockwise to allow the removal of the Port Adaptor.
 - c. Remove Ball, O-Ring (Ball Seat), Spring, and O-Ring (Vent Port Assembly) and discard.
18. Removal of the Backflow Preventer

The Backflow Preventer consists of:

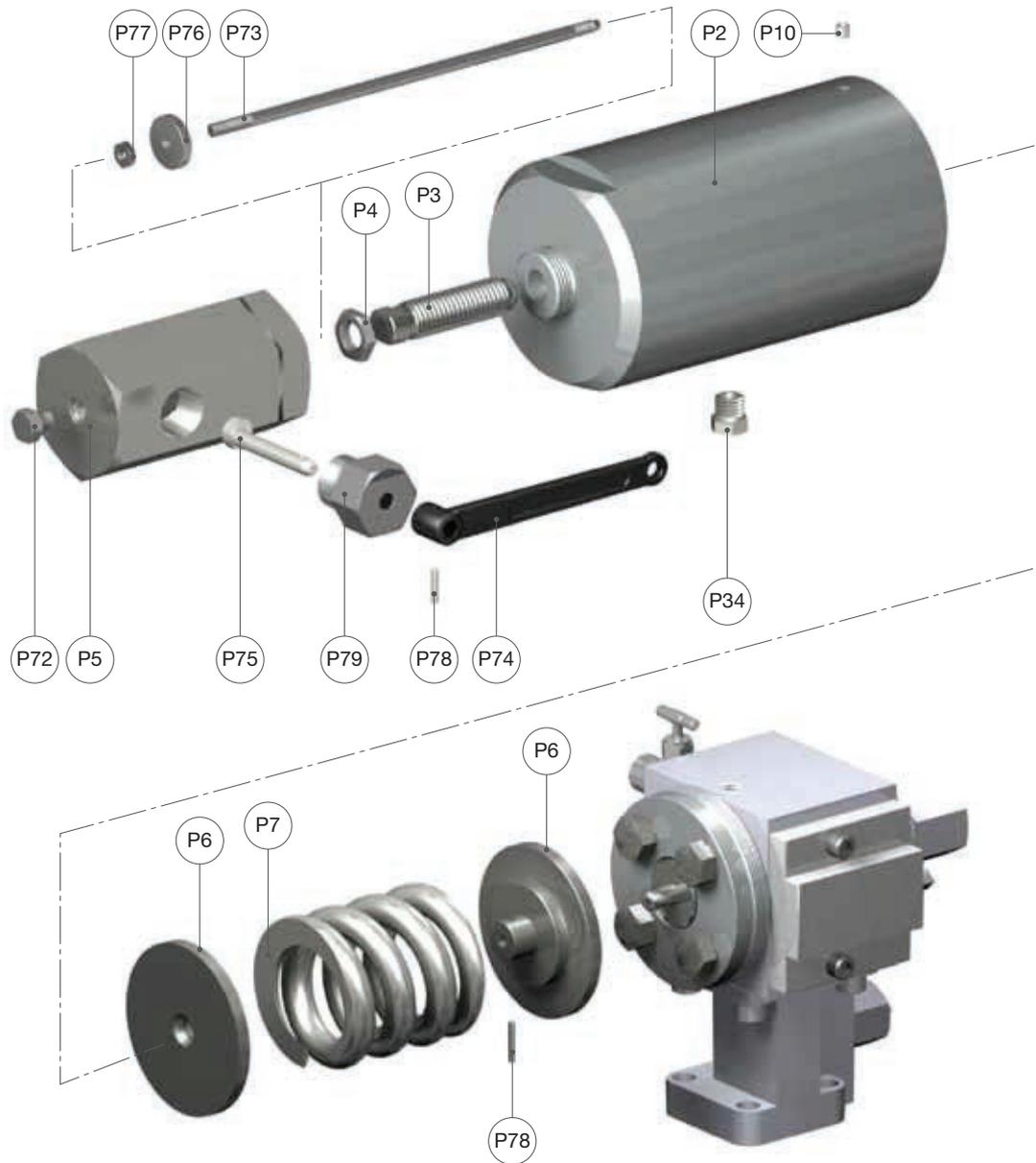
 - 1 – Backflow Preventer Body
 - 1 – Backflow Preventer Guide
 - 1 – Ball
 - 1 – O-Ring (Backflow Preventer) Small
 - 1 – O-Ring (Backflow Preventer) Large
 - 2 – O-Ring (Ball Seat)
 - 1 – Pipe Plug (Backflow Preventer)

XVI. Disassembly of 4900 Series Pilot Valve (Cont.)

Part No.	Nomenclature
P1	Main Base
P2	Bonnet
P3	Compression Screw
P4	Compression Screw Lock Nut
P5	Cap (Compression Screw)
P6	Spring Washer
P7	Spring
P8	Cap Screw (Top Plate)
P9	Top Plate
P10	Set Screw (Bonnet)
P11	O-Ring (Top Plate)
P12	Main Piston
P13	Spring Seal (Main Piston)
P14	Insert Top
P15	Insert Bottom
P16	O-Ring (Insert)
P17	Spring Seal (Insert)
P18	Adjuster Top
P19	Adjuster Bottom
P20	Adjuster Lock Nut
P21	Adjuster Cap
P22	O-Ring (Adjuster Bottom)
P23	O-Ring (Adjuster Top)
P24	Spring Seal (Adjuster Top)
P25	Inlet Adapter

Part No.	Nomenclature
P26	O-Ring (Pilot Base)
P27	O-Ring (Inlet Adapter)
P28	Ball (Backflow Preventer)
P29	Backflow Preventer Guide
P30	Backflow Preventer Body
P31	Pipe Plug (Backflow Preventer)
P32	O-Ring (Backflow Preventer)
P33	O-Ring (Ball Seat) (Backflow Preventer)
P34	Breather Filter Vent (Bonnet)
P35	Manual Blowdown (Needle Valve)
P36	Ball (Field Test)
P37	Tube Filter
P38	Field Test Body
P39	Breather Filter Vent (Field Test Body)
P40	O-Ring (Ball Seat) (Field Test)
P41	O-Ring (Field Test Body)
P42	Cap Screw (Pilot Base/Inlet Adapter)
P43	Cap Screw (Inlet Adapter/Coverplate)
P44	Port Adapter
P45	Cap Screw (Port Adapter/Pilot Base)
P46	Pipe Plug (Port Adapter)
P47	O-Ring (Port Adapter)
P48	Ball (Base)
P49	Spring (Base)
P50	O-Ring (Ball Seat)

XVI. Disassembly of 4900 Series Pilot Valve (Cont.)



Part No.	Nomenclature
P2	Bonnet
P3	Compression Screw
P4	Compression Screw Lock Nut
P5	Cap (Compression Screw)
P6	Spring Washer
P7	Spring
P10	Set Screw (Bonnet)
P34	Breather Filter Vent (Bonnet)

Part No.	Nomenclature
P72	Sealing Plug
P73	Lifting Stem
P74	Lever
P75	Cam Shaft
P76	Release Nut
P77	Release Lock Nut
P78	Drive Pin
P79	Bushing

Figure 18: Lifting Lever Disassembly

XVI. Disassembly of 4900 Series Pilot Valve (Cont.)

19. Remove Backflow Preventer by turning Backflow Preventer Body counterclockwise.
 20. a. Remove Backflow Preventer Guide.
b. Remove Ball and all O-Rings and discard.
 21. Removal of Field Test Connection
The Field Test Connection consists of:
 - 1 – Field Test Body
 - 1 – Ball
 - 1 – Tube Filter
 - 1 – O-Ring (Field Test Body) Small
 - 1 – O-Ring (Field Test Body) Large
 - 2 – O-Ring (Ball Seat)
 - Pipe Plug (Field Test Connection)
 22. Remove Field Test Connection by turning Field Test Body counterclockwise.
 23. Remove Ball, Tube Filter, and all O-Rings and discard.
 24. Removal of the Optional High Capacity Filter
The External Filter consists of:
 - 1 – Canister Filter Sleeve
 - 1 – Canister Filter Base
 - 1 – Filter End Cap
 - 1 – Canister Filter Tie Bolt
 - 1 – Filter Element
 - 1 – Cap Screw (Canister Filter)
 - 1 – Pipe Plug (Canister Filter)
 - 1 – O-Ring (Filter Sleeve)
 - 1 – O-Ring (Filter Base)
 - 1 – O-Ring (Filter Tie Bolt)
 - 1 – O-Ring (Filter Base Bolt)
 - 1 – O-Ring (Filter End Cap)
 25. Remove Canister Filter Tie Bolt by turning counterclockwise.
 26. Keep turning until Canister Filter Sleeve has been removed from Canister Filter Tie Bolt.
 27. Remove Cap Screw (Canister Filter) by turning counterclockwise.
 28. Remove Canister Filter Base.
 29. Remove Filter Element and all O-Rings and discard.
- B. 49MV07** (Figures 18 and 19)
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 18 to remove the Lifting Lever assembly. Then return to Figure 19 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 Cam 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.

XVI. Disassembly of 4900 Series Pilot Valve (Cont.)

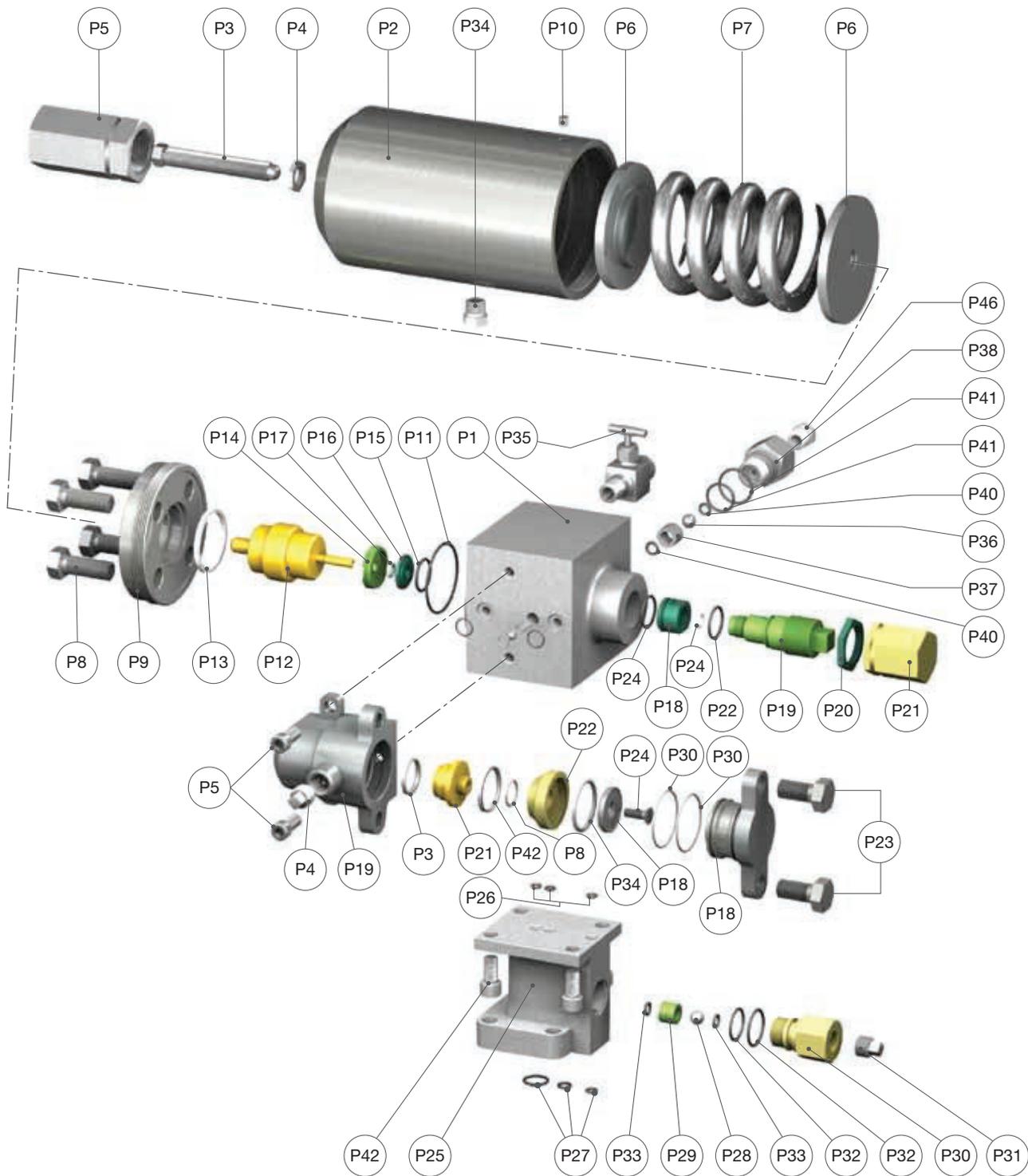


Figure 19: 49MV07 Disassembly

XVI. Disassembly of 4900 Series Pilot Valve (Cont.)

Part No.	Nomenclature
P1	Main Base
P2	Bonnet
P3	Compression Screw
P4	Compression Screw Lock Nut
P5	Cap (Compression Screw)
P6	Spring Washer
P7	Spring
P8	Cap Screw (Top Plate)
P9	Top Plate
P10	Set Screw (Bonnet)
P11	O-Ring (Top Plate)
P12	Main Piston
P13	Spring Seal (Main Piston)
P14	Insert Top
P15	Insert Bottom
P16	O-Ring (Insert)
P17	Spring Seal (Insert)
P18	Adjuster Top
P19	Adjuster Bottom
P20	Adjuster Lock Nut
P21	Adjuster Cap
P22	O-Ring (Adjuster Bottom)
P23	O-Ring (Adjuster Top)
P24	Spring Seal (Adjuster Top)
P25	Inlet Adapter
P26	O-Ring (Pilot Base)
P27	O-Ring (Inlet Adapter)
P28	Ball (Backflow Preventer)
P29	Backflow Preventer Guide
P30	Backflow Preventer Body
P31	Pipe Plug (Backflow Preventer)

Part No.	Nomenclature
P32	O-Ring (Backflow Preventer)
P33	O-Ring (Ball Seat) (Backflow Preventer)
P34	Breather Filter Vent (Bonnet)
P35	Manual Blowdown (Needle Valve)
P36	Ball (Field Test)
P37	Tube Filter
P38	Field Test Body
P39	Breather Filter Vent (Field Test Body)
P40	O-Ring (Ball Seat) (Field Test)
P41	O-Ring (Field Test Body)
P42	Cap Screw (Pilot Base/Inlet Adapter)
P43	Cap Screw (Inlet Adapter/Coverplate)
P48	Ball (Base)
P49	Spring (Base)
P50	O-Ring (Ball Seat)
P57	Modulator Base
P58	Modulator Stop
P59	O-Ring (Modulator Base)
P60	O-Ring (Modulator Stop)
P61	Modulator Piston Top
P62	Modulator Piston Bottom
P63	Spring Seal (Piston Top)
P64	Spring Seal (Piston Bottom)
P65	Spring Seal (Modulator Piston Bottom)
P66	O-Ring (Modulator Seat)
P67	O-Ring Retainer
P68	Lock Screw (Retainer)
P69	Cap Screw (Modulator Stop) (Not Shown)
P70	Socket Head Cap Screw (Modulator)
P71	Pipe Plug (Modulator)

XVI. Disassembly of 4900 Series Pilot Valve (Cont.)

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 44.
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. Removal of the Backflow Preventer
The Backflow Preventer consists of:
 - 1 – Backflow Preventer Body
 - 1 – Backflow Preventer Guide
 - 1 – Ball
 - 1 – O-Ring (Backflow Preventer) Small
 - 1 – O-Ring (Backflow Preventer) Large
 - 2 – O-Ring (Ball Seat)
 - 1 – Pipe Plug (Backflow Preventer)
19. Remove Backflow Preventer by turning Backflow Preventer Body counterclockwise.
20. Remove Backflow Preventer Guide.
20. Remove Ball and all O-Rings and discard.
21. Removal of Field Test Connection
The Field Test Connection consists of:
 - 1 – Field Test Body
 - 1 – Ball
 - 1 – Tube Filter
 - 1 – O-Ring (Field Test Body) Small
 - 1 – O-Ring (Field Test Body) Large
 - 2 – O-Ring (Ball Seat)
 - Pipe Plug (Field Test Connection)
22. Remove Field Test Connection by turning Field Test Body counterclockwise.
23. Remove Ball, Tube Filter, and all O-Rings and discard.
24. Removal of the Optional High Capacity Filter
The External Filter consists of:
 - 1 – Canister Filter Sleeve
 - 1 – Canister Filter Base
 - 1 – Filter End Cap
 - 1 – Canister Filter Tie Bolt
 - 1 – Filter Element
 - 1 – Cap Screw (Canister Filter)
 - 1 – Pipe Plug (Canister Filter)
 - 1 – O-Ring (Filter Sleeve)
 - 1 – O-Ring (Filter Base)
 - 1 – O-Ring (Filter Tie Bolt)
 - 1 – O-Ring (Filter Base Bolt)
 - 1 – O-Ring (Filter End Cap)
25. Remove Canister Filter Tie Bolt by turning counterclockwise.
26. Keep turning until Canister Filter Sleeve has been removed from Canister Filter Tie Bolt.
27. Remove Cap Screw (Canister Filter) by turning counterclockwise.
28. Remove Canister Filter Base.
29. Remove Filter Element and all O-Rings and discard.

XVI. Disassembly of 4900 Series Pilot Valve (Cont.)

30. Remove Socket Head Cap Screw (qty. 2) 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 Assembly

The 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)

31. Remove Cap Screws (Modulator) holding Modulator Stop to Modulator Base.
32. 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.
33. Remove both O-Rings (Modulator Stop) and discard.
34. Disassemble the Modulator Piston Assembly by removing the Lock Screw.
35. 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.
36. Discard Spring Seal (Piston Bottom) and Spring Seal (Piston Top).

C. 49MV22/72 (Figures 20, 21, and 18)

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 18 to remove the Lifting Lever assembly. Then return to Figure 20 or 21 to continue disassembly.
 - a. The Lifting Lever Assembly consists of:
 - 1 – Lifting Lever

- 1 – Drive Pin
- 1 – Cam Shaft
- 1 – Cam Bushing

- b. Remove Lifting Lever Assembly by turning Cam 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.
13. Remove Spring Seal (Main Piston) and Backup Ring (if applicable) and discard.

XVI. Disassembly of 4900 Series Pilot Valve (Cont.)

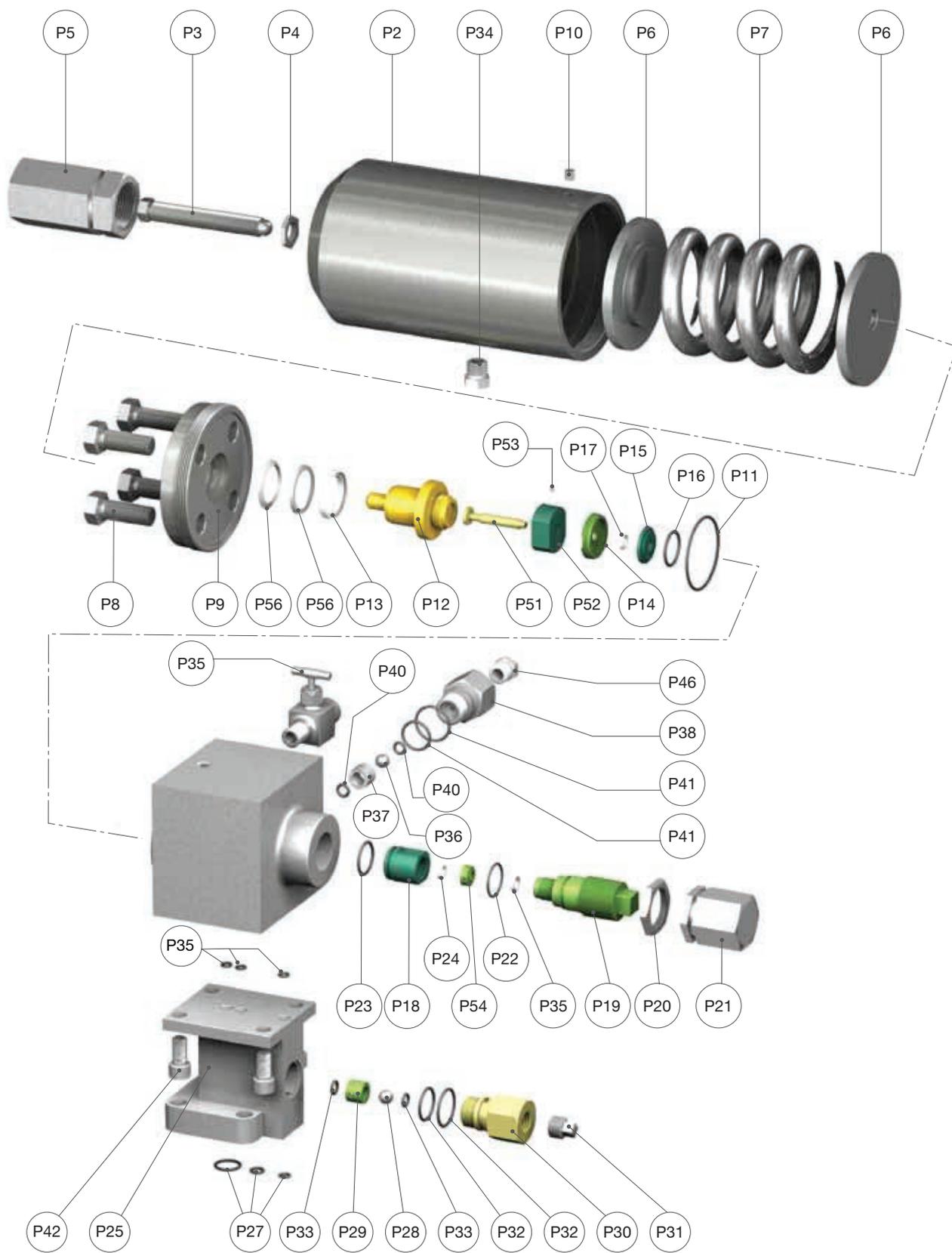


Figure 20: 49MV22 Disassembly

XVI. Disassembly of 4900 Series Pilot Valve (Cont.)

Part No.	Nomenclature
P1	Main Base
P2	Bonnet
P3	Compression Screw
P4	Compression Screw Lock Nut
P5	Cap (Compression Screw)
P6	Spring Washer
P7	Spring
P8	Cap Screw (Top Plate)
P9	Top Plate
P10	Set Screw (Bonnet)
P11	O-Ring (Top Plate)
P12	Main Piston
P13	Spring Seal (Main Piston)
P14	Insert Top
P15	Insert Bottom
P16	O-Ring (Insert)
P17	Spring Seal (Insert)
P18	Adjuster Top
P19	Adjuster Bottom
P20	Adjuster Lock Nut
P21	Adjuster Cap
P22	O-Ring (Adjuster Bottom)
P23	O-Ring (Adjuster Top)
P24	Spring Seal (Adjuster Top)
P25	Inlet Adapter

Part No.	Nomenclature
P26	O-Ring (Pilot Base)
P27	O-Ring (Inlet Adapter)
P28	Ball (Backflow Preventer)
P29	Backflow Preventer Guide
P30	Backflow Preventer Body
P31	Pipe Plug (Backflow Preventer)
P32	O-Ring (Backflow Preventer)
P33	O-Ring (Ball Seat) (Backflow Preventer)
P34	Breather Filter Vent (Bonnet)
P35	Manual Blowdown (Needle Valve)
P36	Ball (Field Test)
P37	Tube Filter
P38	Field Test Body
P39	Breather Filter Vent (Field Test Body)
P40	O-Ring (Ball Seat) (Field Test)
P41	O-Ring (Field Test Body)
P42	Cap Screw (Pilot Base/Inlet Adapter)
P43	Cap Screw (Inlet Adapter/Coverplate)
P51	Piston Nose
P52	Piston Retainer Nut
P53	Set Screw (Piston)
P54	Vent Seal (Adaptor)
P55	Spring Seal (Vent Seal Adaptor)
P56	Back-up Ring (49MV72)

XVI. Disassembly of 4900 Series Pilot Valve (Cont.)

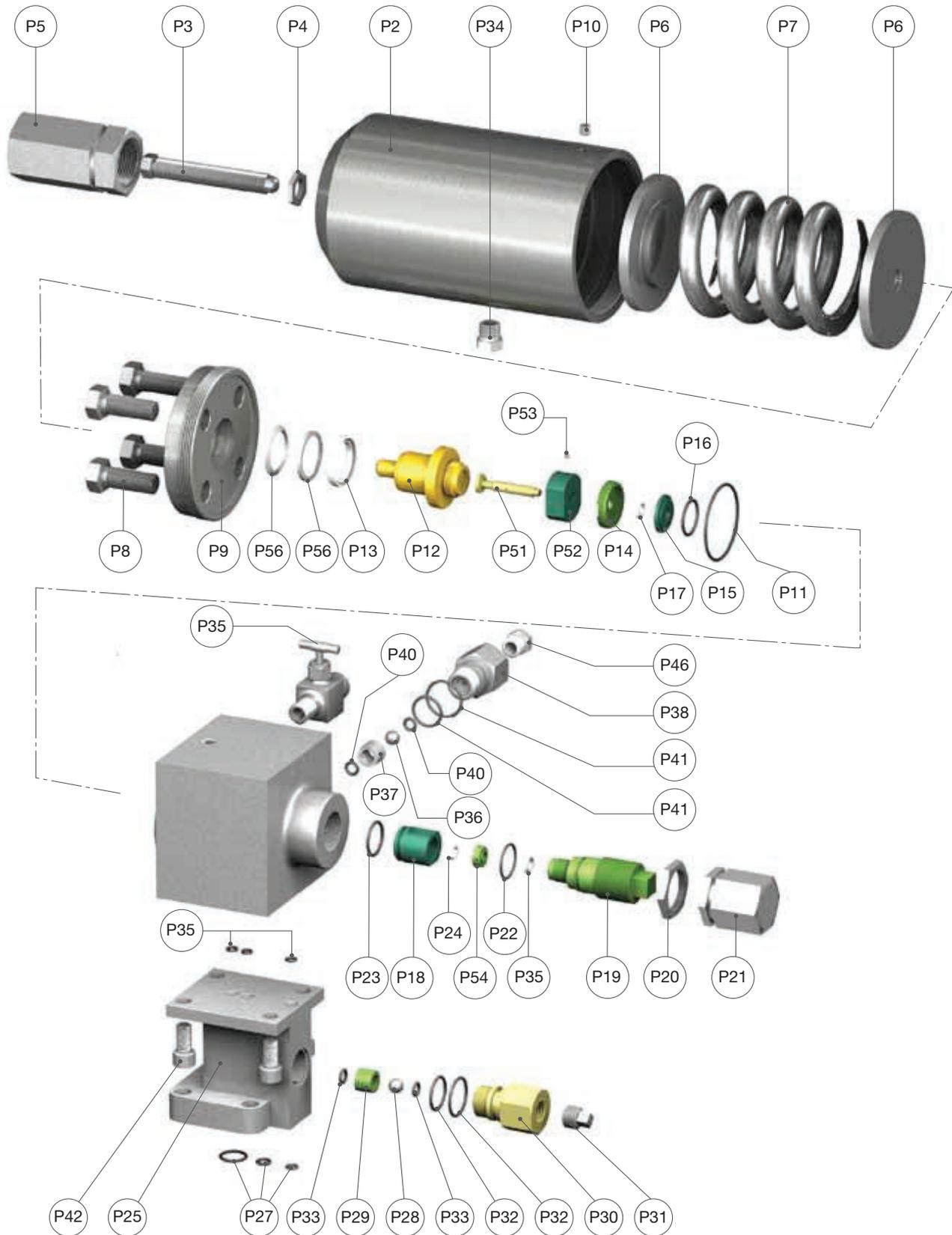


Figure 21: 49MV72 Disassembly

XVI. Disassembly of 4900 Series Pilot Valve (Cont.)

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 44.
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.
 - a. 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. Removal of the Backflow Preventer
The Backflow Preventer consists of:
 - 1 – Backflow Preventer Body
 - 1 – Backflow Preventer Guide
 - 1 – Ball
 - 1 – O-Ring (Backflow Preventer) Small
 - 1 – O-Ring (Backflow Preventer) Large
 - 2 – O-Ring (Ball Seat)
 - 1 – Pipe Plug (Backflow Preventer)
21. Remove Backflow Preventer by turning Backflow Preventer Body counterclockwise.
22. Remove Backflow Preventer Guide.
23. Remove Ball and all O-Rings and discard.
24. Removal of Field Test Connection
The Field Test Connection consists of:
 - 1 – Field Test Body
 - 1 – Ball
 - 1 – Tube Filter
 - 1 – O-Ring (Field Test Body) Small
 - 1 – O-Ring (Field Test Body) Large
 - 2 – O-Ring (Ball Seat)
 - Pipe Plug (Field Test Connection)
25. Remove Field Test Connection by turning Field Test Body counterclockwise.
26. Remove Ball, Tube Filter, and all O-Rings and discard.
27. Removal of the Optional High Capacity Filter
The External Filter consists of:
 - 1 – Canister Filter Sleeve
 - 1 – Canister Filter Base
 - 1 – Filter End Cap
 - 1 – Canister Filter Tie Bolt
 - 1 – Filter Element
 - 1 – Cap Screw (Canister Filter)
 - 1 – Pipe Plug (Canister Filter)
 - 1 – O-Ring (Filter Sleeve)
 - 1 – O-Ring (Filter Base)
 - 1 – O-Ring (Filter Tie Bolt)
 - 1 – O-Ring (Filter Base Bolt)
 - 1 – O-Ring (Filter End Cap)
28. Remove Canister Filter Tie Bolt by turning counterclockwise.
29. Keep turning until Canister Filter Sleeve has been removed from Canister Filter Tie Bolt.
30. Remove Cap Screw (Canister Filter) by turning counterclockwise.
31. Remove Canister Filter Base.
32. Remove Filter Element and all O-Rings and discard.

XVI. Disassembly of 4900 Series Pilot Valve (Cont.)

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. Inspection and Part Replacement 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. 49PV07/37

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 $.243 \pm .001$ " (6.17 \pm .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 \pm 0.03 mm) on 49PV07 model or $.970 \pm .001$ " (24.64 \pm 0.03 mm) on 49PV37. 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. 49MV07

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 \pm 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 \pm 0.03 mm) on 49MV07 model.
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.

XVII. Pilot Valve Part Inspection (Cont.)

- Spring Washer(s):** Galling at the spherical bearing surface. Check for any corrosion or pitting.
- Pilot Base:** Check for any corrosion or pitting. Also, check for galling of threads.
- Spring:** Check for any corrosion or pitting.
- 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).
- 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.
- 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.
- Modulator Base:** Galling or excessive wear on any inside diameter. Any corrosion or pitting.

C. 49MV22/72

- 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 where the Spring Seal (Main Piston) rides must be $.970 \pm .001$ " (24.64 \pm 0.03 mm) on 49MV22 model or $.812 \pm .001$ " (20.63 \pm 0.03 mm) on 49MV72. A surface finish of 8 RMS must be maintained for proper sealing on these surfaces.
- 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 \pm 0.03 mm). The stem itself must have a T.I.R of .001" (0.03 mm) along its length.

- 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.
- Insert Bottom:** Galling or excessive wear on the inside diameter that guides the Main Piston. Check for any corrosion or pitting.
- 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.
- 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.
- Balance Seal Adaptor:** Check for any corrosion or pitting.
- 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.
- 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.
- Compression Screw:** Galling at the spherical bearing surface or in the thread. Check for any corrosion or pitting.

- Spring Washer(s):** Galling at the spherical bearing surface. Check for any corrosion or pitting.
- Pilot Base:** Check for any corrosion or pitting. Also, check for galling of threads.
- 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 12 and 13 for O-Ring/Spring Seal repair kits. Recommended spare parts are listed in Table 10.

XVIII. Reassembly of 4900 Series Pilot Valve

A. Lubricants and Sealants

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

B. Assembly of 49PV07/37

B.1 Making the Main Pilot

1. 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 43.
 - (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 22.
 - (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 23.
- (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 shown in Figure 24.

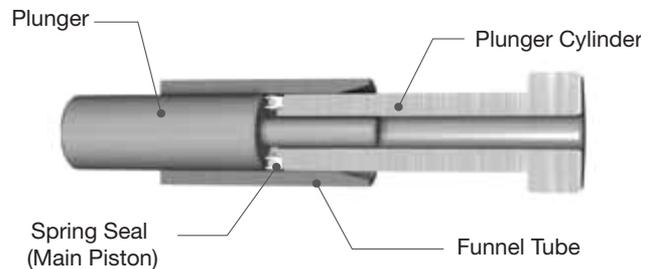


Figure 22: Funnel Tube

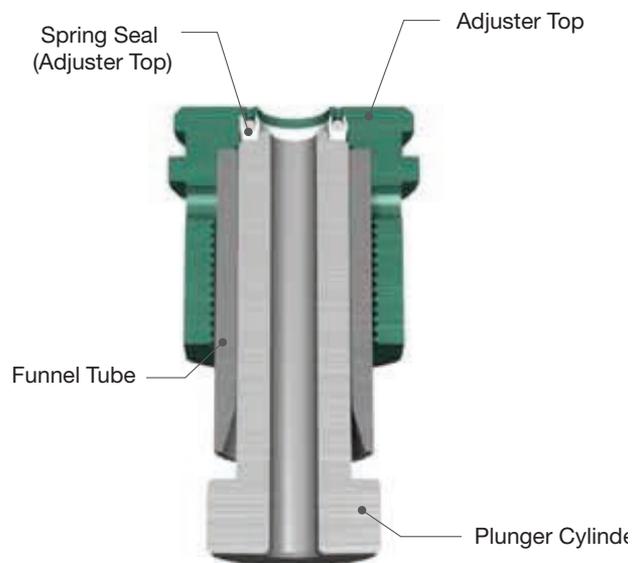


Figure 23: Plunger Cylinder

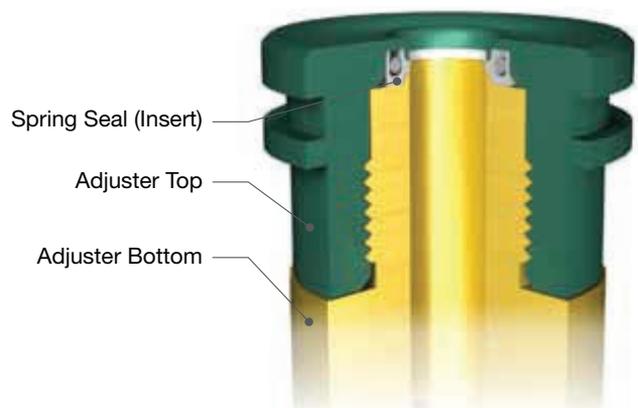


Figure 24: Adjuster Top Assembly

XVIII. Reassembly of 4900 Series Pilot Valve (Cont.)

- 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, step 16 (Section XVI.A).
- 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.

2. 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 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 25.

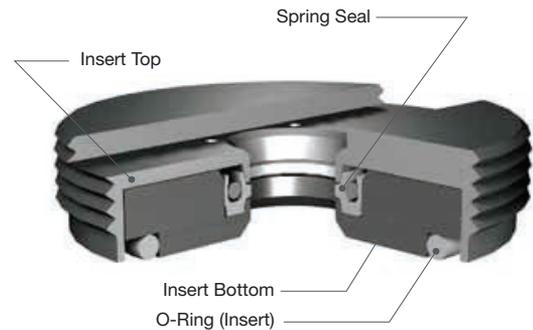


Figure 25: Insert Assembly

- f. Turn Insert Assembly over and thread into Pilot Base with T-handle groove wrench (Part #4995401, Figure 44). 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.
3. Install O-Ring (Top Plate) into groove on top of Pilot Base.

- 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 26 or 27.

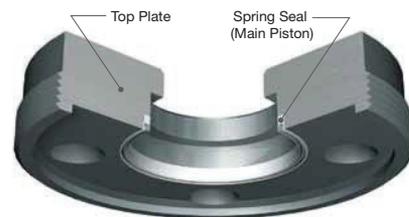


Figure 26: Top Plate (49PV07/MV07)

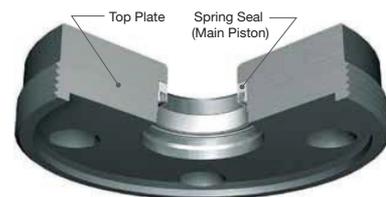


Figure 27: Top Plate (49PV37/MV22/72)

XVIII. Reassembly of 4900 Series Pilot Valve (Cont.)

- 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).
 4. Install Main Piston/Top Plate Assembly into Pilot Base by inserting small diameter end of Main Piston through Insert Assembly.
 5. 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.
 6. Thread Compression Screw into top of Bonnet until the bearing point begins to protrude through Bonnet.
 7. 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.
 8. 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.
 9. 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.
 10. Turn Compression Screw clockwise until dimension has been reached that was noted during disassembly.
 11. Tighten Compression Screw Lock Nut wrench tight.
 12. For Lifting Lever Option, reinstall Release Nut and Release Lock Nut onto Lifting Stem. Turn clockwise until it matches the dimension noted during disassembly.
 13. Install Filter Plug into Bonnet vent hole (if removed).
 14. Install Pipe Plug (Pilot Valve) in port above vent hole (if removed).
- ### B.2 Reassembly of the Backflow Preventer
1. Insert an O-Ring (Ball Seat) into the Pilot Inlet Adaptor seat ring counter bore at the bottom of the backflow preventer fitting opening.
 2. Insert the Backflow Preventer Guide into the Pilot Inlet Adaptor. The end closest to the cross drilled holes must go in first.
 3. Insert an O-Ring (Ball Seat) into the Backflow Preventer Body seat ring counter bore.
 4. Insert the O-Ring (Backflow Preventer) Small and the O-Ring (Backflow Preventer) Large into the Pilot Inlet Adaptor locating them on the seal shoulders.
 5. Position the Pilot Inlet Adaptor with the Backflow Preventer Body opening vertical. Insert the Ball into the Backflow Preventer Guide.
 6. Thread the Backflow Preventer Body into the Pilot Inlet Adaptor. Torque the fitting to 50 ± 5 ft-lbs (68 ± 7 N-m).
- ### B.3 Reassembly of the Field Test Fitting
1. Insert an O-Ring (Ball Seat) into the Pilot Base seat ring counter bore at the bottom of Field Test Fitting bore.
 2. Insert the Tube Filter into the Field Test Fitting opening of the body.
 3. Insert an O-Ring (Ball Seat) into the Field Test Body seat ring counter bore.
 4. Insert the O-Ring (Field Test Body) Small and the O-Ring (Field Test Body) Large into the Pilot Base.
 5. Position the Pilot Base with the Field Test fitting opening vertical. Insert the Ball into the Tube Filter.
 6. Thread the Field Test Body into the Pilot Base. Torque the fitting to 50 ± 5 ft-lbs (68 ± 7 N-m).

XVIII. Reassembly of 4900 Series Pilot Valve (Cont.)

B.4 Assembly of the Port Adaptor for the 49PV valves

1. Insert the Modulator Check Spring into the Modulator Vent Port opening of the Pilot Base.
2. Insert the O-Ring (Inlet Port), O-Ring (Dome Port), and O-Ring (Vent Port) into the O-Ring grooves of the Pilot Base.
3. Insert the Ball (Vent Port) into the vent port letting it rest on the Spring (Vent Port).
4. Align the bolt holes of the Inlet Adaptor with the two Cap Screw threaded holes in the Pilot Base. The two holes on the face of the Inlet Adaptor must align with the vent port and dome port openings of the Pilot Base.

B.5 Assembly of the Optional High Capacity Filter

1. Insert O-Rings into the two .375" (9.53 mm) diameter x .055" (13.97 mm) deep counterbores of the external filter port of the Pilot Base.
2. Insert an O-Ring into the counterbore at the filter base bolt hole.
3. Assemble the Filter Base to the Pilot Base using the filter base bolt reference on the b/m. Torque the bolt to 35 ± 5 ft/lbs (47.45 ± 6.78 Nm).
4. Install a filter sleeve O-Ring seal over the filter sleeve guide shoulder of the Filter Base.
5. Install a filter sleeve/O-Ring seal over the filter sleeve guide shoulder of the filter end cap.
6. Install a filter sleeve O-Ring seal over tie bolt.
7. Install the filter element and spring over tie bolt and onto the raised filter element guide of the filter end cap.
8. Thread the tie bolt with sleeve, filter element, spring, O-Rings & end cap on tie bolt to filter base. The 1/8"-27NPT thread in the end cap must be facing toward the pilot base inlet flange face, tighten the bolt until metal-to-metal make up with the guide sleeve is obtained.

C. Assembly of 49MV07

C.1 Making the Main Pilot

1. 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 40.

- (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 22.

- (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 23.

- (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 24.

- c. Thread Adjuster Top clockwise onto Adjuster bottom and torque to 27 ± 2 ft-lbs (37 ± 2.7 N-m).

XVIII. Reassembly of 4900 Series Pilot Valve (Cont.)

- 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 tightened 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, step 16 (Section XVI.B).
- 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.

2. 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 25.
- f. Turn Insert Assembly over and thread into Pilot Base with T-handle groove wrench (Part #4995401 Figure 44). 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.

3. Install O-Ring (Top Plate) into groove on top of Pilot Base.
 - 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 26.
 - 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).
4. Install Main Piston/Top Plate Assembly into Pilot Base by inserting small diameter end of Main Piston through Insert Assembly.
5. 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).
6. If removed, install Compression Screw Lock Nut 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.

XVIII. Reassembly of 4900 Series Pilot Valve (Cont.)

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.

C.2 Reassembly of the Backflow Preventer

1. Insert an O-Ring (Ball Seat) into the Pilot Inlet Adaptor seat ring counter bore at the bottom of the backflow preventer fitting opening.
2. Insert the Backflow Preventer Guide into the Pilot Inlet Adaptor. The end closest to the cross drilled holes must go in first.
3. Insert an O-Ring (Ball Seat) into the Backflow Preventer Body seat ring counter bore.
4. Insert the O-Ring (Backflow Preventer) Small and the O-Ring (Backflow Preventer) Large into the Pilot Inlet Adaptor locating them on the seal shoulders.
5. Position the Pilot Inlet Adaptor with the Backflow Preventer Body opening vertical. Insert the Ball into the Backflow Preventer Guide.
6. Thread the Backflow Preventer Body into the Pilot Inlet Adaptor. Torque the fitting to 50±5 ft-lbs (68±7 N-m).

C.3 Reassembly of the Field Test Fitting

1. Insert an O-Ring (Ball Seat) into the Pilot Base seat ring counter bore at the bottom of Field Test Fitting bore.
2. Insert the Tube Filter into the Field Test Fitting opening of the body.
3. Insert an O-Ring (Ball Seat) into the Field Test Body seat ring counter bore.

4. Insert the O-Ring (Field Test Body) Small and the O-Ring (Field Test Body) Large into the Pilot Base.
5. Position the Pilot Base with the Field Test fitting opening vertical. Insert the Ball into the Tube Filter.
6. Thread the Field Test Body into the Pilot Base.
Torque the fitting to 50±5 ft-lbs (68±7 N-m).

C.4 Assembly of the Port Adaptor for the 49MV valves

1. Insert the Modulator Check Spring into the Modulator Vent Port opening of the Pilot Base.
2. Insert the O-Ring (Inlet Port), O-Ring (Dome Port), and O-Ring (Vent Port) into the O-Ring grooves of the Pilot Base.
3. Insert the Ball (Vent Port) into the vent port letting it rest on the Spring (Vent Port).
4. Align the bolt holes of the Inlet Adaptor with the two Cap Screw threaded holes in the Pilot Base. The two holes on the face of the Inlet Adaptor must align with the vent port and dome port openings of the Pilot Base.

C.5 Making The Modulator Piston Assembly

1. Install Spring Seal (Piston Top) into groove on Modulator Piston Top. Be sure to have the spring in the seal facing up.
2. Install O-Ring (Modulator Seat) into groove on Modulator Piston Bottom.
3. Turn Modulator Piston Bottom over and place O-Ring (Modulator Piston Bottom) into inner groove.
4. Install Spring Seal (Piston Bottom) onto Modulator Piston Bottom in outer groove. Make sure spring is facing down.
5. Insert Modulator Piston Top into Modulator Piston Bottom through the side with the O-Ring (Modulator Piston Bottom) and the Spring Seal (Piston Bottom).
6. Turn assembly over and install O-Ring Retainer. The chamfered outside diameter goes in first.
7. Thread Lock Screw through the O-Ring Retainer into Modulator Piston Top. Tighten 40 ± 5 in-lbf (4.5 ± 0.6 Nm).

XVIII. Reassembly of 4900 Series Pilot Valve (Cont.)

8. Final Modulator Piston Assembly is shown in Figure 28.

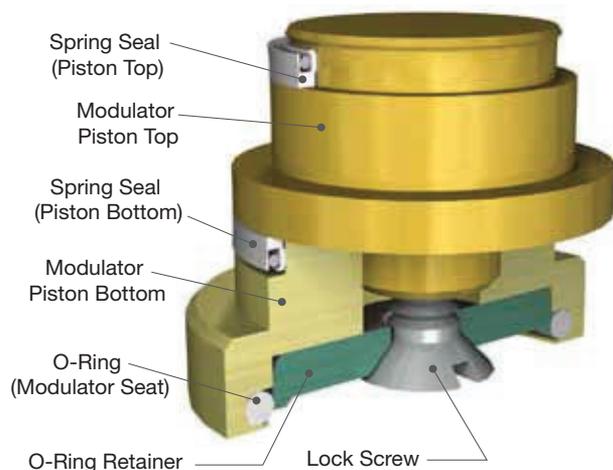


Figure 28:

9. Lubricate Spring Seals before inserting into Modulator Base.
10. 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.
11. Install both O-Rings (Modulator Stop) into grooves on Modulator Piston Stop.
12. 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.
13. Thread the Cap Screws (Modulator) through the Modulator Stop into the Modulator Base. Tighten to 365 ± 30 in-lbf (41.2 ± 3.4 Nm).
14. Do not install Modulator Assembly at this time.

C.6 Assembly of the Optional High Capacity Filter

1. Insert O-Rings into the two $.375$ " (9.53 mm) diameter x $.055$ " (13.97 mm) deep counterbores of the external filter port of the Pilot Base.
2. Insert an O-Ring into the counterbore at the filter base bolt hole.
3. Assemble the Filter Base to the Pilot Base using the filter base bolt reference on the b/m. Torque the bolt to 35 ± 5 ft/lbs (47.45 ± 6.78 Nm).
4. Install a filter sleeve O-Ring seal over the filter sleeve guide shoulder of the Filter Base.
5. Install a filter sleeve/O-Ring seal over the filter sleeve guide shoulder of the filter end cap.

XVIII. Reassembly of 4900 Series Pilot Valve (Cont.)

6. Install a filter sleeve O-Ring seal over tie bolt.
7. Install the filter element and spring over tie bolt and onto the raised filter element guide of the filter end cap.
8. Thread the tie bolt with sleeve, filter element, spring, O-Rings & end cap on tie bolt to filter base. The 1/8- 27 NPT thread in the end cap must be facing toward the pilot base inlet flange face, tighten the bolt until metal-to-metal make up with the guide sleeve is obtained.

D. Assembly of 49MV22/72

D.1 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 44.
 - (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 22.
- (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 23.
- (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.

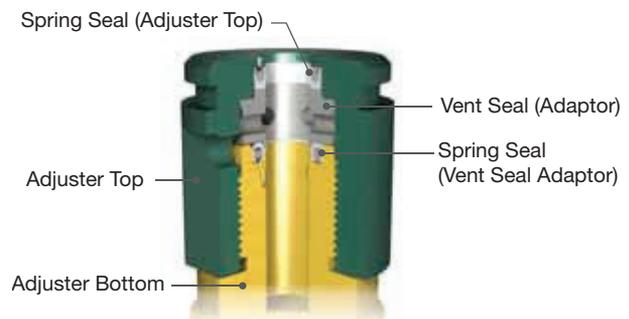


Figure 29: Adjuster Top Assembly (49MV22/72)

- 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.

XVIII. Reassembly of 4900 Series Pilot Valve (Cont.)

- 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, step 16 (Section XVI.C).
- 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 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 25.
 - f. Turn Insert Assembly over and thread into Pilot Base with T-handle groove wrench (Part #4995401 Figure 44). 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.
4. Install O-Ring (Top Plate) into groove on top of Pilot Base.
 - a. 49MV22
 - 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 30.
 - 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 not to damage the Spring Seal (Main Piston).
- b. 49MV72
 - 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 30.
 - 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.
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, install Compression Screw Lock Nut 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.



Figure 30: Top Plate Image with Back-Up Ring

XVIII. Reassembly of 4900 Series Pilot Valve (Cont.)

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.
 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 (if removed).

D.2 Reassembly of the Backflow Preventer

1. Insert an O-Ring (Ball Seat) into the Pilot Inlet Adaptor seat ring counter bore at the bottom of the backflow preventer fitting opening.
2. Insert the Backflow Preventer Guide into the Pilot Inlet Adaptor. The end closest to the cross drilled holes must go in first.
3. Insert an O-Ring (Ball Seat) into the Backflow Preventer Body seat ring counter bore.
4. Insert the O-Ring (Backflow Preventer) Small and the O-Ring (Backflow Preventer) Large into the Pilot Inlet Adaptor locating them on the seal shoulders.
5. Position the Pilot Inlet Adaptor with the Backflow Preventer Body opening vertical. Insert the Ball into the Backflow Preventer Guide.
6. Thread the Backflow Preventer Body into the Pilot Inlet Adaptor. Torque the fitting to 50±5 ft-lbs (68±7 N-m).

D.3 Reassembly of the Field Test Fitting

1. Insert an O-Ring (Ball Seat) into the Pilot Base seat ring counter bore at the bottom of Field Test Fitting bore.
2. Insert the Tube Filter into the Field Test Fitting opening of the body.
3. Insert an O-Ring (Ball Seat) into the Field Test Body seat ring counter bore.
4. Insert the O-Ring (Field Test Body) Small and the O-Ring (Field Test Body) Large into the Pilot Base.
5. Position the Pilot Base with the Field Test fitting opening vertical. Insert the Ball into the Tube Filter.
6. Thread the Field Test Body into the Pilot Base. Torque the fitting to 50±5 ft-lbs (68 ± 7 N-m).

D.4 Assembly of the Optional High Capacity Filter

1. Insert O-Rings into the two .375" (9.53 mm) diameter x .055" (13.97 mm) deep counterbores of the external filter port of the Pilot Base.
2. Insert an O-Ring into the counterbore at the filter base bolt hole.
3. Assemble the Filter Base to the Pilot Base using the filter base bolt reference on the b/m. Torque the bolt to 35 ± 5 ft/lbs (47.45 ± 6.78 Nm).
4. Install a filter sleeve O-Ring seal over the filter sleeve guide shoulder of the Filter Base.
5. Install a filter sleeve O-Ring seal over the filter sleeve guide shoulder of the filter end cap.
6. Install a filter sleeve O-Ring seal over tie bolt.
7. Install the filter element and spring over tie bolt and onto the raised filter element guide of the filter end cap.
8. Thread the tie bolt with sleeve, filter element, spring, O-Rings & end cap on tie bolt to filter base. The 1/8-27 NPT thread in the end cap must be facing toward the pilot base inlet flange face, tighten the bolt until metal-to-metal make up with the guide sleeve is obtained.

XIX. Setting and Testing

A. Pilot Valve Testing

The pilot valve must be adjusted for both set point and blowdown on a test stand prior to its assembly onto the main valve. Failure to do this can cause incorrect blowdown readings. If the valve is to be tested on the pressure vessel, it can successfully be calibrated and tested for set pressure and blowdown.

ATTENTION!

To adjust blowdown when pilot is mounted to main valve, test stand must be capable of flowing the valve at name plate capacity.

B. Pilot Valve Test Stand

The pilot test stand should consist of the equipment shown in Figure 31. All equipment must be rated to at least the set pressure being tested. Test stand requires:

1. Suitable pressure source with regulator.
2. cubic foot (14 liters) inlet side accumulator.
3. 1/30 cubic foot (1 liter) dome simulator.
4. Inlet and dome pressure gauges.
5. Inlet supply throttle valve.
6. Inlet supply vent/throttle valve.
7. Inlet supply and dome simulator pressure gauges.

The inlet accumulator and dome simulator should be fitted with a drain valve at the lowest point in the vessel to allow draining moisture before testing.

C. Pilot Valve Test Procedure

Definitions and guidelines

- **Set Point:** Point where vent pressure is felt from port.
 - **Closing Point:** Point where dome pressure begins to reload.
 - **Blowdown:** Set point minus closing point.
- Leakage will be checked for a one minute interval pilots with Teflon O-Rings may leak on air test.
1. Mount pilot to pilot test stand shown in Figure 31.
 2. Install a Swagelok elbow in the downward position into the pilot vent port to facilitate testing.
 3. Remove Adjuster Cap.
 4. Setting of 49PV07, 49PV37, AND 49MV07 (without modulator).

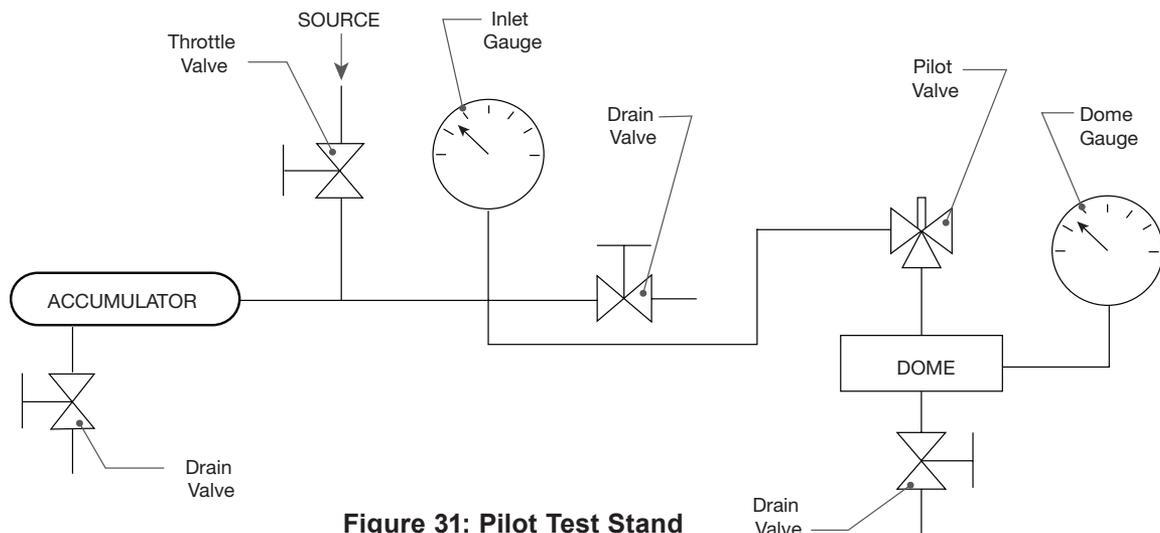


Figure 31: Pilot Test Stand

XIX. Setting and Testing (Cont.)

- a. If Adjuster Assembly has not been previously set, turn Adjuster clockwise into Pilot Base until it stops. Turn out 2 turns.
- b. With finger over vent port, increase pressure until venting occurs; note pressure on inlet gauge.
- c. Increase system pressure to 3 psi (0.21 barg) or 10%, whichever is greater over the pressure noted in step 4.b in Section XIX.C. Dome gauge pressure should read zero.
- d. Vent system pressure until dome pressure starts to increase; note pressure on inlet gauge. This is the blowdown or closing point for the pilot.
- e. If inlet pressure noted in step 4.b in Section XIX.C is less than set pressure, turn Compression Screw clockwise. If inlet pressure noted in step 4.b in Section XIX.C is greater than set pressure, turn Compression Screw counterclockwise.
- f. For steam, vapor and gas service, blowdown for the pilot shall be set at 3 psi (0.21 barg) or 4%, whichever is greater. For liquid service, blowdown shall be set at 5 psi (0.34 barg) or 6%, whichever is greater.
 - (i) If the blowdown noted in step 4.d in Section XIX.C is less than this, turn Adjuster clockwise then lock in Adjuster Lock Nut.
 - (ii) If the blowdown noted in step 4.d in Section XIX.C is greater than this, turn Adjuster counterclockwise then lock in Adjuster Lock Nut.

Note: Adjuster should not be turned unless system pressure is at 110% or if system pressure is zero.

- g. Repeat steps 4.d through 4.f in Section XIX.C until pressure noted in step 8.4.2 is within 3 psi (0.21 barg) or 3% of set pressure. On the last round of tests, assemble a Swagelok fitting sealing the vent port with a 90° tube facing downwards. Place this tube in a cup of water when pilot is at full overpressure. If bubbles are present (> 0 bpm), then Spring Seal (Insert) is leaking. Disassemble pilot and inspect Spring Seal (Insert) and Main Piston for damage.

Table 6: Set Pressure Adjustment		
% Backpressure		Set pressure adjustment
psig	barg	
0—15	0 – 1.03	0%
16—45	1.10 – 3.10	Up 1%
46—65	3.17 – 4.48	Up 2%

Note: If the 49PV07 or 49PV37 vent is piped to the Main Valve Body Bowl, adjust set pressure by Table 6.

- h. Check for leakage at 5 psig (0.34 barg) or 4% below set pressure, whichever is less.

For vent seal, place a cup of water over pilot vent. If bubbles are present (> 0 bpm), then disassemble pilot and inspect Spring Seal (Adjuster Top) and Main Piston for damage.

Snoop all joints, fittings and breather vent for leakage. If bubbles are present, repair as necessary.

- 5. Remove Swagelok elbow from vent port.
- 6. Final test of Modulator, (49MV07 only).

Note: Make sure that inlet pressure has been dropped to 0 psig before continuing.

- a. Remove Pipe Plug on flat modulator surface of Pilot Base. Check to verify that no Teflon tape has been left in vent port or the port above it.
- b. Place two O-Rings (Modulator Base) into grooves on flat surface of Pilot Base.
- c. Attach Modulator to Pilot Base with two Socket Head Cap Screws with 95 ± 10 in-lbf (11 ± 1.1 N-m) of torque.
- d. Repop pilot two times then check for the following:
 - (i) Do not readjust Compression Screw or Adjuster.
 - (ii) Pilot should be tight (0 bpm) up to 4% below set pressure, or 2 psig (0.14 barg), whichever is greater.
 - (iii) Pilot should be tight (0 bpm) at 10% above set pressure, or 3 psig(0.21 barg), whichever is greater.

XIX. Setting and Testing (Cont.)

- (iv) Snoop joint between the modulator and pilot and the weep hole that is located behind Warning tag. If bubbles are present, repair as necessary.
7. Setting of 49MV22 and 49MV72.
 - a. If Adjuster Assembly has not been previously set, turn Adjuster into Pilot Base until it stops. Turn out 2 turns.
 - b. For the 49MV22, pilot will begin to vent at 98.1% of the Main Valve set pressure. For the 49MV72, pilot will begin to vent at 97.3% of the main valve set point.
 - c. To determine what pressure venting should occur, multiply the set pressure by 0.981 for 49MV22 and 0.973 for the 49MV72.
 - d. At the set point, the dome pressure should be 70% of the set pressure.
 - e. Example: 49MV22 valve set at 751 psig (51.8 barg). Venting should begin when pressure is 730 psig (50.3 barg) (751×0.981). Dome pressure will be 527 psig (36.3 barg) at the set pressure of 751 psig (51.8 barg) (751×0.70).
 8. Adjusting blowdown on 49MV22 and 49MV72.
 - a. Raise inlet pressure until the inlet pressure is at 10% or 3 psig (0.21 barg), whichever is greater, above set pressure.
 - b. Slowly lower the inlet pressure until the dome pressure starts to rise. Hold inlet pressure steady until the dome pressure stops rising.
 - c. Lower the inlet pressure in 3 to 5 psig (0.21 to 0.35 barg) increments. Hold inlet pressure until dome pressure stops rising.
 - d. Repeat step 8.c until the dome pressure is 70% of the valve set pressure.
 - e. Note the inlet pressure when the dome pressure is at 70% of set pressure. This will be the blowdown.
 - f. If blowdown is too long, turn Adjuster one flat counterclockwise. If blowdown is too short, turn Adjuster one flat clockwise (only adjust when there is zero pressure on the pilot).
 - g. Repeat steps 8.a to 8.f until blowdown is correct.
 9. Final assembly of 49PV:
 - a. Thread Cap (Compression Screw) onto Bonnet and tighten wrench tight.
 - b. For Lifting Lever Option,
 - (i) Install Lifting Lever Assembly by turning Cam Bushing clockwise.
 - (ii) Make certain that the Cam Shaft sits just under Release Nut.
 - c. Pilot is now ready for assembly to the main base.
 10. Final assembly of 49MV:
 - a. Thread Cap (Compression Screw) onto Bonnet and tighten wrench tight.
 - b. For Lifting Lever Option,
 - (i) Install Lifting Lever Assembly by turning Cam Bushing clockwise.
 - (ii) Make certain that the Cam Shaft sits just under Release Nut.
 - (iii) Pilot is now ready for assembly to the main base.
- After adjustments have been completed, tighten Compression Screw Lock Nut on Compression Screw and Adjuster Cap to secure settings.
- Check for leakage at 96% of set pressure.
- Once the pilot valve set pressure and blowdown are calibrated on the pilot valve test stand, and the pilot valve is installed on the main valve, only the set pressure may be tested and adjusted if necessary on a shop test stand.

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

XIX. Setting and Testing (Cont.)

D. Pilot/Main Valve Assembly Testing

D.1 49PV07/37

1. Insert O-Rings in the inlet sensing port, dome port, and vent port ring grooves of the pilot base.
2. Insert the Inlet Shuttle Seat into the inlet bore of the pilot. The counterbore should be facing out.
3. Insert the Inlet Shuttle Guide into the inlet port with the flanged end outward.
4. Align the inlet port, dome port, and vent port in the Coverplate. Care must be taken to insure that the Shuttle Guide and O-Rings stay in place.
5. Bolt the pilot to main valve using four Socket Head Cap Screws. Torque to 40 ± 5 ft-lbs (54.2 ± 6.8 N-m).
6. Final standard configuration for a 49PV07 or 49PV37 without any options is shown in Figure 32.



Figure 32: 49PV07/37

D.2 49MV07, 49MV22 and 49MV72

1. Insert O-Rings in the inlet sensing port, dome port, and vent port ring grooves of the Pilot Base.
2. Place an O-Ring in the O-Ring shoulder of the small end of the inlet spool.
3. Insert the inlet spool into the inlet port with the flanged end outward.
4. Align the inlet port, dome port, and vent port of the pilot with the matching ports in the Coverplate. Care must be taken to insure that the shuttle guide and O-Rings stay in place.
5. Bolt the pilot to main valve using four Socket Head Cap Screws. Torque to 40 ± 5 ft-lbs (54.2 ± 6.8 N-m).
6. Final standard configuration for the modulation pilot valves without any options is shown in Figures 33 through 34.



Figure 33: 49MV07

Figure 34a: 49MV22

Figure 34b: 49MV72



Figure 34: 49MV22/72

XIX. Setting and Testing (Cont.)

D.3 Reasons for failure:

1. Any leakage from Pilot at 4% below valve set pressure or 2 psig (0.14 psig), whichever is greater. The 49MV22 and 49MV72 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).
2. Main Valve equipped with soft seats.
 - a. For Main Valve equipped with 49MV22 and 49MV72, 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 (155.1 barg) and above, 50 bpm is acceptable for both Pilot and Main Valve.
 - b. For all other valve types, no leakage (0 bpm) is acceptable at 4% below valve set pressure or 2 psig (0.14 psig), whichever if greater.
3. Main Valve equipped with metal seats and air as test media.
 - a. 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.
 - b. If leakage from Main Valve is indicated by a bulging of the wet paper, the standard test fixture (as described in 3.c (Section XIX.D.3)) 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.

- c. Per API standard 527 (ANSI B147.1-72), a standard test fixture consists of a piece of tubing .313" OD (7.94 mm) x 0.032" (0.8 mm) wall, where one end is joined to an adaptor on the valve outlet and other end is immersed .500" (12.7 mm) below the surface of a reservoir of water.

E. 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 3.c (Section XIX D.3). 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 in. 2 minutes for sizes 2.5" (63.50 mm), 3" (76.20 mm) & 4" (101.60 mm) ; 5" (127.00 mm) minutes for sizes 6" (152.40 mm) and 8" (203.20 mm).
4. The leakage rate in bubbles per minute shall not exceed the Table 7 values.

Table 7: Standard Leakage Rates

Set Pressure at 60°F (15.6°C)		Approximate Leakage per 24 Hours					
		Effective Orifice Sizes (0.307 in2 (1.981 cm2) and Smaller) D and E Orifice Only			Effective Orifice Sizes Larger than 0.307 in2 (1.981 cm2) F Orifice and Larger		
psig	barg	Leakage Rate (Bubbles per minute)	ft ³	m ³	Leakage Rate (Bubbles per minute)	ft ³	m ³
15-1000	1.03-68.95	40	0.60	0.02	20	0.30	0.01
1500	103.42	60	0.90	0.03	30	0.45	0.01
2000	137.90	80	1.20	0.03	40	0.60	0.02
2500	172.37	100	1.50	0.04	50	0.75	0.02
3000	206.84	100	1.50	0.04	60	0.90	0.03
4000	275.79	100	1.50	0.04	80	1.20	0.03
5000	344.74	100	1.50	0.04	100	1.50	0.04
6000	413.69	100	1.50	0.04	100	1.50	0.04

XIX. Setting and Testing (Cont.)

- a. Blowdown is long (only consider if system is capable of flowing valve at 10% overpressure).
 - b. 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 49MV22 and 49MV72 pilots, venting will and must begin before the set point. The 49MV22 begins venting at 98% of set pressure and the 49MV72 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) 49PV model (gas/steam): less than or equal to 5% or 3 psig (0.20 barg), whichever is greater.
- (ii) 49PV model (liquid): between 7% and 4%. If set pressure is less than 30 psig (2.1 barg), 3psig (0.20 barg), or less.
- (iii) 49MV model (gas/steam): less than or equal to 4% or 2 psig (0.14 barg), whichever is greater.
- (iv) 49MV 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 section XIX.E.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. Back pressure 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" 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.
 - 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.
9. 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. The valve is to be examined for cause of failure, the cause corrected, and the test repeated.

XIX. Setting and Testing (Cont.)

F. Field Testing of POSRV Assembly

F.1 Field Test Connection

A 1/4" 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 over pressurization during a field test.

F.2 Pilot Valve Tester

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 in Figure 41 is available for remote or local testing.

G. Hydrostatic Testing and Gagging

When hydrostatic tests are required after installation of a POSRV, remove the POSRV and replace it with a blind flange. If the hydrostatic test pressure will not be greater than the set pressure of the POSRV, a test gag may be used (see Figure 5H). Very little force, i.e., hand-tight pressure, on the test gag is sufficient to hold hydrostatic pressures. Too much force applied to the gag may bend the spindle and prevent the pilot from performing correctly.

After a hydrostatic test, the gag must be removed and replaced by the sealing plug furnished for this purpose.

XX. Trouble Shooting

Table 8: 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.	A. Re-install fittings correctly
	B. Did not install Teflon tape or pipe sealant.	B. Re-install fittings with Teflon tape or pipe sealant.
Leakage under the Coverplate when valve is open.	A. Coverplate O-Ring is damaged.	A. Disassemble valve and replace Coverplate O-Ring.
	B. Cap Screws or Stud Nuts on Coverplate are loose.	B. Tighten as required.
Main Valve leaks through the Seat	A. Damaged Seat O-Ring	A. Disassemble valve and replace Seat O-Ring.
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.	A. Slowly increase the inlet pressure.
	B. Sensing Tube is installed upside down.	B. Re-install Sensing Tube correctly.
	C. Closed Filter	C. Clear or replace Filter.
	D. Spring not installed.	D. Install Spring.
Leakage through the Pilot Valve	A. Operating pressure too high.	A. Adjust operating pressure.
	B. O-Ring or Spring Seal degradation	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. Back pressure is greater than set pressure and forces the Main Disc up, and the media flows backward into the vessel.	A. Install Backflow Preventer.
	B. Discharging into a closed container or not enough capacity in the discharge system.	B. Install Backflow Preventer

XXI. 4900 Series POSRV Options

Available Options:

- Backflow Preventer
- Field Test Connections
- Filter (High Capacity)
- Gag
- Lifting Lever
- Manual, Electrical, or Pneumatic Blowdown Valve
- Pilot Valve Tester
- Pressure Differential Switch
- Remote Sensing

A. Backflow Preventer (Figure 35)

When the pilot operated safety relief valve is not vented directly to atmosphere, it is possible to build up back pressure 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.

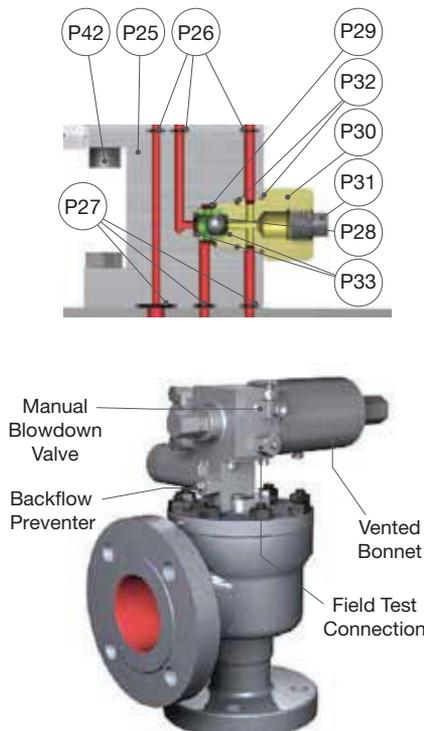


Figure 35: Backflow Preventer Assembly

B. Field Test Connection (Figure 36)

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 3/8" tube fitting equipped with a bug screen.

For all applications on air, water over 140°F (66°C), or steam service, ASME Section XIII (UV) - 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 3.2.7 (a/b)). 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 (66°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.

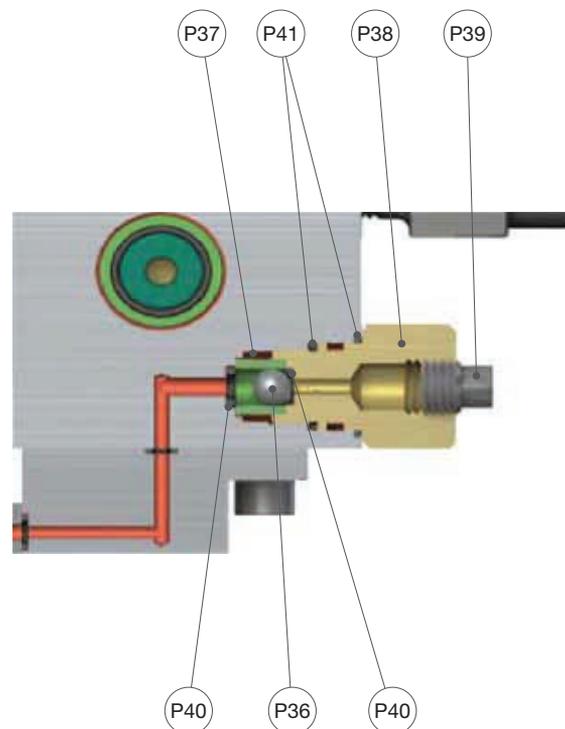


Figure 36: Field Test Connection Assembly

XXI. 4900 Series POSRV Options (Cont.)

C. Filter (High Capacity)

Filter options are available for dirty applications. These filters are installed in the pilot inlet sensing line. For the 49PV and 49MV, an optional high capacity filter options (Figures 37) include:

1. A carbon steel cadmium coated filter body with a 35 micron stainless steel element and 2.
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.

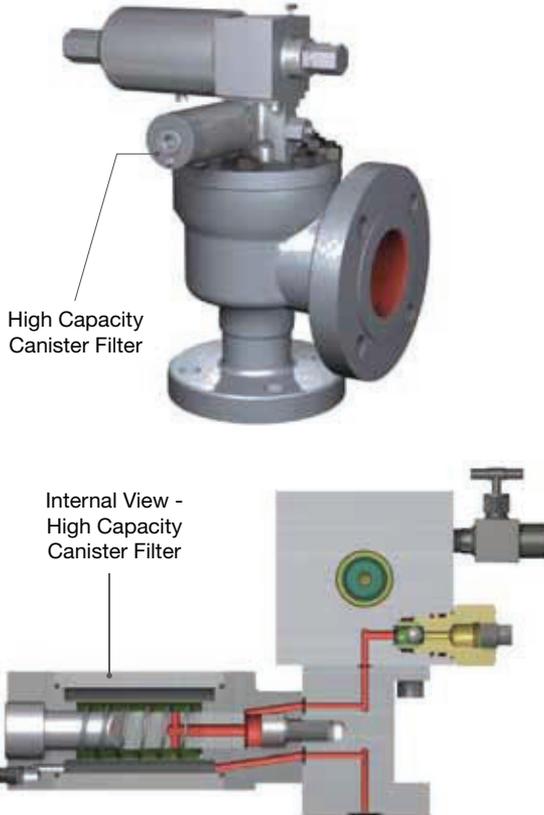


Figure 37: High Capacity Canister Filter

D. Gag (Figure 38)

A manual method of locking a pilot operated relief valve in the closed position for system hydrostatic test. 49MV72 limited to 4800 psig (330.95 barg) with gag option.

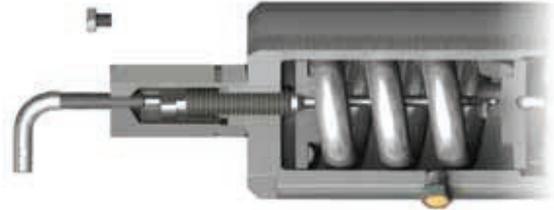


Figure 38: Gag

E. Lifting Lever

(Figure 18 in Section XVI)

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

F. Manual, Electrical or Pneumatic Blowdown Valve (Figures 39, 40)

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.



Figure 39: Manual Blowdown Valve

XXI. 4900 Series POSRV Options (Cont.)

G. Pilot Valve Tester (Figure 41)

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.



Figure 40: Electrical Blowdown Valve

H. Pressure Differential Switch (Figure 42)

Electrical: A pressure differential switch 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.)

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.



Figure 42: Pressure Differential Switch (Shown with Optional 5-way Manifold Valve)

I. 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.)

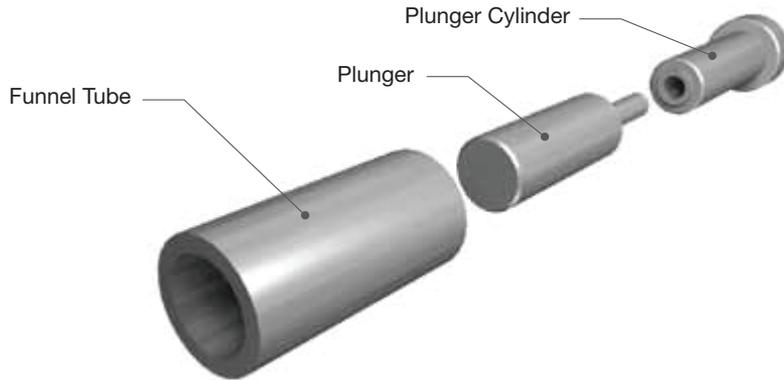


Figure 41: Pilot Valve Tester

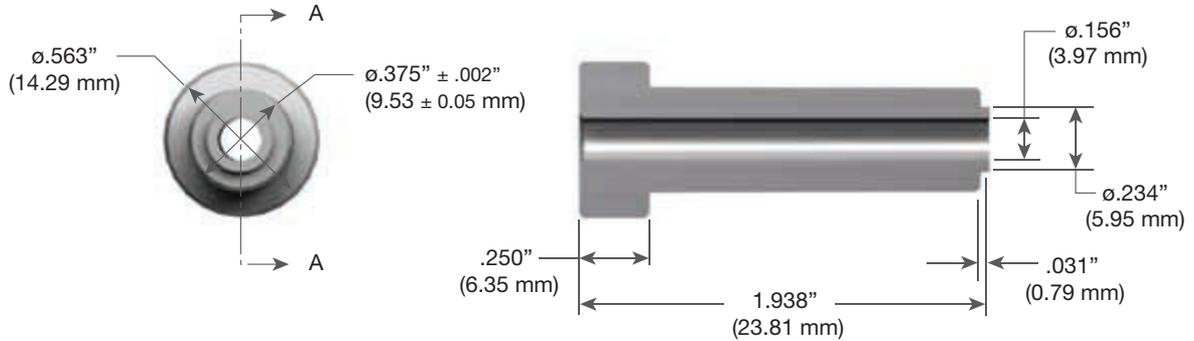
XXII. Maintenance Tools and Supplies

A. Adjuster Top Seal Insertion Tool

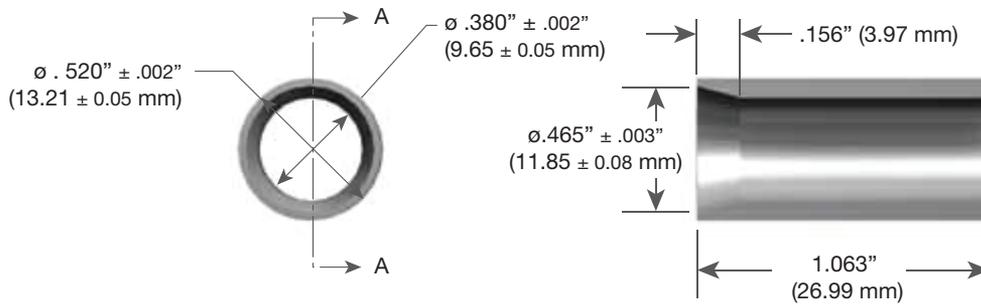
ASSEMBLY VIEW OF INSERTION TOOL



DETAIL OF PLUNGER CYLINDER



DETAIL OF FUNNEL TUBE



DETAIL OF PLUNGER

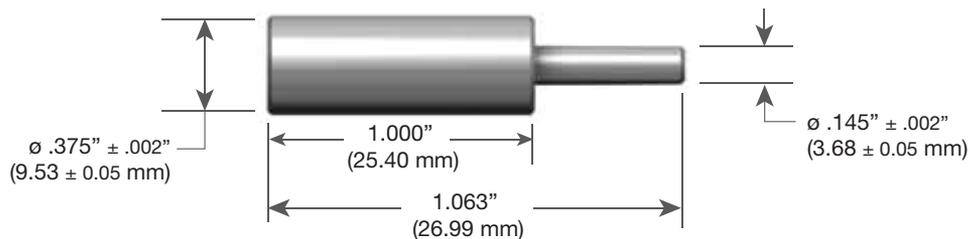
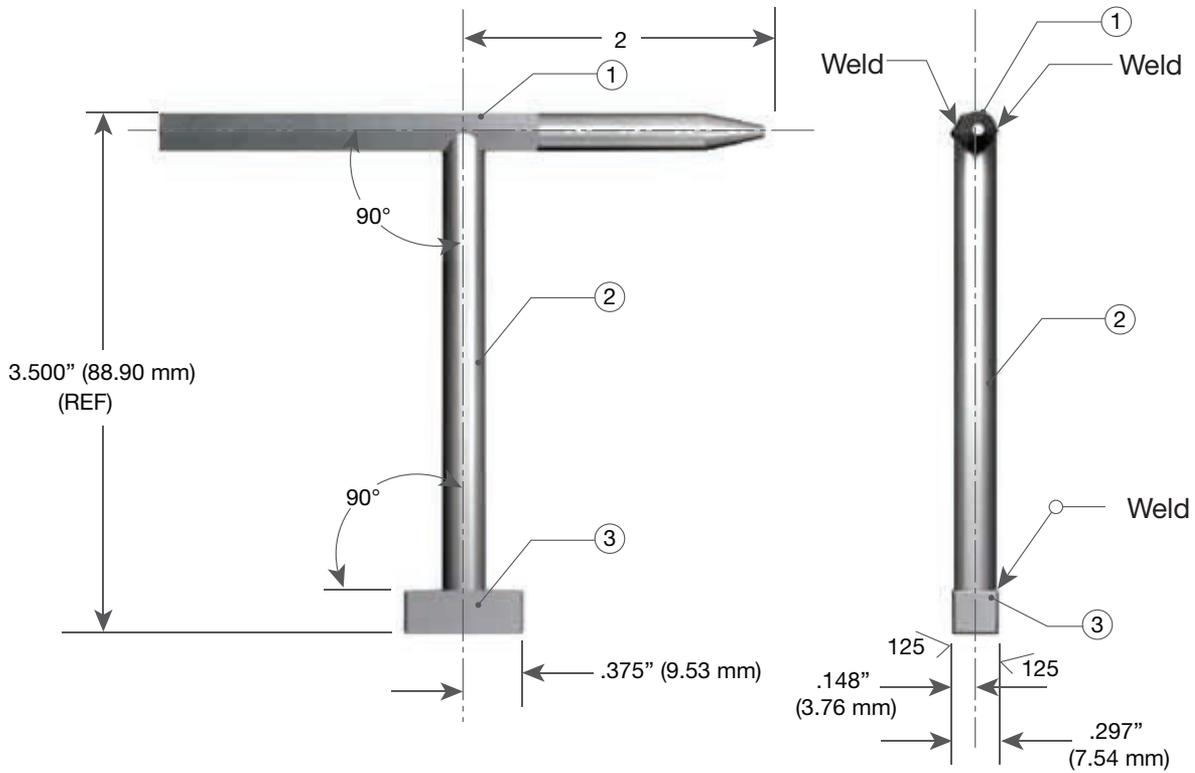


Figure 43: Adjuster Top Seal Insertion Tool

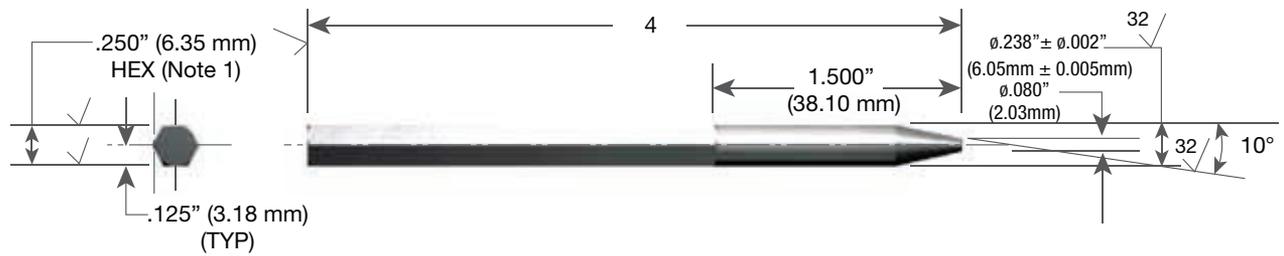
XXII. Maintenance Tools and Supplies (Cont.)

B. Insert Installation Tool

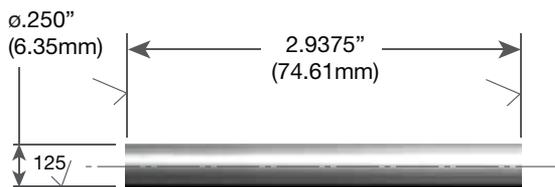
ASSEMBLY VIEW OF INSERT INSTALLATION TOOL



ITEM 1



ITEM 2



ITEM 3

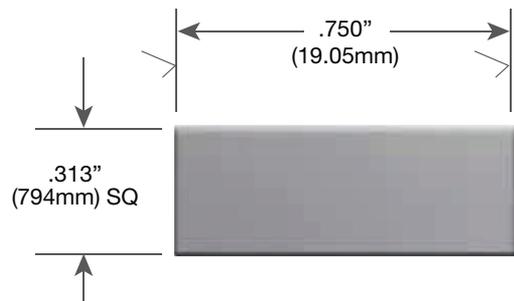


Figure 44: Insert Installation Tool

XXII. Maintenance Tools and Supplies (Cont.)

C. Main Valve Nozzle Wrench

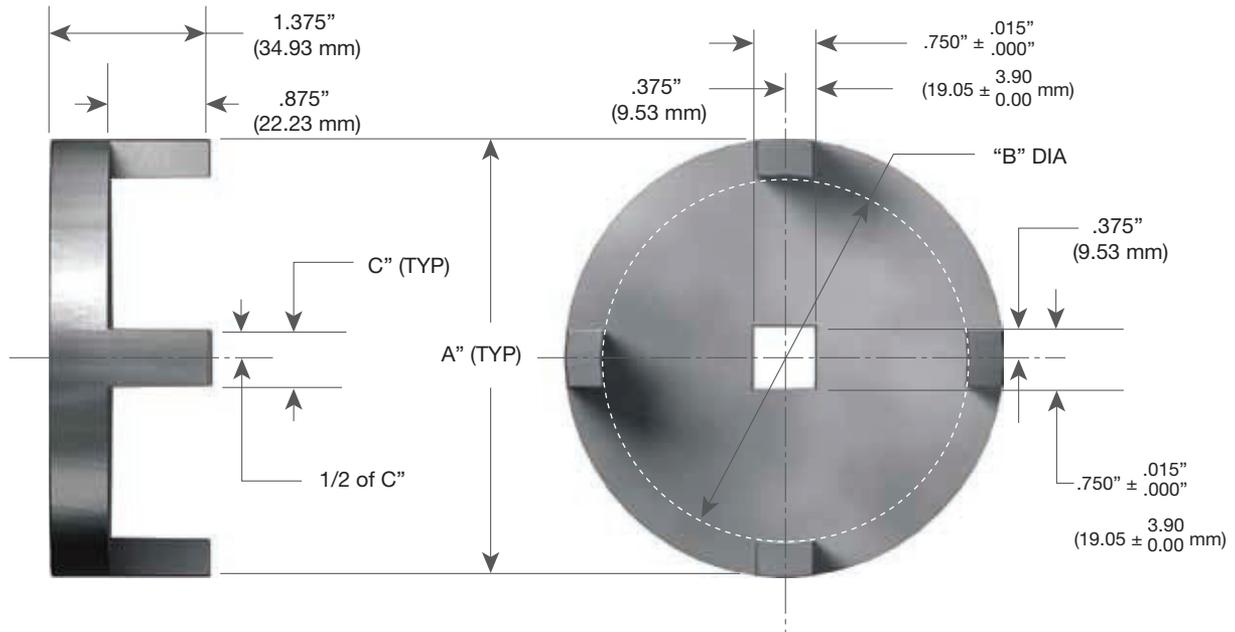


Figure 45: Main Valve Nozzle Wrench

Table 9: 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	2.250" (57.15 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	33.35	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	1.062" (26.97 mm) Socket 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		-	-	-	-	-	-

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 10. “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 8). 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 (49PV07, 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 11, 12 and 13.

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:

4910R-4-CC-DA-RF-GS, TL12345-M

Pilot Valve:

49PV07 -2-CC-B-GS, TL12346-P

How to Verify Material of O-Rings and Seals

Kit coding indicates O-Ring and seals material.

Examples:

MORK-70T006	T = Teflon®
	B=Buna N
PSGK-31B	E = Ethylene/Propylene
	V = Viton
	K = Kalrez



XXIII. Replacement Parts Planning (Cont.)

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 Consolidated 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, 6, 7 and 8)
2. Part Number (if known)
3. Quantity

Contact your local Green Tag Center (GTC).

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 46, 47 and 48.

CONSOLIDATED™		
SIZE		
CRN		
SERIAL NO		
MANUF	CODE CASE	UV
TYPE		
		ASME CERT NO
SET PRESS	CDTP	BACK PRESS
PRESS UNITS	LIFT	
CAP	CAP UNITS	
MEDIA		

Figure 46: Nameplates for Main Valve

THIS VALVE CONTAINS	
TEFLON® SEALS AND AN	
O-RING SEAT SEAL	BUNA 70
O-RING PART NO.	31018432

Figure 47: Nameplates for Main Valve

CONSOLIDATED™	
ASME CERT NO	
←	PILOT VALVE
←	MANUF
MODEL NO	
SERIAL NO	SET PRESS
O RING	PRESS UNITS

Figure 48: Nameplate for Pilot Valve

XXIV. Genuine Consolidated Parts

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

- Baker Hughes designed the parts
- Baker Hughes guarantees the parts
- Consolidated valve products have been in use since 1879
- Baker Hughes has worldwide service
- Baker Hughes has fast response availability for parts with the global Green Tag Center (GTC) Authorized Sales Representatives network.

XXV. Recommended Spare Parts

Table 10: Recommended Spare Parts for 4900 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
		Main Valve	O-Ring Kit
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)

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

Table 11: Main Valve O-Ring Kit

Orifice	Valve Type	Material	Part No.
D, E, F	4914, 16	Buna N (Nitrile 70)	M0RK-83B008
D, E, F	4905, 10, 12	Buna N (Nitrile 70)	M0RK-83B018
D, E, F	4914, 16	Ethylene Propylene 90	M0RK-83E002
D, E, F	4905, 10, 12	Ethylene Propylene 90	M0RK-83E019
D, E, F	4905, 10, 12	Teflon	M0RK-83T006
D, E, F	4914, 16	Viton	M0RK-83V005
D, E, F	4905, 10, 12	Viton	M0RK-83V022
T	4905, 10, 12	Viton	M0RK-88V004
6" Full Bore	4905, 10, 12	Viton	M0RK-88V004
T	4905, 10, 12	Viton	M0RK-88V022
6" Full Bore	4905, 10, 12	Viton	M0RK-88V022
K	4918	Teflon (SPEC)	M0RK-92T006

XXV. Recommended Spare Parts (Cont.)

Table 12: Pilot Valve O-Ring Kit				
Pilot Type	Buna-N	Ethylene/Propylene	Viton	Teflon
49PV01-1-GS & LS	PSGKF - 31B	PSGKF - 31E	PSGKF - 31V	N/A
49PV07-1-GS & LS	PSGKF - 33B	PSGKF - 33E	PSGKF - 33V	N/A
49PV07-2-GS & LA	PSGK - 38B018	PSGK - 38E019	PSGK - 38V022	Note 2
49PV07-2-SS	N/A	PSGK - 38E0021	N/A	PSGK - 38T006
49PV37-1-GS & LS	PSGK - 35B018	PSGK - 35E019	PSGK - 35V022	N/A
49PV37-2-GS & LA	PSGK - 35B018	PSGK - 35E019	PSGK - 35V022	Note 2
49PV37-2-SS	N/A	N/A	N/A	PSGK - 35T006
49MV01, 07 & 37-GS3	PSGK - 32B018	PSGK - 32E019	PSGK - 32V022	Note 2
49MV01, 07 & 37-LS3	PSGK - 34B018	PSGK - 34E019	PSGK - 34V022	Note 2
49MV07 & 37-SS3	N/A	PSGK - 34E002	N/A	PSGK - 34T006
49MV22-LA & GS	PSGK - 46B018	PSGK - 46E019	PSGK - 46V022	PSGK - 46T006
49MV72-LA & GS	PSGK - 47B008	PSGK - 47E002	PSGK - 47V005	PSGK - 47T005

- For steam service at pressures below 50 psig (3.45 barg) the 49PV07-2-SS or 49MV07-2-SS with EPR O-Rings should be used (E962-90).
- For services other than steam consult applications engineering.
- This kit contains modulator O-Rings only. In addition to this PSGK kit, the Comparable PV PSGK kit is also required.
Example: A 49MV07-2-LS with Viton O-Rings would require a PSGK-34V022 and a PSGK-38V022.

Table 13: Pilot Valve O-Ring Kit Options ¹				
Pilot Type	Buna-N	Ethylene/Propylene	Viton	Teflon
Field Test Connection/ Backflow Preventer Seal Kit		PSGK - 37E019		
	PSGK - 37B018	PSGK - 37E0021	PSGK - 37V022	PSGK - 37T006

- For steam service at pressures below 50 psig (3.45 barg) the 49PV07-2-SS or 49MV07-2-SS with EPR O-Rings should be used (E962-90).

XXV. Recommended Spare Parts (Cont.)

Table 14: 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

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

XXI. Field Service, Repair and Training Program

A. Field Service

Utilities and Process Industries expect and demand service at a moment's notice. Baker Hughes Field Service can be depended upon for prompt response, even in extreme off-hour emergency situations.

Baker Hughes maintains the largest and most competent field service staff in the industry. Service engineers are located at strategic points throughout the United States to respond to customers' requirements for service. Each service engineer is factory trained and long experienced in servicing Safety Valves. Baker Hughes service engineers restore disc and seat bushing critical dimensions which affect valve performance, and are capable of modernizing valves in the field.

It is highly recommended that the professional talents of a Baker Hughes Field Service engineer be employed to make final field adjustments during the initial setting of all Consolidated Safety Valves.

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

B. Factory Repair Facilities

The Consolidated factory maintains a Baker Hughes Repair Center. The repair department, in conjunction with the manufacturing facilities, is equipped to perform specialized repairs and product modifications, e.g., bushing replacements, hydroset calibrations, electromatic relief valve repairs, etc.

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

C. Safety Valve Maintenance Training

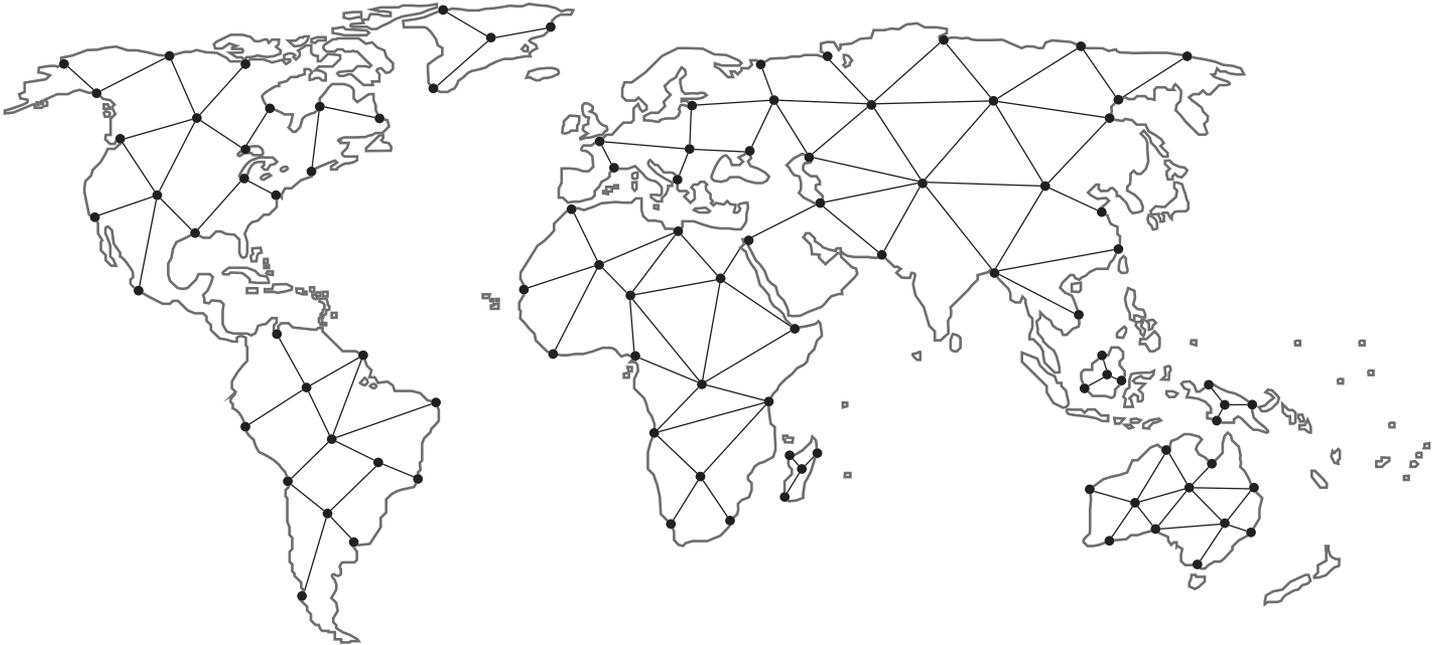
Rising costs of maintenance and repair in the Utility and Process Industries indicate the need for trained maintenance personnel. Baker Hughes conducts service seminars that can help your maintenance and engineering personnel to reduce these costs.

Seminars, conducted either at your site, or at our manufacturing plant, provide participants with an introduction to the basics of preventative maintenance. These seminars help to minimize downtime, reduce unplanned repairs and increase valve safety. While they 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 (GTC).

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