

Consolidated™ 2900-40 Series

Pilot-Operated Safety Relief Valves

Instruction Manual (Rev. D)



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.

THE RIGHTS, OBLIGATIONS AND LIABILITIES OF BAKER HUGHES AND THE CUSTOMER/OPERATOR ARE STRICTLY LIMITED TO THOSE EXPRESSLY PROVIDED IN THE CONTRACT RELATING TO THE SUPPLY OF THE EQUIPMENT. NO ADDITIONAL REPRESENTATIONS OR WARRANTIES BY BAKER HUGHES REGARDING THE EQUIPMENT OR ITS USE ARE GIVEN OR IMPLIED BY THE ISSUE OF THESE INSTRUCTIONS.

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) units are converted to metric units 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 valve configurations not listed in this manual, please contact your local *Green Tag*[™] Center for assistance.

Table of Contents

I.	Product Safety Sign and Label System	7
II.	Safety Alerts.....	8
III.	Safety Notice.....	10
IV.	Warranty Information	11
V.	Terminology for Pilot Operated Safety Relief Valves	12
VI.	Handling and Storage	13
VII.	Pre-Installation and Installation Instructions	14
VIII.	Introduction	15
	A. General Introduction	15
	B. Main Valve Introduction.....	15
	C. Pilot Valve Introduction.....	15
IX.	Consolidated 2900-40 Series Safety Relief Valves	16
	A. 2900-40 Main Valve (Metal Seat).....	16
	B. 2900-40 Main Valve (Soft Seat)	17
	C. 39PV Pilot Valve.....	18
X.	Operating Principles	19
	A. PV Valve Closed (Normal Position).....	19
	B. PV Valve Open (Relieving Position).....	20
XI.	General Planning for Maintenance	21
XII.	Recommended Installation Practices	21
	A. Mounting Position	21
	B. Inlet Piping	22
	C. Outlet Piping	22
	D. Remote Sensing	23
	E. Freeze Protection.....	23
XIII.	Disassembly of the 2900-40 POSRV	25
	A. Removal of the Pilot Valve from the Main Valve	25
	B. Disassembly of the Main Valve	25
	C. Cleaning.....	29
XIV.	Maintenance Instructions	30
	A. General Maintenance Information.....	30
	B. O-Ring Seat	30
	C. Lapping Nozzle Seats (Metal Seat - Non-O-Ring Styles)	30
	D. Lapped Nozzle Seat Widths.....	32
	E. Lapping Disc Seats	32
	F. Precautions and Hints for Lapping Seats.....	34
	G. Reconditioning of Laps	34
	H. Re-Machining Nozzle Seats.....	34
	I. Re-Machining the Disc Seat	35

XV. Inspection and Part Replacement	37
1. Guide	37
2. Base	37
3. Cover Plate	37
4. O-Ring Retainer	37
5. Nozzle	37
6. Spring	37
7. Standard Metal Seated Disc	37
8. Thermodisc™ Metal Seated Disc	37
9. O-Ring Seated Disc	38
10. Disc Holder	38
11. Solid Metal Gaskets	38
12. Main Valve Piston	38
XVI. Reassembly of 2900-40 Main Valve	39
A. Lubricants and Sealants	39
B. Assembly Procedure with Metal Seats	39
C. Assembly Procedure with O-Ring Seats	39
XVII. Disassembly of Pilot Valve	43
A. 39PV07/37 Disassembly	43
B. Cleaning	43
XVIII. Part Inspection of Pilot Valve	46
A. 39PV07/37	46
XIX. Reassembly of Pilot Valve	47
A. Lubricants and Sealants	47
B. Assembly of 39PV07/37	47
XX. Setting and Testing	50
A. General Information	50
B. With Standard Options	50
C. With Sensing Ring Option	51
D. Functional Testing	51
E. Field Testing of POSRV Assembly	53-54
E.1 Mitigation of Main Valve Instability During Startup	55
E.2 Artificial Actuation of Pilot and Main Valve	56
E.2.1 Artificial Actuation of Pilot Only	56
E.3 Hydrostatic Testing and Gagging	57
XXI. Troubleshooting	58
XXII. 2900-40 Series POSRV Options	59
A. Backflow Preventer	59
A.1 Disassembly Instructions	59
A.2 Cleaning	59
A.3 Parts Inspection	59
A.4 Reassembly Instructions	59

B.	Dual Pilots	60
C.	Field Test Connection	60
D.	Single, Dual and High Capacity Filters (optional)	60
E.	Sensing Line Filter (standard).....	61
F.	Gag	62
G.	Heat Exchanger	62
H.	Lifting Lever	63
I.	Manual, Electrical, or Pneumatic Blowdown Valve	63
J.	Pilot Valve Tester.....	64
K.	Pressure Differential Switch.....	64
L.	Pressure Spike Snubber	65
M.	Remote Pilot Mounting.....	65
N.	Remote Sensing	65
O.	Sensing Ring.....	65
XXIII.	Maintenance Tools and Supplies	66
A.	Adjuster Top Seal Insertion Tool.....	66
B.	Insert Installation Tool	67
C.	Lapping Tools	68
D.	Disc Holder and Guide Removal and Assembly Tool.....	69-70
XXIV.	Replacement Parts Planning	71
A.	Basic Guidelines	71
B.	Identification and Ordering Essentials	71
C.	Positive Identification of Main Valve and Pilot Valve Combinations	72
XXV.	Genuine Consolidated Parts	72
XXVI.	Recommended Spare Parts.....	73-78
XXVII.	Manufacturer's Field Service, Repair, and Training Programs	79
A.	Field Service	79
B.	Repair Facilities	79
C.	Safety Relief Valve Maintenance Training.....	79

I. Product Safety Sign and Label System

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

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

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

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

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

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

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

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

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



II. Safety Alerts

Read – Understand – Practice

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. Contact with pressurized or heated parts can result in severe personal injury or death.
5. **WARNING:** Do not allow anyone under the influence or intoxicants or narcotics to work on or around pressurized systems. Workers under the influence 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.
7. **WARNING:** This 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.
8. **WARNING:** Use of improper tools or improper use of right tools could result in personal injury or product or property damage.

⚠ WARNING



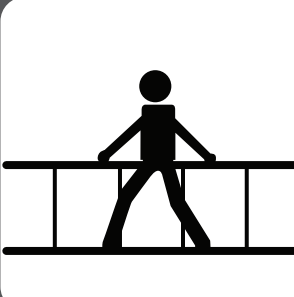
Improper use or repair of pressurized media or steam device may result in severe personal injury or death.

⚠ 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 the influence of intoxicants or narcotics.

⚠ 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.

II. Safety Alerts (Cont.)

9. **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.

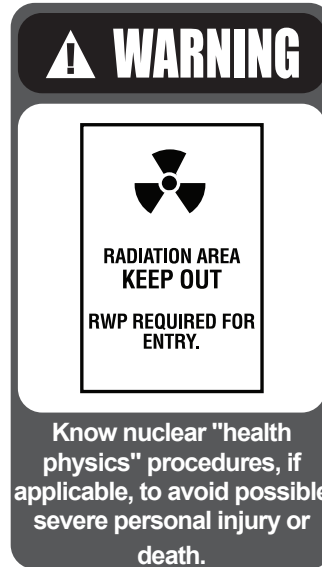
Cautions Concerning Product Warning Labels

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 Consolidated 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’s recommendations, must be thoroughly satisfied that neither personal safety, nor valve safety, will be jeopardized by the method and/or tools selected. Please contact your local Green Tag Center (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 Consolidated 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 IV, for customer information only.

It is the responsibility of the purchaser or user of Baker Hughes’s Consolidated 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. 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⁽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 original F.O.B. point upon request .

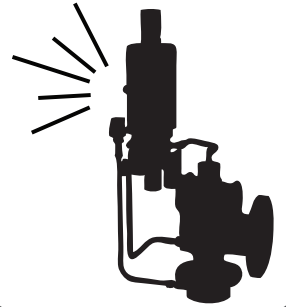
Incorrect Selection or Misapplication of Products - Baker Hughes cannot be responsible for customer 's incorrect selection or misapplication of our products.

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

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

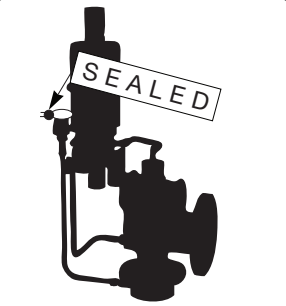
Note: Refer to Baker Hughes's Standard Terms of Sale for complete details on warranty and limitation of remedy and liability.

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 bar), whichever is greater.
- **Overpressure:** A pressure increase over the set pressure of the primary relieving device. Overpressure is similar to accumulation when the relieving device is set at the maximum allowable working pressure of the vessel. Normally, overpressure is expressed as a percentage of set pressure.
- **Pilot Operated Safety Relief Valve (POSRV):** A pressure relief valve in which the major relieving device is combined with, and is controlled by, a self-actuated auxiliary pressure relief valve.
- **Rated Capacity:** The percentage of measured flow at an authorized percent overpressure permitted by the applicable code. Rated capacity is generally expressed in pounds per hour (lb/hr) or kg/hr for vapors, standard cubic feet per minute (SCFM) or m³ /min for gases, and in gallons per minute (GPM) or Liter/min (L/min) for liquids.
- **Safety Relief Valve (SRV):** An automatic pressure-relieving device used as either a safety or relief valve, depending upon application. The SRV is used to protect personnel and equipment by preventing excessive overpressure.
- **Set Pressure:** The gauge pressure at the valve inlet, for which the relief valve has been adjusted to open under service conditions. In liquid service, the inlet pressure at which the valve starts to discharge determines set pressure. In gas or vapor service, the inlet pressure at which the valve pops determines the set pressure.

VI. Handling and Storage

CAUTION



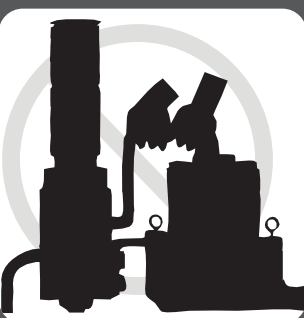
Always keep valve in an upright position when handling or storing.

CAUTION



Do not subject valves to sharp impact.

CAUTION



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

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 cover plate.

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

Pre-Installation and Installation

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.

Mounting Instructions

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.

Hydrostatic Testing

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

Service Considerations

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

Remote Sensing

If the pressure drop between the source of pressure in the equipment to be protected and the pressure at the relief valve inlet exceeds 3%, the sensing line to the pilot valve should be connected directly to the equipment being protected. The optional sensing ring should not be installed. For remote sensing, .375" (9.53 mm) diameter tubing is adequate for distances up to 10 feet, (3.048 m).

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

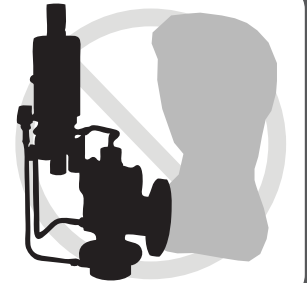
Ramp Rate

As with all pilot operated relief valves, the ramp rate should be carefully controlled in order to minimize the adverse effects of extreme pressure surges. With many years of operational experience along with research and development, the importance of proper ramp rate has been established as one of the primary contributors to many avoidable valve problems. Based on testing and operating experience, a ramp rate of about 2% of valve set pressure per second or the equivalent of a consistent increase in pressure over a one minute interval was shown to have no adverse effects due to water hammer during the pressurization. This has been shown to provide the best balance between quick start up procedures while eliminating the chance of avoidable valve damage. For applications where pressurization rates are expected to be high, a Nitrogen bottle (connected to the field test connector) precharged up to 97% of set pressure may be used.

Pre-fill

During pre-fill of the economizer before pressurization, the prefill pressure is recommended not to exceed 15-25 psi (1-1.5 bar). For pressures exceeding this limit, a Nitrogen bottle (connected to the field test connector) precharged up to 97% of set pressure may be used.

CAUTION



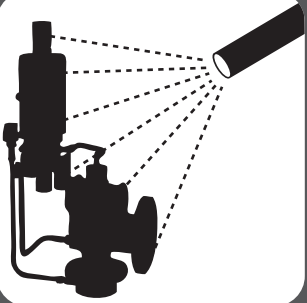
Prevent dirt from entering outlet or inlet port.

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.

VIII. Introduction

A. General Introduction

:A pilot operated pressure relief valve is a pressure relief valve in which the major relieving device is combined with and is controlled by a self actuated auxiliary pressure relief valve." - Source ASME Code, Section VIII-Div.1, Paragraph UG-126.

The Consolidated Pilot Valve (PV) is designed to provide reliable performance characteristics and stable operation within a pressure range of 15 to 3750 psig (10.34 to 2585.53 barg)

B. Main Valve Introduction

The Consolidated Pilot Operated Safety Relief Valve (POS RV) cast bodies are designed to meet the often specified inlet and outlet connection combinations. Sizes range from 1" - 8" (25.4 mm - 203.20 mm); pressure ratings from 150 - 2500 class. The standard metal seat is the same design that has been successfully utilized in the Consolidated SRV for over 50 years.

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

Main Valve Features

- Orifice controlled capacity
- Superior tightness
- Removable nozzles for replacement or remachining
- Standard O-Ring sizes: readily available, easily replaced
- National Board certified capacities
- Uses many parts standard on 1900 Series SRV

C. Pilot Valve Introduction

Standard pilot construction consists of 316SS parts with nitrile O-Rings with Teflon based seals throughout. Alternate materials can be provided by contacting the factory.

Pilot Valve Features

- One pilot fits all main valves
- Standard O-Ring seals
- Superior seat tightness
- Accurate adjustment of blowdown and set point
- Positive closure after blowdown
- Reduces icing and clogging
- Field test connection
- Remote Sensing
- External blowdown adjustments

Service and Applications

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

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

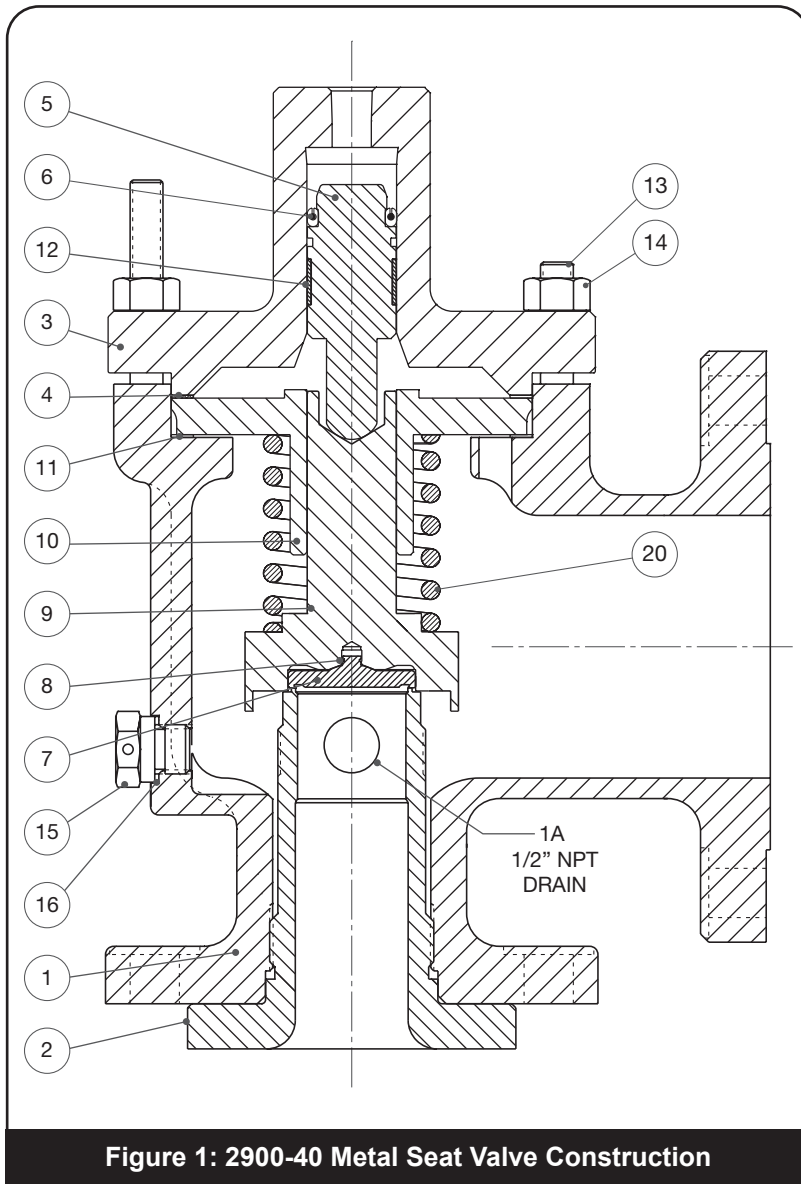
Table 1: Service and Applications

Model	Service	Pressure Range				Temperature Range			
		min.		max.		min.		max.	
		psig	barg	psig	barg	°F	°C	°F	°C
39PV07, SS	Steam	15	1.03	750	51.71	-20	-20.0	505	262.8
39PV37, SS	Steam	751	51.78	3750	258.55	-20	-20.0	505	262.8

Note: With the installation of the heat exchanger, temperature range may be expanded to 1200°F (648.9°C).

IX. 2900-40 Safety Relief Valves

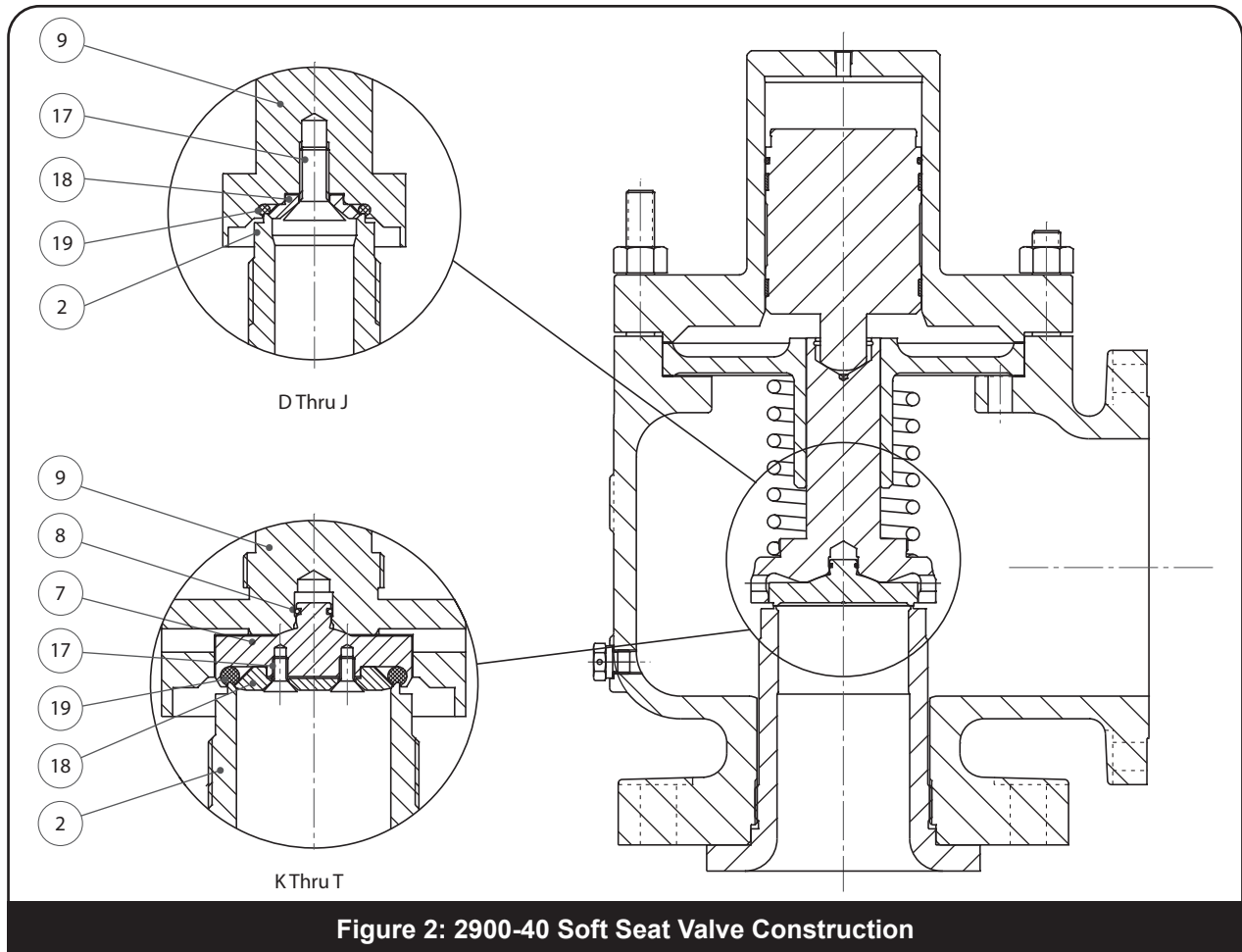
A. 2900-40 Main Valve (Metal Seat)



Part No.	Nomenclature
1	Base
2	Nozzle
3	Coverplate
4	Coverplate Gasket
5	Main Valve Piston
6	Main Valve Piston Spring Energized Seal
7	Disc
8	Disc Retainer
9	Disc Holder
10	Guide
11	Guide Gasket
12	Guide Ring
13	Stud (Base)
14	Nut (Base)
15	Plug/Adaptor
16	Plug/Adaptor Gasket
20	Spring

IX. 2900-40 Safety Relief Valves (Cont.)

B. 2900-40 Main Valve (Soft Seat)



Part No.	Nomenclature
2	Nozzle
7	Disc
8	Disc Retainer
9	Disc Holder
10	Guide
17	O-Ring Retainer Lock Screw
18	O-Ring Retainer
19	O-Ring Seat Seal

IX. 2900-40 Safety Relief Valves (Cont.)

C. 39PV Pilot Valve

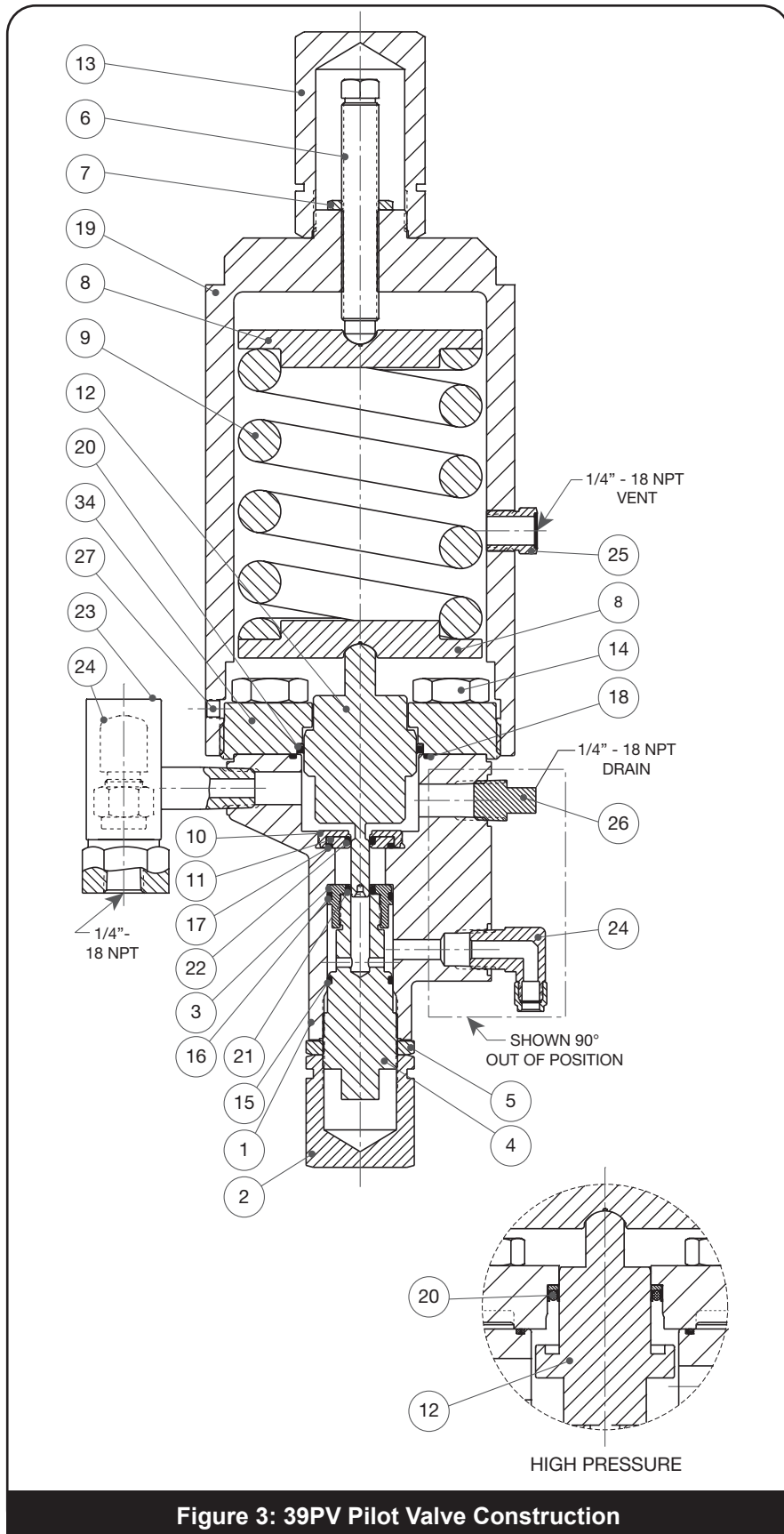


Figure 3: 39PV Pilot Valve Construction

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

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

X. Operating Principles

A. PV Valve Closed (Normal Position)

System pressure from the main valve inlet is fed to the dome by the pilot through interconnecting tubing. This equalizes the pressure on the top of the piston with inlet pressure on the seating surface (bottom) of the disc. Since the area of the top of the piston is larger than the area of the seating surface, the differential area results in a net downward force keeping the main valve tightly closed.

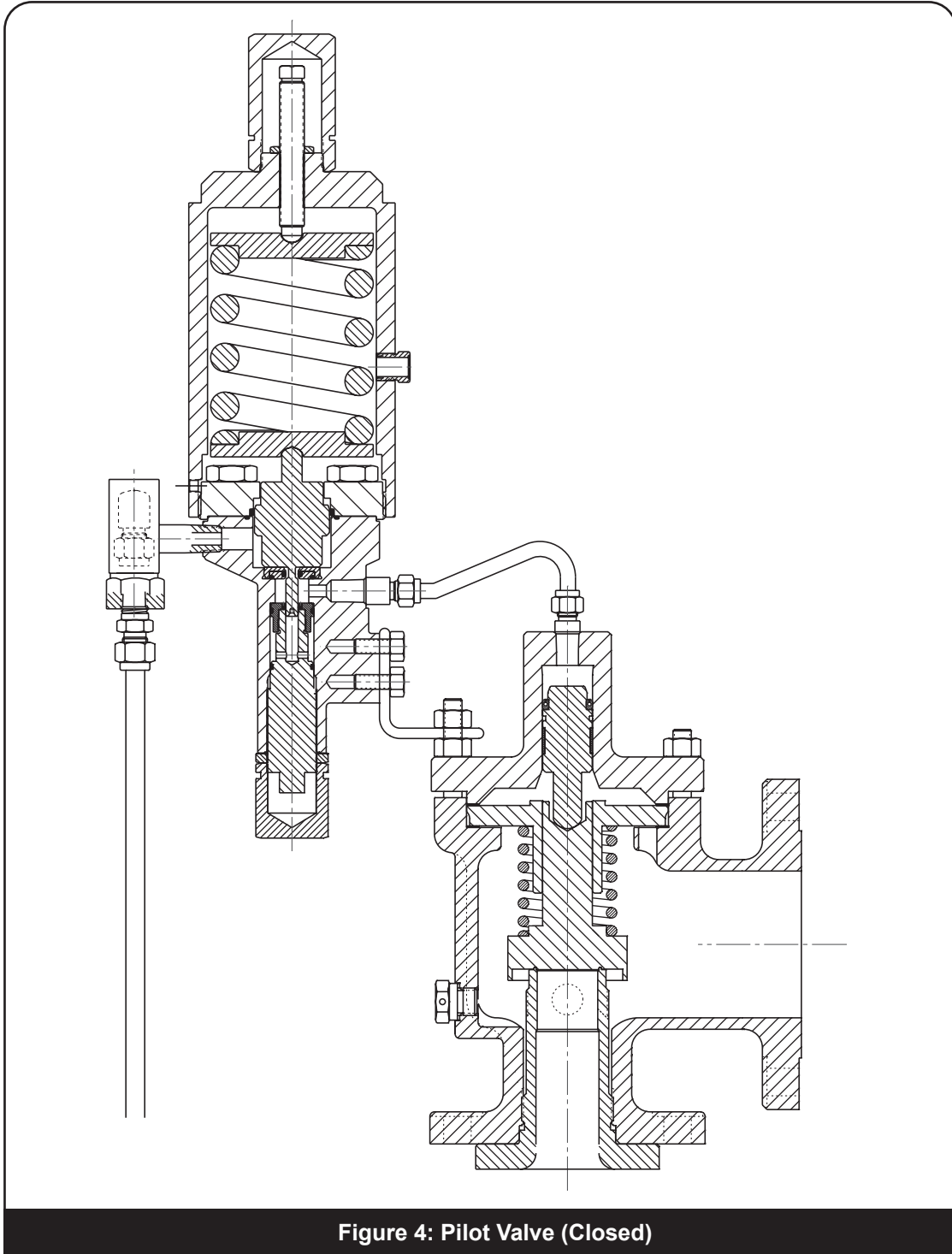


Figure 4: Pilot Valve (Closed)

X. Operating Principles (Cont.)

B. PV Valve Open (Relieving Position)

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

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

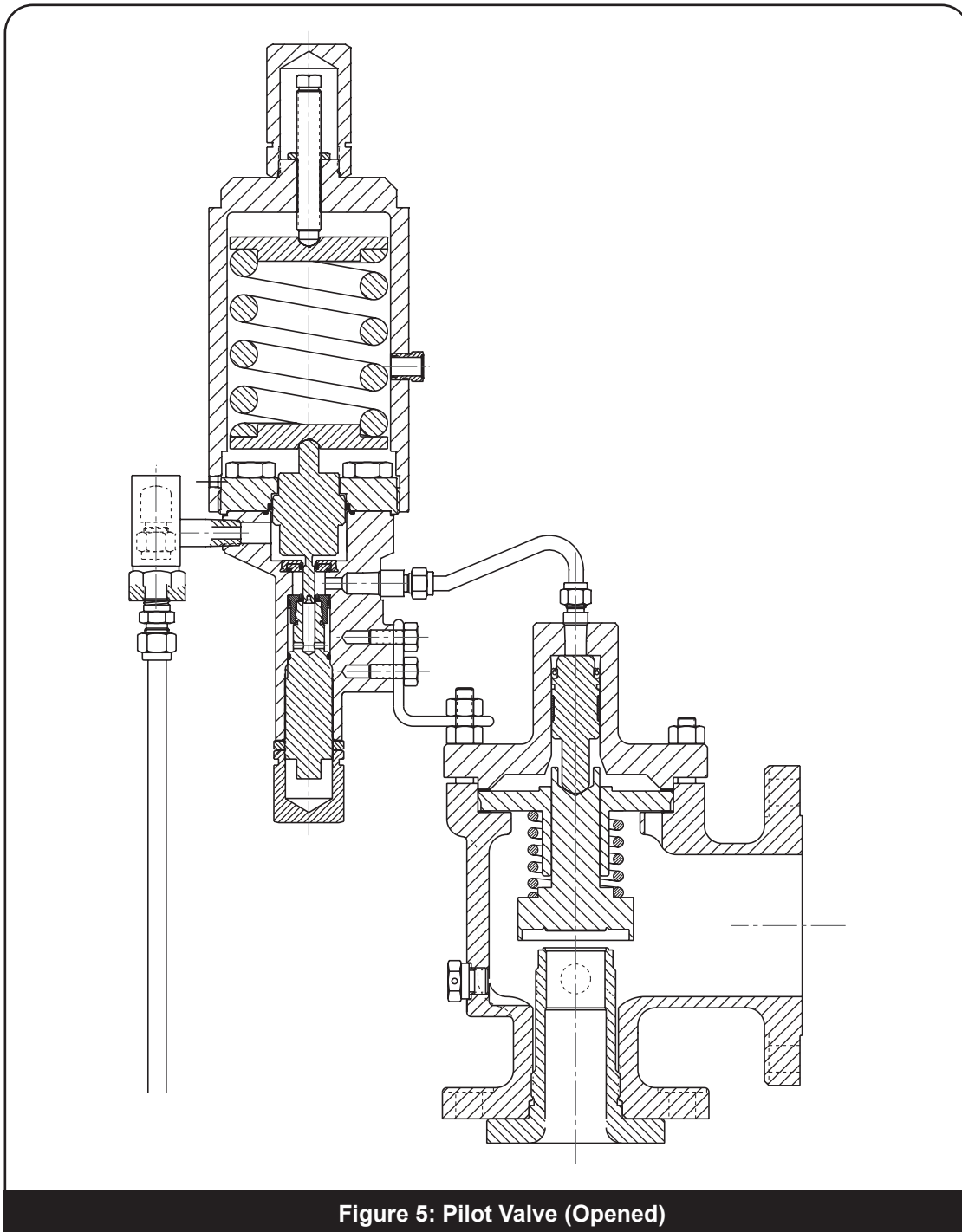


Figure 5: Pilot Valve (Opened)

XI. 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 2900-40 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: Insure there is no pressure in the inlet of the valve before attempting to remove it from the piping system.

XII. Recommended Installation Practices

A. Mounting Position

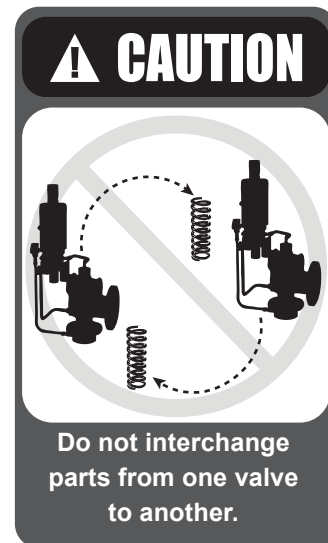
The POSRVs should be mounted in a vertical upright position (in accordance with API RP 520). Installing a pilot operated safety relief valve in any position other than vertical (± 1 degree) will adversely affect its operation as a result of induced misalignment of moving parts.

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.



XII. Recommended Installation Practices (Cont.)

B. Inlet Piping

The inlet piping (Figure 6) 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 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 flowing 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 fixe supports.

C. Outlet Piping

Alignment of the internal parts of the POSRV is important to ensure proper operation (see Figure 7). 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

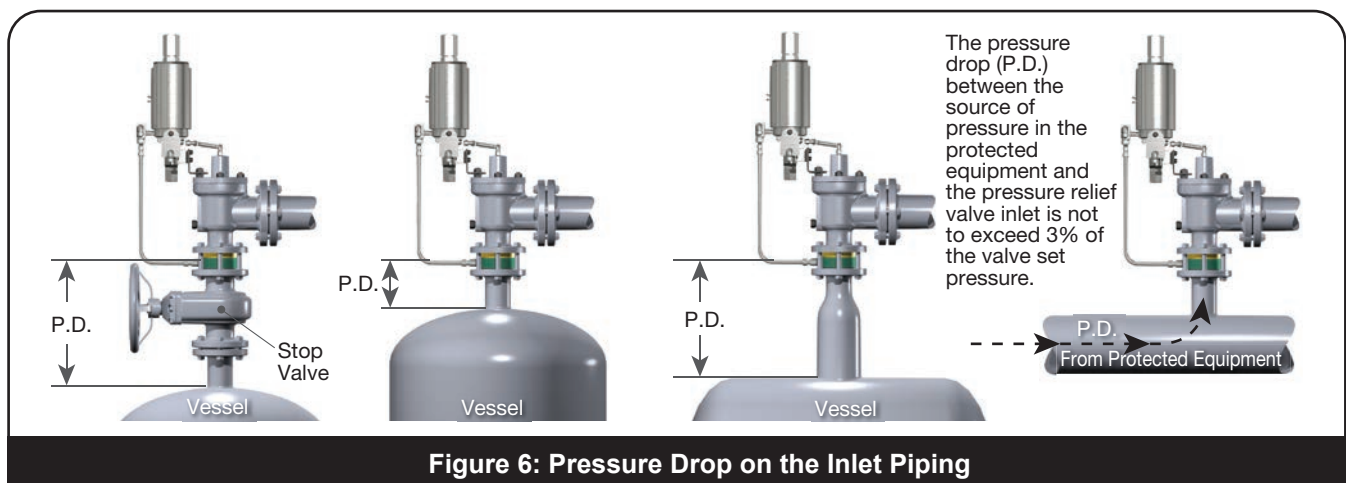


Figure 6: Pressure Drop on the Inlet Piping

XII. Recommended Installation Practices (Cont.)

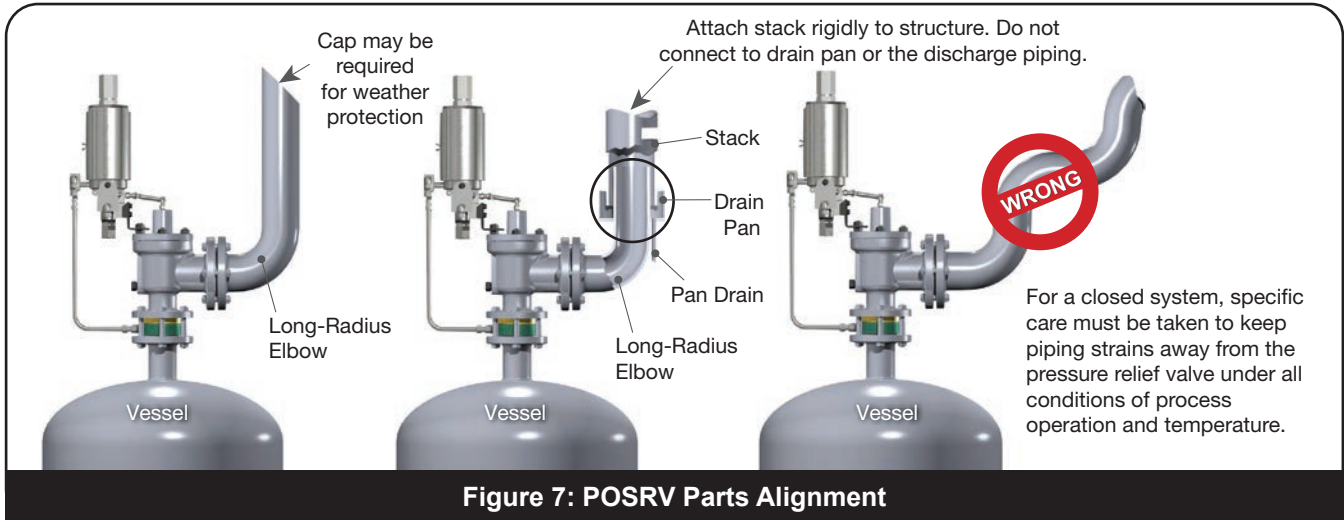


Figure 7: POSRV Parts Alignment

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.

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.

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. The optional sensing ring should not be installed. For remote sensing, .375" (9.53 mm) diameter tubing is adequate for distances up to 10 feet, (3.048 mtr). If distance is longer than 10 feet (3.048 mtr), please contact Baker Hughes's Consolidated Products Application Engineering.

ATTENTION!

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

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

E. Freeze Protection

Type of Applications:

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

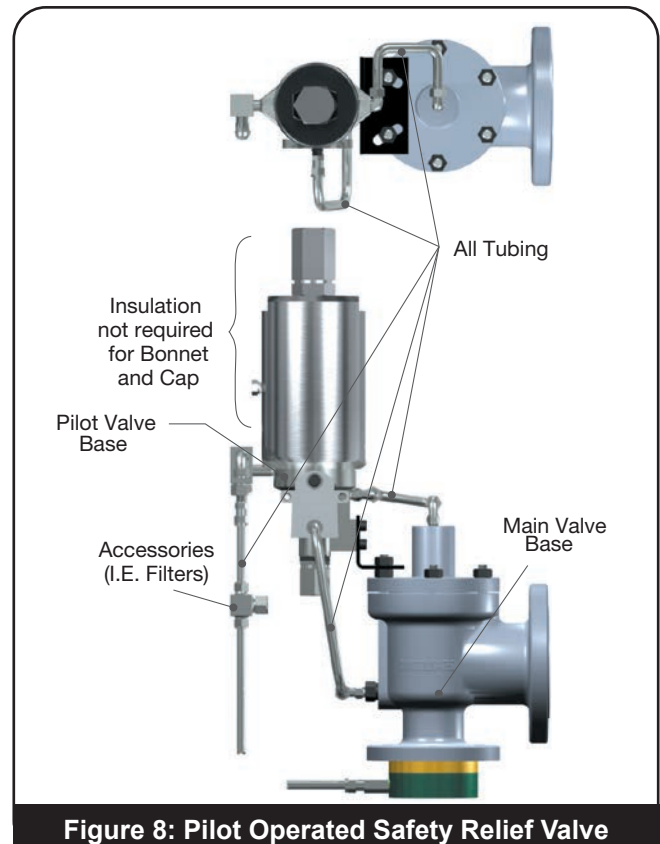


Figure 8: Pilot Operated Safety Relief Valve

XII. Recommended Installation Practices (Cont.)

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

3. 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:

1. 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.

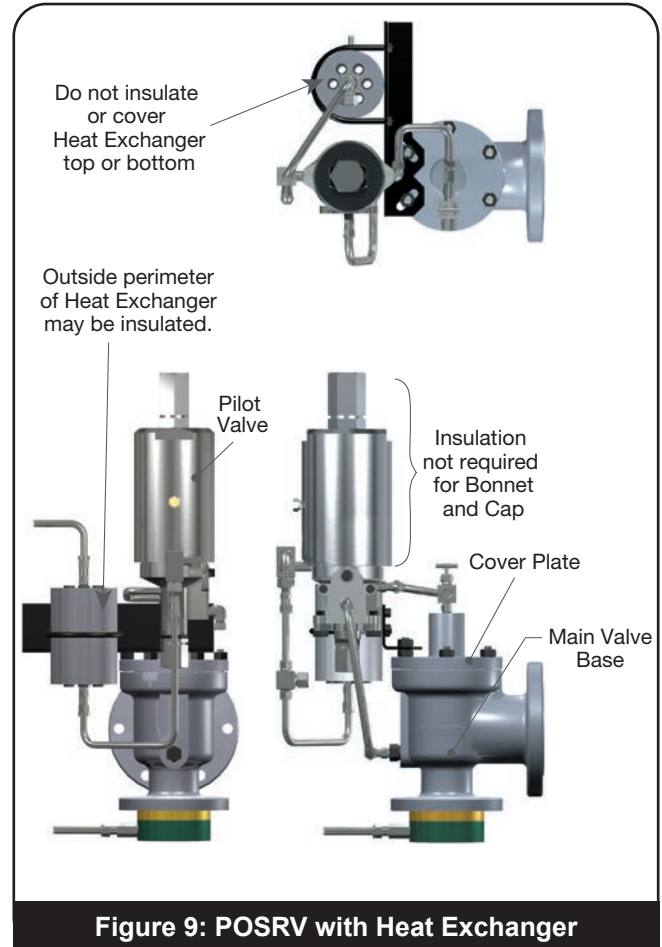
Recommendations for insulating and heat tracing pilot operated safety relief valve:

Types of freeze protection:

- a. Insulation by fiberglass blankets or wrap.
- b. Heat tracing with electrical heat tape.
- c. 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 Figures 8 and 9. Figure 8 shows a standard pilot operated relief valve. Figure 9 shows a pilot operated relief valve equipped with a heat exchanger.



XIII. Disassembly of the 2900-40 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. Disconnect the Sensing Tube, Dome Tube and Discharge Line from the Pilot Valve.
3. All other external attachments should be removed to free the Pilot Valve for Disassembly.
4. Loosen and remove the two cap bolts holding the pilot valve to the mounting bracket.
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 the appropriate section above.

1. If applicable, remove sensing tube fitting from Sensing Tube
2. Remove and discard Plug Filter from Sensing Tube (if applicable).
3. Loosen and remove the Stud Nuts on the Cover Plate.

ATTENTION!

If valve is equipped with spring assist, carefully back off on Stud Nuts in small increments to reduce preload on Cover Plate.

4. Remove the Bracket.
5. Install 1/4" MNPT pipe plug into Cover Plate where dome line is installed. Pipe plug will prevent Main Valve Piston from falling out of Cover Plate when the assembly is removed.
6. Remove Cover Plate and Main Valve Piston assembly from Base.

ATTENTION!

If Main Valve Piston O-Ring or Spring Energize Seal is damaged, then Main Valve Piston may fall out of Cover Plate during disassembly.

7. Remove pipe plug from Cover Plate.



XIII. Disassembly of the 2900-40 POSRV (Cont.)

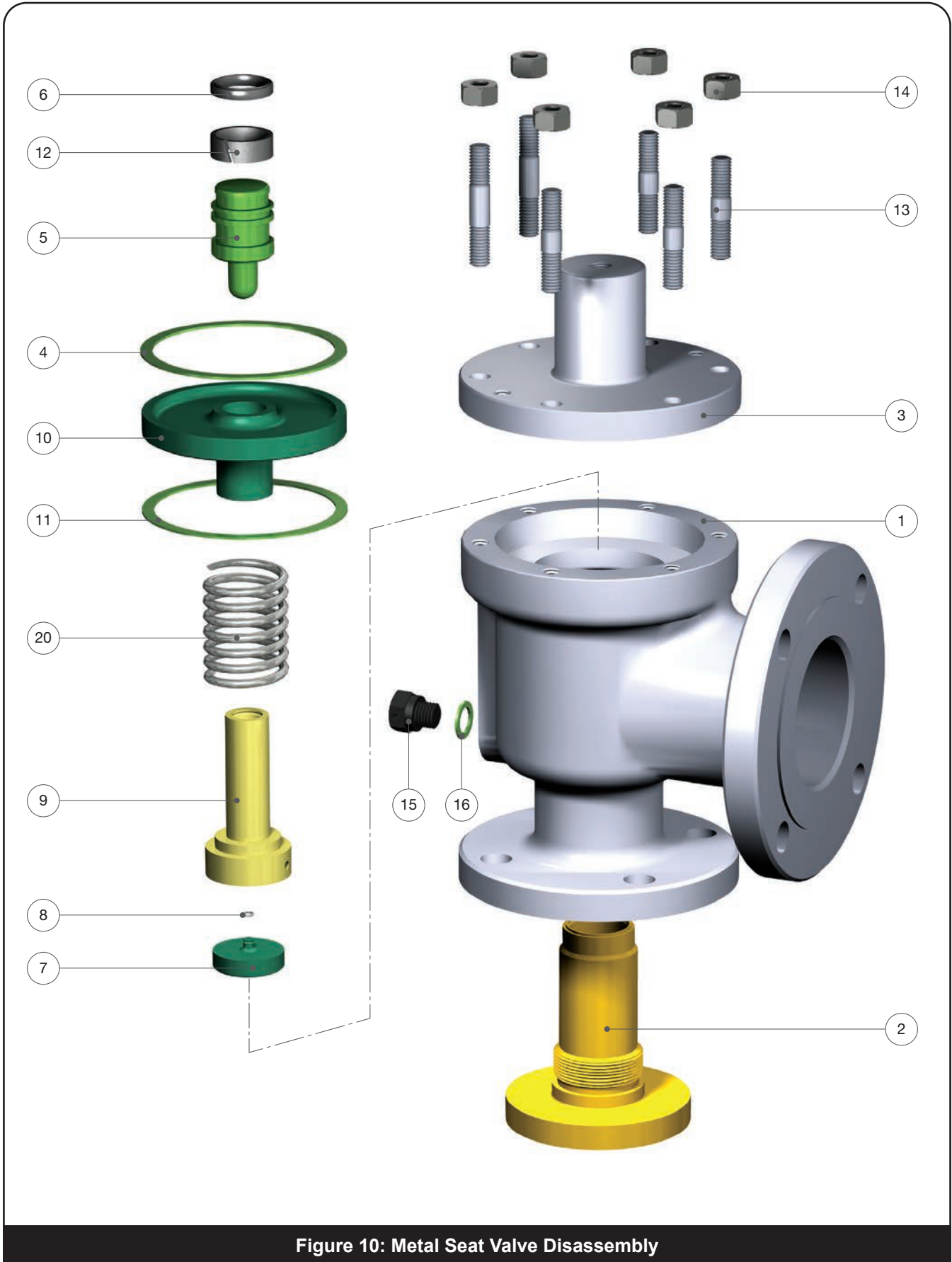


Figure 10: Metal Seat Valve Disassembly

XIII. Disassembly of the 2900-40 POSRV (Cont.)

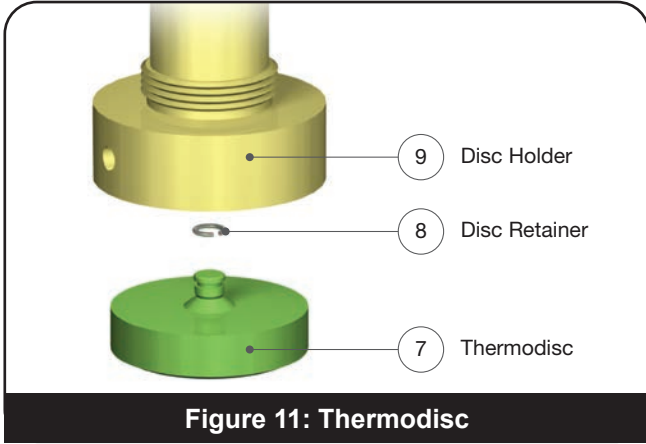


Figure 11: Thermodisc

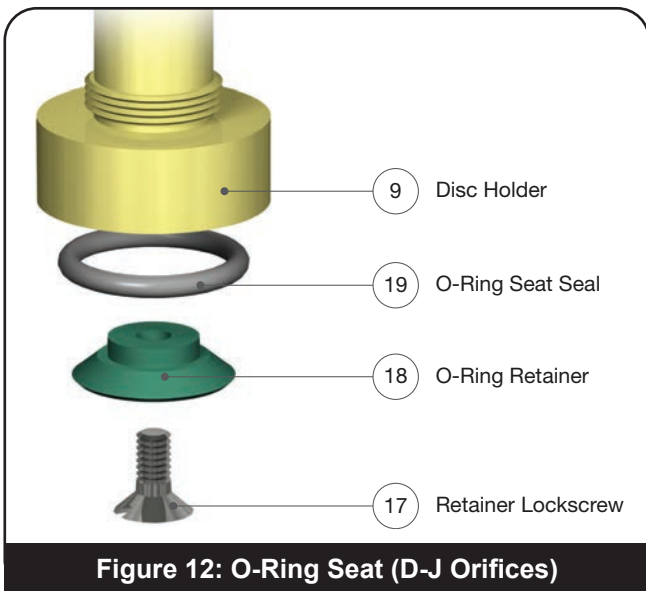


Figure 12: O-Ring Seat (D-J Orifices)

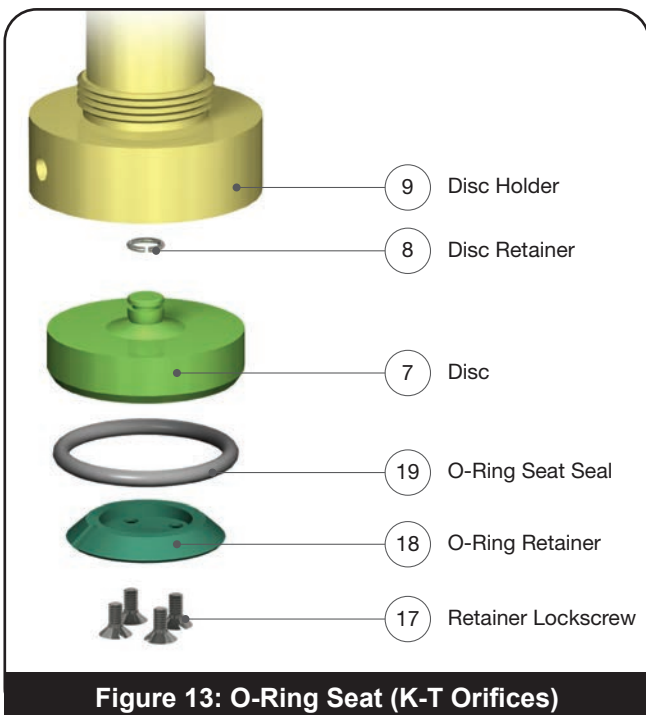


Figure 13: O-Ring Seat (K-T Orifices)

8. Remove the Main Valve Piston from the Cover Plate using a dowel pressed through the center hole in the top of the Cover Plate.
9. Remove the Cover Plate Gasket.
10. For "D" through "N" orifice, removed Disc Holder and Guide.

For "P" through "T" orifices, install the Disc Holder Removal Tool (Baker Hughes P/N 4464604) in the top of the Disc Holder as shown in Figure 14. Lift out and remove the Guide and Disc Holder. Remove the Lifting Tool from the top of the Disc Holder.

11. Lift the Guide off the Disc Holder. For spring assist valves, remove Spring from Disc Holder.

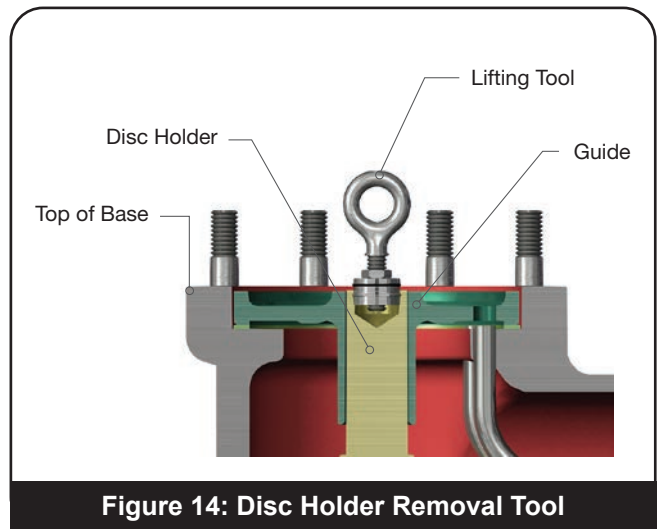


Figure 14: Disc Holder Removal Tool

14. Remove the disc from the disc holder as follows:
 - Clamp the stem portion of the disc holder, disc end up, firmly between two wooden V-blocks in a vise.
 - Start inserting special drift pins into the holes in the disc holder (Figure 15) with the tapered portion of the pins working against the top of the disc,

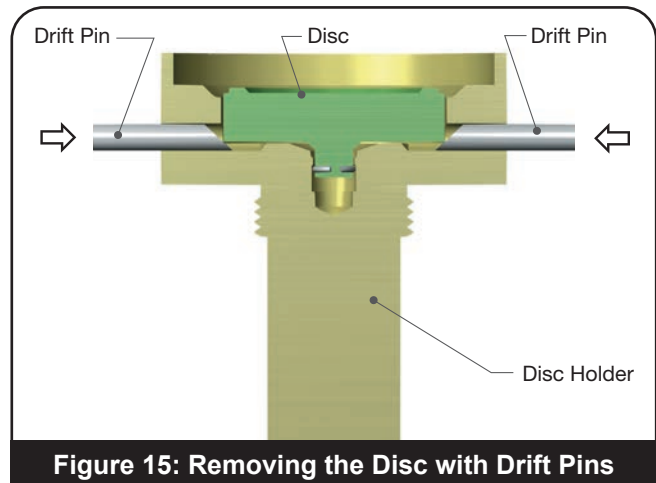


Figure 15: Removing the Disc with Drift Pins

XIII. Disassembly of the 2900-40 POSRV (Cont.)

as indicated. See Figure 61 and Table 18 in the Maintenance Tools and Supplies section for drift pin size.

- Use a light machinist hammer to tap each pin alternately until the disc snaps out of the recess in the disc holder.
15. For O-Ring seat seal valves only, remove the Retainer Lock Screw(s), O-Ring Retainer, and O-Ring Seat Seal.

ATTENTION!
The nozzle is normally removed for routine maintenance and service.

16. The nozzle is threaded onto the base and is removed by turning it counterclockwise (from right to left). Before removing the nozzle, soak the threaded joint with a suitable penetrating liquid or solvent. If the nozzle is frozen to the base, apply dry ice or other cooling medium to the inside of the nozzle and heat the base from the outside with a blowtorch in the area of the nozzle threads.

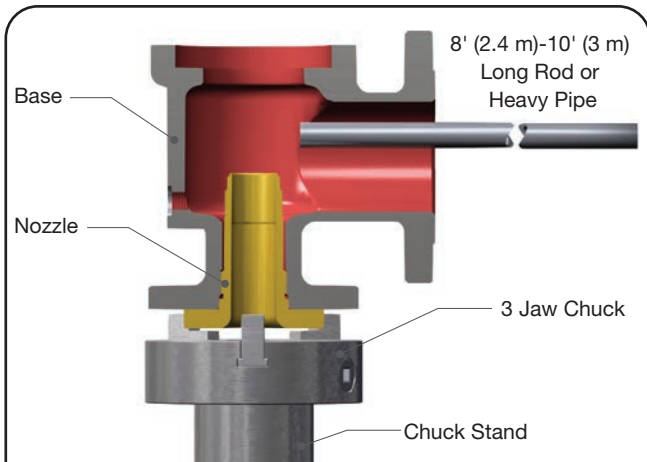


Figure 16: Loosening the Nozzle from the Base

ATTENTION!
Should heat be applied, use care to prevent cracking of cast parts.

17. Using a three- or four-jaw chuck welded vertically to a stand bolted to a concrete floor, clamp the nozzle into the chuck and break the body loose with a heavy rod or pipe (Figure 17).

ATTENTION!
Exercise care when inserting a rod or pipe in the outlet. Ensure the valve nozzle is not damaged during the operation.

18. Use a large pipe wrench on the nozzle flange to remove the nozzle from the base (Figure 16).
19. Remove the Nozzle from the Valve Base as suggested in Figure 16, or by using a Hex wrench or a pipe wrench on the flange as indicated in Figure 17.
20. The Main valve is ready for cleaning, inspection and refurbishing.
21. Discard all O-Rings, guide rings, and seals.

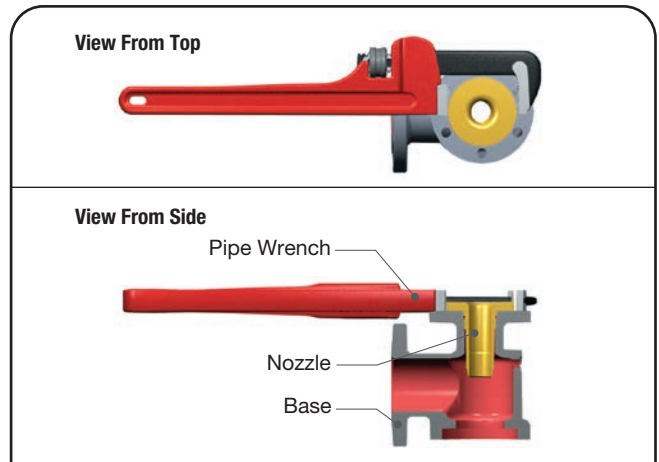


Figure 17: Removing the Nozzle from the Base

XIII. Disassembly of the 2900-40 POSRV (Cont.)

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.



XIV. Maintenance Instructions

A. General Maintenance Information

After the valve has been disassembled, a close inspection should be made of the seating surfaces. In a majority of cases, a simple lapping of seats is all that is necessary to put the valve in first class working order. If an inspection of the parts shows the valve seating surfaces to be badly damaged, machining will be required before lapping. O-Ring seat seal valve nozzles can only be reconditioned by machining, not lapping. (For specific information concerning the machining of nozzle and disc seating surfaces, see Paragraphs F and G which follow.)

The seating surfaces of the metal seated Consolidated Safety Relief Valve are flat. The nozzle seat is relieved by a 5° angle on the outside of the flat seat. The disc seat is wider than the nozzle seat; thus, the control of seat width is the nozzle seat (see Figure 18).

Reconditioning of the seating surfaces of the nozzle and disc is accomplished by lapping with a cast iron lap, and lapping compound.

ATTENTION!

In order to establish leak free valve seats, the nozzle seating surface and the disc seating surface must be lapped flat.

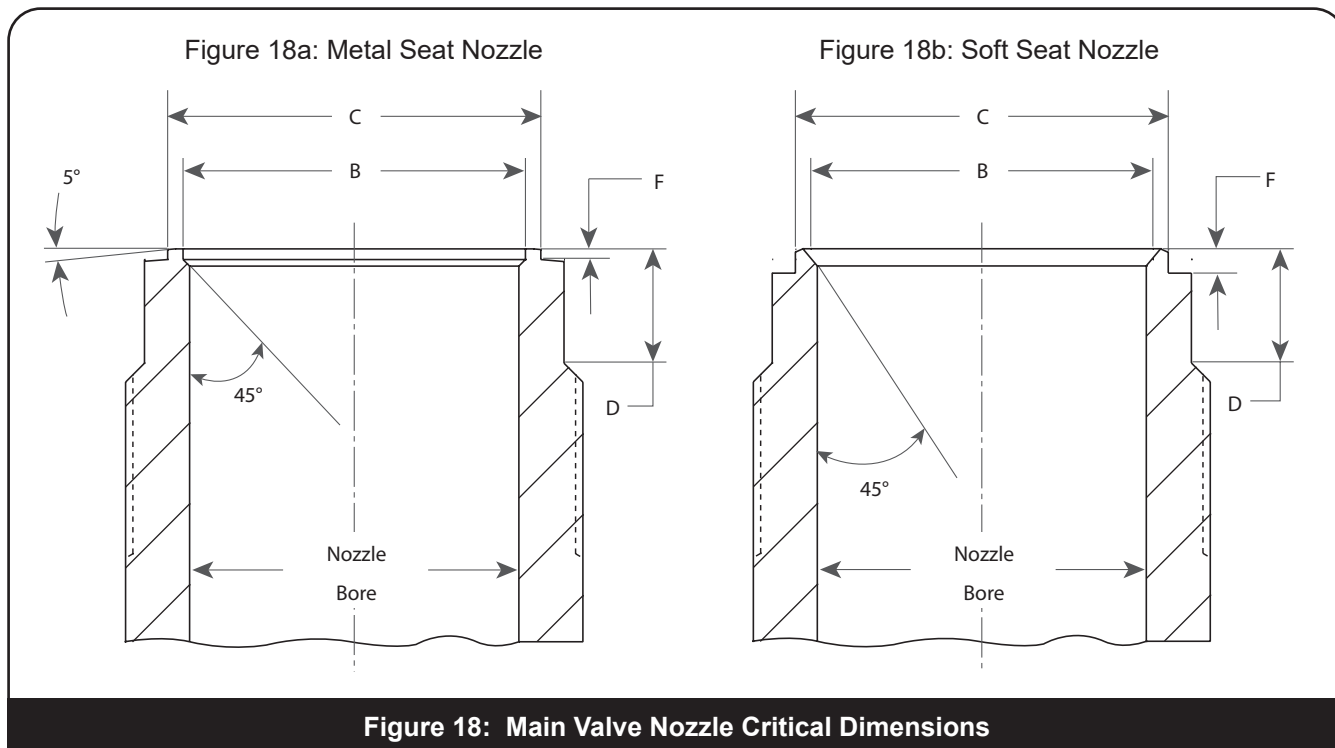
B. O-Ring Seat

The nozzle must not have any defects to prohibit the O-Ring from sealing properly, especially the OD of the seat where the surface must maintain a minimum of 32 RMS finish. See Figure 18 and Table 2 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.

C. Lapping Nozzle Seats (Metal Seat - Non-O-Ring Styles)

Lap the 5° angle of the nozzle first (Figure 19, View A). Then, invert the nozzle lap and use the flat side as a “starter” lap to ensure the seat is square. Use a ring lap in a circular motion to finish lapping and reconditioning of laps. Keep the lap squarely on the flat surface and avoid rocking the lap, which will cause rounding of the seat.



XIV. Maintenance Instructions (Cont.)

Table 2: Nozzle Critical Dimensions												
Orifice	Nozzle Bore				D min. ¹		E ±.005" (0.13 mm)		C (metal seat)		B (metal seat)	
	min.		max.				in.	mm	in.	mm	in.	mm
	in.	mm	in.	mm	in.	mm						
D	.404	10.26	.409	10.39	.313	7.95	.030	0.76	.954 ± .001	24.23 ± 0.03	.831 ± .001	21.11 ± 0.03
E	.539	13.69	.544	13.82	.313	7.95	.030	0.76	.954 ± .001	24.23 ± 0.03	.831 ± .001	21.11 ± 0.03
F	.674	17.12	.679	17.25	.313	7.95	.030	0.76	.954 ± .001	24.23 ± 0.03	.831 ± .001	21.11 ± 0.03
G	.863	21.92	.869	22.07	.313	7.95	.035	0.89	1.093 ± .001	27.76 ± 0.03	.953 ± .001	24.21 ± 0.03
H	1.078	27.38	1.083	27.51	.250	6.35	.035	0.89	1.224 ± .001	31.09 ± 0.03	1.123 ± .001	28.52 ± 0.03
J	1.380	35.05	1.385	35.18	.375	9.53	.035	0.89	1.545 ± .001	39.24 ± 0.03	1.435 ± .001	36.45 ± 0.03
K	1.650	41.91	1.655	42.04	.438	11.13	.063	1.60	1.836 ± .002	46.63 ± 0.05	1.711 ± .002	43.46 ± 0.05
L	2.055	52.20	2.060	52.32	.438	11.13	.063	1.60	2.257 ± .002	57.33 ± 0.05	2.133 ± .002	54.18 ± 0.05
M	2.309	58.65	2.314	58.78	.438	11.13	.063	1.60	2.525 ± .002	64.14 ± 0.05	2.400 ± .002	60.96 ± 0.05
N	2.535	64.39	2.540	64.52	.500	12.70	.063	1.60	2.777 ± .002	70.54 ± 0.05	2.627 ± .002	66.73 ± 0.05
P	3.073	78.05	3.078	78.18	.625	15.88	.093	2.36	3.332 ± .002	84.63 ± 0.05	3.182 ± .002	80.82 ± 0.05
Q	4.045	102.74	4.050	102.87	.875	22.23	.093	2.36	4.335 ± .003	110.11 ± 0.08	4.185 ± .003	106.30 ± 0.08
R	4.867	123.62	4.872	123.75	1.000	25.40	.093	2.36	5.110 ± .003	129.79 ± 0.08	4.960 ± .003	125.98 ± 0.08
T	6.202	157.53	6.208	157.68	.750	19.05	.093	2.36	6.510 ± .003	165.35 ± 0.08	6.315 ± .003	160.40 ± 0.08

Table 2: Nozzle Critical Dimensions											
Orifice	F (metal seat)		Radius B ±.001" (0.03 mm)		F (soft seat) ±.005" (0.13 mm)		C (soft seat)		B (soft seat)		
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	
D	.035 ^{+ .002} _{-.003}	0.97 ^{+0.05} _{-0.08}	.016	0.41	.079	2.01	.867 ± .001	22.02 ± 0.03	.813 ± .001	20.65 ± 0.03	
E	.035 ^{+ .002} _{-.003}	0.97 ^{+0.05} _{-0.08}	.016	0.41	.079	2.01	.867 ± .001	22.02 ± 0.03	.813 ± .001	20.65 ± 0.03	
F	.035 ^{+ .002} _{-.003}	0.97 ^{+0.05} _{-0.08}	.016	0.41	.079	2.01	.867 ± .001	22.02 ± 0.03	.813 ± .001	20.65 ± 0.03	
G	.035 ^{+ .002} _{-.003}	0.97 ^{+0.05} _{-0.08}	.022	0.56	.090	2.29	1.058 ^{+ .002} _{-.001}	26.87 ^{+0.05} _{-0.03}	.998 ± .001	25.35 ± 0.03	
H	.035 ^{+ .002} _{-.003}	0.89 ^{+0.05} _{-0.08}	.022	0.56	.060	1.52	1.214 ^{+ .002} _{-.001}	30.84 ^{+0.05} _{-0.03}	1.165 ^{+ .002} _{-.001}	29.59 ^{+0.05} _{-0.03}	
J	.035 ± .005	0.89 ± 0.13	.022	0.56	.074	1.88	1.532 ^{+ .002} _{-.001}	38.91 ^{+0.05} _{-0.03}	1.479 ^{+ .002} _{-.001}	37.57 ^{+0.05} _{-0.03}	
K	.063 ± .005	1.60 ± 0.13	.022	0.56	.126	3.20	1.836 ± .002	46.63 ± 0.05	1.780 ^{+ .001} _{-.002}	45.21 ^{+0.03} _{-0.05}	
L	.063 ± .005	1.60 ± 0.13	.017	0.43	.126	3.20	2.206 ± .002	56.03 ± 0.05	2.156 ± .002	54.76 ± 0.05	
M	.063 ± .005	1.60 ± 0.13	.022	0.56	.126	3.20	2.534 ± .002	64.36 ± 0.05	2.478 ± .002	62.94 ± 0.05	
N	.063 ± .005	1.60 ± 0.13	.022	0.56	.101	2.57	2.706 ± .002	68.73 ± 0.05	2.650 ± .002	67.31 ± 0.05	
P	0.093 ± .005	2.36 ± 0.13	.022	0.56	.150	3.81	3.332 ± .002	84.63 ± 0.05	3.277 ^{+ .002} _{-.003}	83.24 ^{+0.05} _{-0.08}	
Q	.093 ± .005	2.36 ± 0.13	.022	0.56	.188	4.78	4.335 ± .003	110.11 ± 0.08	4.281 ± .003	108.74 ± 0.08	
R	.093 ± .005	2.36 ± 0.13	.022	0.56	.215	5.46	5.092 ± .003	129.34 ± 0.08	5.033 ± .003	127.84 ± 0.08	
T	.093 ± .005	2.36 ± 0.13	.022	0.56	.142	3.61	6.510 ^{+ .003} _{-.004}	165.35 ^{+0.08} _{-0.10}	6.420 ^{+ .004} _{-.003}	163.07 ^{+0.10} _{-0.08}	

1. Do not remachine threaded areas of the nozzle to reestablish "D" dimension. Once "D" minimum is reached, replacement of nozzle is necessary.

XIV. Maintenance Instructions (Cont.)

D. Lapped Nozzle Seat Widths

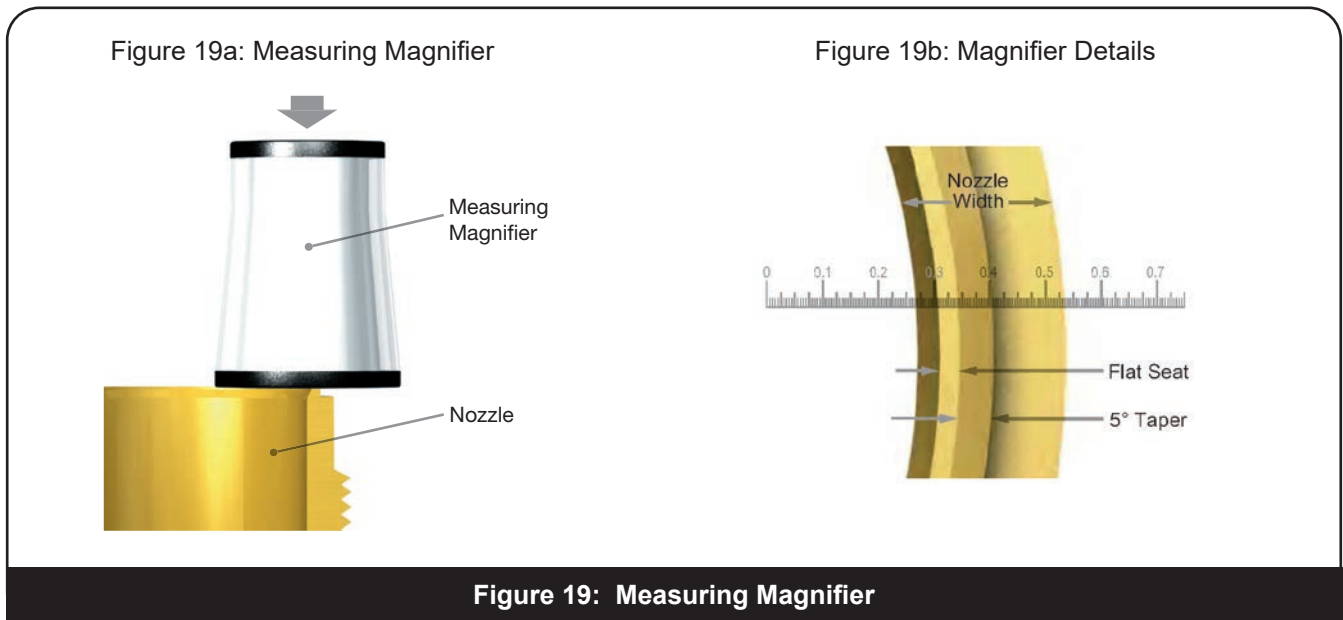
A wide nozzle seat will induce leakage, especially in the smaller-orifice, lower-pressure valves. For this reason, the seat of valves other than O-Ring valves should be as narrow as practical. Since the seat must be wide enough to carry the bearing load imposed upon it by the pressure force, the higher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

To measure the seat width, use a Model S1-34-35-37 Bausch and Lomb Optical Co. measuring magnifier or an equivalent seven-power glass with a 3/4" (19.05 mm) scale showing graduations of 0.005" (0.13 mm). Figure 19a and 19b illustrate the use of this tool in measuring the nozzle seat width. If additional lighting is required for measuring, use a gooseneck flashlight similar to the Type A Lamp Assembly (Standard Molding Corp.), or equivalent.

E. Lapping Disc Seats

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

- Apply 1000 lapping compound (see Table 17 in Lapping Tools Section (Section XXIII.C). Lap disc to a polish finish.
- Remove lapping compound completely from Disc and Disc Holder.



XIV. Maintenance Instructions (Cont.)

Table 3: Approximate Nozzle Seat Width (Std. Metal Seat Designs)								
Orifice	Set Pressure Range ¹				Lapped Seat Width			
	min.		max.		min.		max.	
	psig	barg	psig	barg	in.	mm	in.	mm
D-G	1	0.07	50	3.45	.012	0.30	.015	0.38
	51	3.52	100	6.89	.015	0.38	.022	0.56
	101	6.96	250	17.24	.022	0.56	.028	0.71
	251	17.31	400	27.58	.028	0.71	.035	0.89
	401	27.65	800	55.16	.035	0.89	.042	1.07
	801	55.23	Above		Note 2		Note 2	
H-J	1	0.07	50	3.45	.019	0.48	.022	0.56
	51	3.52	100	6.89	.022	0.56	.027	0.69
	101	6.96	250	17.24	.027	0.69	.031	0.79
	251	17.31	400	27.58	.031	0.79	.035	0.89
	401	27.65	800	55.16	.035	0.89	.040	1.02
	801	55.23	Above		Note 2		Note 2	
K-N	1	0.07	50	3.45	.025	0.64	.028	0.71
	51	3.52	100	6.89	.028	0.71	.033	0.84
	101	6.96	250	17.24	.033	0.84	.038	0.97
	251	17.31	400	27.58	.038	0.97	.043	1.09
	401	27.65	800	55.16	.043	1.09	.048	1.22
	801	55.23	Above		Note 2		Note 2	
P-R	1	0.07	50	3.45	.030	0.76	.034	0.86
	51	3.52	100	6.89	.034	0.86	.041	1.04
	101	6.96	250	17.31	.041	1.04	.049	1.24
	251	17.31	400	27.58	.049	1.24	.056	1.42
	401	27.65	800	55.16	.056	1.42	.062	1.57
	801	55.23	Above		.062	1.57	.064	1.63
T	1	0.07	50	3.45	.040	1.02	.043	1.09
	51	3.52	100	6.89	.043	1.09	.049	1.24
	101	6.96	250	17.24	.049	1.24	.057	1.45
	251	17.31	300	20.68	.057	1.45	.060	1.52

1. Seat widths for set pressures below 15 psig (1.03 barg) should be approximately the same as those shown for 15 psig (1.03 barg).
2. .042" + .005" (1.07 + 0.13 mm) per 100 psig (6.89 barg). Not to exceed .070 ± .005" (1.78±0.13 mm).

Table 4: Approx. Nozzle Seat Width (Thermodisc Designs)								
Orifice	Set Pressure Range ¹				Lapped Seat Width			
	min.		max.		min.		max.	
	psig	barg	psig	barg	in.	mm	in.	mm
D - F	15	1.03	100	6.89	.020	0.51	.035	0.89
	101	6.96	300	20.68	.035	0.89	.045	1.14
	301	20.75	800	55.16	.045	1.14	.055	1.40
	801	55.23	Above		Full Width ²			
G - J	15	1.03	100	6.89	.025	0.64	.035	0.89
	101	6.96	300	20.68	.035	0.89	.045	1.14
	301	20.75	800	55.16	.045	1.14	.055	1.40
	801	55.23	Above		Full Width ²			
K - N	15	1.03	100	6.89	.035	0.89	.045	1.14
	101	6.96	300	20.68	.045	1.14	.055	1.40
	301	20.75	800	55.16	.055	1.40	.065	1.65
	801	55.23	Above		Full Width ²			
P-R	15	1.03	100	6.89	.040	1.02	.050	1.27
	101	6.96	300	20.68	.050	1.27	.060	1.52
	301	20.75	800	55.16	.060	1.52	.070	1.78
	801	55.23	Above		Full Width ²			
T	15	1.03	100	6.89	.050	1.27	.060	1.52
	101	6.96	300	20.68	.060	1.52	.075	1.91

1. Seat widths for set pressures below 15 psig (1.03 barg) should be approximately the same as those shown for 15 psig (1.03 barg).
2. Not to exceed .070 ± .005" (1.78±0.13 mm).

XIV. Maintenance Instructions (Cont.)

F. Precautions and Hints for Lapping Seats

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

Keep work materials clean. Always use a fresh lap. If signs of wear (out of flatness) are evident, recondition the lap.

Apply a very thin layer of lapping compound to the lap to prevent rounding off the edges of the seat.

Keep the lap squarely on the flat surface, and avoid rocking the lap, which causes rounding of the seat.

When lapping, keep a firm grip on the lapped part to prevent dropping it and damaging the seat.

Lap in a circular motion while applying a uniform pressure. Slowly rotate the lap to evenly distribute the lapping compound. Wipe off the old compound and replace it with new compound frequently. Apply more pressure to speed the cutting action of the compound. To check the seating surfaces, remove all compound from the seat and the lap. Then, shine the seat with the same lap using the lapping method as described above. Low sections on the seating surface show up as shadow in contrast to the shiny portion. If shadows are present, further lapping is necessary. Only laps known to be flat can be used. It should take only a few minutes to remove the shadows.

When lapping is complete, any lines appearing as cross-scratches can be removed by rotating the lap on its axis (which has been wiped clean of compound) on the seat. Thoroughly clean the lapped seat using lint free cloth and a cleansing fluid.

ATTENTION!

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

G. Reconditioning of Laps

Ring laps are reconditioned by lapping them on a flat lapping plate in a figure-eight motion (Figure 20). To ensure the best results, recondition the ring laps after each use. Use an optical flat to check the quality of the lap.

Nozzle laps must be re-machined to recondition the lapping surfaces. Place the nozzle lap in a lathe between centers (Figure 21). The surfaces marked A and B must be running concentric.

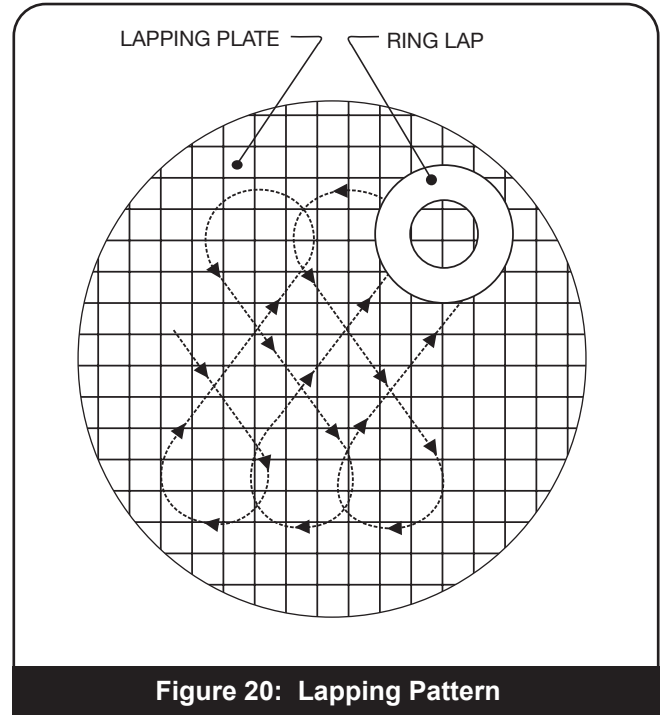


Figure 20: Lapping Pattern

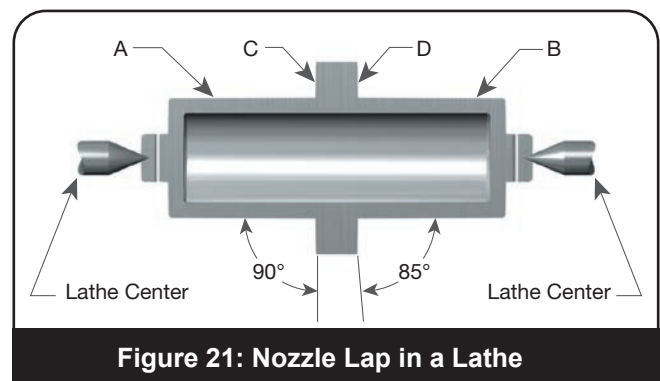


Figure 21: Nozzle Lap in a Lathe

H. Re-Machining Nozzle Seats

1. Remove the nozzle from the valve to be remachined. If it cannot be removed from the base, re-machine it inside the base.
2. Take the following steps to setup the lathe and nozzle:
 - a. 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 22).
 - b. True up the nozzle so that the surfaces marked B and C run true within .001" (0.03 mm) on indicator (Figure 22).

XIV. Maintenance Instructions (Cont.)

3. Take the following steps to re-machine the metal-to-metal nozzle (Figure 18a and Table 2):
 - a. Make light cuts across the surface L at 5° until the damaged areas are removed. Turn to the smoothest possible finish.

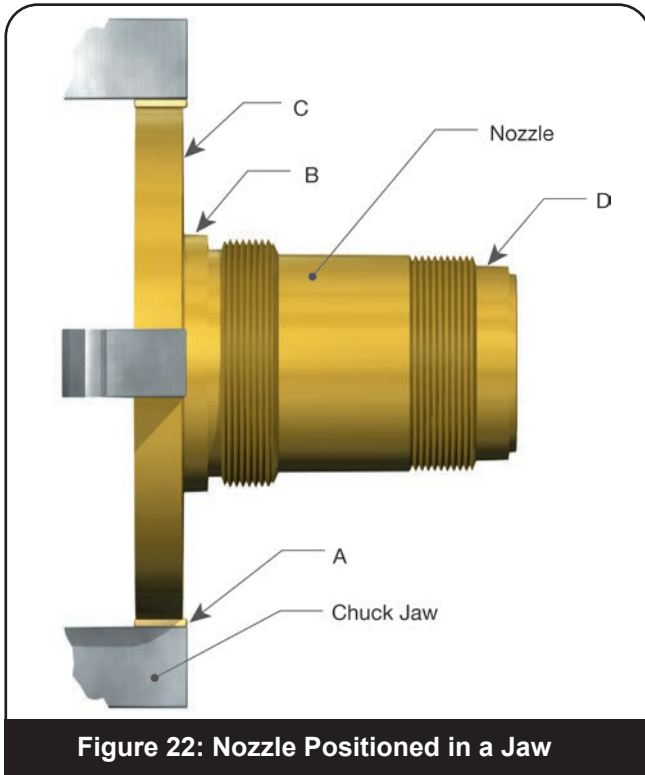


Figure 22: Nozzle Positioned in a Jaw

- b. The nozzle is now ready for lapping.
 - c. When the minimum dimension D from Table 2 is reached, discard the nozzle.
4. Take the following steps to re-machine the O-Ring seat seal (Figure 18b and Table 2):
 - a. Make light cuts across surface A (45°) until the damaged areas are removed. Turn to the smoothest possible finish.
 - b. Re-machine radius R.
 - c. The nozzle is now ready for lapping.
 - d. When the minimum dimension H is reached, discard the nozzle.

I. Re-Machining the Disc Seat

Take the following steps to machine the standard disc seating surface (Figure 23):

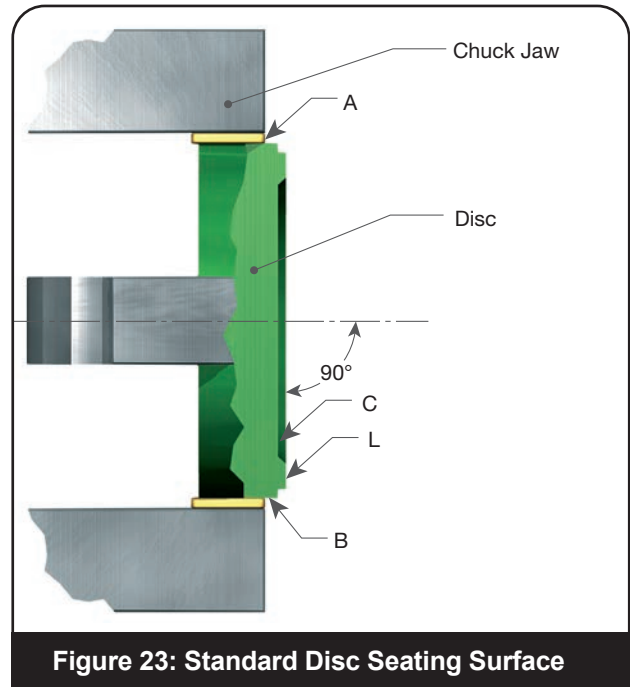


Figure 23: Standard Disc Seating Surface

1. Grip the disc in a four-jaw independent chuck (or collet, if appropriate), using a piece of soft material such as copper or fiber between the jaws and the disc as shown at A.
2. True up the disc so that the surface marked B and C run true within .001" (0.03 mm), TIR.
3. Make light cuts across the seating surface L until damaged areas are removed. Turn to the smoothest possible finish.
4. The disc is now ready for lapping.
5. Discard the disc if the minimum dimension N or T (Figure 24, Table 5) is reached. Do not reestablish surface C.

ATTENTION!

Do not remachine a Thermodisc or O-Ring Retainer.

XIV. Maintenance Instructions (Cont.)

Figure 24a: Type 1 (D - H Orifice)

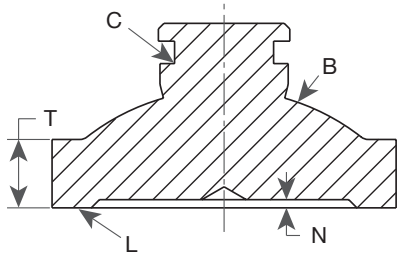


Figure 24b: Type 2 (J - T Orifice)

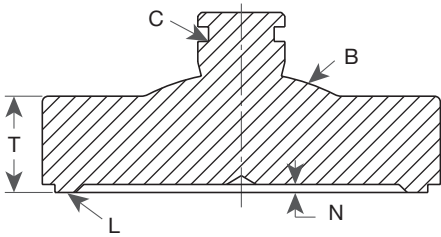


Figure 24c: Disc O-Ring Soft Seat (K-T Orifices Only)

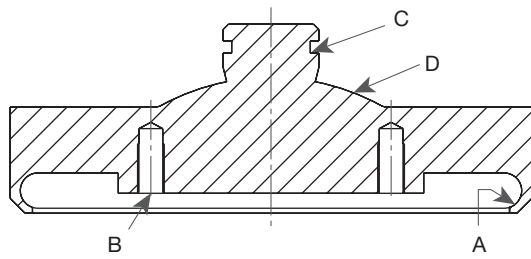


Figure 24: Disc Inspection Areas

Table 5: Disc Seat Machining Dimensions

Disc Type	Orifice Size	T min.		N min.	
		in.	mm	in.	mm
Type 1	D	.174	4.42	.010	0.25
	E	.174	4.42	.010	0.25
	F	.174	4.42	.010	0.25
	G	.174	4.42	.010	0.25
	H	.335	8.51	.010	0.25
Type 2	J	.359	9.12	.010	0.25
	K	.422	10.72	.015	0.38
	L	.457	11.61	.015	0.38
	M	.457	11.61	.015	0.38
	N	.485	12.32	.015	0.38
	P	.610	15.49	.015	0.38
	Q	.610	15.49	.015	0.38
	R	.610	15.49	.015	0.38
	T	.822	20.88	.015	0.38

XV. Inspection and Part Replacement

1. Guide Replacement Criteria:

2900-40 Series Guide should be replaced:

- a. If the sliding surface is galled, pitted or scratched or the machined gasket surfaces are damaged.
- b. The "A" dimension (See Figures 25) exceeds A max. in Table 6.

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

3. Cover Plate: Cover Plate Should be reused if:

- a. The sliding surface in the dome area is not galled, scratched, corroded or pitted.
- b. The Gasket surface is not scratched, corroded or pitted.

4. O-Ring Retainer: Inspect surface that sits on the disc for any corrosion or defects that might cause the disc not to sit flush with nozzle.

5. Nozzle: Nozzle should be replaced if:

- a. The seat width requires adjustment, and the Dimension from the seat to the first thread is less than "D" minimum on Table 2.
- b. Thread sections are damaged from pitting and/or corrosion.
- c. Top of the nozzle flange and intersecting surface are damaged from galling and/or tearing.
- d. The nozzle flange thickness can change center to face Dimensions. The minimum dimension for orifices "D" through "P" is .672" (16.50 mm) and "Q" through "T" orifices is .797" (20.20 mm).

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

To reduce the seat width, the 5° angle surface must be machined. The nozzle must be replaced if the D min is reduced below the minimum as indicated in Table 2.

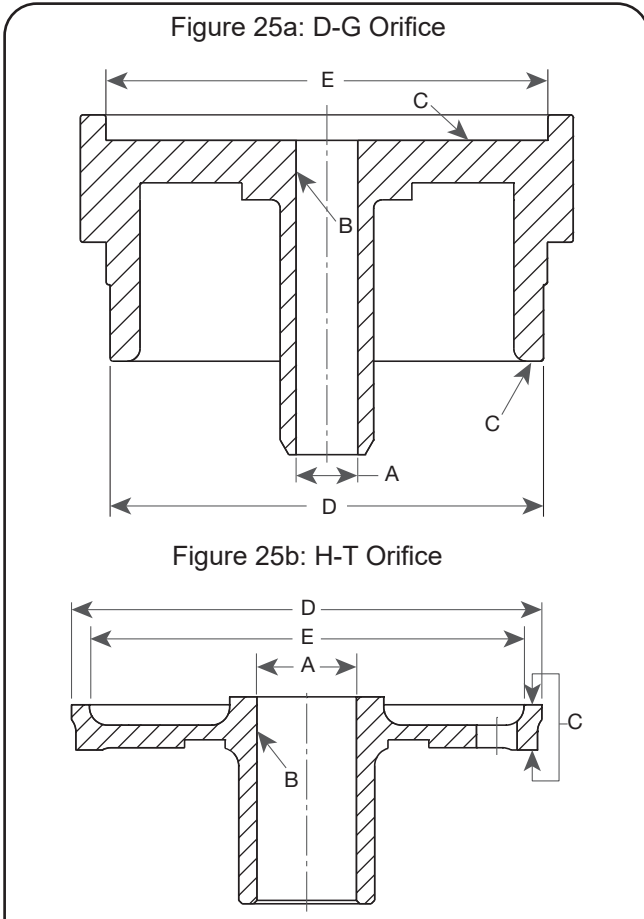


Figure 25: Guide (Metal Seat & Soft Seat)

Table 6: Guide Critical Dimension

Orifice	Non-Bellows Guide A max.		Orifice	Bellows Guide A max.	
	in.	mm		in.	mm
D	1.001	25.43	D	0.455	11.56
E	1.001	25.43	E	0.455	11.56
F	1.001	25.43	F	0.455	11.56
G	1.001	25.43	G	0.501	12.73
H	1.127	28.63	H	0.689	17.50
J	1.002	25.45	J	1.002	25.45
K	1.252	31.80	K	1.252	31.80
L	1.377	34.98	L	1.377	34.98
M	1.752	44.50	M	1.752	44.50
N	1.877	47.68	N	1.877	47.68
P	2.315	58.80	P	2.315	58.80
Q	2.315	58.80	Q	2.315	58.80
R	2.315	58.80	R	2.315	58.80
T	2.315	58.80	T	2.315	58.80

6. Spring: Check for any corrosion or pitting.

7. Standard Metal Seated Disc: This disc (Figure 24) can be machined until the T dimension is reduced to the minimum, as listed in Table 5. The "N" minimum dimension must be maintained as well.

8. Thermodisc Metal Seated Disc: This disc (Figure 26) cannot be machined. It can be lapped as long as the "A" minimum dimension has been maintained. If lapping does not fix damaged area, part must be discarded.

The Thermodisc must be replaced if:

- a. Seat defects and damage cannot be lapped out without reducing the "A" dimension in Figure 26 that is listed in Table 7.
- b. If the dimension cannot be measured, replace the Thermodisc.

XV. Inspection and Part Replacement (Cont.)

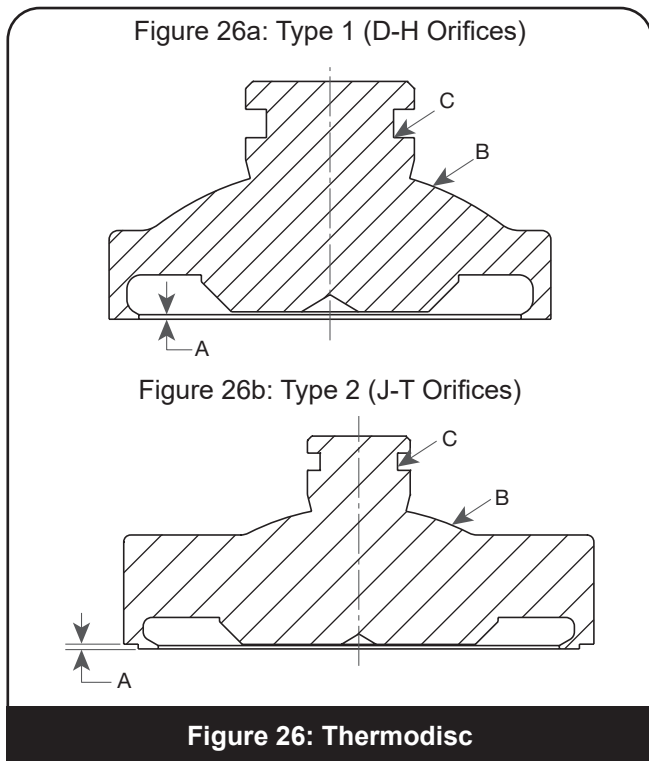


Table 7: Thermodisc Replacement Criteria

Orifice	A min.		Orifice	A min.	
	in.	mm		in.	mm
D	.006	0.15	L	.014	0.36
E	.006	0.15	M	.014	0.36
F	.006	0.15	N	.014	0.36
G	.006	0.15	P	.017	0.43
H	.006	0.15	Q	.015	0.38
J	.013	0.33	R	.015	0.38
K	.014	0.36	T	.025	0.64

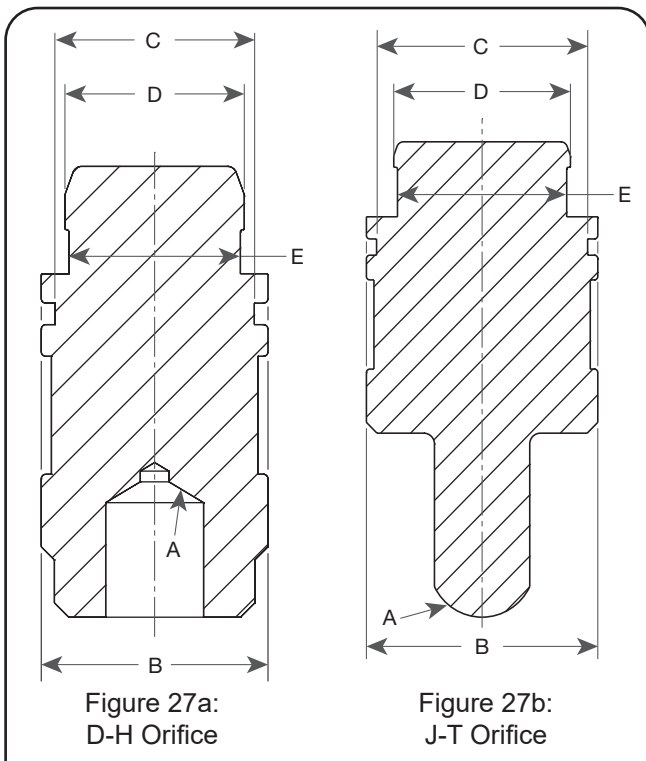


Table 8: Piston Critical Dimensions

Orifice	B min.		E min.	
	in.	mm	in.	mm
D	.989	25.12	.748	19.00
E	.989	25.12	.748	19.00
F	.989	25.12	.748	19.00
G	1.114	28.30	.873	22.17
H	1.365	34.67	.998	25.35
J	1.677	42.60	1.310	33.27
K	1.990	50.55	1.623	41.22
L	2.490	63.25	2.123	53.92
M	2.867	72.82	2.498	63.45
N	3.117	79.17	2.748	69.80
P	3.741	95.02	3.372	85.65
Q	4.861	123.47	4.498	114.25
R	5.735	145.67	5.372	136.45
T	7.360	186.94	6.997	177.72

9. O-Ring Seated Disc: The O-Ring Retainer cannot be machined. It can be lapped for minor scratches. If lapping does not fix damaged area, part must be discarded.
10. Disc Holder: Disc Holder should be replaced if the sliding surface of the Holder is galled, pitted, or scratched.
11. Solid Metal Gaskets: Solid Metal Gaskets can be reused unless they are corroded, pitted, or crimped.
12. Main Valve Piston Replacement Criteria:
The Piston should be re-used if:
 - a. There is no indication of galling, scratched, corroded or pitted on any surface of the piston.
 - b. The "B" & "E" dimensions (See Figure 27) are less than "B" minimum and "E" minimum, indicated in Table 8.

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

Refer to Tables 20 for a list of recommended spare parts and Table 21 for a list of O-Ring repair kits.

XVI. Reassembly of the 2900-40 Main Valve

A. Lubricants and Sealants

1. Operating temperatures below -40°F (-40°C), consult the Factory.
2. Operating temperatures above -40°F (-40°C)
 - a. Lubricate all O-Rings, except silicone, spring energized seals, and back-up rings sparingly with silicone grease (Baker Hughes P/N SP505).
 - b. Seal all pipe threads with Teflon tape or pipe sealant (Baker Hughes P/N SP364-AB).
 - c. Lubricate standard threads and bearing points with nickel graphite N5000 (Baker Hughes P/N 4114507) or equivalent.

B. Assembly Procedure with Metal Seats

1. If the valve Nozzle was removed, apply thread lubricant to the nozzle threads before reinstalling in the Base. Insert it into the inlet flange of the Base, and torque to the correct value listed in Table 9.
2. Assemble the disc/disc holder as follows:
 - a. Prior to assembly of the Disc into the Disc Holder,

remove the Disc Retainer from the back of the Disc. Use 1000 grit grinding compound on the bearing surface to grind the Disc into the Disc Holder to properly establish the bearing surface.

- b. Place the Disc Retainer into the groove in the disc. The Disc with the Disc Retainer should “snap” into the Disc Holder pocket with moderate finger or hand force. Do not use excessive force to assemble these parts. Be sure that the Disc is free to “wobble” after it is in place.

C. Assembly Procedure with O-Ring Seats

1. If the valve Nozzle was removed, apply thread lubricant to the nozzle threads before reinstalling in the Base. Insert it into the inlet flange of the Base, and torque to the correct value listed in Table 9.
2. Assemble the disc/disc holder as follows:
 - a. For disc sizes “D” through “J”, reassemble the Disc Holder using a new O-Ring, O-Ring Retainer, and new Lock Screw(s). Refer to Table 10 for the proper torque. These Disc Holders are ready for torque the next step.

Table 9: Nozzle Torque Values +0 / -10%

Orifice	Required Torque ¹	
	ft-lbs	Nm
D	165	223.71
E	165	223.71
F	165	223.71
G	145	196.59
H	165	223.71
J	335	454.20
K	430	583.00
L	550	745.70
M	550	745.70
N	640	867.72
P	1020	1382.93
Q	1400	1898.15
R	1070	1450.73
T	1920	2603.17

1. DO NOT USE impact wrench on "D" through "K" orifice Nozzles.

Table 10: Disc Holder Torque Values

Orifice	No. of Bolts	Bolt Size	Torque	
			in-lbs	N-m
D	1	1/4-28UNF	75 ± 3	8.5 ± 0.3
E	1	1/4-28UNF	75 ± 3	8.5 ± 0.3
F	1	1/4-28UNF	75 ± 3	8.5 ± 0.3
G	1	1/4-28UNF	75 ± 3	8.5 ± 0.3
H	1	1/4-28UNF	75 ± 3	8.5 ± 0.3
J	3	#10-32UNF	30 ± 2	3.4 ± 0.2
K	3	#8-32NC	18 ± 1	2.0 ± 0.1
L	3	#8-32NC	18 ± 1	2.0 ± 0.1
M	4	#8-32NC	18 ± 1	2.0 ± 0.1
N	4	#8-32NC	18 ± 1	2.0 ± 0.1
P	4	1/4-28UNF	75 ± 3	8.5 ± 0.3
Q	4	1/4-28UNF	75 ± 3	8.5 ± 0.3
R	4	1/4-28UNF	75 ± 3	8.5 ± 0.3
T	4	1/4-28UNF	75 ± 3	8.5 ± 0.3

XVI. Reassembly of the 2900-40 Main Valve (Cont.)

- b. For disc sizes “K” through “T”, reassemble the Disc using a new O-Ring, O-Ring Retainer, and new Lock Screws. Refer to Table 10 for the proper torque.
 - (i) Prior to assembly of the Disc into the Disc Holder, remove the Disc Retainer from the back of the Disc. Use 1000 grit grinding compound on the bearing surface to grind the Disc into the Disc Holder to properly establish the bearing surface.
 - (ii) Place the Disc Retainer into the groove in the disc. The Disc with the Disc Retainer should “snap” into the Disc Holder pocket with moderate finger or hand force. Do not use excessive force to assemble these parts. Be sure that the Disc is free to “wobble” after it is in place.

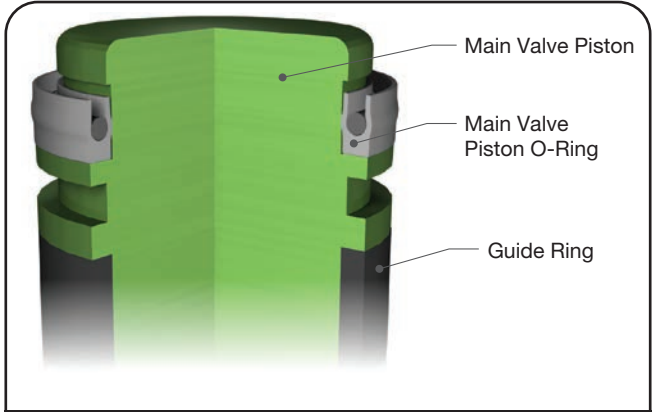


Figure 28: Main Valve Piston

- 3. Set the Disc Holder (disc side down), on the work surface. Place a small amount of 1000 grit grinding compound onto the ball end of the Main Valve Piston and place it in the disc holder pocket. Turn the Main Valve Piston clockwise, and then counter clockwise, to seat the Main Valve Piston. Clean all grinding compound from parts.
- 4. Place the Spring down onto the Disc Holder.
- 5. Place the Guide over the Disc Holder. (DO NOT DROP.) If Bellows is present, the weight of the Guide will slightly compress the Bellows.
- 6. Place the Guide Gasket in the Base.
- 7. Install disc guide assembly. Use the same lifting tool (see Figure 14) as was used during disassembly, then carefully lower it into the Base.
- 8. Using a small amount of Silicone Grease supplied with soft goods replacement kit, rub a small amount on the seals and O-Rings prior to assembly.
- 9. Take the Main Valve Piston and measure and cut diagonally the proper length of Guide Ring material to fit in the groove of the Main Valve Piston. Allow 1/16 of an inch (1.59 mm) gap between the ends for proper fit.

- 10. 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 28.

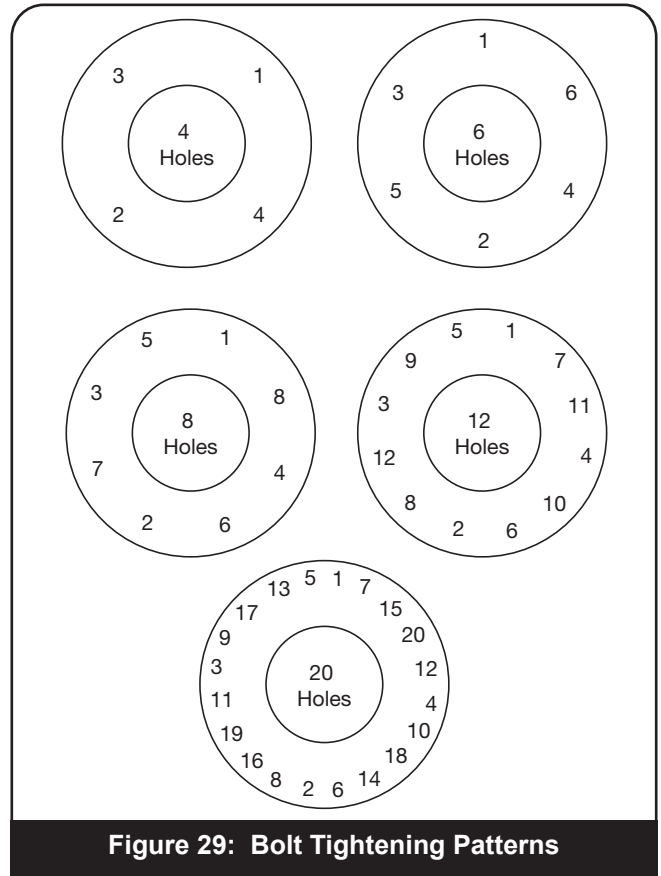
Table 12: Torque Required for Each Round of Pattern	
Round	Percentage of Required Torque
1	Wrench Tight
2	25
3	60
4	100
5	100

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 28).

- 11. Install the Guide Ring(s) onto the Main Valve Piston. If there is more than one Guide Ring, stagger the cut locations 180° apart.
- 12. To prevent seal damage during assembly, check the chamfer on the bottom of the Cover Plate for burrs. If any sharp edges exist, polish the chamfer.
- 13. Insert Main Valve Piston (energize seal/O-Ring side first) into bottom of Cover Plate. Continue pushing Main Valve Piston into Cover Plate, being careful not to pinch the guide rings. Push Main Valve Piston in until bottom of Main Valve Piston is even with the bottom of the Cover Plate.
- 14. Install 1/4” MNPT pipe plug into Cover Plate where dome line connects.

XVI. Reassembly of the 2900-40 Main Valve (Cont.)

15. Install Cover Plate Gasket. Install Cover Plate on top of Base such that the pilot will be aligned for proper tubing connections. Make note of the length of the studs. The two longer ones will straddle the vertical line of the inlet sensing port on the Main Base of the pilot valve. Install the bracket between the Cover Plate and the Nut or Cap Screw. Be sure that the bracket is aligned so that the two smaller pilot attachment holes are above the horizontal plane of the Cover Plate.
16. Remove pipe plug from Cover Plate.
17. Torque to the values found in Table 11 using the torque patterns in Figure 29 and Table 12.
18. Once the Main Valve is assembled before any tubing is connected reach through the hole in the center of the Cover Plate and force the Main Valve Piston down until it contacts the Disc Holder. Failure to complete this procedure will prevent the Main Valve from loading and closing, when pressure is applied to the valve.
19. The Main Valve is ready to receive the pilot and finished assembly.



XVI. Reassembly of the 2900-40 Main Valve (Cont.)

Table 11: Cover Plate Nut Torque														
Orifice	2905		2906		2910		2912		2914		2916		2918	
	ft lb	Nm	ft lb	Nm	ft lb	Nm	ft lb	Nm	ft lb	Nm	ft lb	Nm	ft lb	Nm
D	55	75	55	75	55	75	60	81	60	81	60	81	120	163
E	55	75	55	75	55	75	60	81	60	81	60	81	120	163
F	55	75	55	75	55	75	60	81	70	95	70	95	115	156
G	55	75	55	75	55	75	60	81	70	95	70	95	75	102
H	90	122	90	122	60	81	75	102	65	88	65	88	—	—
J	60	81	60	81	75	102	100	136	100	136	100	136	—	—
K	65	88	65	88	60	81	60	81	135	183	145	197	—	—
L	75	102	75	102	90	122	90	122	140	190	140	190	—	—
M	95	129	95	129	110	149	95	129	95	129	—	—	—	—
N	105	142	105	142	130	176	85	115	85	115	—	—	—	—
P	120	163	120	163	145	197	125	169	125	169	—	—	—	—
Q	105	142	105	142	125	169	150	203	—	—	—	—	—	—
R	115	156	115	156	115	156	135	183	—	—	—	—	—	—
T	95	129	95	129	95	129	125	169	—	—	—	—	—	—

Table 11: Cover Plate Nut Torque													
Orifice	2920		2922		2923		2924		2926		2928		
	ft lb	Nm	ft lb	Nm	ft lb	Nm	ft lb	Nm	ft lb	Nm	ft lb	Nm	
D	55	75	55	75	—	—	60	81	60	81	115	156	
E	55	75	55	75	—	—	60	81	60	81	115	156	
F	55	75	55	75	—	—	70	95	70	95	115	156	
G	55	75	60	81	—	—	70	95	70	95	75	102	
H	60	81	60	81	—	—	75	102	85	115	—	—	
J	75	102	75	102	—	—	100	136	100	136	—	—	
K	60	81	60	81	—	—	60	81	140	190	—	—	
L	90	122	90	122	—	—	140	190	140	190	—	—	
M	90	122	95	129	—	—	95	129	—	—	—	—	
N	130	176	85	115	—	—	85	115	—	—	—	—	
P	145	197	—	—	125	169	125	169	—	—	—	—	
Q	105	142	150	203	—	—	—	—	—	—	—	—	
R	115	156	135	183	—	—	—	—	—	—	—	—	
T	125	169	—	—	—	—	—	—	—	—	—	—	

XVII. Disassembly of Pilot Valve

A. 39PV07/37 Disassembly

Figures 30 and 31

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 31 to remove the Lifting Lever assembly. Then return to Figure 30 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 59. Remove and discard the O-Ring (Insert) on the bottom of the Insert Assembly. Disassemble Insert Assembly by removing the Insert Bottom from the Insert Top. Discard Spring Seal (Insert).

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

The Adjuster Assembly consists of:

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

B. 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.

XVII. Disassembly of Pilot Valve (Cont.)

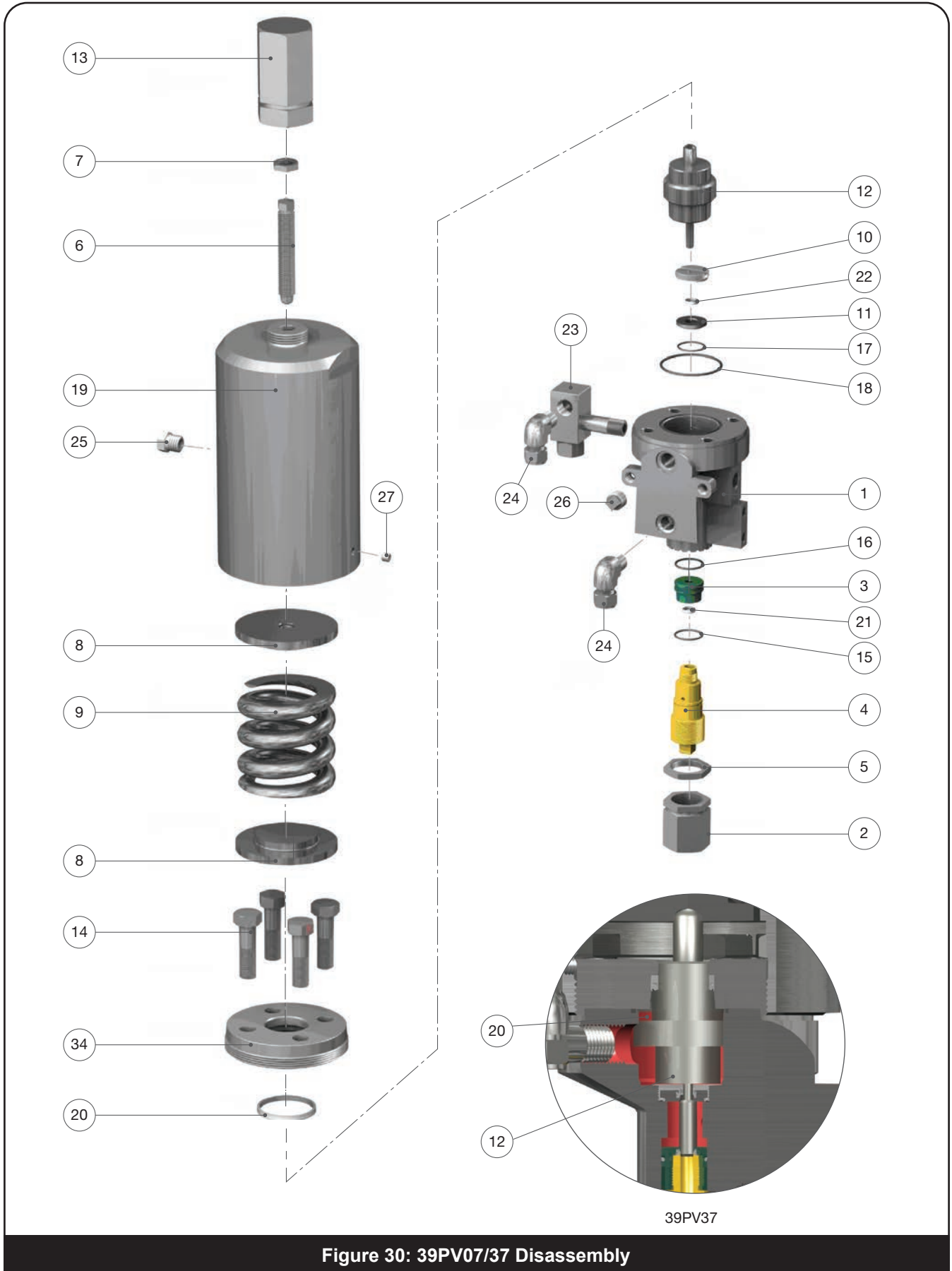
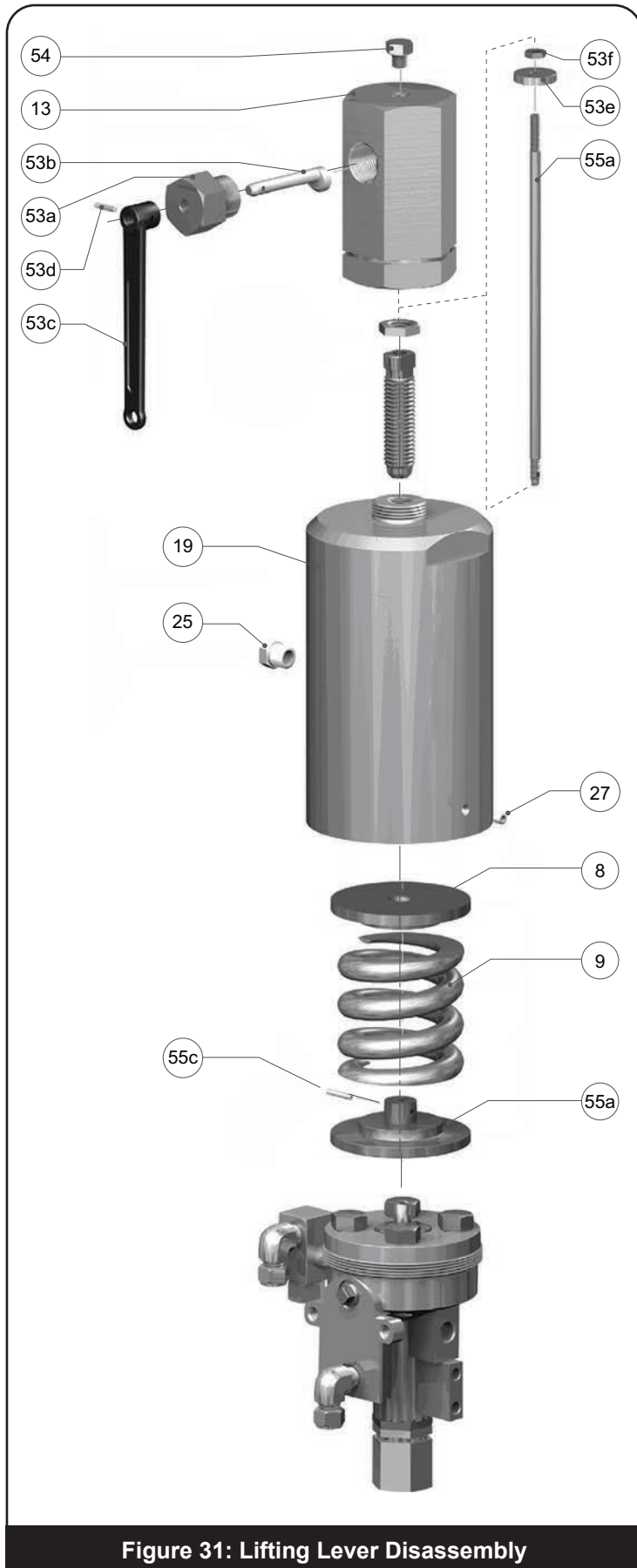


Figure 30: 39PV07/37 Disassembly

XVII. Disassembly of Pilot Valve (Cont.)

5. Do not “sand blast” internal parts as it can reduce the dimensions of the parts.



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

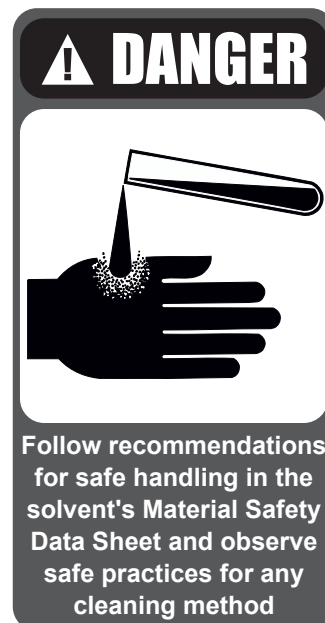


Figure 31: Lifting Lever Disassembly

XVIII. Part Inspection of Pilot Valve

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

A. 39PV07/37

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

6. Top Plate: Galling or excessive wear on the inside diameter that guides the Main Piston. Check for any corrosion or pitting. Also, check for galling of threads.
7. Bonnet: Check for any corrosion or pitting. Also, check for galling of threads for the compression screw and where it attaches to the Pilot Base.
8. Compression Screw: Galling at the spherical bearing surface or in the thread. Check for any corrosion or pitting.
9. Spring Washer(s): Galling at the spherical bearing surface. Check for any corrosion or pitting.
10. Pilot Base: Check for any corrosion or pitting. Also, check for galling of threads.
11. Spring: Check for any corrosion or pitting.

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 22 and 23 for O-Ring/Spring Seal repair kits. Recommended spare parts are listed in Table 20.

XIX. Reassembly of Pilot Valve

A. Lubricants and Sealants

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

B. Assembly of 39PV07/37

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 58 in Section XXIII.
 - 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 32.

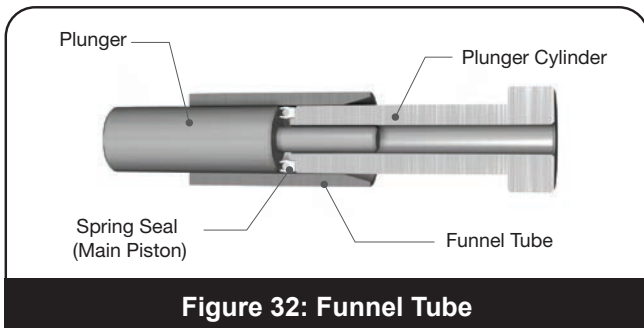


Figure 32: Funnel Tube

- v. Remove Plunger.
- vi. Insert Funnel Tube Assembly into Adjuster Top until Funnel Tube contacts Spring Seal (Adjuster Top) gland.
- viii. Push down on Plunger cylinder to insert Spring Seal (Adjuster Top) into Adjuster Top as shown in Figure 33.
- 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 34.

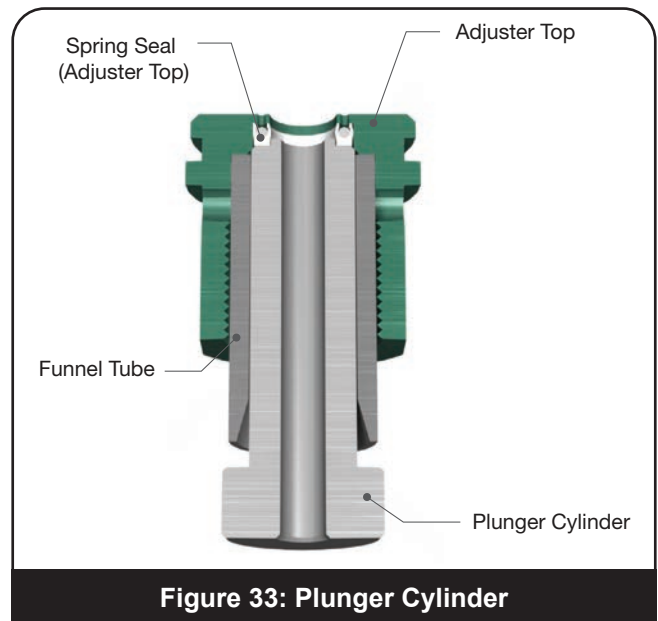


Figure 33: Plunger Cylinder

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

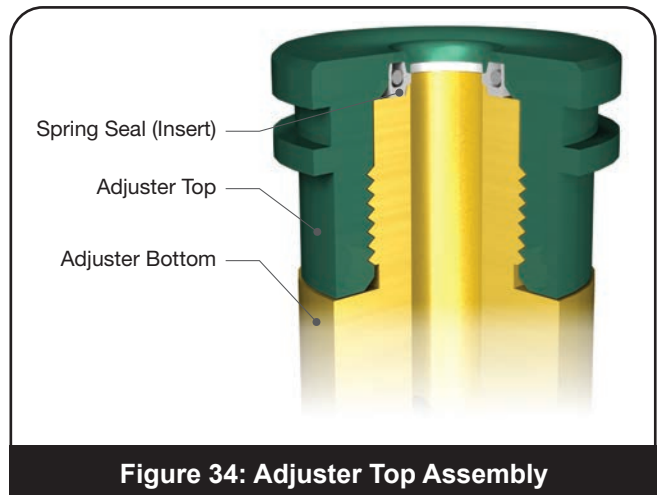


Figure 34: Adjuster Top Assembly

XIX. Reassembly of 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 the Adjuster Top is not tighten properly.

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

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

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.

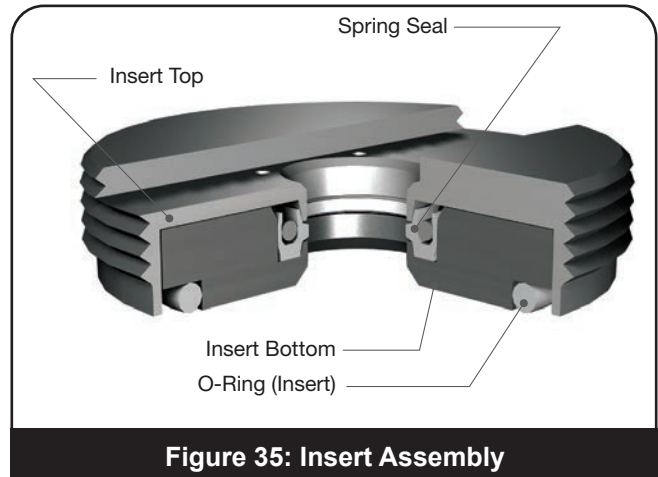


Figure 35: Insert Assembly

- e. Final Insert Assembly is shown in Figure 35.
 - f. Turn Insert Assembly over and thread into Pilot Base with T-handle groove wrench (Part #4995401 Figure 59 in Section XXIII). 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 Figures 36 or 37.
 - 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.

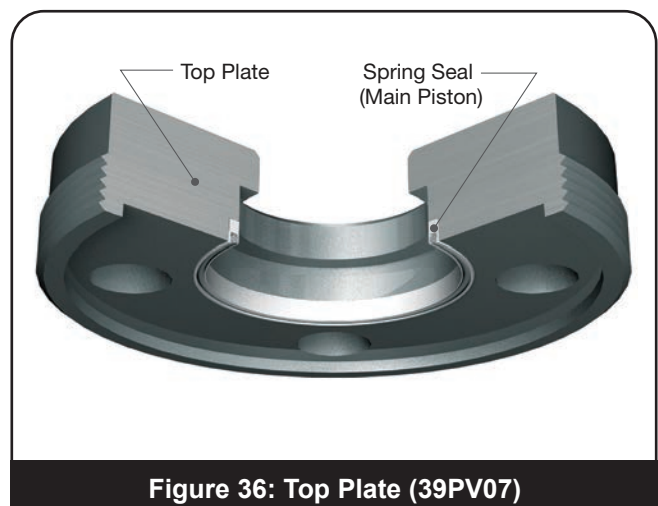


Figure 36: Top Plate (39PV07)

XIX. Reassembly of Pilot Valve (Cont.)

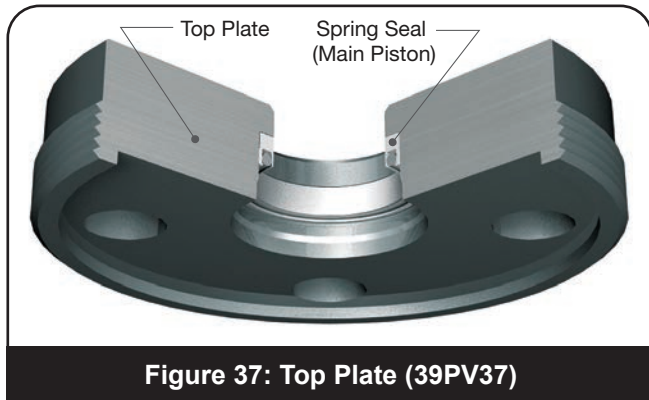


Figure 37: Top Plate (39PV37)

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).
Install Pipe Plug (Pilot Valve) in port above vent hole (if removed).

Refer to Field Test Connection / Backflow Preventer Option (Section XXII.A) for reassembly of Field Test Connection.

XX. Setting and Testing

A. General Information

1. Before putting the reconditioned valve in service, it must be set to open at the required set pressure. Although the valve can be set on the service installation, it is more convenient to set the valve and check seat tightness on a test stand.
2. Test Equipment: The test stand used for testing POSRVs normally consists of a pressure source supply line with a throttle valve and receiver that have the following features:
 - a. Outlet for attaching the valve to be tested on steam
 - b. Pressure gauge with a shutoff valve
 - c. Drain line with a shutoff valve
 - d. Adequate receiver volume for the valve to be tested and to achieve proper operation
3. Test Media: Valves shall be tested on steam.
4. Pretesting: It is recommended that the pilot valve be tested prior to installation on the main valve.

B. With Standard Options

Note: Seal all pipe threads with a non-organic sealant or Teflon® tape.

1. Attach pilot to main valve using two Socket Head Cap Screws (Bracket).
2. Install the 3/8" O.D. tubes into the fittings for the inlet and dome ports.
3. The vent port of the pilot valve is vented to atmosphere in standard configuration.
4. Final standard configuration for a 39PV07 or 39PV37 without any options is shown in Figure 38.



Figure 38: 39PV07/37

XX. Setting and Testing (Cont.)

C. With Sensing Ring Option

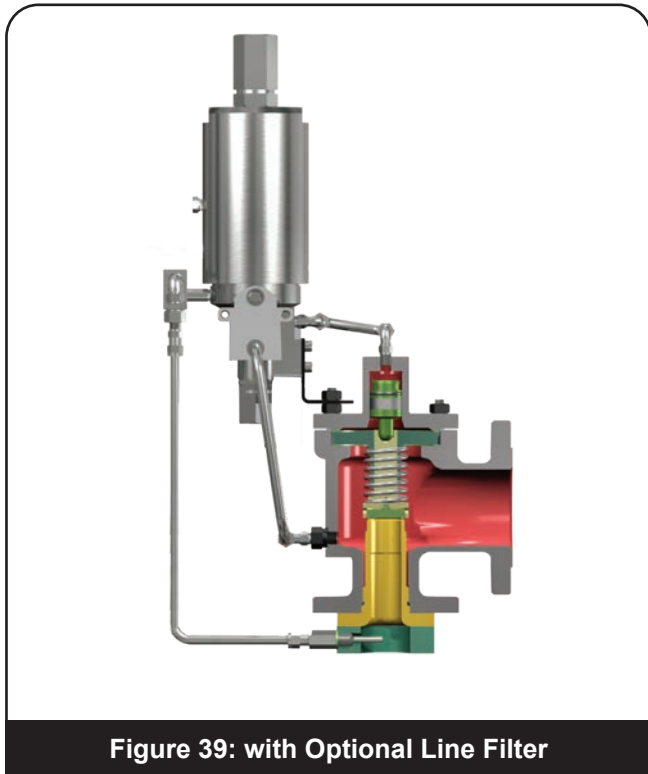


Figure 39: with Optional Line Filter

Remote sensing is the standard pressure connection to the pilot valve used on the 2900-40 Pilot Operated Safety Relief Valve. However with the Sensing Ring Option, the pilot valve pressure can be picked up just before the inlet of the main valve.

The gaskets which are supplied by the customer are to be inserted between the Valve Nozzle and the Sensing Ring and between the Sensing Ring and the test system flange.

D. Functional Testing

ATTENTION!

Filter in sensing tube to be removed if the following filter options are utilized.

1. 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.
 - c. Drop system to 90% of set pressure between cycles.

- d. The 3 tests should be within the tolerances listed in Table 15.
- e. If blowdown is being checked, the following guidelines are to be followed.

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

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

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

CAUTION

Do not adjust blowdown, compression screw, or adjuster while pilot is pressurized.

- f. If adjustments are necessary, adjust Compression Screw or Adjuster and retighten corresponding lock nut. Starting position of adjuster shall be 8 turns. Retest beginning at step 9.
2. Main valve equipped with metal seats and steam as the test media.
 - a. Leak tightness shall be checked visually using a black background. There shall be no visual or audible leakage after the interior of the valve is allowed to dry after popping. The leak test pressure shall be when pressure is held at 4% below valve set pressure or 2 psig (0.14 barg), whichever is greater.
 - b. 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.
 - c. 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.
 - d. 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.
 - e. Leakage from main valve can come from either the main valve seat, nozzle seal or dome seal. To

XX. Setting and Testing (Cont.)

determine if the leakage is from either the main valve seat or nozzle seal, the outlet must be filled to above the seat line and checked for bubbles. If no bubbles are present, then leakage is either coming from the dome seal.

3. Back pressure testing for leakage
 - a. Backpressure is the pressure measured at the valve outlet, in pounds per square inch gauge (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" (25.4 mm) NPS.
 - c. The pressure, at which the valve is to be backpressure tested, shall be 30 psig (2.1 barg) (minimum) or system backpressure, whichever is higher. Air or nitrogen shall be used as the test medium for applying backpressure.
 - d. Backpressure tests are to be performed by applying pressure with air or nitrogen to the valve outlet and the valve dome. Pressure may be applied directly to the valve dome or via the pilot valve. 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.
4. Drain all water from pilot valve, main valve, and tubing after completion of testing. Compressed air may be used to aid in drying.
 - e. The following points shall be examined for leakage during backpressure testing.
 - (i) Cover Plate, inlet and outlet joints.
 - (ii) All tube fittings and connections.
 - (iii) Possible point of leakage on the pilot valve.

XX. Setting and Testing (Cont.)

E. Field Testing of POSRV Assembly

IMPORTANT - Read First:

- A. These procedures shall not be used unless in the presence of a qualified Consolidated technician
- B. These procedures are specialized and shall not be incorporated into any of the customer's SOP's
- C. In no case shall the auxiliary pressure be raised more than 115% of MAWP.
 - a. The auxiliary system providing pressure must contain proper control to regulate flow into pilot.
- D. The necessary tubing, gauges, and fittings to perform this test must have a minimum pressure rating of 2x the maximum desired set point.
- E. In the cases when the auxiliary pressure is higher than the set pressure of the valve, these procedures may interfere with normal valve operation and the valve may not perform its intended function. The process system pressure shall be monitored at all times during the performance of these tests. If system pressure increases past 95% of desired set pressure, the auxiliary pressure source shall be removed and the vent valve downstream of the exhaust gauge shall be opened. This will allow the PRV to function as intended.
- F. In cases where there is a large pressure gap between the bottle/source pressure and desired dome pressure, it is recommended multiple regulators be installed to maintain the ability to fine tune the pressure setting in the pilot dome.



XX. Setting and Testing (Cont.)

E.1 Field Test Connection

A 1/4" FNPT field test connection (Figure 40) is standard on all Consolidated pilot valve types, 39PV series and 39MV series. The field test connection along with an auxiliary pressure source can be used to provide a stable and constant pressure to the pilot valve and dome of the main valve. An internal check valve is present in the field test connection isolating the inlet media from the auxiliary pressure source media and at the same time, allowing the valve to open normally in the event of a system over pressurization while using the field test connection. Figure 41 and 42 represent the recommended schematic for supplying auxiliary pressure to the POSRV. The "Connection to Valve Test Plug" mates with the 1/4" FNPT of the Field Test Connection.

Below are some common usages for the field test connection:

1. **Mitigation of main valve instability during startup** - During system startup, it is common for a POSRV to experience instability due to pressure fluctuations and differentials present between the main valve and the pilot. Instability may take the form of rapid opening and closing of the system called chatter or a transient relieving condition until pressure within the pilot stabilizes with the main valve pressure. Proper POSRV startup procedures can be practiced to mitigate these issues using the already installed Field Test Connector on the POSRV.
2. **Artificial actuation of pilot and main valve** - Per ASME Section I and Section VIII-1, all pilot-operated pressure relief valves used in the respective services shall be provided with either a lifting device or means for connecting and applying pressure to the pilot adequate to verify that the moving parts critical to proper operation are free to move. The field test connection fulfills the latter.

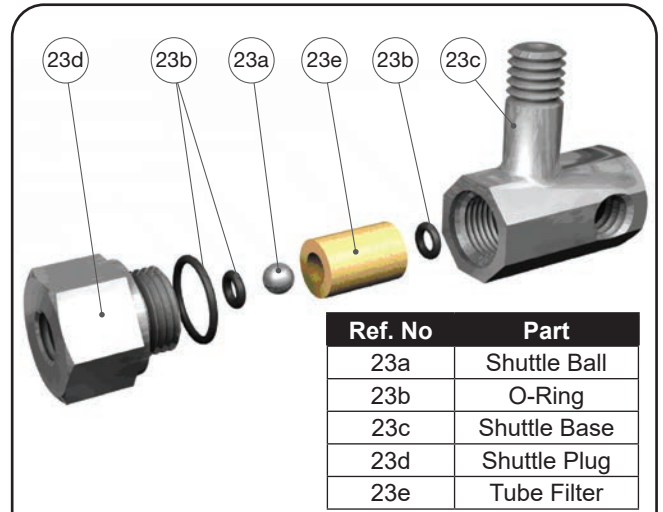


Figure 40: Backflow Preventer Option

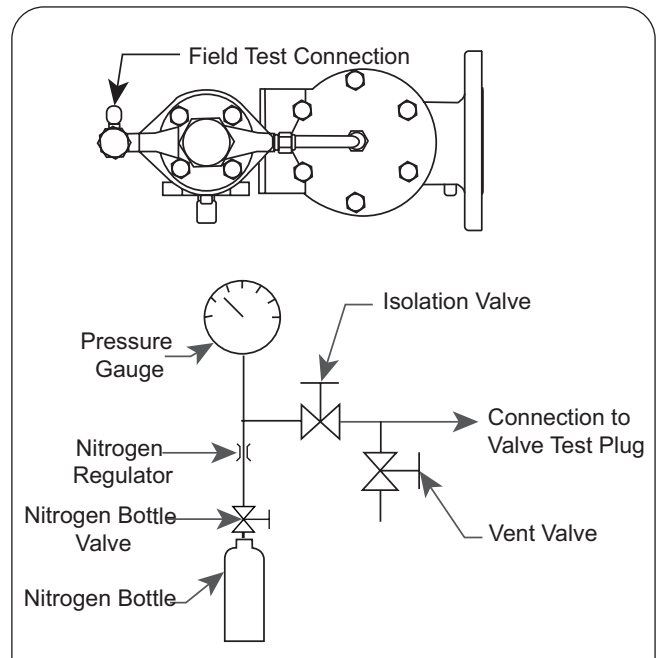


Figure 41: Typical Field Test Arrangement

XX. Setting and Testing (Cont.)

E.1.1 Mitigation of Main Valve Instability During Startup

Below are the recommended steps for charging the pilot in preparation for startup:

1. Close all valves and regulator.
2. Connect **Field Test Arrangement** to **Field Test Connection** (Figure 42).
3. Open the **Isolation Valve #1**.
4. Slowly open the **Nitrogen Bottle Valve** to its fully open position.
5. Slowly adjust the **Nitrogen Regulator** (pressure increase should not exceed 10 psig/sec) till the downstream pressure is equal to 90% of the set pressure as indicated by **Pressure Gauge #1**. Should the pressure input exceed the set pressure, follow these steps:
 - i. Close the **Isolation Valve #1**.
 - ii. Reduce the output pressure of the **Nitrogen Regulator** to 90% of set pressure.
 - iii. Slowly open **Vent Valve #1** until all pressure in the pilot is below 90% of set pressure.
 - iv. Close **Vent Valve #1**.
 - v. Open **Isolation Valve #1**.

6. With the pilot pressurized to 90% of set pressure, system startup may begin.
7. After startup, close **Nitrogen Bottle Valve**.
8. Fully open **Vent Valve #1** until **Pressure Gauge #1** reads 0 psig.
9. Disconnect **Field Test Arrangement** from the **Field Test Connection**.
10. Ensure **Field Test Connection** is not plugged.

It is still possible that pressure excursions may actuate the valve, therefore it is recommended to minimize system pressure ramp rate.

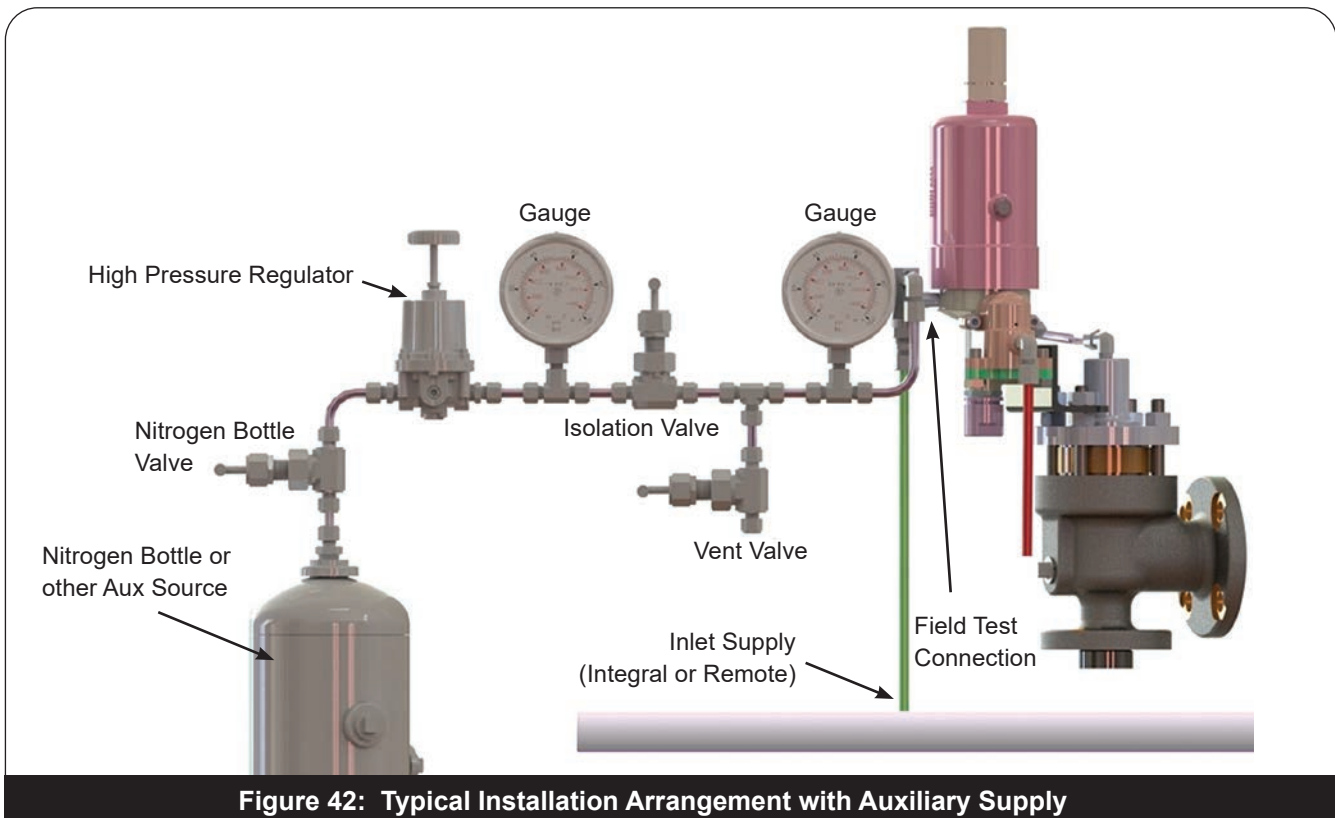


Figure 42: Typical Installation Arrangement with Auxiliary Supply

XX. Setting and Testing (Cont.)

E.1.2 Artificial Actuation of Pilot and Main Valve

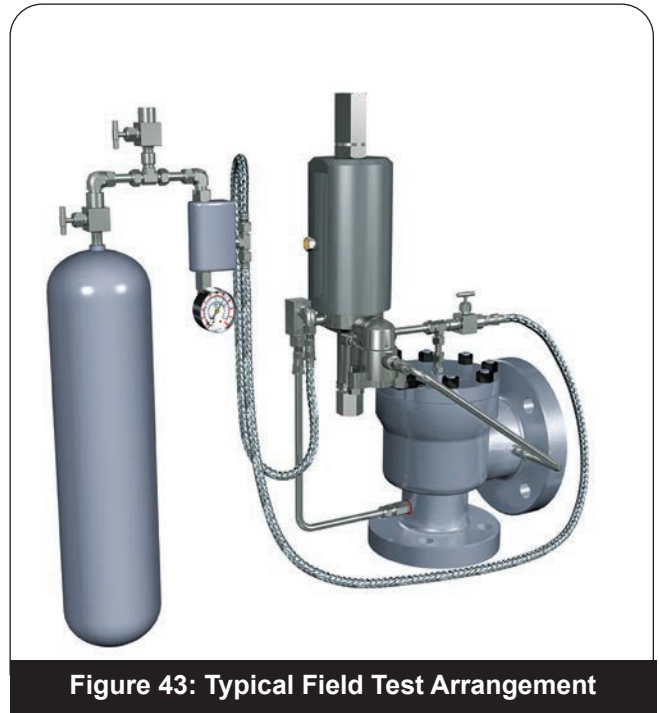
1. Close all valves and regulator.
2. Connect **Field Test Arrangement** to **Field Test Connection**.
3. Open **Isolation Valve #1**.
4. Slowly open **Nitrogen Bottle Valve** to its fully open position.
5. Slowly adjust **Nitrogen Regulator** (pressure increase should not exceed 10 psig/sec) till the downstream pressure is equal to 90% of the set pressure as indicated by the **Pressure Gauge #1**.
6. After 90% of set pressure is achieved, lower the auxiliary pressure ramp rate to 2 psig/sec. Record set pressure by the audible discharge (gas) or steady stream (water) of the main valve.
7. Continue the pressure ramp up until the valve set point is exceeded in order to ensure the disc is not sticking.

Note: When the auxiliary test pressure reaches the accumulation pressure of 103% or 110%, the pressure relief valve will be relieving its rated capacity. Proper safety precautions, including process controls, administrative controls and PPE controls should be taken to ensure the safety of the test personnel who can be in close vicinity of the relieving pressure relief valve.

8. Close **Isolation Valve #1** and open **Vent Valve #1** to begin to drop pressure at a rate of 2 psi/sec until the main valve closes. Record the reseal pressure when the valve stops relieving. Continue to drop pressure until 80% of set pressure.
9. Close **Nitrogen Bottle Valve**.
10. Fully open **Vent Valve #1** and **Isolation Valve #1** until **Pressure Gauge #1** reads 0 psig.
11. Disconnect **Field Test Arrangement** from the **Field Test Connection**.
12. Ensure **Field Test Connection** is not plugged.

E.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 43 is available for remote or local testing.



XX. Setting and Testing (Cont.)

E.2.1 Artificial Actuation of Pilot Only

1. Remove OEM exhaust tubing connected to pilot exhaust port and outlet neck (confirm there is no exhaust leakage prior to removal of tubing)
2. Connect a pressure gauge to outlet of pilot followed by an isolation/vent valve to prevent exhaust to atmosphere.
3. With system pressure operating at <90% of set pressure, connect **Field Test Arrangement to Field Test Connection**
4. Close all valves and regulators
5. Slowly open **Nitrogen Bottle Valve** to its fully open position
6. Slowly adjust **Nitrogen Regulator** (pressure increase should not exceed 10 psig/sec) till the downstream pressure is equal to 90% of the set pressure as indicated by **Pressure Gauge #1**
7. After 90% of set pressure is achieved, lower the pressure ramp rate to 2 psig/sec.
8. Increase auxiliary pressure until **Pressure Gauge #2** indicates a pressure increase; the value of

Pressure Gauge #1 at this point is the set point of the valve. Perform set point adjustment as required by adjusting the compression screw. Reclose isolation valve and vent valve. Retest.

9. Close **Isolation Valve #1** and use **Vent Valve #1** to begin to drop pressure at a rate of 2 psi/sec until **Pressure Gauge #1** reads 80% of set pressure.

Note: Accurate blowdown settings cannot be determined by this test procedure. Actual main valve operation is required to measure blowdown values.

10. Open **Vent Valve #2** to remove pressure in exhaust port.
11. Close **Nitrogen Bottle Valve**
12. Fully open **Vent Valve #1** and **Isolation Valve #1** until **Pressure Gauge #1** reads 0 psig
13. Disconnect **Field Test Arrangement** from the **Field Test Connection**
14. Ensure **Field Test Connection** is not plugged

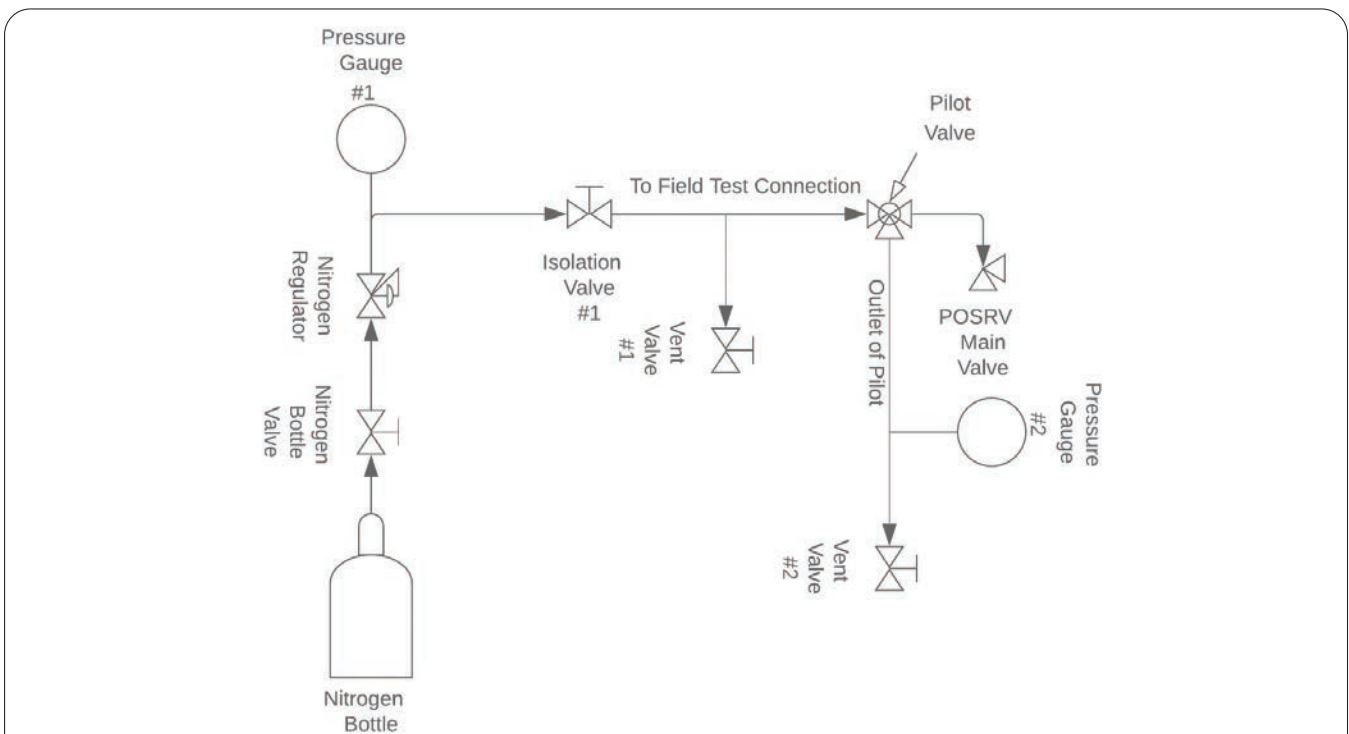


Figure 44: Typical Installation Arrangement with Auxiliary Supply for Artificial Actuation of Pilot Only

E.3. Hydrostatic Testing and Gaggling

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 POSRV, a test gag may

be used (see Figure 48 in Section XXII). 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.

XXI. Troubleshooting

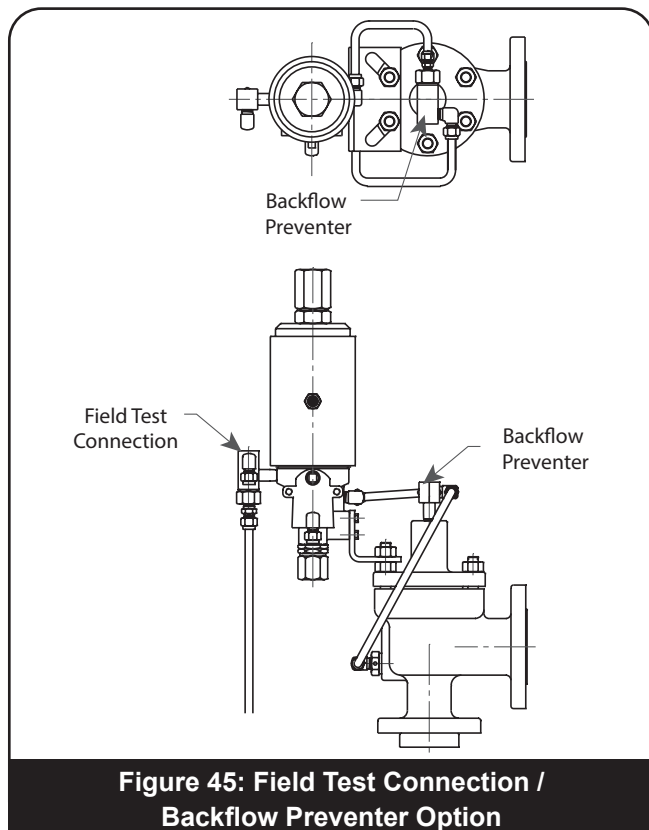
Table 13: Troubleshooting 2900-40 Series POSRV's

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 Cover Plate when valve is open.	A. Guide or Cover Plate Gasket/O-ring is damaged.	A. Disassemble valve and replace Cover Plate Gasket/O-ring.
	B. Cap Screws or Stud Nuts on Cover Plate 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.
	B. Damaged Metal Seat	B. Disassemble valve and lap Metal Disc and/or Nozzle.
	C. Metal Seat is not lapped in properly to Disc Holder	C. Disassemble Disc and Disc Holder to lap two together properly
	D. Seat too wide	D. Recheck Tables 3 and 4
Main Valve leaks under the Nozzle Seat	A. Damaged Nozzle O-Ring	A. Disassemble Main Valve and replace damaged Nozzle O-Ring.
Pilot Valve is not opening at set pressure and Main Valve will not open	A. Wrong set pressure	A. Readjust the set pressure of the valve.
Main Valve does not close upon start up. P2 chamber does not load with system pressure.	A. Start-up procedures pressurize the valve too rapidly.	A. Slowly increase the inlet pressure.
	B. Sensing Tube is installed upside down.	B. Re-install Sensing Tube correctly.
	C. Clogged Filter	C. Clear or replace Filter.
	D. Main Valve Piston is not resting on nozzle.	D. Push the Main Valve Piston down to nozzle through the compression fitting on top of the Cover Plate.
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.

XXII. 2900-40 Series POSRV Options

A. Backflow Preventer

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



A.1 Disassembly Instructions

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

A.2 Cleaning

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

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

A.3 Parts Inspection

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

A.4 Reassembly Instructions

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

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

XXII. 2900-40 Series POSRV Options (Cont.)

B. Dual Pilots

A dual pilot arrangement (Figure 46) is available for applications in which the pilot valve soft goods require monitoring and/or maintenance more often than the main valve. In this installation, the pilot valves may be alternated for maintenance, without bringing the system down.



Figure 46: Dual Pilots

ATTENTION!

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

C. Field Test Connection

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

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

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

D. Single, Dual and High Capacity Filters (Optional)



Figure 47: Sensing Line Filter

Filter options are available for dirty applications. These filters are installed in the pilot inlet sensing line. For the 39PV, an optional sensing line filter is available (Figure 46). This filter has a 316 stainless steel body, Teflon® seals, and a 40-50 micron stainless steel filter element. Other high capacity filter options (Figure 48) include:

1. A carbon steel cadmium coated filter body with a 35 micron stainless steel element; and
2. An entirely stainless steel filter arrangement. These filters may be equipped with a manually operated needle valve which allows for purging the filtered material while the valve is in operation. All filter elements are stainless steel, and all filters, including carbon steel, conform to NACE Standard MR0103 and MR0175. A dual filter arrangement (Figure 49)

XXII. 2900-40 Series POSRV Options (Cont.)

is available for applications in which the customer is unsure of the filter maintenance requirements. In these cases, a preventive maintenance program may be developed by monitoring the filters, without taking the valve off line.



Figure 48: High Capacity Filter

ATTENTION!

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

E. Sensing Line Filter (Standard)



Figure 49: Dual Filter

Consolidated 2900 Pilot Operated Relief valves come configured directly from the factory with specially designed filters to ensure long term operation. These filters should be maintained based on the service conditions and cleanliness of the media the valve will be exposed to. Depending on the amount of contamination expected to be introduced to the valve, these filters need to be regularly inspected and replaced to ensure proper flow through the valve is maintained. Regular maintenance intervals should be established based on inspection of the filter at the time of service. Heavy accumulation at the filter is an indication that more frequent maintenance is needed. In applications that call for exposure to a significant amount of contaminants, our high capacity filters should be installed that allow regular maintenance to be performed easily. Please consult your factory authorized representatives for details on how to obtain this configuration. The high capacity filter configuration can be installed with independent filters that allow the maintenance to be performed while the valve remains in service.

Note: Tables 25 to 28 for replacement filter parts information.

XXII. 2900-40 Series POSRV Options (Cont.)

F. Gag

A manual method of locking a pilot operated relief valve in the closed position for system hydrostatic test. (Figure 50).

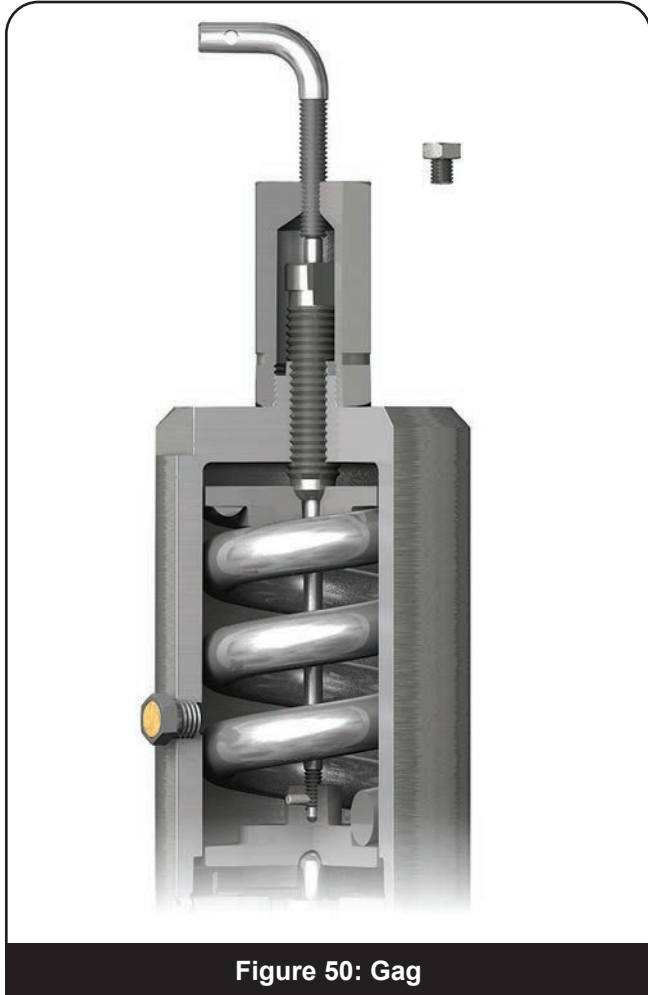


Figure 50: Gag

G. Heat Exchanger



Figure 51: Heat Exchanger - Hot Service



Figure 52: Heat Exchanger - Cold Service

This allows the temperature range for the 2900-40 POSRV with metal seats to be extended to -450°F to 1200°F (-267.8°C to 648.9°C). Not available above 3750 psig (258.5 barg). When the heat exchanger is selected, the POSRV shall be piped so that the media enters the heat exchanger first to condition the media's temperature. Option(s) such

XXII. 2900-40 Series POSRV Options (Cont.)

as line filter, canister filter, 5-way manifold valve, pressure differential switch, pressure spike snubber, etc. shall be piped downstream of the heat exchanger (Figures 51 & 52).

H. Lifting Lever

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

I. Manual, Electrical, or Pneumatic Blowdown Valve

(Figures 53 & 54)

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 53: Manual Blowdown Valve



Figure 54: Electrical Blowdown Valve

XXII. 2900-40 Series POSRV Options (Cont.)

J. Pilot Valve Tester

The pilot valve test indicator (Figure 55) is available for the 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.

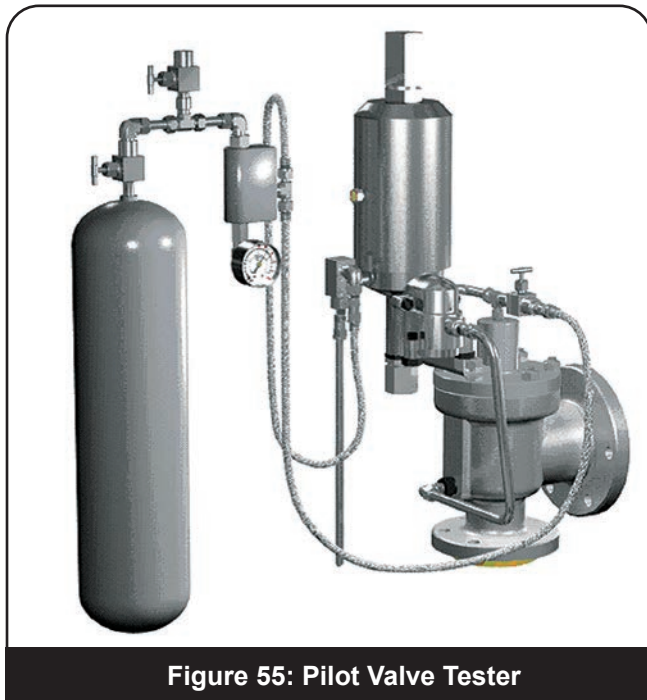
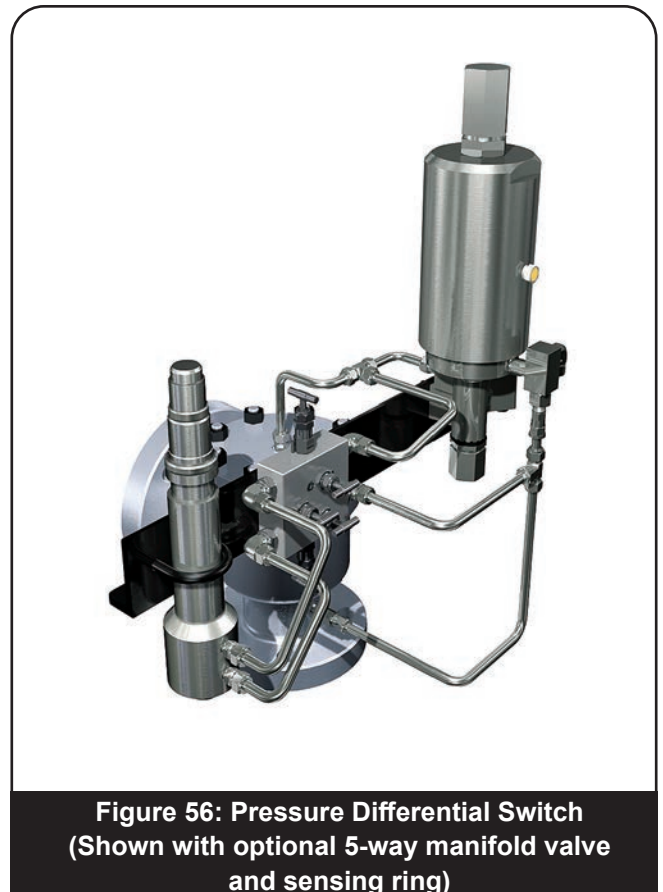


Figure 55: Pilot Valve Tester

K. Pressure Differential Switch

Electrical: A pressure differential switch (Figure 56) 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 56: Pressure Differential Switch
(Shown with optional 5-way manifold valve
and sensing ring)**

XXII. 2900-40 Series POSRV Options (Cont.)

L. Pressure Spike Snubber

Consolidated recommends the use of a pressure spike snubber (Figure 57) for all applications which may have high frequency pressure spikes. The pressure spike snubber is designed to dampen the pressure spikes which could cause unnecessary parts wear or premature valve opening.



Figure 57: Pressure Spike Snubber (Shown with optional sensing ring)

O. Sensing Ring

(Figure 58)

An option which allows the pilot valve inlet to be piped to a location just below the inlet flange of the main valve base.

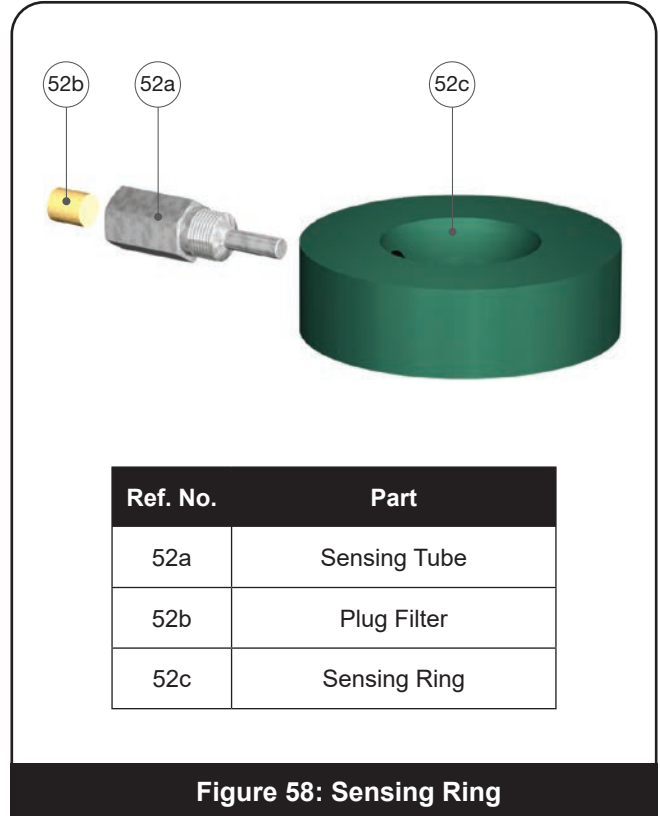


Figure 58: Sensing Ring

M. Remote Pilot Mounting

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

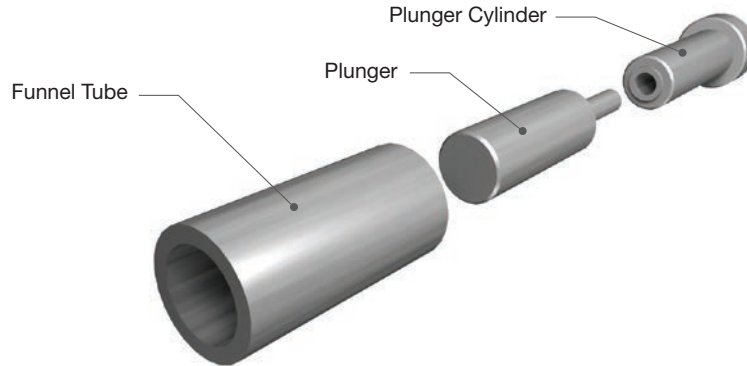
N. Remote Sensing

As standard, the pilot valve inlet is piped to a location remote from the main valve. In this application, the customer pipes 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).

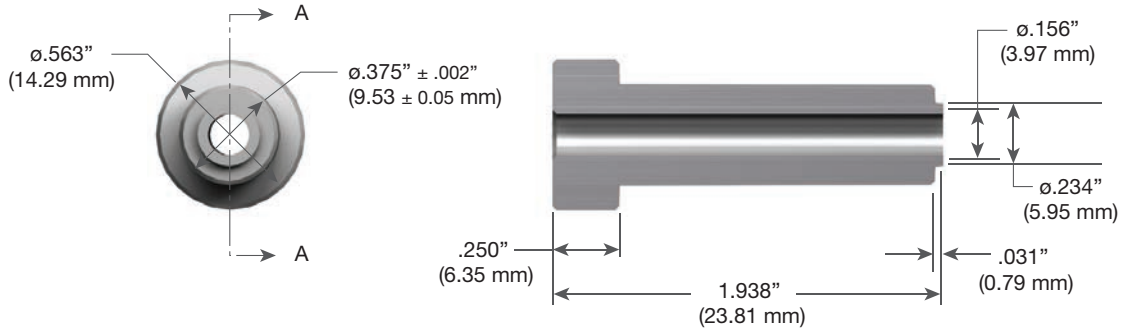
XXIII. Maintenance Tools and Supplies

A. Adjuster Top Seal Insertion Tool

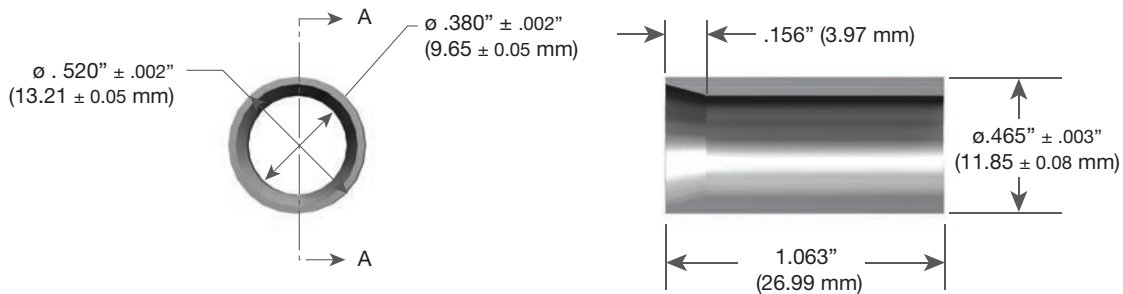
ASSEMBLY VIEW OF INSERTION TOOL



DETAIL OF PLUNGER CYLINDER



DETAIL OF FUNNEL TUBE



DETAIL OF PLUNGER

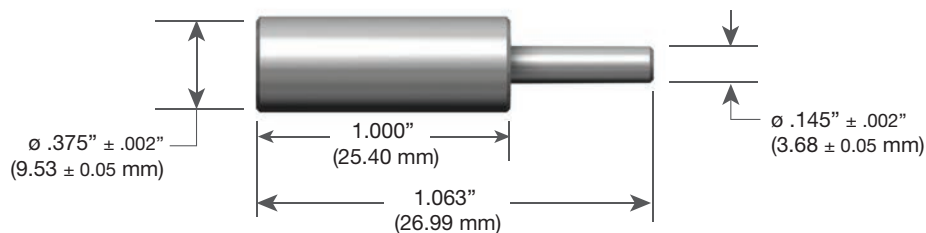
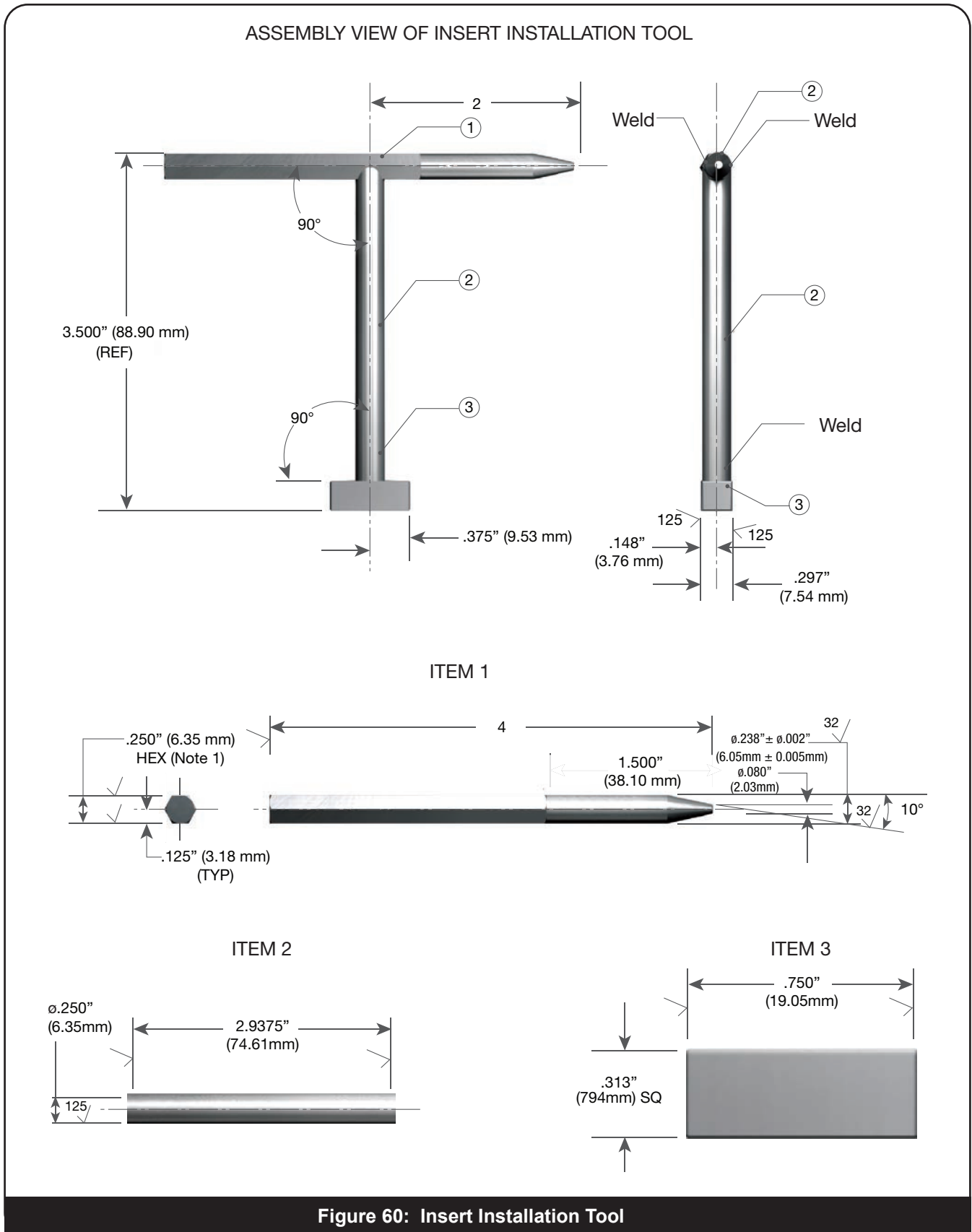


Figure 59: Adjuster Top Seal Insertion Tool

XXIII. Maintenance Tools and Supplies (Cont.)

B. Insert Installation Tool



XXIII. Maintenance Tools and Supplies (Cont.)

C. Lapping Tools

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

1. Ring Lap: The ring lap is used for lapping the disc seat and finish lapping of the nozzle seat.
2. Lapping Plate: The lapping plate is used for reconditioning the ring lap. It may also be used for lapping the disc. One 11" (279.40 mm) diameter plate is required for the entire line of valves (Part No. 0439004).
3. Lapping Compound: Lapping compound is used as a cutting medium when lapping the valve seats, as specified in Table 14.

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

4. Drift Pins: Two drift pins are required for the removal of the disc from the disc holder. Refer to Figure 60 and Table 15 for Drift Pin specifications.

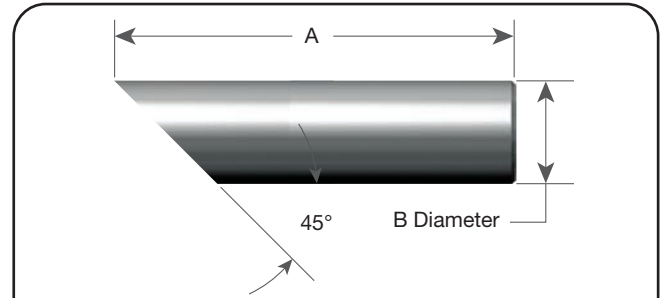


Figure 61: Drift Pin Specifications

Orifice	A		B		Part No.
	in.	mm	in.	mm	
D, E, F, G, H, J, K	1.75	44.5	.219	5.55	430401
L, M, N, P	2.50	63.5	.375	9.53	430402
Q, R	3.00	76.2	.625	15.88	430403
T	3.50	88.9	.875	22.23	430404

5. Nozzle Lap: The nozzle lap is used for lapping the nozzle seat and has one flat side and one side with a 5° angle. This lap guides in the bore of the nozzle; therefore, a different size lap is required for each valve orifice (Table 16).
6. Lifting Tools: Lifting tools are used for the removal of upper internal parts of larger valves, as specified in Table 17.

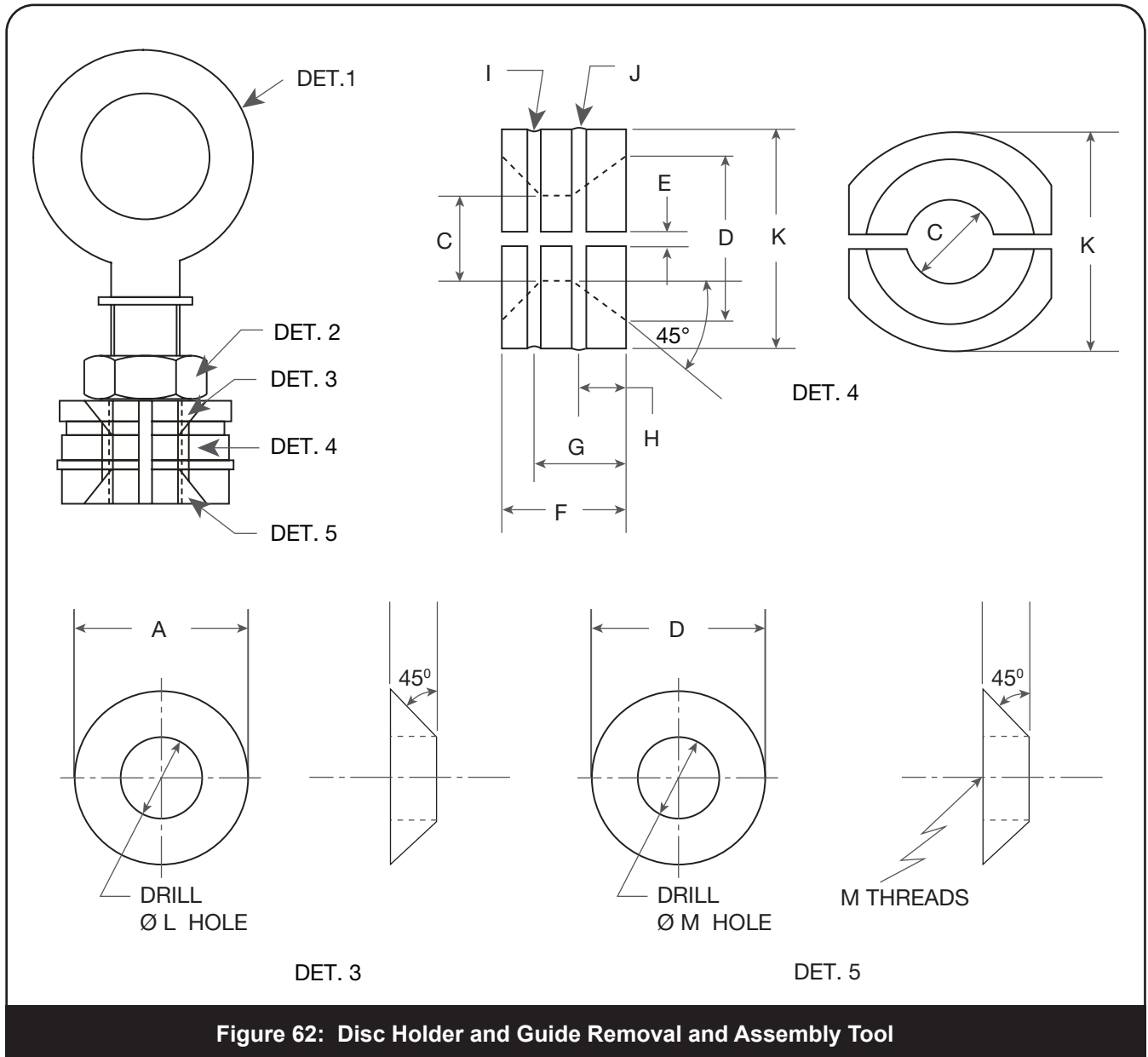
Orifice	Nozzle Bore				Nozzle Lap	Nozzle Lap Handle	Ring Lap ¹
	min.		max.				
	in.	mm	in.	mm			
D	.404	10.26	.409	10.39	4451501	544603	1672805
E	.539	13.69	.544	13.82	4451502	544601	1672805
F	.674	17.12	.679	17.25	4451503	544601	1672805
G	.863	21.92	.868	22.05	4451504	544601	1672805
H	1.078	27.38	1.083	27.51	4451505	544601	1672805
J	1.380	35.05	1.385	35.18	4451506	544601	1672805
K	1.650	41.91	1.655	42.04	4451507	544601	1672807
M	2.309	58.65	2.314	58.78	4451602	544601	1672809
N	2.535	64.39	2.540	64.52	4451603	544601	1672809
P	3.073	78.05	3.078	78.18	4451604	544602	1672810
Q	4.045	102.74	4.050	102.87	4451605	544602	1672812
R	4.867	123.62	4.872	123.75	4451606	544602	1672812
T	6.037	153.34	6.043	153.49	4451607	544602	1672813

1. Ring Laps: One set of three (3) ring laps is recommended for each orifice to assure ample flat laps are available at all times.

XXIII. Maintenance Tools and Supplies (Cont.)

Valve Orifice	Description of Wrench				Pin Spanner Wrench No.	Valve Orifice	Description of Wrench				Pin Spanner Wrench No.
	Wrench Radius		Pin				Wrench Radius		Pin		
	in	mm	in	mm			in	mm	in	mm	
F	.750	19.05	.219	5.56	4451801	M	1.675	42.55	.328	8.33	4451806
G	.750	19.05	.219	5.56	4451801	N	1.875	47.63	.359	9.13	4451607
H	.875	22.23	.266	6.75	4451802	P	1.875	47.63	.359	9.13	4451607
J	1.125	28.58	.266	6.75	4451803	Q	2.500	63.50	.438	11.11	4451808
K	1.250	31.75	.281	7.14	4451804	R	3.000	76.20	.500	12.70	4451809
L	1.375	34.93	.297	7.54	4451805	T	3.750	95.25	.500	12.70	4451810

D. Disc Holder and Guide Removal and Assembly Tool



XXIII. Maintenance Tools and Supplies (Cont.)

Table 18 : Disassembly Tool Dimensions																
Orifices Sizes	"Eye Bolt (Notes)"	"Jam Nut (Notes)"	Ø A		Ø B		Ø C		Ø D		Ø E		Ø F		Ø G	
			in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
D,E,F,G,H,J	#1	#5	.703	17.86	.250	6.35	.437	11.10	.730	18.54	.094	2.39	.750	19.05	.406	10.31
K,L	#2	#6	.828	21.03	.250	6.35	.437	11.10	.847	21.51	.125	3.18	.750	19.05	.438	11.13
M,N	#3	#7	.828	21.03	.250	6.35	.437	11.10	.828	21.03	.125	3.18	.750	19.05	.438	11.13
P, Q, R, T	#4	#8	1.375	34.93	.376	9.55	.750	19.05	1.375	34.93	.125	3.18	1.000	25.40	.750	19.05

Table 18 - Contd.: Disassembly Tool Dimensions														
Orifices Sizes	Ø H		I Radius		J Radius		Ø K		Ø L		Ø M Drill Size		M NC Tap Size	
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
D,E,F,G,H,J	.156	3.96	.047	1.19	.034	0.86	.798	20.27	.375	9.53	Note 7		.250 - 20 thd.	6.35 - 20 thd.
K,L	.188	4.78	.062	1.57	.040	1.02	.927	23.55	.375	9.53	.313	7.94	.375 - 16 thd.	9.53 - 16 thd.
M,N	.188	4.78	.062	1.57	.047	1.19	1.126	28.60	.500	12.70	.313	7.94	.375 - 16 thd.	9.53 - 16 thd.
P, Q, R, T	.375	9.53	.094	2.39	.055	1.40	1.834	46.58	.750	19.05	.531	13.49	.625 - 11 thd.	15.88 - 11 thd.

Notes:

1. Use a Standard Eye-Bolt – .250" (6.35 mm) - 20 thd. x 3.5" (88.90 mm) Long
2. Use a Standard Eye-Bolt – .375" (9.53 mm) - 16 thd. x 4.5" (114.30 mm) Long
3. Use a Standard Eye-Bolt – .375" (9.53 mm)-16 thd. x 4.5" (114.30 mm) Long
4. Use a Standard Eye-Bolt – .625" (15.88 mm)-11 thd. x 4.5" (114.30 mm) Long
5. Use a Standard Nut – .250" (6.35 mm) - 20 thd.
6. Use a Standard Nut – .375" (9.53 mm) - 16 thd.
7. Use a Standard Nut – .375" (9.53 mm) - 16 thd.
8. Use a Standard Nut – .625" (15.88 mm) - 11 thd.

Additional: Use an appropriate sized O-Ring in groove "I", to hold the parts together.

XXIV. Replacement Parts Planning

A. Basic Guidelines

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

- A. The total number of valves in service should be classified by size, type and temperature class.
- B. 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
- C. Parts for the valve types covered by this manual are classified on Tables 20. “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.
- D. When ordering replacement parts, please specify in accordance with applicable nomenclature (see Figures 1 to 7). Be sure to state the size, type and serial number of the valve for which parts are required. When ordering pilot parts please state specific pilot type (39PV07, 37 etc.)

For ease of maintenance O-Ring kits are available for each main valve and pilot type. A stock of these kits should be kept on hand for maximum operating efficiency. See Tables 23, 24 and 25 in Section XXVI.

B. Identification and Ordering Essentials

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 (Refer to Figures 62, 63 and 64):

- A. Size
- B. Type
- C. Pressure/Temperature Class Rating
- D. Serial Numbers from both main valve and pilot valve

Example:

Main Valve: 2910-40R-00-1-CC-MS-B-RF-GS-RS, TL12345-M

Pilot Valve: 39PV07-2-CC-B-GS-60, TL12346-P

How to verify Materials of O-Rings and Seals:

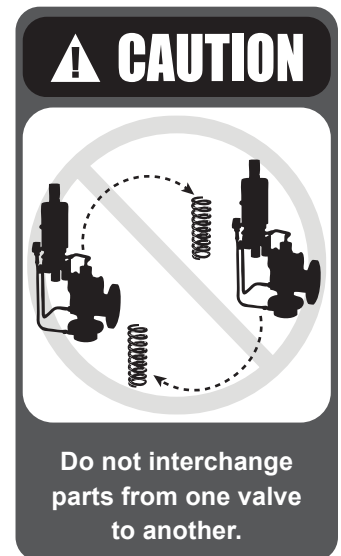
Kit coding indicates O-Ring and seals material.

Examples:

MORK-70I006

PSGK - 32E019

T	Teflon®
E	Ethylene/Propylene



XXIV. 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 Center (GTC) 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 report to the appropriate plant authority.

Specify parts required by:

1. Part Name (See Nomenclature, Figures 1 - 7)
2. Part Number (if known)
3. Quantity

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

Figure 63: Nameplates for Main Valve

Figure 64: Nameplates for Main Valve

Figure 65: Nameplate for Pilot Valve

XXV. 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

XXVI. Recommended Spare Parts

Table 20: Pilot Operated Safety Relief Valves (POSRV) For 2900-40 Main Valve¹

	Class	Part Name
Class I parts should be stocked at the rate of one Disc (1) per valve. Maintaining this level of spare parts will provide replacement parts for 70% of possible maintenance requirements.	I	Coverplate Gasket Guide Gasket Plug/Adaptor Gasket Disc Guide Ring on Piston Piston O-Ring ² Disc Retainer Ring O-Ring Retainer O-Ring Retainer Lock Screw O-Ring Seat Seal
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 of an additional 15% of possible maintenance requirements.	II	Piston Disc Holder Guide Sensing Tube (If Equipped)
Class III	III	Nozzle Spring

1. A combination of Class I and II parts will satisfy maintenance requirements 85% of the time.
2. Depending on service, either an O-Ring or Spring Energized Teflon[®] Seal is required.

XXVI. Recommended Spare Parts (Cont.)

Table 21: Main Valve O-Ring Kits		
Material: Teflon®		
Orifice	Valve Type	Part No. Conventional Valves (-00)
D, E, F	2905, 06, 10, 20, 22	M0RK29001T006
D, E, F	2912	M0RK29016T006
D, E, F	2914,16,24,26	M0RK29020T006
D, E, F	2918, 28	M0RK29025T006
G	2905, 06, 10, 20, 22	M0RK29002T006
G	2912	M0RK29017T006
G	2914,16,18, 24,26, 28	M0RK29021T006
H	2905, 06, 10, 12, 20, 22	M0RK29003T006
H	2914,16, 24,26	M0RK29022T006
J	22905,06,10,20,22	M0RK29004T006
J	2912,14,16,24,26	M0RK29018T006
K	2905,06,10,12,20,22,24	M0RK29005T006
K	2914,16	M0RK29023T006
K	2926,28	M0RK29026T006
L	2905,06,10,12,20,22	M0RK29006T006
L	2914,16,24,26	M0RK29024T006
M	2905,06,10,12,14,20,22,24	M0RK29007T006
N	2905,06,10,12,14,20,22,24	M0RK29008T006
P	2905,06,10,20	M0RK29009T006
P	2912,14	M0RK29019T006
Q	2905,06,10,12,20,22	M0RK29010T006
R	2905,06,10,12,20,22	M0RK29011T006
T	2905,06,10,12,20,22	M0RK29012T006

XXVI. Recommended Spare Parts (Cont.)

Table 21: Main Valve O-Ring Kits		
Material: Ethylene Propylene (EPR EPDM 90 Durometer)		
Orifice	Valve Type	Part No. Conventional Valves (-00)
D, E, F	2905, 06, 10, 20, 22	M0RK29001E002
D, E, F	2912	M0RK29016E002
D, E, F	2914,16,24,26	M0RK29020E002
D, E, F	2918, 28	M0RK29025E002
G	2905, 06, 10, 20, 22	M0RK29002E002
G	2912	M0RK29017E002
G	2914,16,18, 24,26, 28	M0RK29021E002
H	2905, 06, 10, 12, 20, 22	M0RK29003E002
H	2914,16, 24,26	M0RK29022E002
J	22905,06,10,20,22	M0RK29004E002
J	2912,14,16,24,26	M0RK29018E002
K	2905,06,10,12,20,22,24	M0RK29005E002
K	2914,16	M0RK29023E002
K	2926,28	M0RK29026E002
L	2905,06,10,12,20,22	M0RK29006E002
L	2914,16,24,26	M0RK29024E002
M	2905,06,10,12,14,20,22,24	M0RK29007E002
N	2905,06,10,12,14,20,22,24	M0RK29008E002
P	2905,06,10,20	M0RK29009E002
P	2912,14	M0RK29019E002
Q	2905,06,10,12,20,22	M0RK29010E002
R	2905,06,10,12,20,22	M0RK29011E002
T	2905,06,10,12,20,22	M0RK29012E002

XXVI. Recommended Spare Parts (Cont.)

Table 21: Main Valve O-Ring Kits		
Material: Ethylene Propylene (EPR 70 Durometer)		
Orifice	Valve Type	Part No. Conventional Valves (-00)
D, E, F	2905, 06, 10, 20, 22	M0RK29001E019
D, E, F	2912	M0RK29016E019
D, E, F	2914,16,24,26	M0RK29020E019
D, E, F	2918, 28	M0RK29025E019
G	2905, 06, 10, 20, 22	M0RK29002E019
G	2912	M0RK29017E019
G	2914,16,18, 24,26, 28	M0RK29021E019
H	2905, 06, 10, 12, 20, 22	M0RK29003E019
H	2914,16, 24,26	M0RK29022E019
J	22905,06,10,20,22	M0RK29004E019
J	2912,14,16,24,26	M0RK29018E019
K	2905,06,10,12,20,22,24	M0RK29005E019
K	2914,16	M0RK29023E019
K	2926,28	M0RK29026E019
L	2905,06,10,12,20,22	M0RK29006E019
L	2914,16,24,26	M0RK29024E019
M	2905,06,10,12,14,20,22,24	M0RK29007E019
N	2905,06,10,12,14,20,22,24	M0RK29008E019
P	2905,06,10,20	M0RK29009E019
P	2912,14	M0RK29019E019
Q	2905,06,10,12,20,22	M0RK29010E019
R	2905,06,10,12,20,22	M0RK29011E019
T	2905,06,10,12,20,22	M0RK29012E019

XXVI. Recommended Spare Parts (Cont.)

A. 39PV-2 Pilot Valve Seal Kits Material Class “CC” per configuration

Table 22: 39PV-2 Pilot Valve Seal Kits (Material Class “CC” per configuration)		
Pilot Valve Seal Kits		
Pilot	Material	Part No.
39PV07-2 GS & LS	E.P.R. (Ethylene Propylene 70)	PSGK-38E019
39PV07-2 GS, LA & SS	Teflon®	PSGK-38T006
39PV07-2 SS	E.P.R. (Ethylene Propylene 90)	PSGK-38E002
39PV37-2 GS, LS & SS	E.P.R. (Ethylene Propylene 70)	PSGK-35E019
39PV37-2 GS, LS & SS	Teflon®	PSGK-35T006

Note: Pilot valve seal kits consist of O-Rings in materials shown above, spring energized Teflon® seals, one .281” (7.14 mm) ball, one tube filter, grease and instruction sheet.

B. 39PV-2 Pilot Valve Backflow Preventer/Field Test Connection

Table 23: 39PV-2 Backflow Preventer Kit		
Material	Part No.	
E.P.R. (Ethylene Propylene 70)	PAP79E019	
Teflon®	PAP79T006	
E.P.R. (Ethylene Propylene 90)	PAP79E002	
Each Kit Consists Of:		
Description	Qty.	Part No.
Fitting	1	6000609 ¹
Fitting	1	6000608 ¹
Reducing Bushing	1	4941504

Table 24: And One Of The Following Shuttle Valve Assemblies:	
Seal Material	Part No.
E.P.R. (Ethylene Propylene 70)	5040103
Teflon®	5040105
E.P.R. (Ethylene Propylene 90)	5040106

- Field Test Connector Consist of one of the Select Shuttle Valve assemblies shown above.
SP561-Q replaced by 6000609, SP561-R replaced by 6000608, SP468-G replaced by 6000622.

XXVI. Recommended Spare Parts (Cont.)

C. Pilot Valve Options Material Class “CC” per configuration

Table 25: Line Filter Assembly	
Seal Material	Part No.
Teflon®	SP540-J
Line Filter Kit (For Repair Of Line Filter Assembly)	
Seal Material	Part No.
Teflon®	SP540-J Kit

Line filter kit consists of filter element and two Teflon® O-Rings only.

Table 26: High Capacity Filter/CC	
Seal Material	Part No.
Teflon®	9465-1851
High Capacity Filter/S4	
Seal Material	Part No.
Teflon®	9465-18191

Table 27: Standard Filter	
Description	Part No.
Sensing tube filter element	SP-540-V

Note: The sensing tube filter element cannot be cleaned and must be replaced when clogged.

Table 28: High Capacity Filter Replacement Parts		
Description	Part No.	No. Required Per Valve
Filter Element	6027301	1
O-Rings	31006131	2

D. Pilot Valve Hardware

Table 29: Mounting Bracket Screws		
Description	Part No.	No. Required Per Valve
SS Screw	2310166	2

Table 30: Tubing	
Description	Part No.
Low Pressure Tubing	S31607310004
High Pressure Tubing ¹	S31607310124

1. 2916 & 2918 requires high pressure tubing.

XXVII. Manufacturer's 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 one of the largest and most competent field service staffs in the industry. Each Service Engineer is factory trained and experienced in servicing Consolidated Safety Valves. Baker Hughes Service Engineers restore disc and seat bushing critical dimensions which affect valve performance and are capable of field modernization of many valve 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 safety valves.

B. Repair Facilities

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

C. Safety Relief 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 preventive maintenance necessary to minimize downtime, reduce unplanned repairs and increase valve safety. While these seminars do not make "instant" experts, they do provide the participants with "Hands On" experience with Consolidated Valves. The seminar also includes valve terminology, trouble shooting, setting and testing, with emphasis on the ASME Boiler and Pressure Vessel Code.

Direct Sales Office Locations

Australia

Brisbane
Phone: +61-7-3001-4319

Perth
Phone: +61-8-6595-7018

Melbourne
Phone: +61-3-8807-6002

Brazil

Phone: +55-19-2104-6900

China

Phone: +86-10-5738-8888

France

Courbevoie
Phone: +33-1-4904-9000

India

Mumbai
Phone: +91-22-8354790

New Delhi

Phone: +91-11-2-6164175

Italy

Phone: +39-081-7892-111

Japan

Tokyo
Phone: +81-03-6871-9008

Korea

Phone: +82-2-2274-0748

Malaysia

Phone: +60-3-2161-03228

Mexico

Phone: +52-55-3640-5060

Russia

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

Moscow

Phone: +7-495-585-1276

Saudi Arabia

Phone: +966-3-341-0278

Singapore

Phone: +65-6861-6100

South Africa

Phone: +27-11-452-1550

**South & Central
America and the Caribbean**

Phone: +55-12-2134-1201

Spain

Phone: +34-935-877-605

United Arab Emirates

Phone: +971-4-8991-777

United Kingdom

Phone: +44-7919-382-156

United States

Houston, Texas
Phone: +1-713-966-3600

Find the nearest local Channel Partner in your area:

valves.bakerhughes.com/contact-us

Tech Field Support & Warranty:

Phone: +1-866-827-5378

valvesupport@bakerhughes.com

valves.bakerhughes.com

Copyright 2020 Baker Hughes Company. All rights reserved. Baker Hughes provides this information on an "as is" basis for general information purposes. Baker Hughes does not make any representation as to the accuracy or completeness of the information and makes no warranties of any kind, specific, implied or oral, to the fullest extent permissible by law, including those of merchantability and fitness for a particular purpose or use. Baker Hughes hereby disclaims any and all liability for any direct, indirect, consequential or special damages, claims for lost profits, or third party claims arising from the use of the information, whether a claim is asserted in contract, tort, or otherwise. Baker Hughes reserves the right to make changes in specifications and features shown herein, or discontinue the product described at any time without notice or obligation. Contact your Baker Hughes representative for the most current information. The Baker Hughes logo, Consolidated, Thermodisc, and Green Tag are trademarks of Baker Hughes Company. Other company names and product names used in this document are the registered trademarks or trademarks of their respective owners.

Baker Hughes 

bakerhughes.com