



Technical Manual

MSI Pressure Relief Valve



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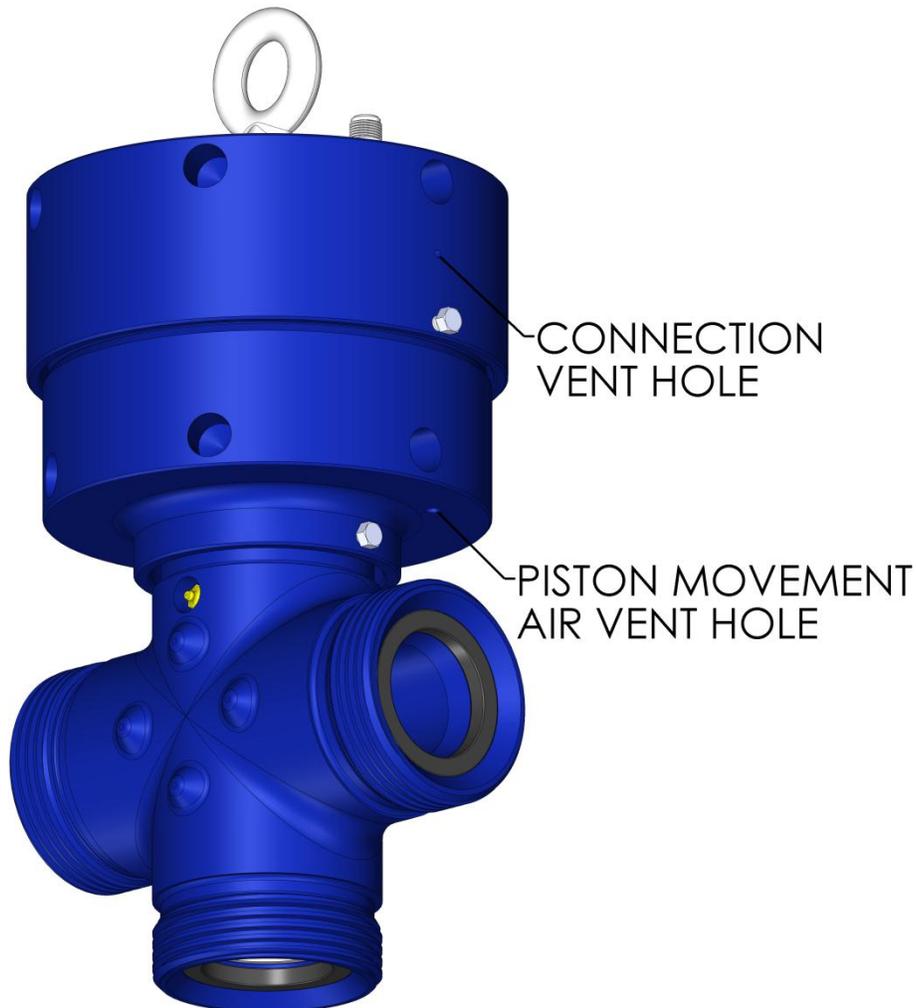
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SECTION 1 WARNINGS

The MSI Pressure Relief Valve has hoses and fittings that are connected to high pressure equipment. High pressure equipment, if not used and maintained properly, can cause serious injury and damage to equipment. Not taking proper precautions and failing to perform routine maintenance and inspections can also contribute to damage to equipment and property.

Never plug or obstruct vent holes (see image below) in the Pressure Relief Valve as this may cause the device to malfunction resulting in serious injury and/or damage to equipment.

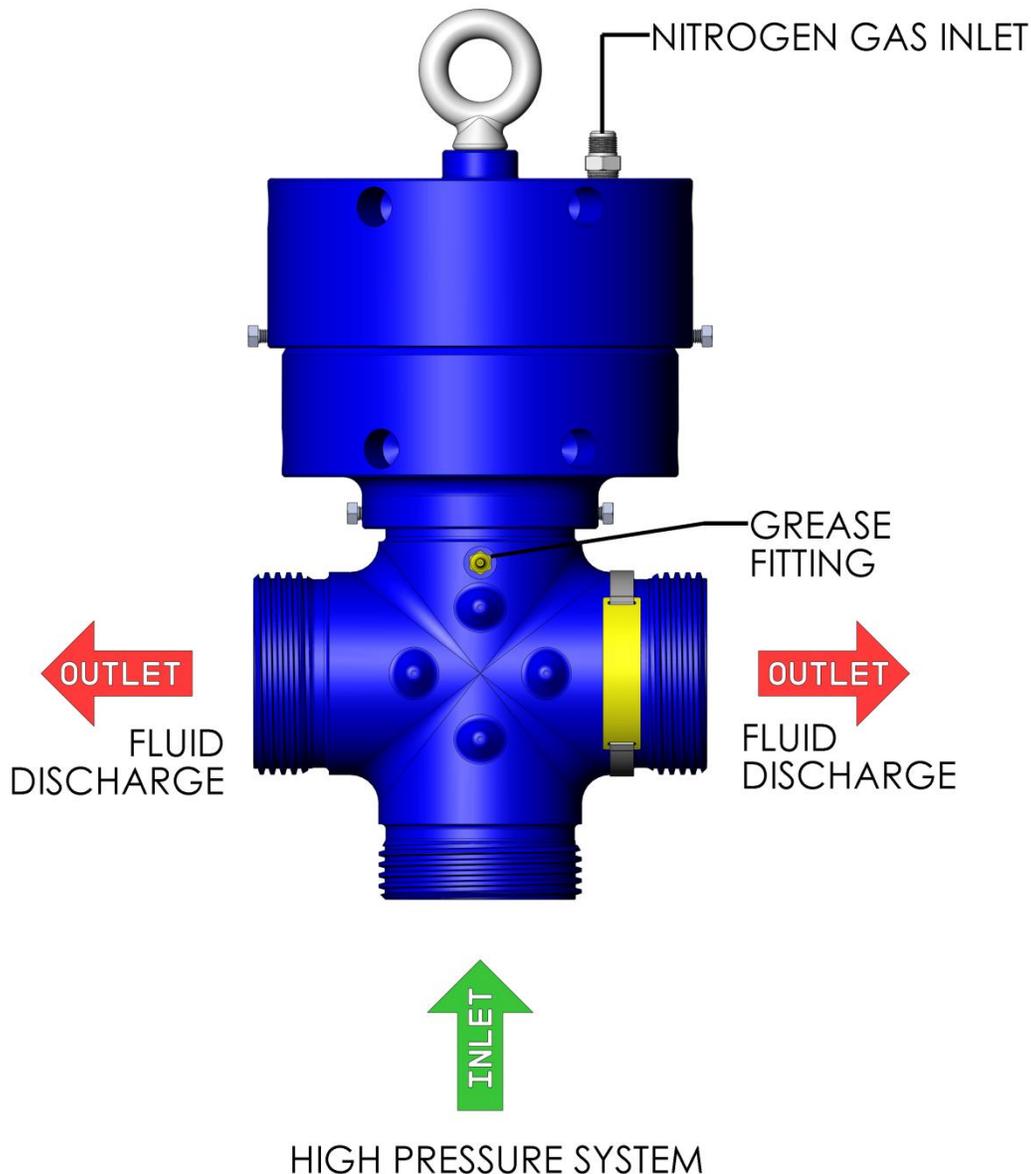
ALL OPERATORS AND MAINTENANCE PERSONNEL SHOULD BE THOROUGHLY TRAINED IN THE SAFE OPERATION, MAINTENANCE, AND INSPECTION OF THIS EQUIPMENT.



2.1 General Description

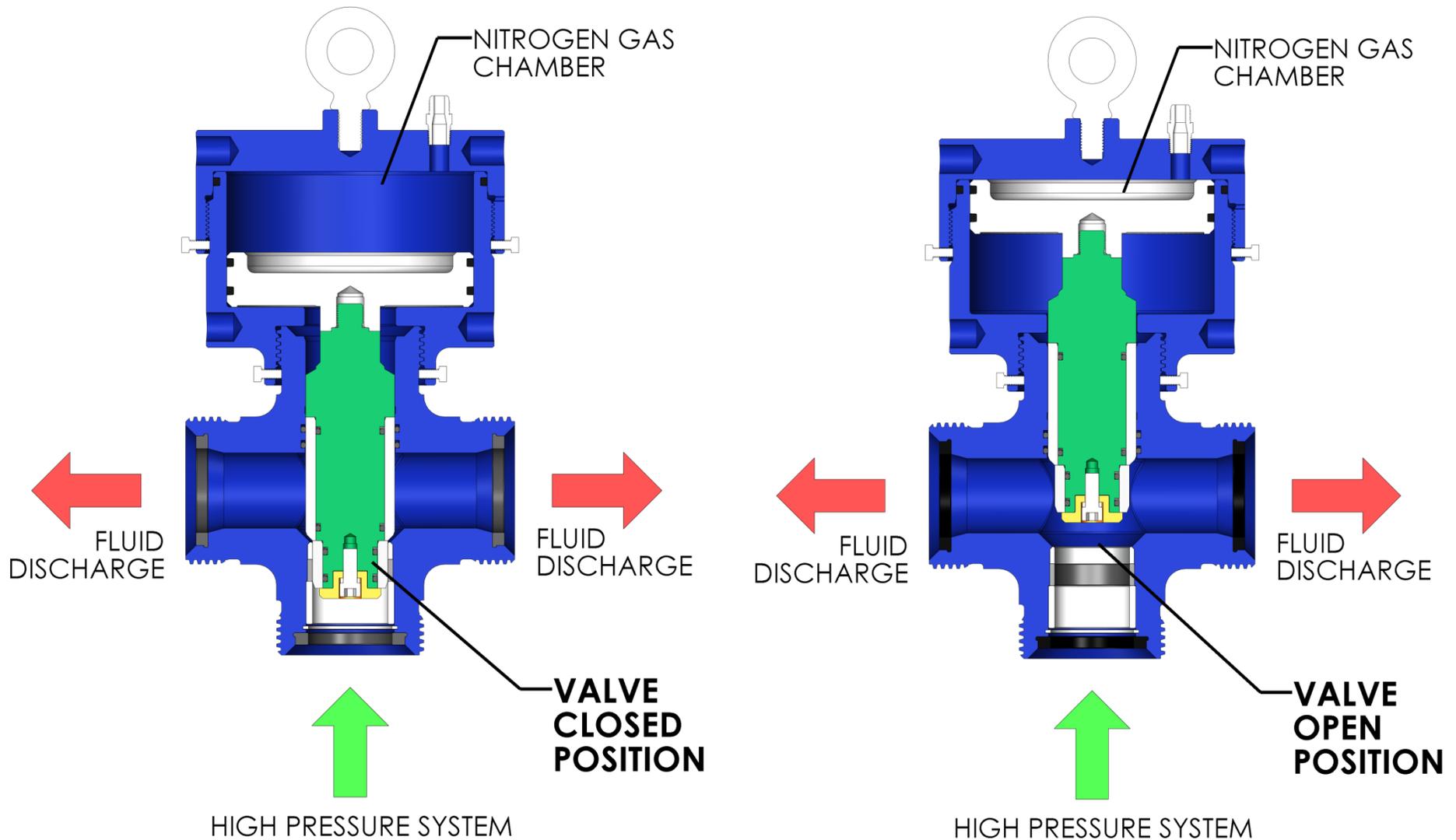
The MSI Pressure Relief Valve (PRV) provides over-pressure protection to pressure vessels, reciprocating pumps, flow lines, and other systems exposed to pressure surges that might exceed their design limit. The PRV protects equipment from high pressures by allowing safe fluid discharge into an auxiliary route. The PRV is designed to open at a predetermined pressure setting, and will remain open momentarily allowing just enough fluid discharge to bring the pressure down to the relief pressure setting or lower.

The PRV consists of a floating piston assembly that has pressurized nitrogen gas on one side, and line pressure on the other side. The piston assembly moves when the force created by the high pressure system overcomes the force created by the pressurized nitrogen chamber, allowing fluid to be discharged into the auxiliary route. The relief pressure setting is adjusted by increasing/decreasing the pressure inside the nitrogen chamber. As the pressure inside the nitrogen chamber increases, so does the relief pressure (see [Section 4](#) for more details).



2.2 Assembly Description

The MSI Pressure Relief Valve consists of a cross body, a piston assembly, and a cylinder assembly. The cross body has an inlet connection, two discharge ports, and a connection for the cylinder assembly. The piston assembly consists of the piston shaft which is connected to the piston head. The piston shaft sits inside the intake bore of the cross body and seals the high pressure system from the discharge bore. The piston shaft has replaceable carbide liners that serve as wear protection for the sealing surfaces. The piston head seals the nitrogen gas chamber inside the cylinder assembly. Once the system becomes over-pressured, the force acting on the piston shaft overcomes the force acting on the piston head and the piston assembly moves towards the nitrogen gas chamber, opening the valve.



SECTION 3 INSTALLATION

The MSI Pressure Relief Valve is designed to adapt to a wide variety of high pressure systems. Its compact design makes it easy to accommodate in many different configurations where protection from surging pressure is needed. The PRV can be installed as a single unit or as a complete skid. The skid comes with a control panel, placement for two 9" diameter nitrogen cylinders, forklift receivers, and a secured spot for the PRV. A fully charged nitrogen gas cylinder will be required during installation, since it will supply the nitrogen gas chamber to the relief valve.

Install the PRV between the high pressure system and the equipment being protected using a branched fitting. The PRV should be installed as close to the pressure source as possible to reduce the effect of overpressure on downstream equipment. Always be aware that the PRV only provides protection downstream of the device.

There are two discharge ports that should be used to route the vented fluids. Using both outlets substantially enhances product performance by providing more flow area to reduce flow speeds, and extends product life by eliminating extreme side loading inherent with single outlet devices. MSI strongly recommends that both outlets be used if at all possible. All potential fluid discharging must be done in accordance with any and all applicable safety and environmental regulations.

SECTION 4 SYSTEM OPERATION

The purpose of the MSI Pressure Relief Valve is to protect other equipment from exceeding their design limits by safely relieving excess pressure. Due to the rapid pressure relief characteristic of this device it is very difficult to prevent and predict when and where erosion will take place. The type of fluids that the PRV is exposed to, as well as line pressure, will greatly influence the life of the PRV. The more abrasive the fluid is, the less life expectancy that parts will have and the greater the maintenance frequency should be. Also, the relief pressure setting plays an important role in the life expectancy of the overall assembly. The higher the pressures in the high pressure system, the faster the fluids will discharge into the PRV when it opens.

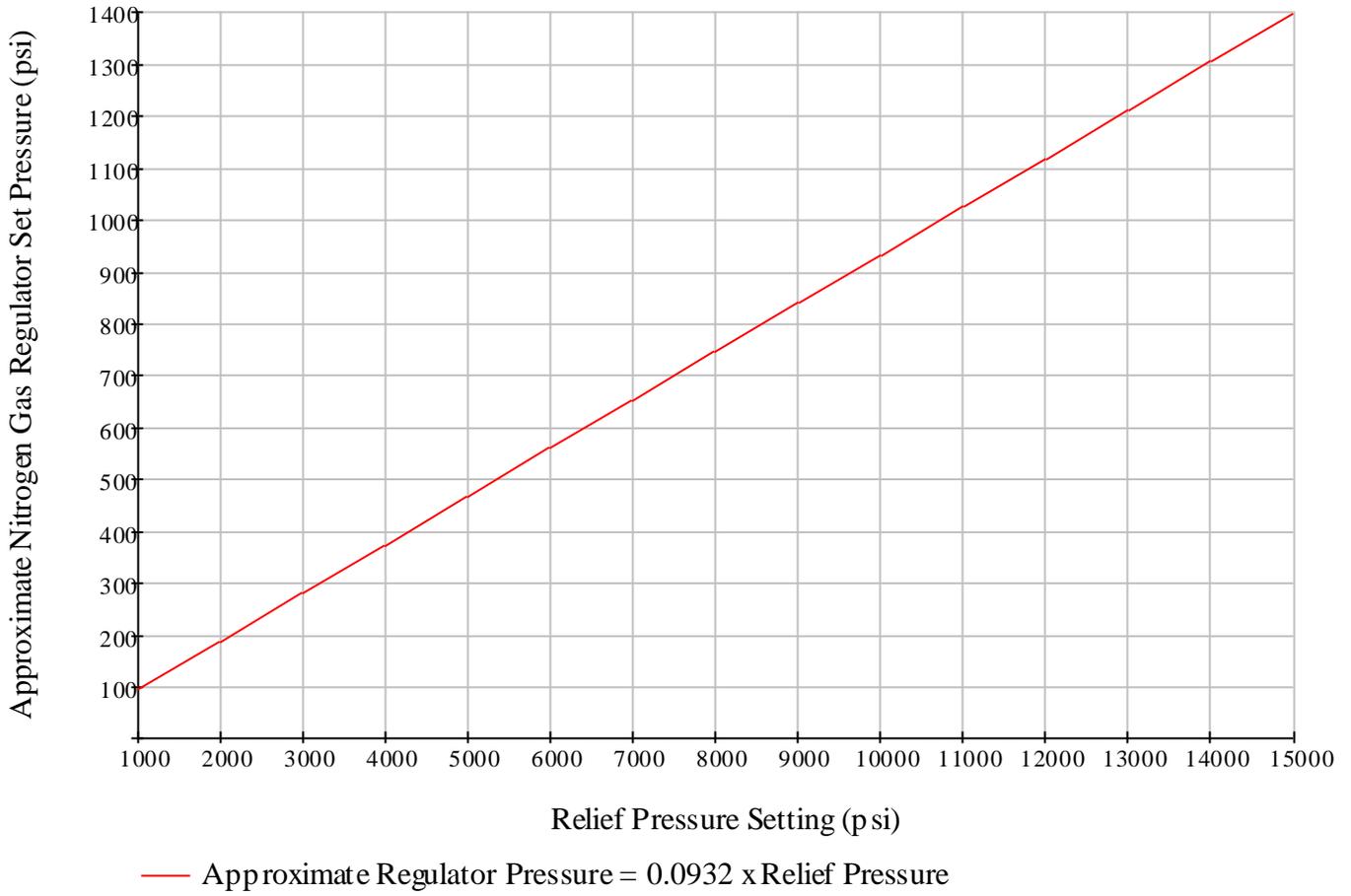
The PRV is designed to easily adapt to specific customer needs. The relief pressure can be adjusted by regulating the nitrogen gas pressure. Refer to the chart below to determine the nitrogen gas regulator pressure setting, corresponding to the high pressure system relief pressure needed.

Caution: The PRV is rated to 15,000 psi maximum line pressure.

SYSTEM RELIEF PRESSURE (psi)	APPROXIMATE NITROGEN GAS REGULATOR SET PRESSURE (psi)
1000	93
2000	186
3000	280
4000	373
5000	466
6000	559
7000	652
8000	745
9000	839
10000	932
11000	1025
12000	1118
13000	1211
14000	1304
15000	1398

Alternatively, the graph or formula below can be used to determine the approximate regulator setting.

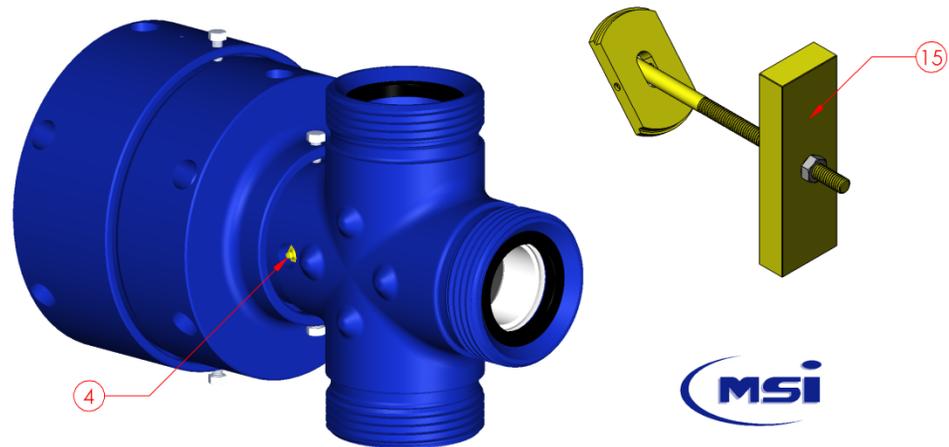
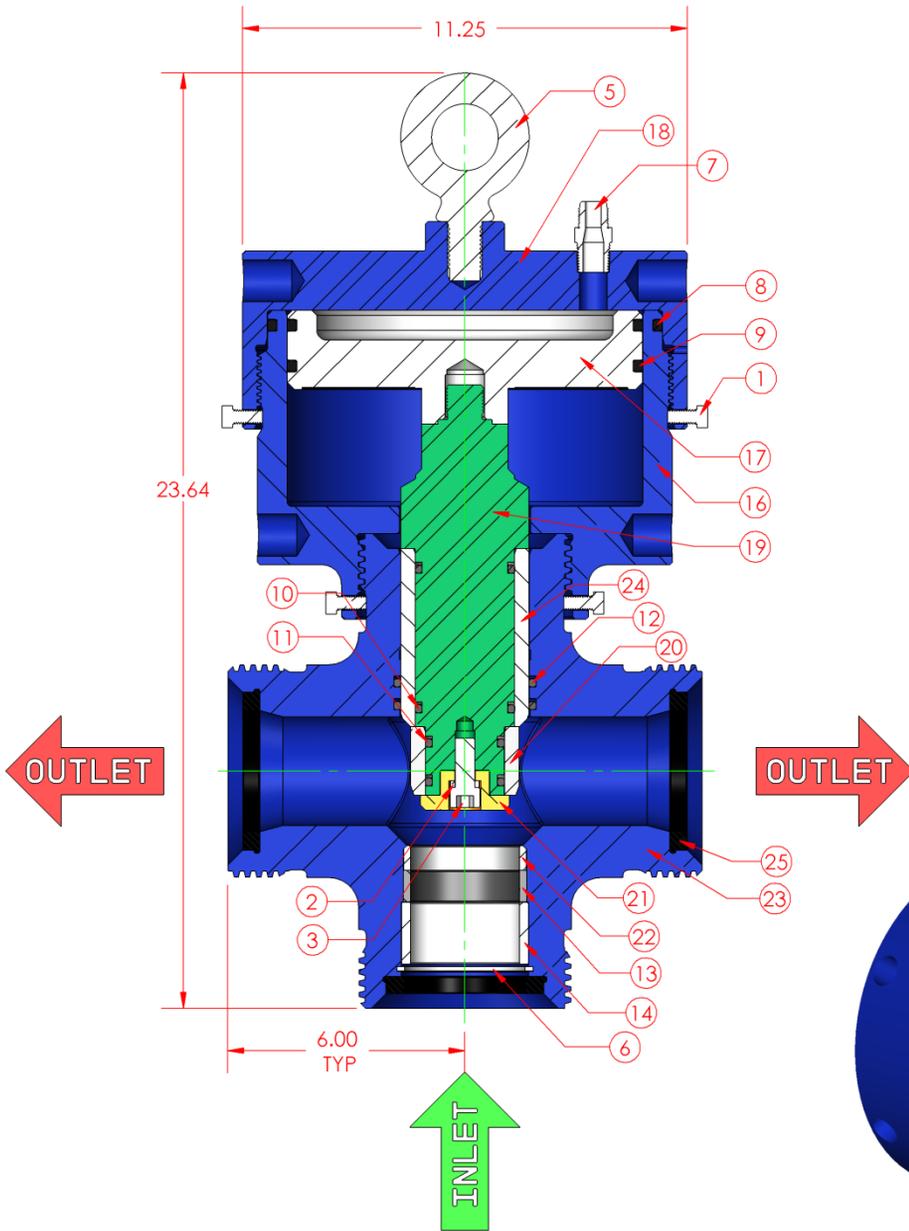
MSI Relief Valve



SECTION 5 ASSEMBLY DETAILS

5.1 Bill of Materials

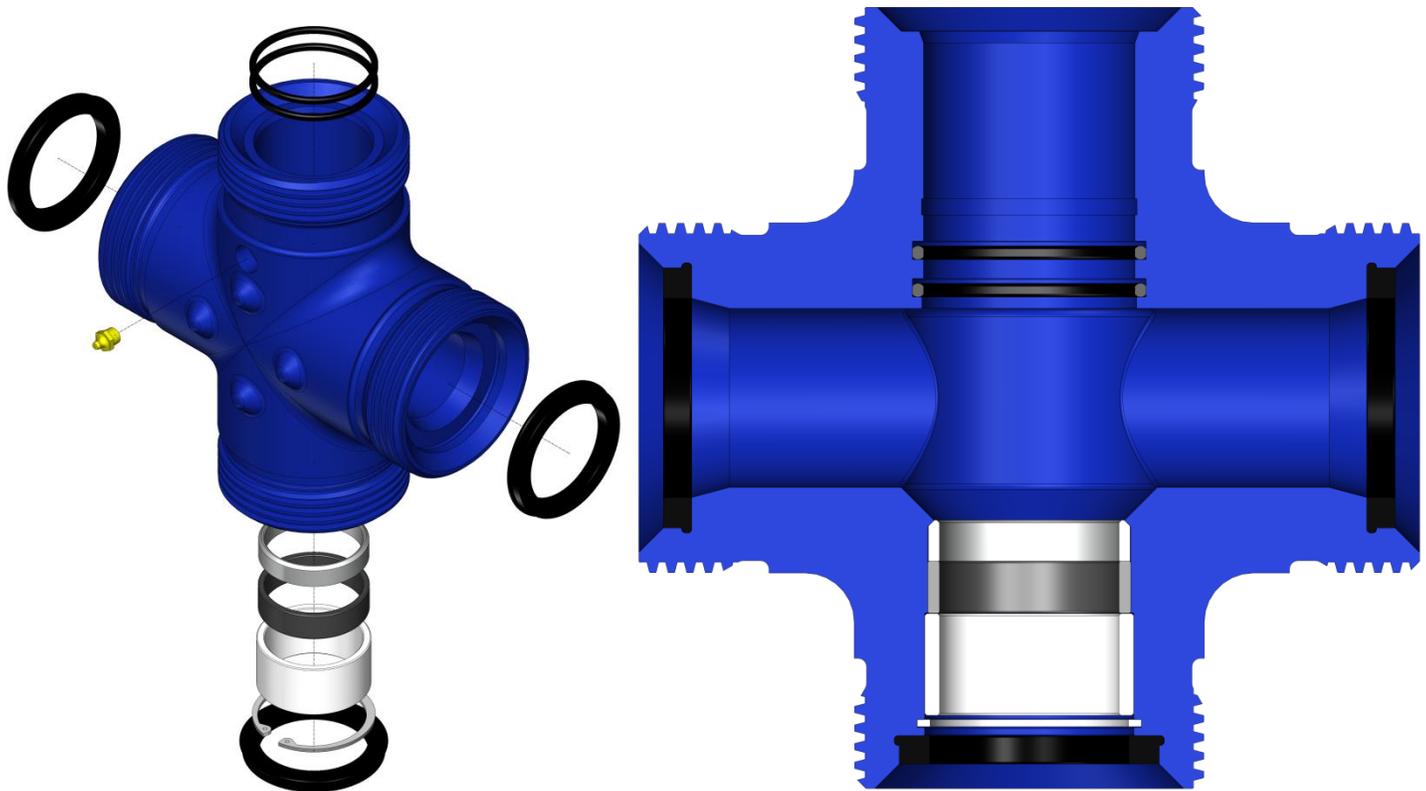
ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	4	HC0004	HEX HD, 3/8"-16 x 0.75"
2	1	HC0023	LOCK WASHER, 1/2" HIGH COLLAR
3	1	HC0028	SOC HD, 1/2"-13 x 1.25"
4	1	HC0199	GREASE FITTING, 1/4"NPT ALEMITE
5	1	HC0281	EYE BOLT, 7/8"-9 x 2.25" WITH 1.75" EYE OPENING
6	1	HC0416	SNAP RING, 3.250" ID
7	1	HF0007	HOSE ADPT, NIPPLE 1/2" JIC M x 1/2" PIPE M
8	1	OC0050	O-RING, RV CYLINDER CAP SEAL
9	2	OC0119	O-RING, RV CYLINDER 9"
10	2	OC0141	O-RING, LARGE - PISTON SHAFT 3" RELIEF VALVE
11	2	OC0142	O-RING, SMALL - PISTON SHAFT 3" RELIEF VALVE
12	2	OC0143	O-RING, BODY SEAL 3" RELIEF VALVE
13	1	PC0009	RV PACKING, INLET (DUAL-PAC 3.121"x2.75"x0.738")
14	1	PC0010	RV BUSHING RETAINER, 3" BODY
15	1	PC0013	POV TOOL ASSY, PACKING REMOVER
16	1	PC0021	RV COUPLER/CYLINDER, 3" 1502 BODY *GAS
17	1	PC0023	PISTON HEAD, 9" RV CYLINDER
18	1	PC0024	RV CYLINDER CAP, 9" CYLINDER
19	1	PC0044	RV PISTON SHAFT, 3" BODY FOR CARBIDE
20	1	PC0045	RV PISTON SHAFT LINER, 3" BODY CARBIDE NOSE
21	1	PC0046	RV PISTON SHAFT CAP, 3" BODY FOR CARBIDE NOSE
22	1	PC0047	RV PACKING BUSHING, 3" BODY CARBIDE
23	1	PC0048	RV BODY, 3" 1502 DUALFLO FxF STD 15M CARBIDE
24	1	PC0049	RV PISTON SHAFT LINER, 3" BODY CARBIDE STEP
25	3	UC0013	RESILIENT SEAL, 3" 1502 STD (BUNA)



5.2 Assembly Steps

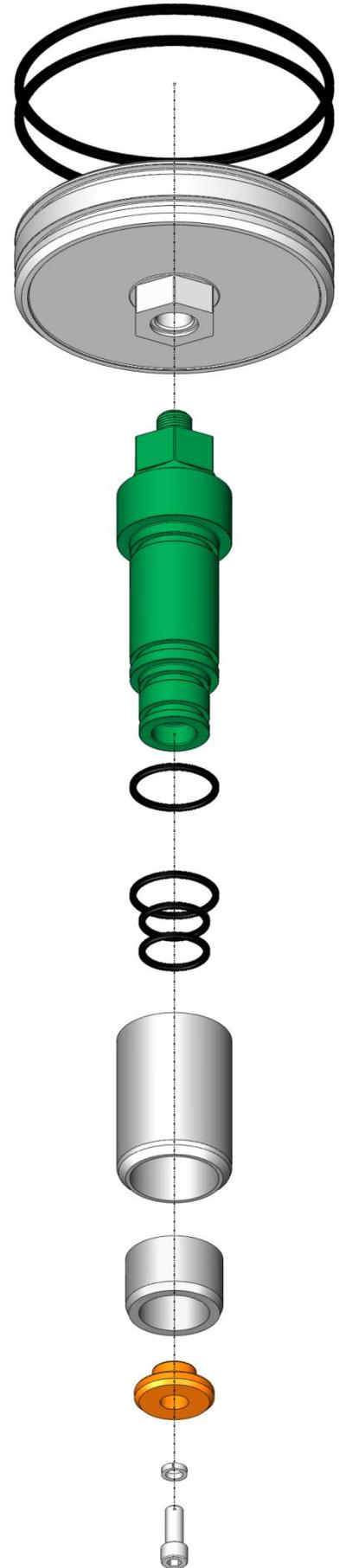
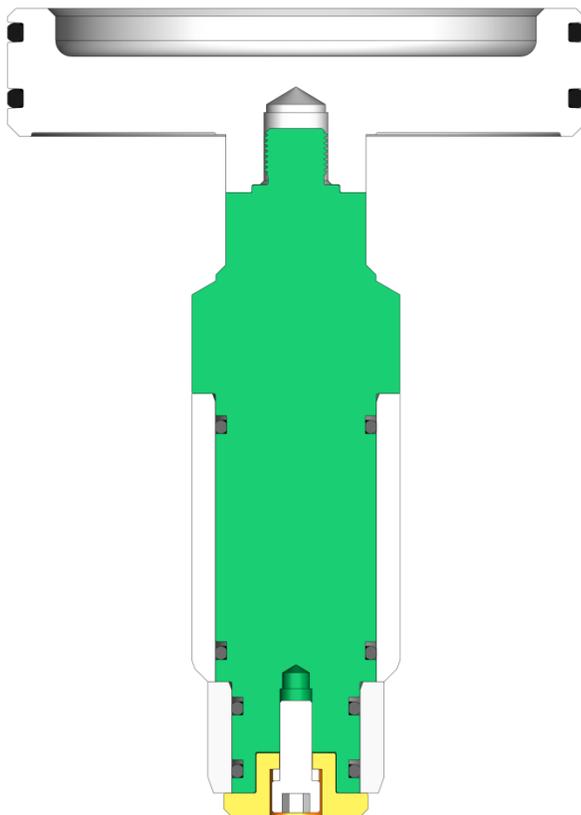
Note - Always use high quality graphite grease or anti-seize during assembly. Lubricate all parts thoroughly, especially threads.

- Assembling the cross body assembly:
 - 1) Apply grease or anti-seize in the packing gland of the cross body (Item 23).
 - 2) Install packing in the following order:
 - a) Apply grease or anti-seize and install packing busing (Item 22)
 - b) Apply grease and install inlet packing (Item 13)
 - c) Apply grease or anti-seize and install bushing retainer (Item 14)
 - d) Install packing retainer snap ring (Item 6)
 - 3) Apply grease and install the 2 body o-rings (Item 12)
 - 4) Apply grease and install the 3 resilient seals (Item 25)
 - 5) Apply PTFE (Teflon®) tape on grease fitting (Item 4) and install on cross body



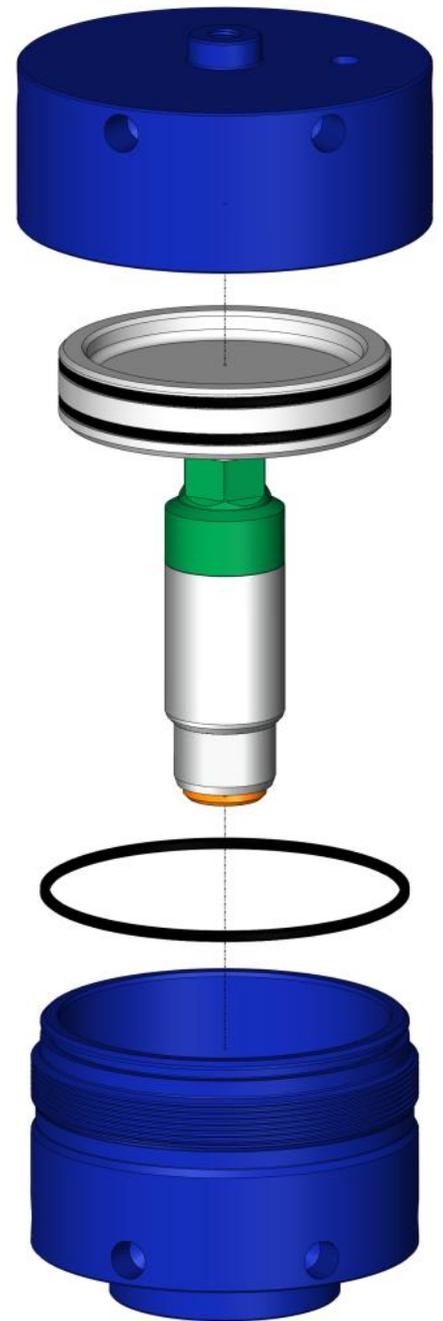
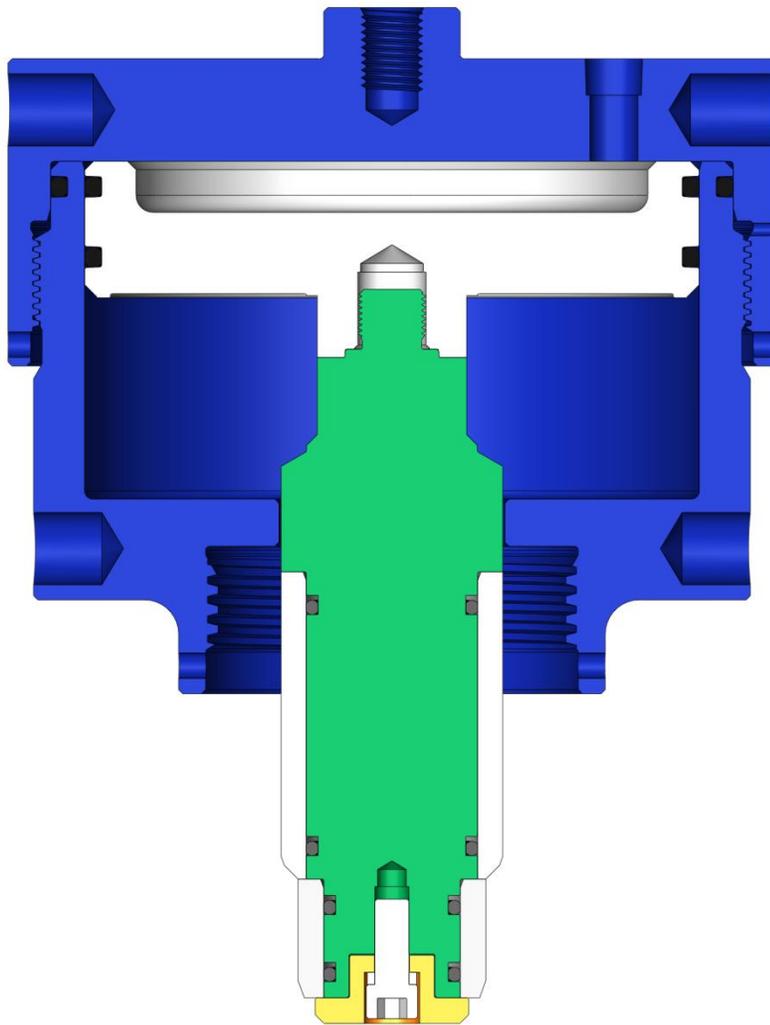
- Assembling the piston assembly:

- 1) Apply grease or anti-seize to the piston shaft outer surfaces (Item 19) and install parts in the following order:
 - a) Apply grease and install 2 large piston shaft o-rings (Item 10)
 - b) Apply grease and install 2 small piston shaft o-rings (Item 11)
 - c) Apply grease or anti-seize to the inner diameter and install piston shaft body liner (Item 24)
 - d) Apply grease or anti-seize to the inner diameter and install piston shaft nose liner (Item 20)
 - e) Install piston shaft cap (Item 21)
 - f) Apply blue Loctite® and install socket head screw along with lock washer (Items 2, 3)
- 2) Apply grease and install 2 cylinder o-rings (Item 9) on piston head (Item 17)
- 3) Apply blue Loctite® on external threads of piston shaft (Item 19)
- 4) Fully tighten piston shaft (Item 19) and piston head (Item 17) using flats on both parts (2-3/16" across flats)

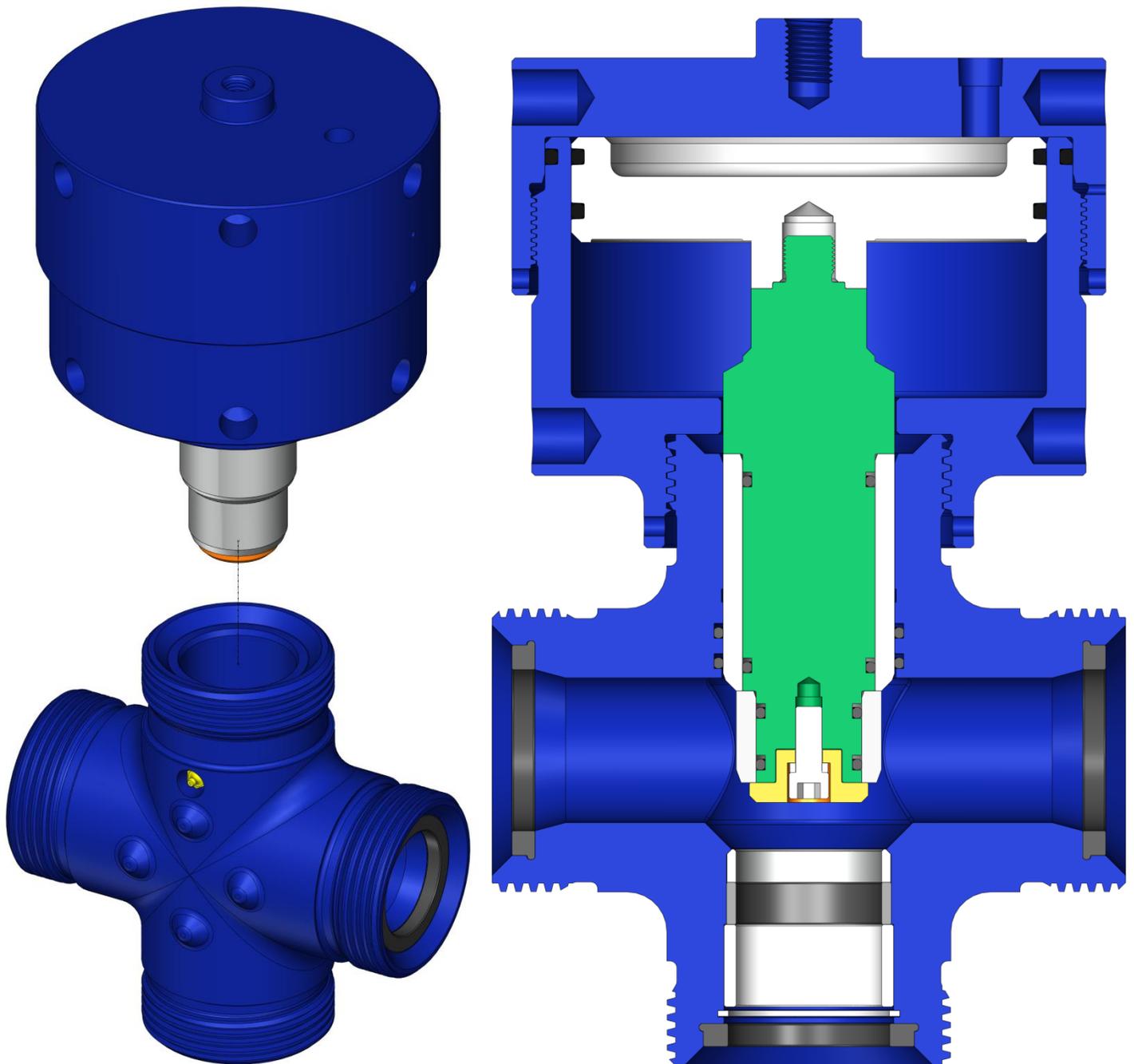


- Assembling the cylinder assembly

- 1) Apply grease and install cylinder o-ring (Item 8) on cylinder body (Item 16)
- 2) Apply grease to the internal diameter of the cylinder body (Item 16)
- 3) Push evenly across the piston head (Item 17) and insert the piston assembly into the cylinder body (Item 16)
- 4) Install the cylinder cap (Item 18) on the cylinder body temporarily (do not fully tighten at this time)

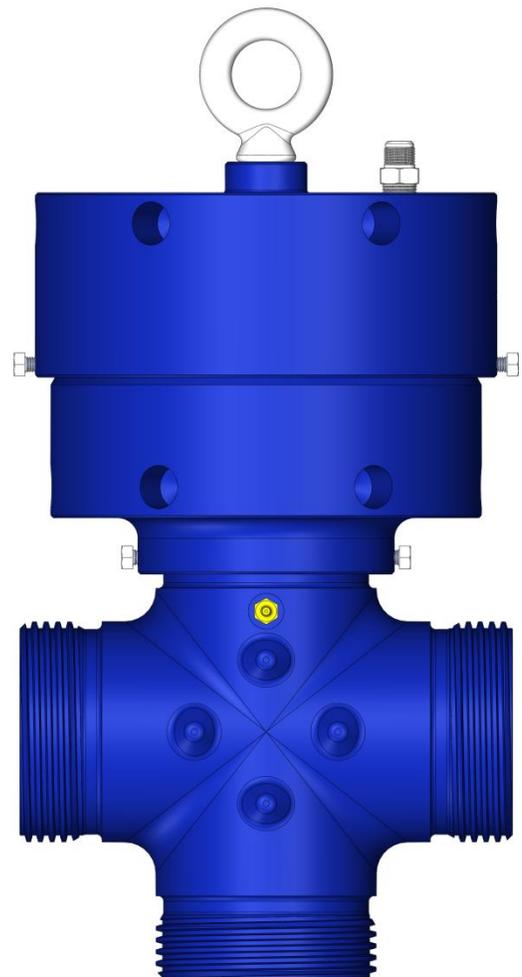
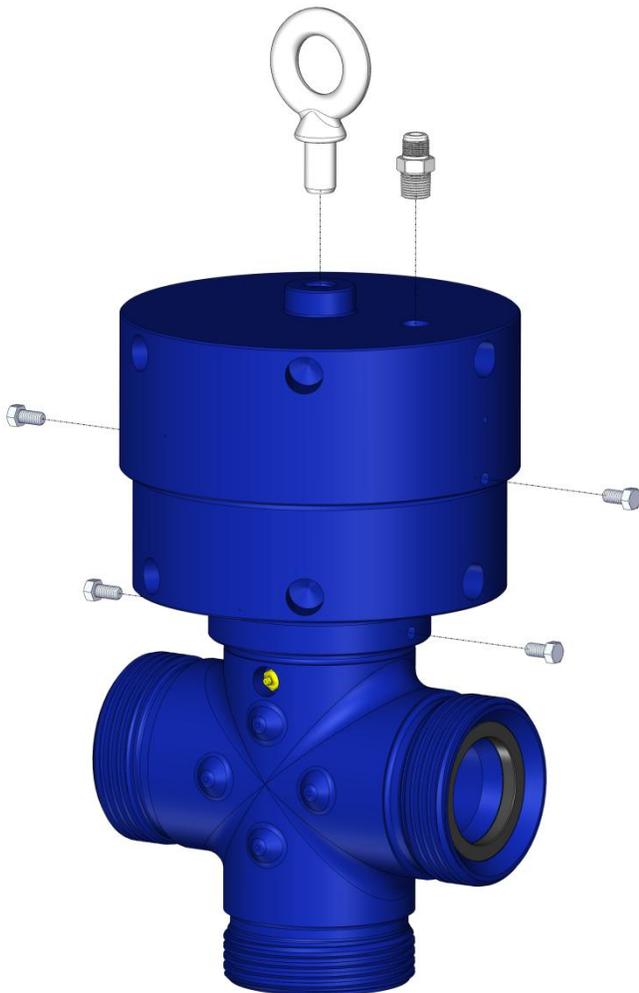
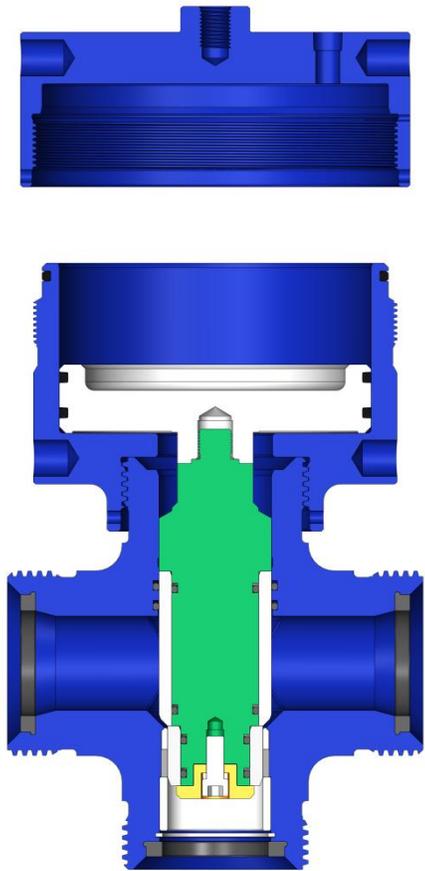


- Install cylinder assembly onto the cross body assembly
 - 1) Apply grease or anti-seize to outer surface of both carbide liners on the piston assembly (Items 20, 24)
 - 2) Apply grease or anti-seize to the threads on the cross body (Item 23)
 - 3) Insert cylinder assembly onto cross body (Item 23)
 - 4) Fully thread cylinder assembly onto cross body assembly. Do this using radial holes on cylinder to rotate it while holding down the cross body (this will help the piston shaft overcome the internal o-rings on the cross body assembly)



- Final assembly

- 1) Remove cylinder cap (Item 18) from the cylinder assembly
- 2) Push piston assembly all the way down into the cylinder (this is the close position of the PRV)
- 3) Apply grease or anti-seize to the external threads of the cylinder body (Item 16)
- 4) Fully thread cylinder cap (Item 18) onto cylinder body (Item 16)
- 5) Fully thread eye bolt (Item 5) onto cylinder cap (Item 18)
- 6) Apply PTFE (Teflon®) tape on hose adapter (Item 7) and install on cylinder cap (Item 18)
- 7) Apply blue Loctite® to 4 hex head screws (Item 1) and install on cylinder body and cylinder cap for anti-rotation as shown



5.3 Disassembly Steps

- The disassembly of the PRV is basically the opposite of the assembly. See disassembly steps below:

Caution – *Make sure any pressure is relieved prior to working on this assembly.*

- 1) Remove the 4 hex head screws (Item 1) from the cylinder assembly
 - 2) If needed, remove eye bolt (Item 5) from cylinder cap (Item 18)
 - 3) If needed, remove hose adapter (Item 7) from cylinder cap (Item 18)
 - 4) Remove cylinder cap (Item 18) from the cylinder assembly
 - 5) Remove cylinder o-ring (Item 8) from cylinder body (Item 16)
 - 6) Remove cylinder assembly from cross body (Item 23). Do this using radial holes on cylinder to rotate it while holding down the cross body.
 - 7) Push evenly across the piston shaft cap (Item 21) and remove the piston assembly from the cylinder body (Item 16)
- Disassembling the piston assembly:
 - 8) Remove 2 cylinder o-rings (Item 9) on piston head (Item 17)
 - 9) Disassemble piston shaft (Item 19) and piston head (Item 17) using flats on both parts (2-3/16" across flats)
 - 10) Remove parts from the piston shaft (Item 19) in the following order:
 - a) Remove socket head screw along with lock washer (Items 2, 3)
 - b) Remove piston shaft cap (Item 21)
 - c) Remove piston shaft nose liner (Item 20)
 - d) Remove piston shaft body liner (Item 24)
 - e) Remove 2 small piston shaft o-rings (Item 11)
 - f) Remove 2 large piston shaft o-rings (Item 10)
 - Disassembling the cross body assembly:
 - 1) If needed, remove grease fitting (Item 4) from cross body (Item 23)
 - 2) Remove the 3 resilient seals (Item 25)
 - 3) Remove the 2 body o-rings (Item 12)
 - 4) Remove packing in the following order:

- a) Remove packing retainer snap ring (Item 6)

Note – If using packing removal tool (Item 15) the following items 14, 13, and 22 will be removed simultaneously.

- b) Remove bushing retainer (Item 14)
- c) Remove inlet packing (Item 13)
- d) Remove packing bushing (Item 22)

5.4 **Inspection**

- Visually inspect all parts for physical damage (due to erosion, wear...) and replace as needed. Parts to pay close attention during inspection include, but are NOT limited to:
 - 1) Piston assembly parts:
 - a) Replace socket head screw along with lock washer (Items 2, 3)
 - b) Inspect piston shaft cap (Item 21) and replace as needed
 - c) Inspect piston shaft nose liner (Item 20) and replace as needed
 - d) Inspect piston shaft body liner (Item 24) and replace as needed
 - 2) Cross body assembly parts:
 - a) Inspect cross body bores for any signs of erosion
 - b) Inspect packing retainer snap ring (Item 6), bushing retainer (Item 14), and packing bushing (Item 22)

Caution – Make sure to replace ALL elastomeric seals (o-rings, resilient seals, packing)



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