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INTRODUCTION

Pressure and/or vacuum relief valves are used on liquid storage tanks and other process vessels or systems to prevent structural damage due to excess internal pressure or vacuum.

Storage tanks are pressurized when liquid is pumped in, compressing the existing vapor or

when increasing temperature causes increased evaporation or expansion of existing vapor. Conversely, vacuum may be created when pumping out or due to decreasing temperature. To prevent damage, vapor must be allowed to escape or enter the tank at a specified pressure or vacuum condition. The volume rate of venting depends upon tank size, volatility of contents, pumping rate and temperature. See API Standard 2000 for the procedures to determine venting requirements.

The pilot operated relief valve has two principal advantages over other types of relief valves:

- 1) Better sealing capabilities.
- 2) It is fully open at less than 10% above set pressure.

These characteristics permit operating pressures nearer to the maximum allowable working pressure of the tank. High operating pressures reduce evaporation and total venting volume, thereby reducing product loss and the cost of processing emissions. A tank may also have provisions for emergency pressure relief due to fire exposure and/or inert gas blanketing of the vapor space. A typical tank installation is shown in Figure 1 which includes a 1660A Pilot Operated Pressure-Vacuum Relief Valve, a 3011H Blanket Gas Regulator and a 2000 emergency relief valve. Groth Corporation manufactures all of these devices.

A Pilot Operated Valve (POV) must be carefully maintained by a qualified valve technician. It should only be assembled under clean conditions, preferably in a service shop environment. Carefully read and understand this manual before attempting to repair a 1660A series POV. *Groth Corporation provides repair services for all products manufactured by Groth Products Group.*

The 1660A Series Pilot Operated Valves are designed to provide either pressure or vacuum relief for API 620 and 650 tanks and other storage and process vessels. Several configurations are available; these are

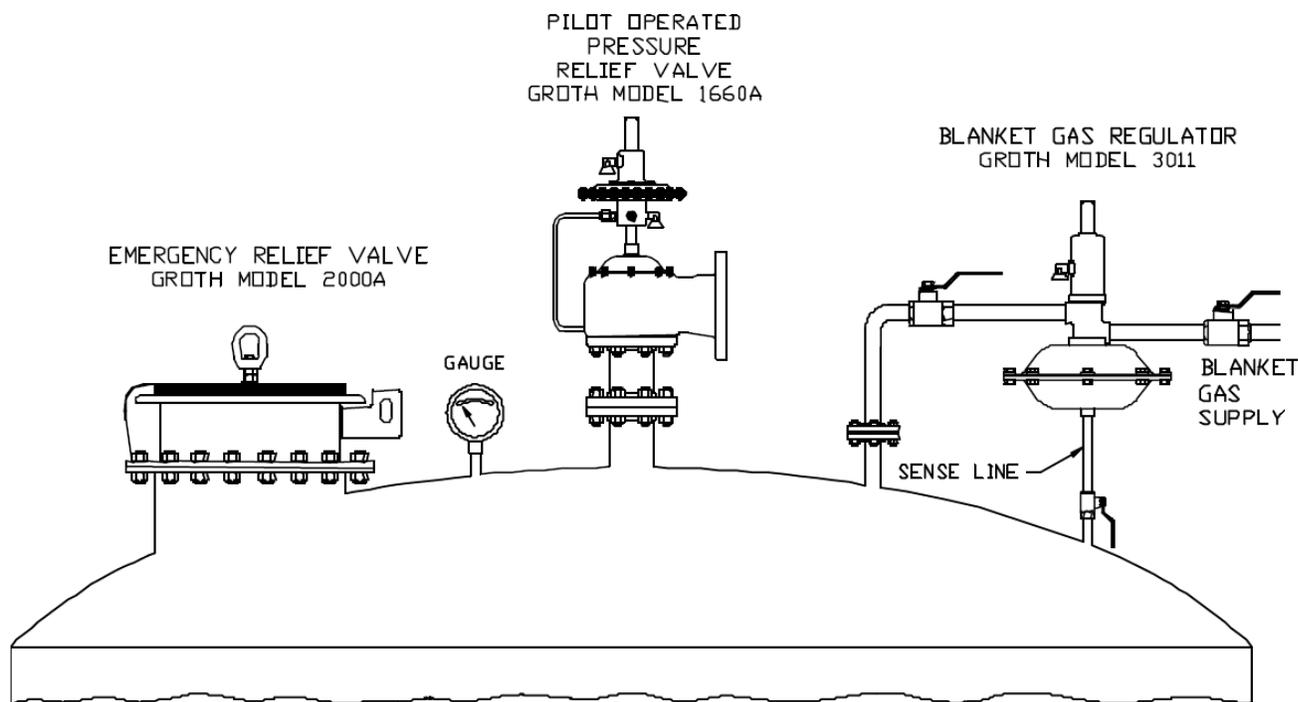


Figure 1: Tank Installation – Safety Equipment

summarized in Table 1 below. Each type is available with either a standard O-Ring seat or the optional mechanically tensioned FEP film seat. The FEP film diaphragm provides a tight seal and is recommended for cryogenic applications.

Model	Pressure	Vacuum	Vacuum Operation
1660A	X		Not available
1662A		X	Pilot actuated

A variety of material options are available in addition to the standard constructions listed in the Bill of Materials on page 13. The nameplate shows the basic information that is listed on each relief valve. See Fig. 2.

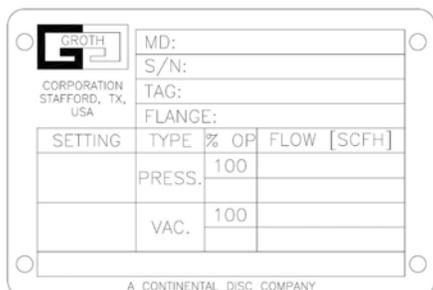


Figure 2: Nameplate

Each application must be reviewed to ensure material compatibility of all metal and soft goods components with the service conditions. The pallet assembly and wetted components are aluminum or 316 SS and may be upgraded to Alloy C276 or other alloys for severely corrosive service. Diaphragms, gaskets and bushings are FEP film or PTFE. O-Rings can be specified as Buna-N, EPDM, FFKM or FKM. Sense tubing is 316SS, and it is available in Kynar ® for severely corrosive service.

The pilot valve is set at the factory to comply with the specification on the purchase order. The range of adjustment will depend on the spring installed and will be stamped on the pilot nameplate. The pressure setting may be changed within the design range either while on line or in a service shop. Observe the proper setting and testing procedure in the appropriate pilot valve manual.

This manual is intended to provide recommended procedures and practices for installation, operation, and maintenance of the Groth Series 1660A Pilot Operated Valve (POV). Any standard procedures and practices developed for a specific plant or process may supersede this manual. Although this manual cannot cover all possible

contingencies, following these guidelines should provide safe, reliable pilot valve performance.

Note: This manual covers the operation and maintenance of the pressure/vacuum relief valve; refer to the appropriate manual for the pilot valve instructions.

For information not contained in this manual, please contact:

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SAFETY WARNINGS

This section is an overview of safety guidelines that should be followed during the installation, operation, and maintenance of your valve. To understand the context of these instructions and warnings, read and understand this complete manual.

The purpose of a POV is to prevent excessive pressure in a tank or process system. The valve must be designed for the proper MAWP and flow requirements of the system. Consult API Standard 2000 for tank protection sizing procedures. An improperly specified or functioning relief valve may result in structural damage to the tank or system.

In the event of an actuator diaphragm failure, the valve will vent pressure to the atmosphere, causing the pressure relief valve to fail in the OPEN position. The valve will function like a weight loaded valve under this condition with a lower set point, and will normally provide rated flow capacity. Consult factory for any questions related to this over-pressure condition.

POV relief pressure and blowdown are set at the factory per purchase order specifications. The set pressure is stamped on the pilot valve nameplate. Do not attempt to readjust the set pressure beyond the limit specified on the pilot nameplate.

The pilot sense line is either 3/8" OD SS tubing, or 1/2" NPT Kynar® pipe. It must be open and unobstructed to ensure that the pilot "senses" actual tank pressure. For applications where tank vapors may condense

or "solidify" in the sense tube or pilot valve, a nitrogen purge may be required to prevent internal obstruction. Consult the factory for recommendations.

DO NOT attempt to remove the pilot valve from the main valve without removing or isolating the relief valve from the system. ALTERNATIVE MEANS OF PRESSURE RELIEF MUST BE PROVIDED WHEN THE VALVE IS OUT OF SERVICE. After isolating the relief valve, bleed all pressure from both main and pilot valve before removing the valve. Consult the pilot valve manual before attempting to repair it. Both the pilot valve and POV are exposed to process vapors. Observe all plant procedures and Material Safety Data Sheet recommendations for the products in the system when inspecting, adjusting or servicing the valves. Vents on the body and spring bonnet of the pilot valve must be clean and unobstructed for proper and safe operation of the valve. These vents should be inspected periodically, and cleaned or replaced, if necessary.

INSPECTION AND STORAGE

The POV should be protected during handling and storage. Always keep all ports plugged to prevent intrusion of foreign materials. Before installation inspect the unit visually. If there are indications of physical damage or internal contamination, the valve must be disassembled, cleaned and inspected before installation. The spring adjustment cap and blow down screw lock nut may be "car sealed" to ensure that the factory pressure setting has not been altered.

Inspect the valve for any sign of damage that may have occurred in shipment and report this to the carrier and Groth Corporation. Removal of car seal may invalidate warranty.

Lifting eyes are provided on the upper actuator for handling the valve. To avoid damage to the lower flange surface, set the valve on a soft clean gasket material until it is ready to be installed. It should be stored in a clean environment until it is mounted on the tank. The pilot pickup fitting is in the body and must be kept completely free of all foreign materials.

INSTALLATION

Handle the 1660A POV carefully to ensure seat tightness & proper operation.

WARNING: The valve must be installed in a vertical position as shown in Fig 1. Any nozzle, piping, or fittings between the relief valve and the protected equipment must be such that the pressure drop will not reduce the relieving capacity below that required or adversely affect the proper operation of the relief valve. A nozzle as shown in Fig 3 will not significantly impact the flow capacity or operation of the relief valve.

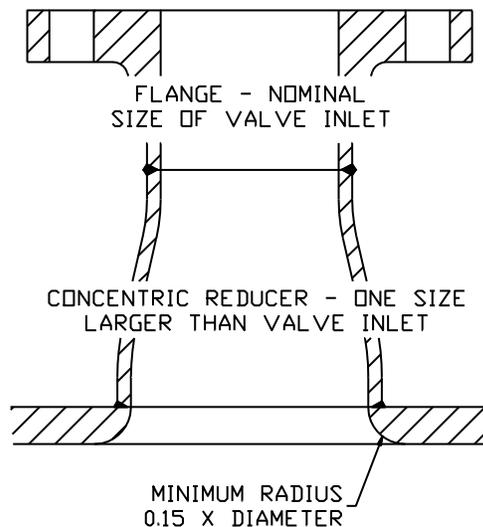


Figure 3: Suggested Tank Nozzle Design

- At installation, the valve should be smoothly lifted into position using the lifting eyes on the actuator. NOTE: Care should be taken as to not damage flange face during installation. Use the actuator housing or outlet flange to align the valve directly over the flange. Do NOT use the pilot valve or sense line to pull the valve into position.
- Aluminum valve bodies should be connected with flat-faced 150# ANSI flanges with a full-faced gasket. Mating flanges should be flat within .020" and clean, free of scratches, corrosion and tool marks.
- Each valve is leak tested at the factory as part of our standard inspection procedures.

- Inspect the gasket; make sure that the material is suitable for the service. Gasket dimensions are listed in Table 2. Full gaskets must be used with flat face flanges. Either full or ring gaskets may be used with raised face flanges.

ANSI 150#	I.D.	Ring O.D.	Full Face Gasket			
			O.D.	B.C.	Holes	Qty
2"	2.38"	4.12"	6.00"	4.75"	0.75"	4
3"	3.50"	5.38"	7.50"	6.00"	0.75"	4
4"	4.50"	6.88"	9.00"	7.50"	0.75"	8
6"	6.62"	8.75"	11.00"	9.50"	0.88"	8
8"	8.62"	11.00"	13.50"	11.75"	0.88"	8
10"	10.80"	13.38"	16.00"	14.25"	1.00"	12
12"	12.80"	16.12"	19.00"	17.00"	1.00"	12
16"	16.00"	20.25"	23.50"	21.25"	1.12"	16

- Lubricate all studs and nuts with an appropriate thread lubricant. If stainless steel fasteners are used, use an anti-seize lubricant such as moly-disulfide.
- Studs are installed in the valve body at the factory. Center the gasket within the bolt circle of the tank nozzle flange.
- Set the valve carefully on the nozzle. Make sure the flow path is not restricted by valve or gasket miss-alignment.
- Install nuts and lock washers and torque all fasteners to half the value listed in Table 3 or 4 in a staggered, alternating pattern.
- Make sure that the flanges are not distorted and that the gasket is evenly compressed.
- Make up the final torque and check that no further nut rotation occurs at the specified torque value.
- Normally, the pilot sense line is integral to the valve assembly. However, if the optional remote sense connection is specified, an external sense line must be installed. See the appropriate options manual or attached tag for recommendations.

ANSI 150# Drilling	Number of Bolts	Stud Size UNC	Torque Ft. Lb. (Kg. m)
2"	4	5/8"-11	81 (11)
3"	4	5/8"-11	106 (15)
4"	8	5/8"-11	68 (9.4)
6"	8	3/4"-10	101 (14)
8"	8	3/4"-10	142 (20)
10"	12	7/8"-9	138 (19)
12"	12	7/8"-9	179 (25)

Torque values are based on 30 PSI pressure and gasket factors: $m = 3.5$ & $y = 4000$

MAINTENANCE

The 1660A POV does not require routine lubrication or adjustments. It should be checked periodically, at least twice a year, to confirm that the valve is functioning properly and that the set point is correct. Test connections can be provided to facilitate testing the valve in the field.

The pilot valve is designed to function in a fail-safe manner. The failure of a seal or diaphragm will cause pressure to be vented to the atmosphere; the resulting loss in pressure will cause the main valve to open under rising pressure.

Periodic inspection for seat tightness is recommended to ensure compliance with local air pollution control requirements. The valve will need to be periodically removed from the tank for inspection of diaphragms, gaskets and seals. When this is done, the valve must be carefully lifted using the lifting eyes on the actuator housing. Refer to handling instructions listed in the Installation section of this manual.

If a leak is detected, it will likely be from one of the following sources:

1. Pilot valve
2. Main valve actuator
3. Main valve diaphragm
4. Body - nozzle flange joint gasket

Refer to the troubleshooting guide of this manual or the pilot valve manual for probable causes for these types of problems.

ANSI 150# Drilling	Number of Bolts	Stud Size UNC	Torque Ft. Lb. (Kg. m)
2"	4	5/8"-11	31 (4.3)
3"	4	5/8"-11	43 (6.0)
4"	8	5/8"-11	29 (4.0)
6"	8	3/4"-10	51 (7.1)
8"	8	3/4"-10	78 (11)
10"	12	7/8"-9	75 (10)
12"	12	7/8"-9	93 (13)

WARNING

If the valve must be removed from the tank for any reason, make sure that all pressure has been released before the flange fasteners are loosened. Refer to your company procedures before venting the tank pressure and when handling toxic or otherwise hazardous materials. Observe all standard safety precautions as specified on Material Safety Data Sheets for the product(s) in the system while removing the valve and when repairing it.

The main and pilot valve actuator housings, valve bodies, pallet assemblies and other components are exposed to the process vapor.

TOOLS

Most service, adjustment and assembly of the 1660A valve can be performed with the following common tools:

- ◆ 7/16" - 11/16" open end wrenches
- ◆ 1/4" - 9/16" socket wrenches
- ◆ Adjustable Wrench
- ◆ 1/16", 3/32" & 3/16" Allen wrenches

DISASSEMBLY

Note that throughout this manual, numbers shown in [] after the part descriptions refer to the item numbers in the drawings (Figures 3-12) and bill of materials, Table 7. Assembly instructions vary depending on the pallet/seat configuration and valve size. Exploded views of the pallet/seat assemblies are included for clarity.

Observe plant safety procedures in removing and cleaning the valve before it is sent to a shop for maintenance. Refer to the SAFETY WARNINGS listed on page 4 of this manual.

The valve should be handled by the lifting eyes which are attached to the main valve actuator housing. It should be supported on blocks to provide clearance for the outlet flange during all repair operations.

The external tubing that connects the pilot valve to the pressure pickup should be removed first. Loosen the union connection at the pressure pickup and the tubing fitting at the pilot body. It is not necessary to remove the pickup fitting from the body.

Remove the pilot valve [51] from the upper actuator housing [2] by disconnecting at the threaded pipe nipple [1]. Inspect and service the pilot according to the appropriate Groth manual for either the 1401 or 1402 series pilots. As noted on name tag.

Unscrew the hex nuts [6] and lift the upper actuator housing [2] and gasket [20] carefully from the valve body. There are two types of actuator diaphragm support assemblies. The Model 1660A has one support plate, which is not attached to the diaphragm. All other models have the diaphragm sandwiched between two support plates. Otherwise the actuator construction is the same for all models.

If the actuator diaphragm [15] is not attached to the support plate [4], remove it at this time. Otherwise, leave it in place and continue.

Lift the lower actuator housing [14], including the stem and pallet assembly, from the body. Remove the second gasket [20]. Check the movement of the pallet assembly by sliding it until it stops against the stem guide [11]. It should move freely with no sign of binding that may be caused by foreign materials between the stem [12] and stem guide [11].

Hold the diaphragm support plate [4] while unscrewing the swivel ball [24] from the stem rod [13]. See the following sections for disassembly and assembly of the specific pallet types. Remove the stem [12] from the guide [11] and inspect the Teflon bushing(s) [10] and/or O-Ring seal [67]. The split bushings are easily removed by prying from the groove with a sharp probe. Inspect the stem surface for scratches or foreign material.

If the diaphragm is retained between two support plates, remove the jam nut [47], flat washer [49], upper (vacuum) support plate [4.1], and FEP washer [50]. Inspect the diaphragm carefully to see if there are any tears, pinholes or signs of chemical

degradation. Remove the lower (pressure) support plate [4] and O-Ring [48]. All soft goods should be replaced; refer to Table 5 for the list of recommended spare parts.

REPLACEMENT PARTS

Table 5. Spare parts kits

2" Model 1660A		
Soft Goods/Type	Film	O-Ring
Buna-N	KS1660SG02TB	KS1660SG02BB
EPDM	KS1660SG02TE	KS1660SG02EE
FFKM	KS1660SG02TK	KS1660SG02KK
FKM	KS1660SG02TV	KS1660SG02VV

3" Model 1660A		
Soft Goods/Type	Film	O-Ring
Buna-N	KS1660SG03TB	KS1660SG03BB
EPDM	KS1660SG03TE	KS1660SG03EE
FFKM	KS1660SG03TK	KS1660SG03KK
FKM	KS1660SG03TV	KS1660SG03VV

4" Model 1660A		
Soft Goods/Type	Film	O-Ring
Buna-N	KS1660SG04TB	KS1660SG04BB
EPDM	KS1660SG04TE	KS1660SG04EE
FFKM	KS1660SG04TK	KS1660SG04KK
FKM	KS1660SG04TV	KS1660SG04VV

6" Model 1660A		
Soft Goods/Type	Film	O-Ring
Buna-N	KS1660SG06TB	KS1660SG06BB
EPDM	KS1660SG06TE	KS1660SG06EE
FFKM	KS1660SG06TK	KS1660SG06KK
FKM	KS1660SG06TV	KS1660SG06VV

8" Model 1660A		
Soft Goods/Type	Film	O-Ring
Buna-N	KS1660SG08TB	KS1660SG08BB
EPDM	KS1660SG08TE	KS1660SG08EE
FFKM	KS1660SG08TK	KS1660SG08KK
FKM	KS1660SG08TV	KS1660SG08VV

10" Model 1660A		
Soft Goods/Type	Film	O-Ring
Buna-N	KS1660SG10TB	KS1660SG10BB
EPDM	KS1660SG10TE	KS1660SG10EE
FFKM	KS1660SG10TK	KS1660SG10KK
FKM	KS1660SG10TV	KS1660SG10VV

12" Model 1660A		
Soft Goods/Type	Film	O-Ring
Buna-N	KS1660SG12TB	KS1660SG12BB
EPDM	KS1660SG12TE	KS1660SG12EE
FFKM	KS1660SG12TK	KS1660SG12KK
FKM	KS1660SG12TV	KS1660SG12VV

Pilot Valve for Model 1660A		
Soft Goods/Type	1401E	1402A
Buna-N	KS1401SGBP	KS1402SGBP
EPDM	KS1401SGEP	KS1402SGEP
FFKM	KS1401SGKP	KS1402SGKP
FKM	KS1401SGVP	KS1402SGVP

2" Model 1662A		
Soft Goods/Type	Film	O-Ring
Buna-N	KS1662SG02TB	KS1662SG02BB
EPDM	KS1662SG02TE	KS1662SG02EE
FFKM	KS1662SG02TK	KS1662SG02KK
FKM	KS1662SG02TV	KS1662SG02VV

3" Model 1662A		
Soft Goods/Type	Film	O-Ring
Buna-N	KS1662SG03TB	KS1662SG03BB
EPDM	KS1662SG03TE	KS1662SG03EE
FFKM	KS1662SG03TK	KS1662SG03KK
FKM	KS1662SG03TV	KS1662SG03VV

4" Model 1662A		
Soft Goods/Type	Film	O-Ring
Buna-N	KS1662SG04TB	KS1662SG04BB
EPDM	KS1662SG04TE	KS1662SG04EE
FFKM	KS1662SG04TK	KS1662SG04KK
FKM	KS1662SG04TV	KS1662SG04VV

6" Model 1662A		
Soft Goods/Type	Film	O-Ring
Buna-N	KS1662SG06TB	KS1662SG06BB
EPDM	KS1662SG06TE	KS1662SG06EE
FFKM	KS1662SG06TK	KS1662SG06KK
Viton	KS1662SG06TV	KS1662SG06VV

8" Model 1662A		
Soft Goods/Type	Film	O-Ring
Buna-N	KS1662SG08TB	KS1662SG08BB
EPDM	KS1662SG08TE	KS1662SG08EE
FFKM	KS1662SG08TK	KS1662SG08KK
FKM	KS1662SG08TV	KS1662SG08VV

10" Model 1662A		
Soft Goods/Type	Film	O-Ring
Buna-N	KS1662SG10TB	KS1662SG10BB
EPDM	KS1662SG10TE	KS1662SG10EE
FFKM	KS1662SG10TK	KS1662SG10KK
FKM	KS1662SG10TV	KS1662SG10VV

12" Model 1662A		
Soft Goods/Type	Film	O-Ring
Buna-N	KS1662SG12TB	KS1662SG12BB
EPDM	KS1662SG12TE	KS1662SG12EE
FFKM	KS1662SG12TK	KS1662SG12KK
FKM	KS1662SG12TV	KS1662SG12VV

Pilot Valve for Model 1662A		
Soft Goods/Type	1401EV	
Buna-N	KS1401SGBV	
EPDM	KS1401SGEV	
FFKM	KS1401SGKV	
FKM	KS1401SGVV	

FILM SEAT PALLET

Turn the pallet assembly upside down to disassemble. If placing in a vise, clamp against the flats on the swivel ball [24]. Do not clamp on the socket or it will be deformed and restrict seat alignment. Loosen the jam nut [34] and turn the jackscrew [33] counterclockwise to release tension on the FEP film [40]. Use an allen wrench to hold the countersunk screws [42] and loosen the hex nuts [43] that retain the ring [41]. Remove all components from the jackscrew assembly (see Figure 4) and replace the film. Remove the retaining ring [28] and replace the O-Ring [29].

To assemble, install the O-Ring [29] in the pallet counter bore and insert the swivel socket [26]. Replace the retaining ring [28]. **Do not expand the retaining ring excessively.**

SIZE	O.D.	HOLE DIA.
2"	4.50"	0.38"
3"	5.50"	0.38"
4"	6.50"	0.38"
6"	8.50"	0.44"
8"	10.63"	0.44"
10"	12.63"	0.62"
12"	14.63"	0.62"

The FEP film [40] is provided at least 3/4" larger than the outside diameter of the film seat ring [41]. This excess material is required for handling at assembly. Place the film on a clean flat surface. Install the jackscrew bushing [35] through the film tension plate [39]; as shown in Figure 4. Lay the film [40] over the plate [39], then the Teflon washer [46]; flat washer [38]; Belleville washer [37]; and tighten the jam nut [36] while holding the jackscrew bushing with a wrench. Tighten until the Belleville washer is visually flat; do not over-tighten as the FEP film can be damaged or cut at the washer O.D. Use care in handling the film at all stages of assembly.

Screw the jam nut [34] completely onto to the jackscrew [33] and thread the jack screw into the jackscrew bushing [35] until the tip

extends slightly through the opposite end (hex side).

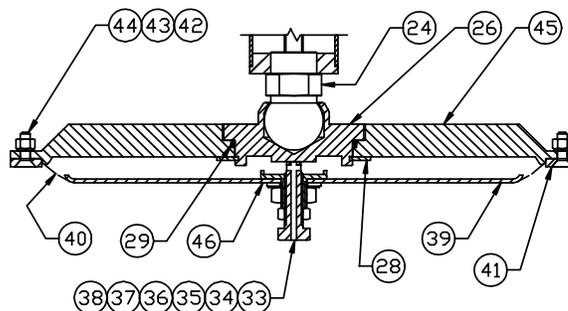


Figure 4: Film Pallet Assembly

Position the film sub-assembly on the face of the pallet with the tip of the jackscrew [33] in the counter bore of the swivel socket [26]. Hold the film so it is taut and wrinkle free. Align the bolt holes of the seat ring [41] and pallet [45] and press the parts firmly together, clamping the film securely.

Punch four holes at 90° apart through the film and insert the screws [42] through the ring and plate. Install the lock washers [44] and hex nuts [43] and tighten using an allen wrench to hold the screws. Complete the assembly by punching the remaining holes and install the screws, lock washers and hex nuts.

After all fasteners are tightened, turn the jackscrew [33] clockwise to tighten the film until the slope is approximately 15°. Do not over-tighten, as it is possible to bend the tension plate [39] or tear the film. Tighten the jam nut [34] to lock the jackscrew. Using a sharp knife, trim the excess film at the O.D. of the ring [41].

Carefully set the film seat pallet assembly onto the valve body seat. Check the gap between the bottom of the film seat ring [41] and the top surface of the body seat; it should be between 1/32" and 1/16". If there is insufficient clearance, the film seat diaphragm tension should be increased. Carefully lift the assembly out of the valve and loosen the jam nut [34] on the jackscrew two or three turns. Rotate jackscrew clockwise as required to add tension to the film seat diaphragm and then retighten the jam nut [34]. Lower the pallet assembly into the valve and recheck the film seat gap. Remove this sub-assembly and store on a clean surface.

O-RING SEAT PALLET

Remove the retaining ring [28], the retainer plate [30] and two O-Rings [29 & 31]. Inspect and clean the O-Ring groove and the bore in the pallet. Install new O-Rings, and replace the retainer plate [30] and retaining ring [28]. **Do not expand the retaining ring excessively.**

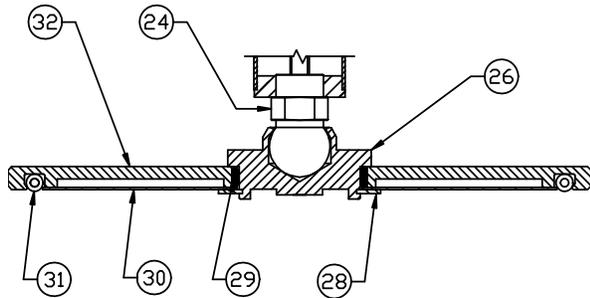


Figure 5: O-Ring Pallet Assembly

BODY SEAT INSERT

The seating surface is a thin stainless steel insert [27] bonded into the body. The flat top surface contacts the O-Ring in the standard pallet assembly. The corner radius contacts the tensioned film of the optional pallet assembly.

Inspect the appropriate surface to be sure it is clean, smooth and flat. Press and twist the insert manually to verify that it firmly bonded into the body.

If the O-Ring pallet is used, the flat sealing surface of the insert may be lapped, using a flat lapping block.

If the film pallet is used, the sealing radius may be hand polished, very carefully. The radius must be uniform and not exceeding .030".

ASSEMBLY

Model 1660A: This model has one support plate riveted [3] to the stem cap. Screw the jam nut [47] onto the stem rod [13] and screw the rod into the stem cap [22] until it is flush with the top surface of the support plate [4]. Then tighten the jam nut securely.

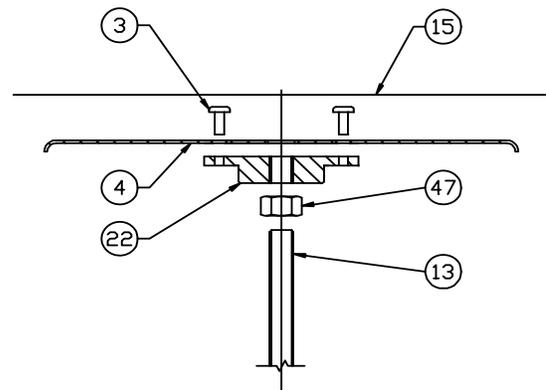


Figure 6: Support plate Assembly-Model 1660A

Model 1662A: The actuator diaphragm is mounted between the upper (vacuum) [4.1] support plate and the lower (pressure) [4] support plate. Thread the stem rod [13] through the upper stem cap [22].

Temporarily seat the stem tube against the cap and adjust the rod until it extends 3/16" beyond the lower end of the tube. Remove the tube and install the O-Ring [48], pressure support plate [4], diaphragm [15], Teflon washer [50], vacuum support plate [4.1], and flat washer [49]. Install the jam nut [47] and tighten securely.

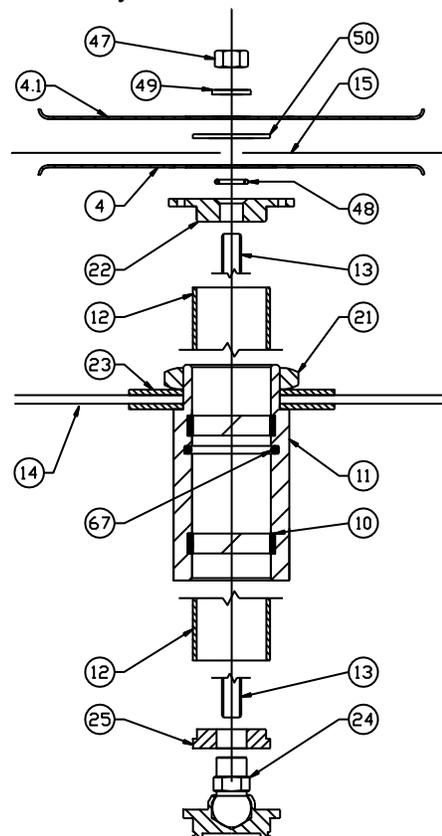


Figure 7: Stem Assembly-Model 1662

Replace the bushing(s) [10] and/or O-Ring seal [67] in the stem guide sub-assembly. Insert the stem tube and make sure that it moves freely. Insert the stem rod sub-assembly into the tube and seat the tube against the upper cap. Install the lower stem cap [25] and screw the rod into the swivel ball on the pallet sub-assembly. Hold the support plate [4] and tighten the swivel ball [24] securely.

Place a gasket [20] on the actuator mounting surface of the valve body. Turn the lower actuator housing [14] with stem and pallet assembly upright. Place two temporary blocks between the housing and the diaphragm support plate [4]. This will hold the pallet suspended above the body seat when it is lowered into the body. On 6" or smaller valve sizes, the stem/seat assembly can be supported manually.

Carefully lower the assembly into the body. Raise the diaphragm support plate manually and remove the wood blocks. Lower the diaphragm support plate gently, while aligning the diaphragm hole pattern with the body studs, until the pallet assembly is seated in the valve body. Install the diaphragm [15] onto the studs.

Note: If the Model 1402A pilot is used, a spacer gasket [58] is installed between the lower actuator housing [14] and the diaphragm [15]. The pilot will be connected to a hole on the actuator mounting surface of the valve body. In this case, the odd hole in the body gasket [20], lower actuator housing [14] and spacer gasket [58] must align with the body hole.

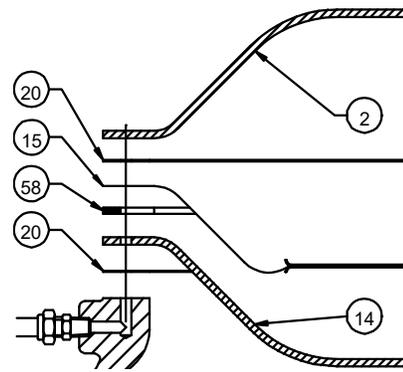


Figure 8: 1402A Pilot Connection

Note: If the diaphragm is not attached to the support plate, install the diaphragm after the pallet assembly is in place. Lay it on top of the support plate and align the holes with the studs.

Install the second gasket [20], upper actuator housing [2], lock washers [8] and hex nuts [6], and tighten evenly in a crisscross pattern.

Wrap the threads of the pipe nipple [1] with PTFE tape and thread it into the coupling in the upper actuator housing [2]. Install the pilot valve [51] and reconnect the tubing between the body pickup fitting and the pilot inlet port.

WARNING

Failure to properly align gaskets and the lower housing on valves equipped with the Model 1402A pilot will prevent the valve from opening.

TROUBLESHOOTING GUIDE

PROBLEM	INSPECTION	SUGGESTED CORRECTIVE ACTION
Pilot Valve Leak	Visual or audible	Consult 1401 or 1402 IOM troubleshooting guide for specific pilot valve manual
Main Valve Actuator Leak	Visual or audible	Leakage at the actuator flange may be corrected by tightening the fasteners adjacent to the leak path. If this is not successful, it will be necessary to install a new gasket. Refer to page 10, Assembly.
Vapor leakage from the valve body outlet.	Visual or audible	Leakage can occur at the valve body seat - FEP film interface; other leak paths are the swivel seal or a torn actuator diaphragm. After removing the upper actuator housing, lift the pallet assembly off the seat and inspect for damage to the film or foreign debris buildup on the seat or film. Clean or replace diaphragm as required. Refer to page 9, Film Seat Pallet.
Vapor leakage between the valve body and tank nozzle	Visual or audible	Leakage between the flanges may be corrected by tightening the fasteners. Follow instructions listed on page 5, Installation. The gasket may have deteriorated due to the chemical environment; replace if required. The tank nozzle may be warped, corroded or scratched. This will require resurfacing of the flange face; note that a flat-faced flange is recommended to avoid potential damage to an aluminum valve body.

Options

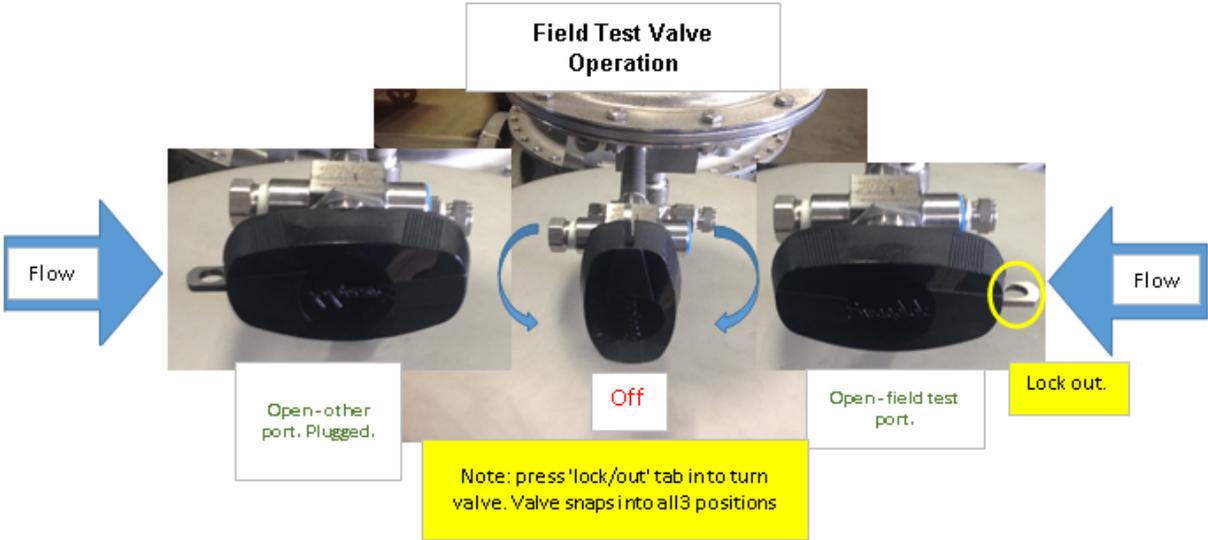
Field Test Connection

This option is available to test the set pressure of the pilot valve. To field test your pilot valve first remove or isolate the relief valve from the system. Attach an independent air supply with regulator and pressure gauge to the 3-way field test connection. See Figure below. Attach a second pressure gauge to one side of the cross fitting. This second gauge will allow you to verify what the set pressure is. Be sure the regulator is closed so no air is pressurizing the sense line. Open the 3-way field test connection. **NOTE: lock/out tab indicates flow direction.** Slowly open the regulator to allow air into the pilot valve and upper dome of the main valve. Pressure on gauge should not exceed the set pressure of the pilot valve noted on the tag. As you get to this set pressure the air will escape thru the vent and you will hear it. By spraying a leak detection solution or a soapy water on the vent will indicate when the pilot has opened

Pilot Supply Filter

This option is available when process has an unusual amount of foreign particulates. To maintain this option, remove or isolate the relief valve from the system. Remove the canister from the sense line and take out the stainless steel filter. Carefully clean with a power washer or high pressure steam and reassemble.





DRAWINGS AND BILL OF MATERIAL

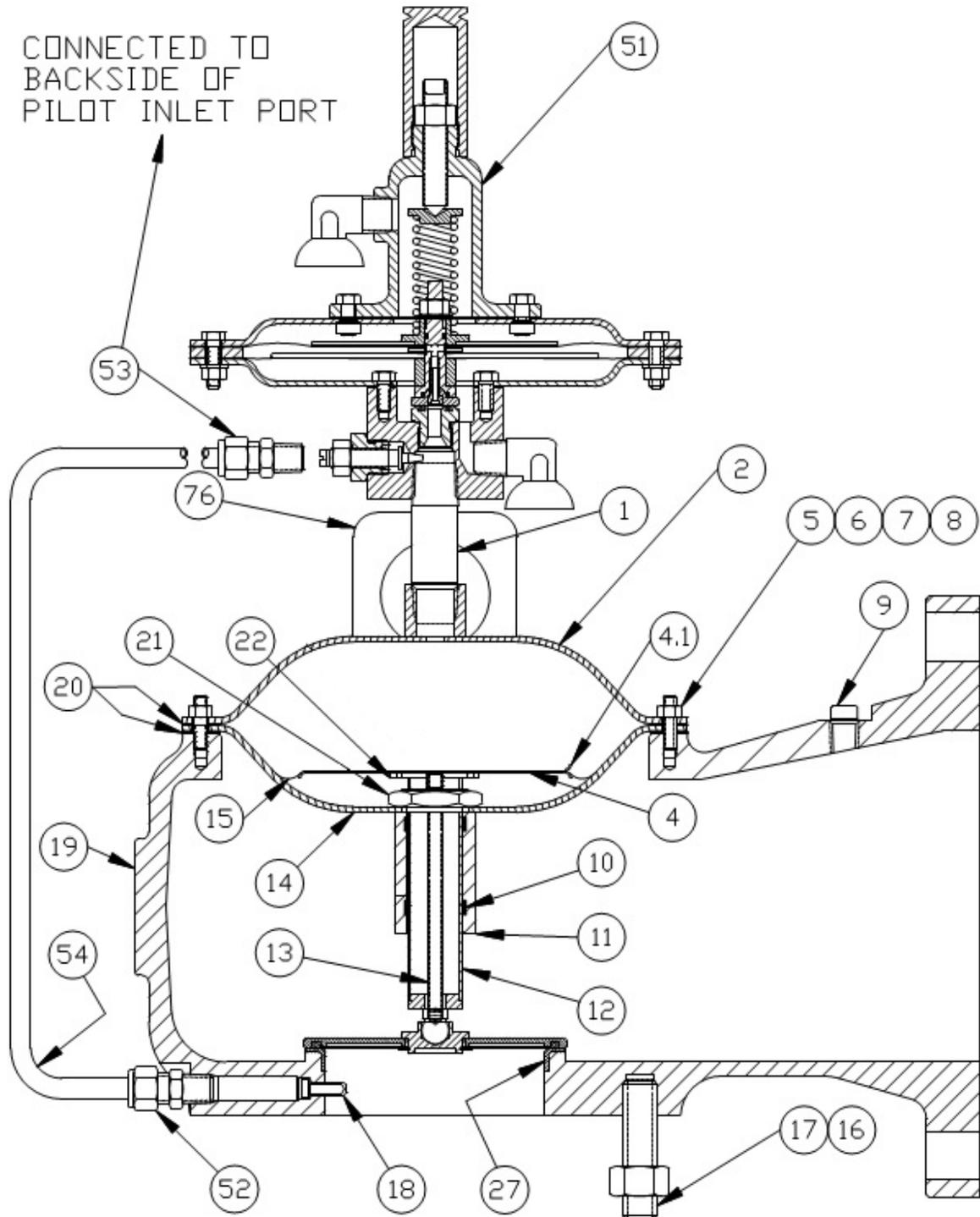


Figure 9: Model 1660A with 1401E Pilot

Table 7: Bill of Materials

ITEM	DESCRIPTION	Material			Spare Parts
		Alum	CS	SS	
1	Nipple, Pipe, 1/2" NPT		316		
2	Housing, Upper Actuator	Alum	CS	316	
3	Rivet, Plate		316		
4	Plate, Support, Pressure	Alum	316	316	
4.1	Plate, Support, Vacuum	Alum	316	316	
5	Stud		316		
6	Nut, Hex		316		
7	Washer, Flat		316		
8	Washer, Lock		316		
9	Plug, Pipe		316		
10	Bushing Stem		Fluoropolymer		✓
11	Guide, Stem		316		
12	Stem	Alum	316	316	
13	Rod, Stem		316		
14	Housing, Lower Actuator	Alum	CS	316	
15	Diaphragm, Actuator		FEP		✓
16	Stud		304		
17	Nut, Hex		304		
18	Fitting, Pick-Up		316		
19	Body	Alum	CS	316	
20	Gasket, Actuator		FEP		✓
21	Nut, Hex Jam,		316		
22	Cap, Upper Stem	Alum	316	316	
23	Washer, Bearing		316		
24	Swivel, Ball		316		
25	Cap, Lower Stem	Alum	316	316	
26	Swivel, Socket		316		
27	Seat Ring		316		
28	Snap Ring		SS		
29	O-Ring		Elastomer		✓
30	Retainer, O-Ring		316		
31	O-Ring		Elastomer		✓
32	Pallet, O-Ring	Alum	316	316	
33	Jack Screw		316		
34	Nut, Hex Jam,		316		
35	Bushing, Jack Screw	Alum	316	316	
36	Nut, Hex Jam,		316		
37	Belleville Washer		SS		
38	Washer, Flat		316		
39	Plate, Film Tension	Alum	316	316	
40	Film		FEP		✓
41	Ring, Film Retaining	Alum	316	316	
42	Screw, FH Hex Socket		SS		
43	Nut, Hex		SS		
44	Washer, Lock		SS		
45	Pallet, Film	Alum	316	316	

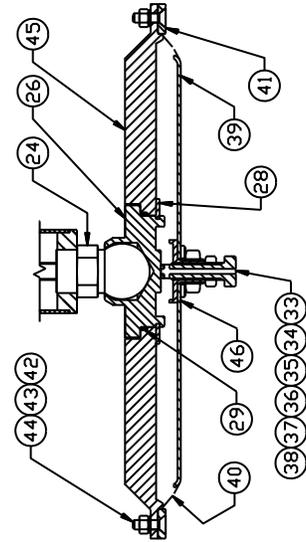


Figure 4: Film Pallet Assembly

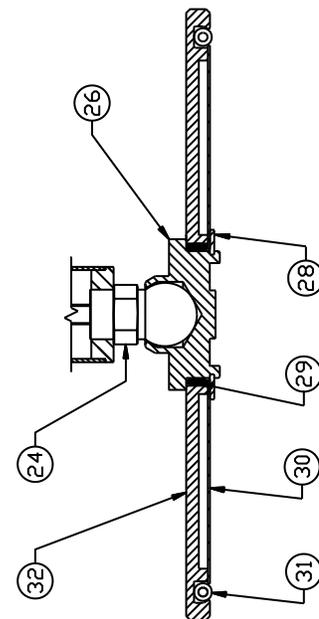


Figure 5: O-Ring Pallet Assembly

ITEM	DESCRIPTION	Material			Spare Parts
		Alum	CS	SS	
46	Washer		FEP		✓
47	Hex Jam Nut		316		
48	O-Ring		Teflon		✓
49	Washer, Flat		316		
50	Washer		FEP		✓
51	Pilot, Model 1401E	SS	SS	316	
52	Male Connector		316		
53	Male Connector		316		
54	Tubing, 3/8 OD (Sense Line)		316		
55	Tee, 3/8 Tubing		316		
56	Check Valve, Model 1900	Alum	316	316	
57	Male Connector		316		
58	Gasket, Spacer		Non Asbestos Fiber		✓
59	Vent		Alum		
60	Cross, 1/2 NPT[F]		316		
61	Plug, 1/2" Pipe		316		
62	Pilot, Model 1401EV	SS	SS	316	
63	Pilot, Model 1402A	SS	SS	316	
64	Cross, 3/8 Tubing		316		
65	Nipple, 1/2 NPT		316		
66	Elbow, Street, 1/2"		316		
67	O-Ring		Elastomer		✓
68	Nipple, 1/4 NPT		316		
76	Lifting Eye		SS		

(✓) Recommended spare parts, included in soft goods kits. Elastomer is Buna-N, EPDM, FKM, FFKM or other as specified by the purchaser.

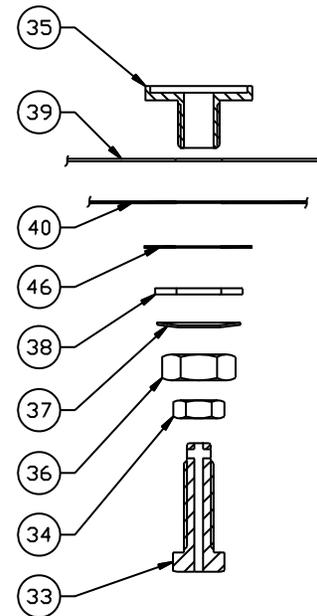


Figure 10: Jackscrew Assembly

Note: Some components are not used on all models; refer to assembly and sub-assembly drawings

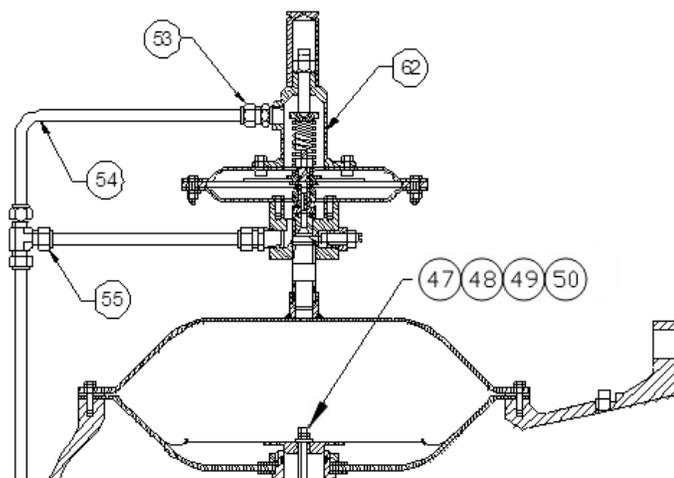
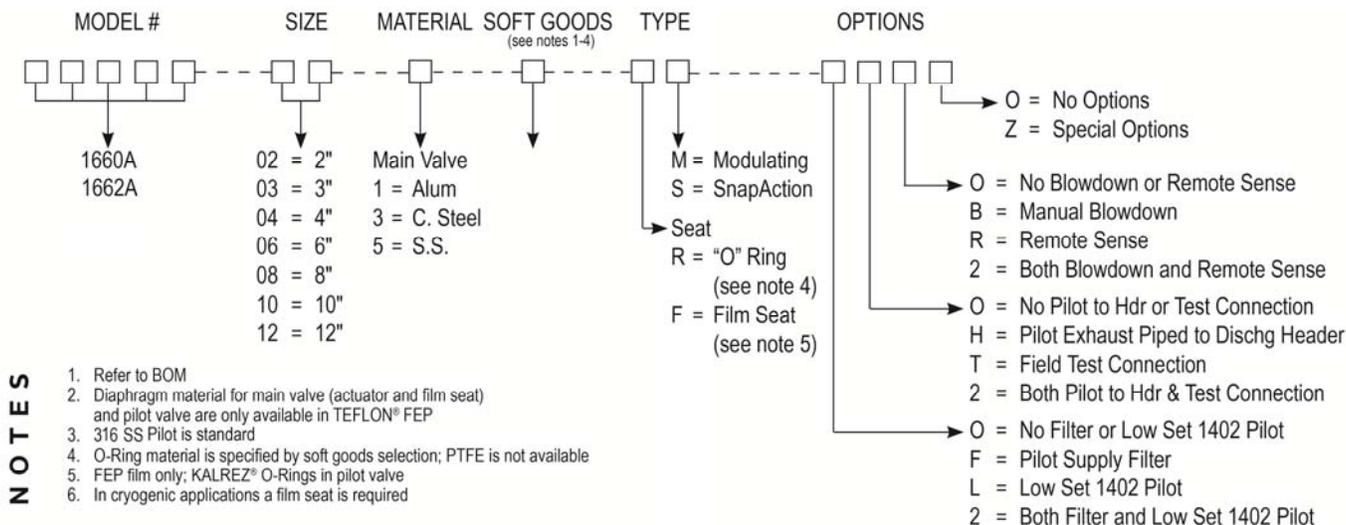


Figure 11: Model 1662A with 1401E Pilot

MODEL NUMBER

The nameplate on the Groth Series 1660A Pilot Operated Valve contains the model number, serial number, set pressure and flow capacity. The model number contains additional information about materials of construction and options. The following chart will assist in relating the model number to the specifications of your pilot operated valve:



NOTES

1. Refer to BOM
2. Diaphragm material for main valve (actuator and film seat) and pilot valve are only available in TEFLON® FEP
3. 316 SS Pilot is standard
4. O-Ring material is specified by soft goods selection; PTFE is not available
5. FEP film only; KALREZ® O-Rings in pilot valve
6. In cryogenic applications a film seat is required

EXAMPLE

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Indicates a 6" Model 1660A (pressure relief only) with carbon steel body and "O-Ring" seat using VITON® soft goods with snap action pilot with remote pilot sense connection and no specials.

PRODUCT LIMITED WARRANTY

- | | |
|---|--|
| <p>A. Seller warrants that products which are manufactured by Seller, are manufactured in accordance with published specifications and free from defects in materials and/or workmanship for a period of (12) twelve months. Seller, at its option, will repair or replace any products returned intact to the factory, transportation charges prepaid, which Seller, upon inspection, shall determine to be defective in material and/or workmanship. The foregoing shall constitute the sole remedy for any breach of Seller's warranty.</p> <p>B. THERE ARE NO UNDERSTANDINGS, AGREEMENTS, REPRESENTATIONS, OR WARRANTIES, EXPRESS OR IMPLIED, (INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING PRODUCTS) UNLESS SPECIFIED IN THE SALES CONTRACT. THIS CONTRACT STATES THE ENTIRE OBLIGATION OF SELLER.
Seller makes no warranties, either express or implied, except as provided herein, including without limitation</p> | <p>thereof, warranties as to marketability, merchantability, for a particular purpose or use, or against infringement of any patent of products. In no event shall Seller be liable for any direct, incidental or consequential damages of any nature, or losses or expenses resulting from any defective new product or the use of any such product, including any damages for loss of time, inconvenience, or loss of use of any such product.</p> <p>C. The original Manufacturer shall be solely responsible for the design, development, supply, production, and performance of its products hereunder, and the protection of its trade name or names, if any. It assumes no responsibility, for products modified or changed in any way by its agent or customer. Any such modifications or changes to products sold by Seller hereunder shall make the product limited warranty null and void.</p> <p>D. The Manufacturer shall be under no obligation to manufacture, sell, or supply, or to continue to manufacture, sell or supply any of the Products</p> |
|---|--|

Groth Corporation has representatives throughout the world.
 Contact Groth Corporation or visit us on the web for the authorized representative in your area.



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APPROVALS:

Effective Date: 3/27/15_____

Engineering: _____

Date: _____

Quality Assurance: _____

Date: _____

REVISION STATUS:

REV	ECN#	EFFECTIVE DATE	ENG. APPROVAL	DATE	Q.A. APPROVAL	DATE
IR						
A	12577	3/27/2015				
E	12637	7/06/2015				
F	12888	12/16/2016				