Type 99 Pressure Reducing Regulator

WARNING

Since a pilot-operated regulator is constructed of both a pilot and a main valve, care should be used not to exceed the maximum inlet pressure shown on the nameplate of either unit. When inlet pressure exceeds the pilot limitation, a pilot supply reducing regulator and/or relief valve is required.

WARNING

Failure to follow these instructions or to properly install and maintain this equipment could result in an explosion and/or fire causing property damage and personal injury or death.

Fisher™ regulators must be installed, operated and maintained in accordance with federal, state and local codes, rules and regulations and Emerson Process Management Regulator Technologies, Inc. instructions.

If the regulator vents gas or a leak develops in the system, service to the unit may be required. Failure to correct trouble could result in a hazardous condition.

Call a gas service person to service the unit. Only a qualified person must install or service the regulator.

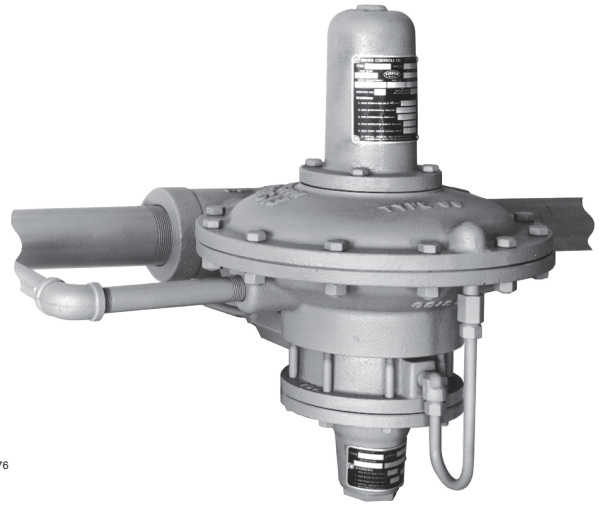

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Figure 1. *Type 99 Regulator with Type 61H (High Pressure) Pilot*

Introduction

Scope of the Manual

This manual describes and provides instructions for installation, startup, adjustment and parts ordering information of Type 99 pressure reducing regulator complete with standard P590 Series integral filter. Information on other equipment used with this regulator can be found in separate manuals.

Specifications

Specifications and ratings for various Type 99 constructions are listed in the Specifications section below. Some specifications for a given regulator as it originally comes from the factory are stamped on the nameplates located on the pilot and actuator spring cases. An additional nameplate may be installed on the pilot to indicate a regulator with O-ring stem seal. These regulators and their installations should be checked for compliance with applicable codes.

Available Constructions

Type 99L: Type 99 with Type 61L pilot which has 2 in. w.c. to 20 psig / 5 mbar to 1.4 bar pressure range

Type 99LD: Type 99 with Type 61LD pilot which has a narrower proportional band than the standard Type 61L pilot

Type 99LE: Type 99 with Type 61LE pilot which has a broader proportional band than the standard Type 61L pilot

Type 99H: Type 99 with Type 61H pilot which has 10 to 65 psig / 0.69 to 4.5 bar pressure range

Type 99HP:v Type 99 with Type 61HP pilot has 35 to 100 psig / 2.4 to 6.9 bar pressure range

Body Size and End Connection Styles

NPS 2 / DN 50 body with NPT, CL125 FF, CL150 RF, CL250 RF and CL300 RF end connections

Maximum Allowable Inlet Pressure(1)

160 psig / 11.0 bar: Type 61LD pilot

400 psig / 27.6 bar: Type 61L, 61LE or 61H pilots

1000 psig / 69.0 bar: Type 61HP pilot, along with Type 1301F pilot supply regulator and Type H110 relief valve (1/2 in. / 13 mm orifice only)

Outlet (Control) Pressure Ranges(1)

See Table 1

Approximate Proportional Bands

See Table 2

Maximum Allowable Pressure Drop(1)

See Table 3

Maximum Actuator Pressures(1)

Operating: 100 psig / 6.9 bar

Emergency: 110 psig / 7.6 bar

Maximum Pilot Spring Case Pressure for Pressure Loading(1)(2)

Types 61L, 61LD and 61LE: 50 psi / 3.4 bar with special steel closing cap

Types 61H and 61HP: 100 psi / 6.9 bar

Minimum Differential Pressure Required for Full Stroke

See Table 3

Maximum Rated Travel

1/4 in. / 6.4 mm

Temperature Capabilities(1)

With Nitrile (NBR) / Neoprene (CR) / Nylon (PA): -20 to 180°F / -29 to 82°C

With Fluorocarbon (FKM): 0 to 300°F / -18 to 149°C

1. The pressure/temperature limits in this Instruction Manual and any applicable standard or code limitation should not be exceeded.
2. For stability or overpressure protection, a pilot supply regulator may be installed in the pilot supply tubing between the main valve and pilot.

Description

The Type 99 gas regulator provides a broad capacity for controlled pressure ranges and capacities in a wide variety of distribution, industrial and commercial applications.

A Type 99 regulator has a Type 61L, 61LE or 61LD (low pressure); Type 61H (high pressure); or Type 61HP (extra high pressure) pilot integrally mounted to the actuator casing as shown in Figure 1. The Type 99 regulator can handle up to 1000 psig / 69.0 bar inlet pressure (the 1000 psig / 69.0 bar regulator requires a Type 1301F pilot supply regulator and a Type H110 pop relief valve). The pilot supply regulator reduces inlet pressure to a usable 200 psig / 14 bar for the extra high-pressure pilot. The standard Type 99 regulator comes with O-ring seals on the guide bushing and valve carrier to keep main valve body outlet pressure from interfering with outlet pressure in the lower casing assembly.

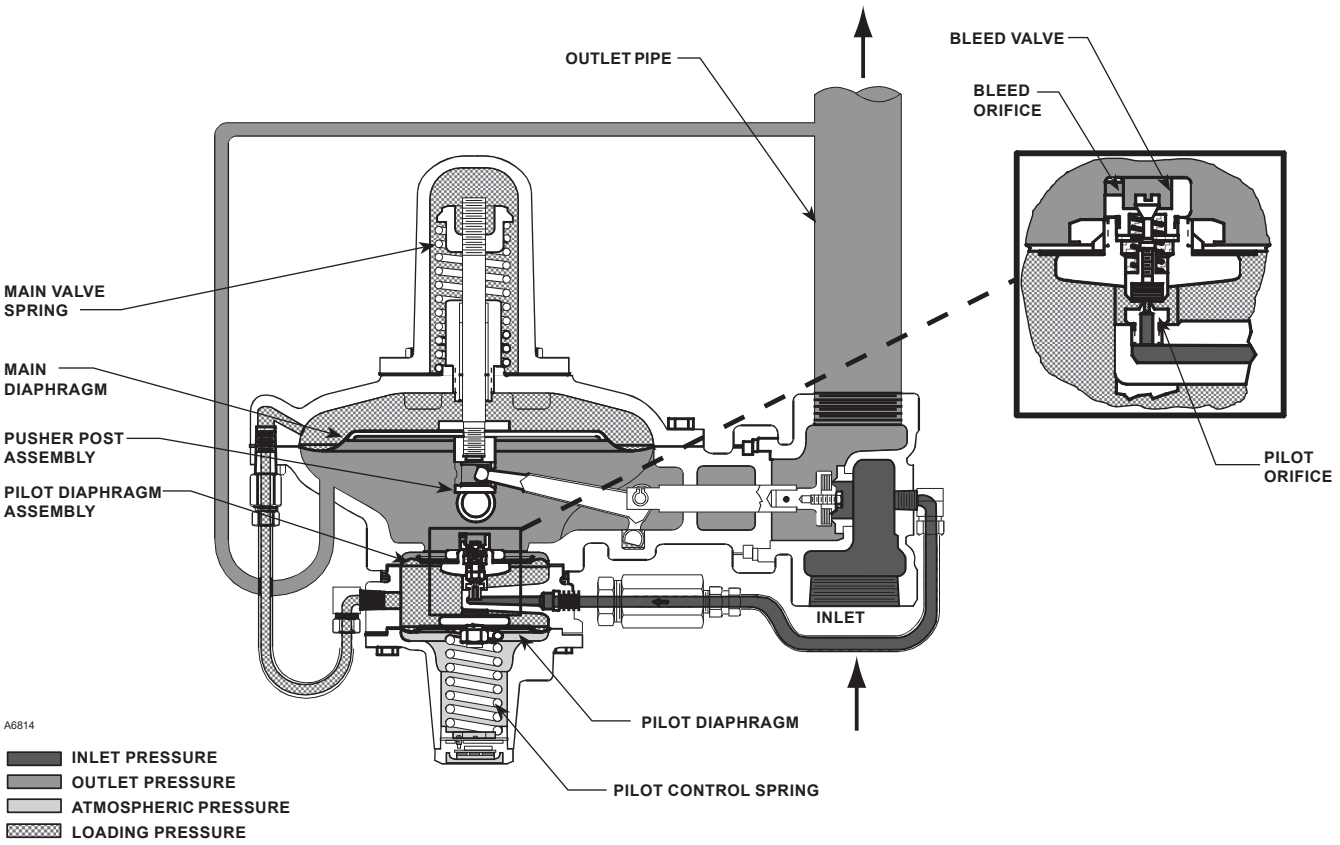


Figure 2. *Schematic of Type 99 Regulator with Type 61L (Low Pressure) Pilot*

Principle of Operation

The key to the operation of a Type 99 regulator is the yoked double-diaphragm pilot. Fast response and accuracy are made possible by the amplifying effect of the pressure-balanced pilot and by the two-path control system. The function of the pilot is to sense change in the controlled pressure and amplify it into a larger change in the loading pressure. Any changes in outlet pressure act quickly on both the actuator diaphragm and the loading pilot, thus providing the precise pressure control that is a characteristic of a two-path system.

A typical pilot has an approximate gain of 20, which means the outlet pressure needs to droop only 1/20 as much as a direct-operated regulator in order to obtain the same pressure differences across the main diaphragm. Advantages of a pilot-operated regulator are high accuracy and high capacity.

Upstream or inlet pressure is utilized as the operating medium, which is reduced through pilot operation to load the main diaphragm chamber. Tubing connects the inlet pressure to the pilot through a filter assembly. Downstream or outlet pressure registers underneath the main diaphragm through the downstream control line.

In operation, assume the outlet pressure is less than the setting of the pilot control spring. The top side of the pilot diaphragm assembly will have a lower pressure than the setting of the spring. Spring forces the diaphragm head assembly upward, opening the relay or inlet orifice. Additional loading pressure is supplied to the pilot body and to the top side of the main diaphragm.

This creates a higher pressure on the top side of the main diaphragm than on the bottom side, forcing the diaphragm downward. This motion is transmitted through a lever, which pulls the valve disk open, allowing more gas to flow through the valve.

When the gas demand in the downstream system has been satisfied, the outlet pressure increases. The increased pressure is transmitted through the downstream control line and acts on top of the pilot diaphragm head assembly. This pressure exceeds the pilot spring setting and forces the head assembly down, closing the orifice. The loading pressure acting on the main diaphragm bleeds to the downstream system through a small slot between the pilot bleed valve and the bleed orifice.

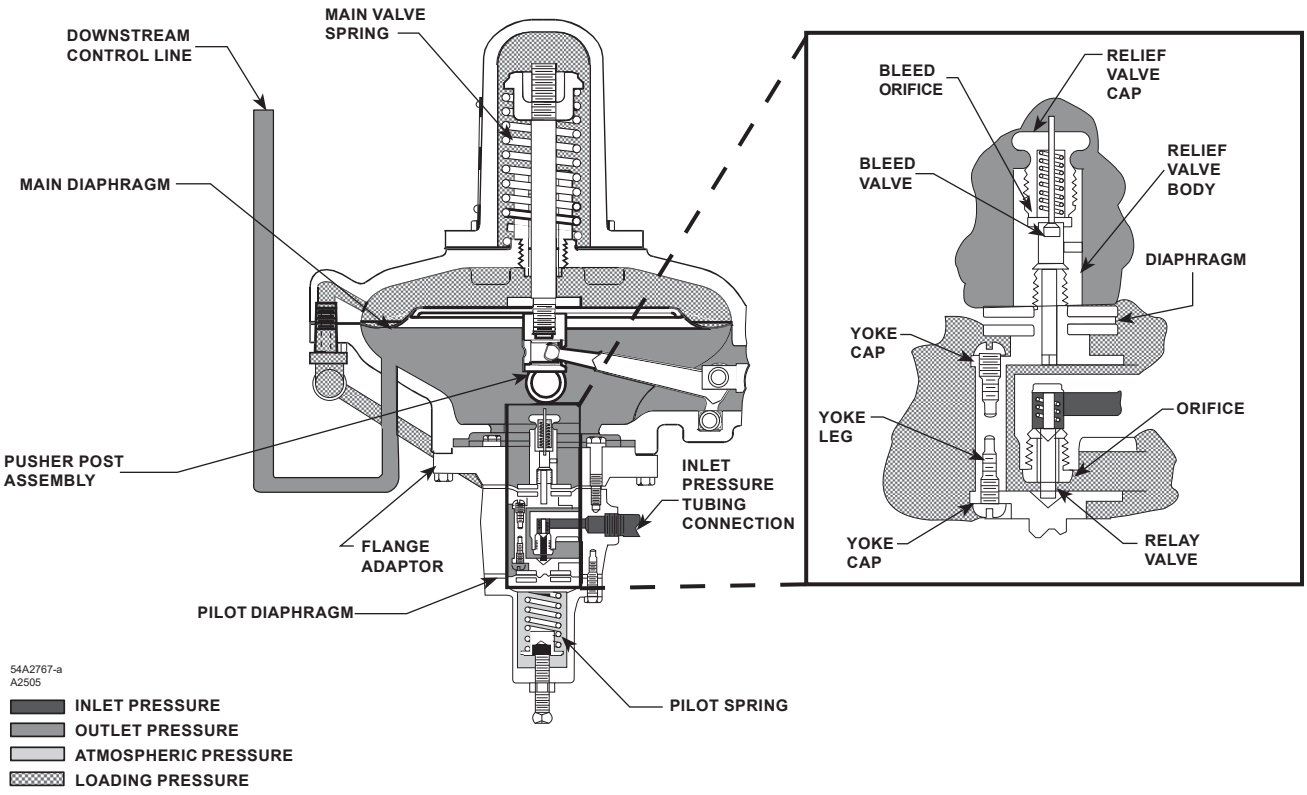


Figure 3. *Schematic of Type 99 Regulator with Type 61HP (Extra High Pressure) Pilot*

Table 1. *Outlet Pressure Ranges*

PILOT TYPE	MAXIMUM PILOT SUPPLY PRESSURE		OUTLET (CONTROL) PRESSURE RANGE		PILOT CONTROL SPRING					
					Part Number	Color Code	Wire Diameter		Free Length	
	psig	bar	psig	bar			In.	mm	In.	mm
61L	400	27.6	2 to 4 in. w.c.[1]	5 to 10 mbar[1]	1B558527052	Orange	0.07	1.83	3.78	96.0
			3 to 12 in. w.c.[1]	7 to 30 mbar[1]	1C680627222	Unpainted	0.08	2.03	3.00	76.2
61LD	160	11.0	0.25 to 2	0.02 to 0.14	1B886327022	Red	0.11	2.77	2.75	69.9
			1 to 5	0.07 to 0.35	1J857827022	Yellow	0.14	3.61	2.75	69.9
61LE	400	27.6	2 to 10	0.14 to 0.69	1B886427022	Blue	0.17	4.37	2.88	73.2
			5 to 15	0.35 to 1.0	1J857927142	Brown	0.19	4.75	3.03	77.0
			10 to 20	0.69 to 1.4	1B886527022	Green	0.21	5.26	3.13	79.5
61H	400	27.6	10 to 65	0.69 to 4.5	0Y066427022	Green stripe	0.36	9.22	6.00	152
61HP	600	41.4	35 to 100	2.4 to 6.9	1D387227022	Blue	0.20	5.08	1.69	42.9

1. Type 61LD pilot only.

Table 2. *Proportional Bands*

PILOT TYPE	PILOT CONTROL SPRING						PROPORTIONAL BAND	
	Part Number	Color Code	Wire Diameter		Free Length			
			In.	mm	In.	mm	In. w.c.	mbar
61LD	1B558527052	Orange	0.075	1.91	4.13	105	0.1 to 0.5	0.25 to 1
	1C680627222	Unpainted	0.080	2.03	3.25	82.6		
61L	1B886327022	Red	0.109	2.77	2.75	69.9	1.0 to 2.0	2 to 5
61LD	1B886327022	Red	0.109	2.77	2.75	69.9	0.3 to 1.0	0.62 to 2
61LE	1B886327022	Red	0.109	2.77	2.75	69.9	5.0 to 8.0	12 to 20
61L, 61LD and 61LE	1J857827022	Yellow	0.142	3.61	2.75	69.9	0.1 to 0.3 psi	0.01 to 0.02 bar
	1B886427022	Blue	0.172	4.37	2.88	73.2		
	1J857927142	Brown	0.187	4.75	2.88	73.2		
	1B886527022	Green	0.207	5.26	3.13	79.5		
61H	0Y066427022	Green stripe	0.363	9.22	6.00	152	0.1 to 0.3 psi	0.01 to 0.02 bar
61HP	1D387227022	Blue	0.200	5.08	1.69	42.9	1.0 to 2.0 psi	0.07 to 0.14 bar

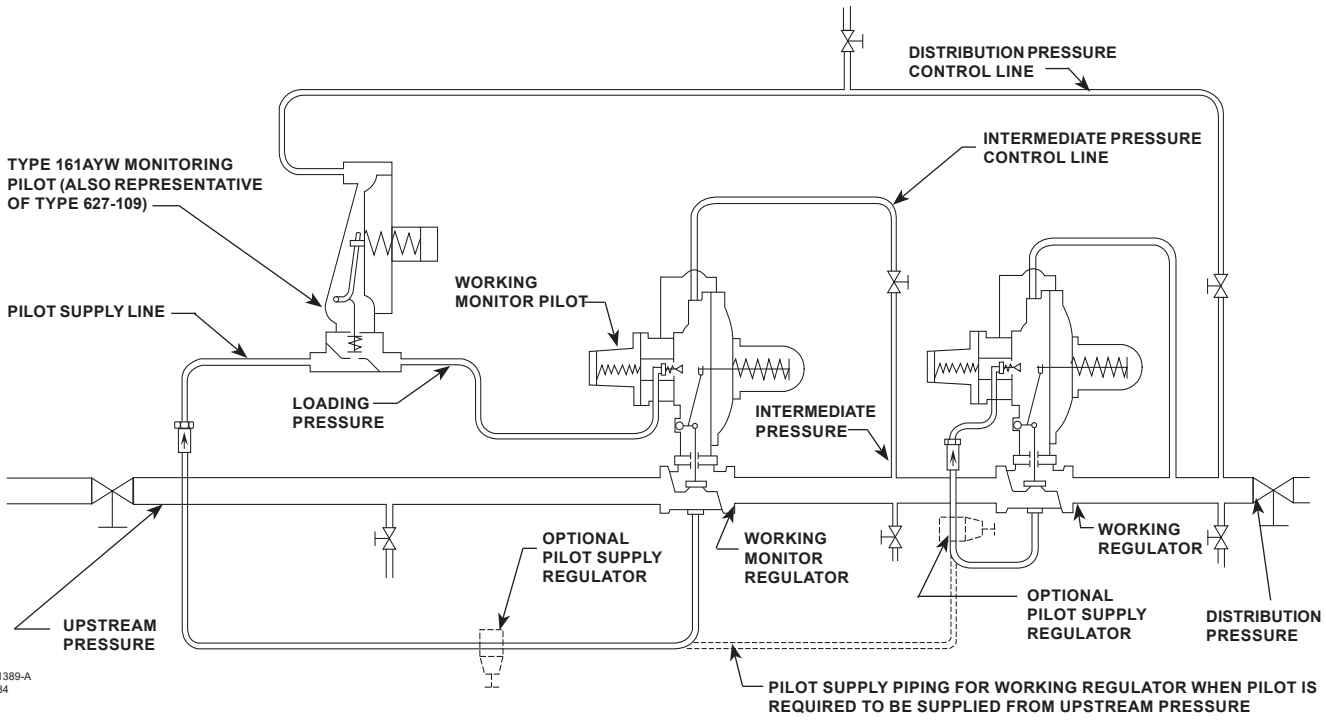
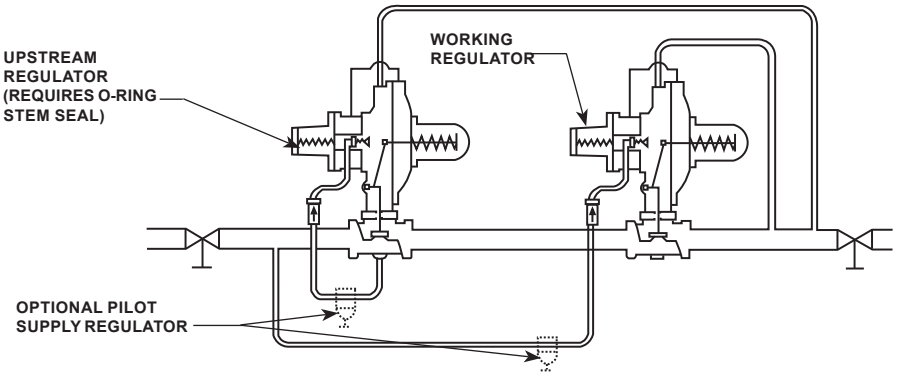
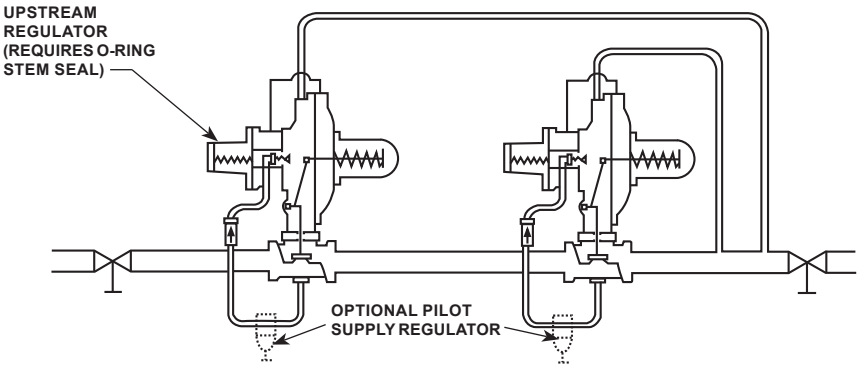


Figure 4. *Working Monitor Installation*



FLEXIBLE ARRANGEMENT THAT PERMITS WIDE-OPEN MONITOR TO BE EITHER UPSTREAM OR DOWNSTREAM



MINIMUM PIPING ARRANGEMENT THAT REQUIRES WIDE-OPEN MONITOR TO ALWAYS BE UPSTREAM

Figure 5. *Typical Wide-Open Monitor Installations*

Table 3. *Maximum Allowable Pressure Drop and Minimum Differential Pressures*

MAXIMUM ALLOWABLE PRESSURE DROP		MAIN VALVE SPRING					MINIMUM DIFFERENTIAL PRESSURE FOR FULL STROKE		DISK MATERIAL	MAXIMUM ORIFICE SIZE(1)(5)	
		Part Number	Wire Diameter		Free Length						
psig	bar		In.	mm	In.	mm	psig	bar		In.	mm
25	1.7	1C277127022	0.148	3.76	6.00	152	0.75	0.05	Nitrile (NBR), Fluorocarbon (FKM)	1-1/8	29
50	3.4	1N801927022	0.156	3.96	7.13	181	1.50	0.10	Neoprene (CR), Fluorocarbon (FKM)	1-1/8	29
150	10.3	1B883327022	0.187	4.75	6.63	168	3.00	0.21	Nitrile (NBR), Neoprene (CR), Fluorocarbon (FKM)	1-1/8	29
175(2)	12.1(2)	1B883327022	0.187	4.75	6.63	168	3.00	0.21	Nitrile (NBR), Neoprene (CR), Fluorocarbon (FKM)	7/8	22
250	17.2	1B883327022	0.187	4.75	6.63	168	3.00	0.21	Nitrile (NBR), Neoprene (CR), Fluorocarbon (FKM)	7/8	22
300	20.7	0W019127022	0.281	7.22	6.00	152	10.0	0.69	Nylon (PA)	1-1/8(3)	29(3)
400	27.6	0W019127022	0.281	7.22	6.00	152	10.0	0.69	Nylon (PA)	7/8	22
1000	69.0	0W019127022	0.281	7.22	6.00	152	10.0	0.69	Nylon (PA)	1/2(4)	13(4)

1. Can use all orifice sizes up to maximum size listed. See Table 4.
2. CL125 FF flanged body only.
3. 1-1/8 in. / 29 mm is the only orifice available for 300 psig / 20.7 bar maximum inlet pressure regulator.
4. 1/2 in. / 13 mm is the only orifice available for 1000 psig / 69.0 bar maximum inlet pressure regulator.
5. O-ring seat construction is only available for 7/8 and 1-1/8 in. / 22 and 29 mm orifice sizes.

Table 4. *Orifice Sizes*

TRIM CONSTRUCTION	ORIFICE SIZE	
	In.	mm
Restricted capacity trim, Straight bore — Composition or Nylon (PA) disk seat only	1/2(1) 3/4	13(1) 19
Restricted capacity trim(2), Stepped bore — Composition or Nylon (PA) disk seat only	7/8 x 3/8 7/8 x 1/2 7/8 x 5/8	22 x 10 22 x 13 22 x 16
Full capacity trim, Composition or Nylon (PA) disk or O-ring seat	7/8 1-1/8	22 29

1. 1/2 in. / 13 mm is the only orifice size available for 1000 psig / 69.0 bar maximum inlet pressure regulator.
2. Maximum inlet rating is equivalent to the 7/8 in. / 22 mm orifice.

Normally, excess loading pressure slowly escapes downstream around the bleed valve (Figure 2) or through the relief valve body (Figure 3). Since loading pressure needs to exceed outlet pressure only moderately to stroke the main valve fully open, a continued increase in loading pressure differential extends the main diaphragm and the pusher post assembly far enough to separate the bleed valve and the bleed orifice. This action permits quick dumping of excess loading pressure into the downstream system.

With a decrease in loading pressure on top of the main diaphragm, the main spring exerts an upward force on the diaphragm rod connected to the main diaphragm, pulling it in an upward direction. This moves the main valve towards the seat, decreasing the flow to the downstream system.

The pilot valve diaphragm acts as a sealing member for the loading chamber and as a balancing member to the upper pilot diaphragm. These two diaphragms are connected by a yoke so any pressure change in the pilot chamber has little effect on the position of the pilot valve. Therefore, the active diaphragm in the pilot is the upper pilot diaphragm and the pressure on the top side of this diaphragm opposes the force of the pilot control spring.

Monitoring Systems

Monitoring regulators serve as overpressure protection devices to limit system pressure in the event of an open failure of a working regulator feeding the system. Two methods of using Type 99 regulators in monitoring applications are:

Table 5. *Working Monitor Performance*

MONITORING PILOT INFORMATION								MINIMUM PRESSURE AT WHICH WORKING MONITORREGULATOR CAN BE SET
Construction	Spring Range		Pilot Spring					
			Part Number	Wire Diameter		Free Length		
	psig	bar		In.	mm	In.	mm	
Type 161AYW with 1/8 in. / 3.2 mm orifice size and 150 psig / 10.3 bar maximum allowable inlet pressure	3 to 12 in. w.c. 11 to 25 in. w.c.	7 to 30 mbar 27 to 62 mbar	1B653927022 1B537027052	0.105 0.114	2.67 2.90	3.750 4.312	95.2 109	3 in. w.c. / 7 mbar over normal distribution pressure
	0.9 to 2.5 2.5 to 4.5 4.5 to 7	0.06 to 0.17 0.17 to 0.31 0.31 to 0.48	1B537127022 1B537227022 1B537327052	0.156 0.187 0.218	3.96 4.75 5.54	4.060 3.937 3.980	103 100 101	0.5 psi / 0.03 bar over normal distribution pressure
3/4 NPT Type 627-109 with 1/8 in. / 3.2 mm orifice size and 1000 psig / 69.0 bar maximum inlet pressure / body rating for ductile iron body	5 to 20 15 to 40	0.34 to 1.4 1.0 to 2.8	10B3076X012 10B3077X012	0.170 0.207	4.32 5.26	3.190 3.190	81.0 81.0	3.0 psi / 0.21 bar over normal distribution pressure
	35 to 80 70 to 150	2.1 to 5.5 4.8 to 10.3	10B3078X012 10B3079X012	0.262 0.313	6.65 7.95	3.200 3.070	81.3 78.0	5.0 psi / 0.34 bar over normal distribution pressure

Working Monitor

On a working monitor installation (Figure 4), the control line of the monitoring pilot is connected downstream of the working regulator. During normal operation, distribution pressure causes the monitoring pilot to stand wide open. Full pilot supply pressure enters the working monitor pilot and permits the working monitor regulator to control at its intermediate pressure setting.

Open failure of the working regulator increases distribution pressure as the working regulator goes wide open. Intermediate pressure is then ignored by the monitoring regulator, which controls downstream pressure at its own pressure setting (slightly higher than the normal control pressure).

The monitoring pilot should be upstream of the working monitor regulator. This enables a closer setpoint between the working regulator and the monitoring pilot. Special Types 161AYW and 627-109 monitoring pilots with quick-bleed operation have been designed to give faster response to abnormal downstream conditions. Table 5 gives the spread between normal distribution pressure and the minimum pressure at which the working monitor regulator can be set to take over if the working regulator fails open.

Wide-Open Monitor

The control line of the upstream regulator is connected downstream of the second regulator (Figure 5), so that during normal operation the monitoring regulator is standing wide open with the reduction to distribution pressure being taken across the working regulator. Only in case of open failure of the working regulator does the wide-open monitoring regulator take control at its slightly higher setting.

The upstream regulator must have an O-ring seal on the valve carrier assembly. This seals off the leak path that otherwise would let line pressure ahead of the working regulator inlet try to close the wide-open monitoring regulator.

Installation

WARNING

Personal injury, equipment damage or leakage due to escaping gas or bursting of pressure containing parts might result if this regulator is overpressured or is installed where service conditions could exceed the limits for which the regulator was designed or where conditions exceed any ratings of the adjacent piping or piping connections. To avoid such injury or damage, provide pressure relieving or pressure limiting devices (as required by the appropriate code, regulation or standard) to prevent service conditions from exceeding those limits.

A regulator may vent some gas to the atmosphere in hazardous or flammable gas service, vented gas might accumulate and cause personal injury, death or property damage due to fire or explosion. Vent a regulator in hazardous gas service to a remote, safe location away from air intakes or any hazardous location. The vent line or stack opening must be protected against condensation or clogging.

Clean out all pipelines before installation and check to be sure the regulator has not been damaged or collected foreign material during shipping.

Apply pipe compound to the external pipe threads only with a threaded body or use suitable line gaskets and good bolting practices with a flanged body. This regulator may be installed in any position desired as long as the flow through the body is in the direction indicated by the arrow on the body. Install a three-valve bypass around the regulator if continuous operation is necessary during maintenance or inspection.

Although the standard orientation of the actuator and pilot to the main valve body is as shown in Figure 1, this orientation may be changed as far as the inlet tubing (key 24, Figure 9 or 17) will permit by loosening the union nut (key 14, Figure 9), rotating the actuator lower casing (key 29, Figure 9) as desired and tightening the union nut. To keep the pilot spring case from being plugged or the spring case from collecting moisture, corrosive chemicals or other foreign material, the vent must be pointed down, oriented to the lowest possible point on the spring case or otherwise protected. Vent orientation may be changed by rotating the spring case with respect to the pilot body.

To remotely vent a low-pressure pilot, install the vent line in place of the pressed-in vent assembly (key 60, Figure 9). Install obstruction-free tubing or piping into the 1/4 in. / 6.4 mm vent tapping. Provide protection on a remote vent by installing a screened vent cap into the remote end of the vent pipe.

To remotely vent a high-pressure pilot, remove the threaded-in vent assembly (key 72, Figure 12) from the high-pressure pilot spring case and install obstruction-free tubing or piping into the 1/4 in. / 6.4 mm vent tapping. Provide protection on a remote vent by installing a screened vent cap into the remote end of the vent pipe.

An upstream pilot supply line is not required because of the integral pilot supply tubing (key 24, Figure 9 or 17). However, as long as the 1/4 NPT tapping in the main valve body is plugged, this tubing may be disconnected from both the main valve and filter assembly (key 75, Figures 9 and 16) in order to install a pilot supply line from a desired remote location into the filter.

If the maximum pilot inlet pressure will be exceeded by main valve pressure, install a separate pressure reducing regulator (if not already provided) in the pilot supply line.

A Type 99 regulator has two 1/2 NPT control line pressure taps on opposite sides of the lower casing (key 29, Figure 9). The regulator normally comes from the factory with the tap closest to the regulator outlet left unplugged for the downstream control line as shown in Figure 1 and with opposite tap plugged.

Attach the control line from the unplugged tap 2 to 3 ft / 0.61 to 0.91 meter downstream of the regulator in a straight run of pipe. If impossible to comply with this recommendation due to the pipe arrangement, it may be better to make the control line tap nearer the regulator outlet rather than downstream of a block valve. Do not install the tap near any elbow, swage or nipple which might cause turbulence.

In many instances, it will be necessary to enlarge the downstream piping to keep flow velocities within good engineering practices. Expand the piping as close to the regulator outlet as possible.

WARNING

Adjustment of the pilot control spring to produce an outlet pressure higher than the upper limit of the outlet pressure range for that particular spring can cause personal injury or equipment damage due to bursting of pressure-containing parts. Dangerous accumulation of gases may also cause bursting if the maximum actuator emergency casing pressure in the Specifications section is exceeded. If the desired outlet pressure is not within the range of the pilot control spring, install a spring of the proper range according to the Maintenance section.

Each regulator is factory-set for the pressure setting specified on the order. If no setting was specified, outlet pressure was factory-set at the midrange of the pilot control spring. In all cases, check the control spring setting to make sure it is correct for the application.

Overpressure Protection

The Type 99 regulator has an outlet pressure rating lower than its inlet pressure rating. Complete downstream overpressure protection is required if the actual inlet pressure can exceed the regulator outlet pressure rating or the pressure ratings of any downstream equipment. Although the Type H110 relief valve provides sufficient relief capacity to protect

the extra high-pressure pilot of 1000 psig / 69.0 bar maximum inlet pressure in case the Type 1301F supply regulator fails open, this protection is insufficient if the main valve body fails open. Regulator operation within ratings does not preclude the possibility of damage from external sources or from debris in the lines. A regulator should be inspected for damage periodically and after any overpressure condition.

WARNING

The 1000 psig / 69.0 bar maximum inlet regulator must not be used on hazardous gas service unless the Type H110 relief valve can be vented into a safe area. If vented gas can accumulate and become a hazard in enclosed conditions such as in a pit, underground or indoors, the relief valve must be repiped to carry the gas to a safe location.

A repiped vent line or stack must be located to avoid venting gas near buildings, air intakes or any hazardous location. The line or stack opening must be protected against condensation, freezing and clogging.

Startup

Key numbers are referenced in Figures 9 through 15 for a low or high-pressure pilot and in Figure 18 for an extra high-pressure pilot.

1. Very slowly open the upstream block valve.
2. Slowly open the hand valve (if used) in the control line. The unit will control downstream pressure at the pilot control spring setting. If changes in the pressure setting are necessary, follow the procedure in the Adjustment section.
3. Slowly open the downstream block valve.
4. Slowly close the bypass valve, if any.
5. Check all connections for leaks.

Adjustment

With proper installation completed, perform the adjustment procedure while using pressure gauges to monitor pressure.

The only adjustment on the regulator is the reduced pressure setting affected by the pilot control spring (key 43, Figure 9, 12, 14 or 18). Remove the closing cap assembly (key 46, Figure 9, 14 or 15) and turn the adjusting screw (key 45, Figure 9, 14, 15 or 18). Turning the adjusting screw clockwise into the spring case increases the controlled or reduced pressure setting. Turning the adjusting screw counterclockwise decreases the reduced pressure setting. Always replace the closing cap after making adjustments.

Shutdown

Installation arrangements may vary, but in any installation, it is important to open and close valves slowly and the outlet pressure be vented before venting inlet pressure to prevent damage caused by reverse pressurization of the regulator.

1. Isolate the regulator from the system. Close the upstream block valve to the pilot and regulator inlet.
2. Close the downstream block valve to the pilot sense connection and the regulator outlet.
3. Vent the downstream pressure by slowly opening the vent valve to vent all pressures.
4. Vent inlet pressure slowly through the vent valve to release any remaining pressure in the regulator.

Maintenance

Regulator parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement of parts depend on the severity of service conditions or the requirements of local, state and federal rules and regulations.

WARNING

Avoid personal injury or damage to property from sudden release of pressure or uncontrolled gas or other process fluid. Before starting to disassemble, isolate the pilot or regulator from all pressure and cautiously release trapped pressure from the pilot or regulator. Use gauges to monitor inlet, loading and outlet pressures while releasing these pressures.

On reassembly of the regulator, it is recommended that a pipe thread sealant be applied to pressure connections and fittings as indicated in Figures 7 and 9 and lubricant be applied to sliding and bearing surfaces as indicated in Figures 7 and 9, and that an anti-seize compound be applied to adjusting screw threads and other areas indicated in Figures 9 and 11.

Actuator and Standard P590 Series Filter

This procedure is to be performed if changing the main spring and spring seat for those of a different range, or if inspecting, cleaning or replacing any other parts. Unless otherwise indicated, part key numbers for a Type 99 regulator with low or high-pressure pilot and disk or O-ring seat are referenced in Figures 9 through 15, part key numbers unique to the 1000 psig / 69.0 bar maximum inlet regulator are referenced in Figure 17 and part key numbers for a Type 61HP (extra high pressure) pilot are referenced in Figure 18.

1. Access to all internal actuator parts can be gained without removing the main valve body from the line. Disconnect the loading tubing from the upper casing.

CAUTION

If the regulator has an indicator assembly, perform the following step carefully to avoid bending the travel indicator stem (key 103, Figure 6).

Note

The O-rings and gaskets (keys 111 and 108, Figure 6) in the indicator assembly are static seals and need not be disturbed, unless they are leaking.

2. Remove the four cap screws (key 58, Figure 9) and lift off the spring case (key 1). Remove the travel indicator stem, if any, by unscrewing the indicator stem adaptor (key 101, Figure 6).
3. Remove the main spring seat (key 2, Figure 9) and main spring (key 3).
4. Remove the 12 cap screws (key 12, Figure 9) and hex nuts (key 13), and lift off the upper casing.
5. Remove the diaphragm (key 11, Figure 9) and diaphragm plate (key 10) by tipping it so that the lever (key 9) slips out of the pusher post (key 8).
6. Separate the diaphragm (key 11, Figure 9) and diaphragm plate (key 10) by unscrewing the diaphragm rod (key 4) from the pusher post (key 8). Inspect the diaphragm (key 11) and pusher post gasket (key 7). Either part must be replaced if it is damaged or no longer pliable.
7. If the unit has a stem seal O-ring (key 64, Figure 7 or 17), this O-ring may be replaced by removing the retaining ring or cotter pin (key 28, Figure 9) and disconnecting the lever (key 9) from the valve carrier (key 26, Figure 9 or 17), removing the union nut (key 14, Figure 9), disconnecting the pilot supply tubing (key 24, Figure 9 or 17), and sliding the lower casing (key 29) away from the valve body (key 17, Figure 9), with a disk or O-ring seat, the valve carrier must be pulled out of the lower casing (key 29, Figure 9 or 17) to gain access to the O-ring. Another O-ring, held captive by the pressed-in bushing, is part of the lower casing assembly on a stem seal unit and normally does not require replacement.
8. If clogging is suspected in the upstream regulator passages, disconnect the pilot supply tubing (key 24, Figure 9 or 17), remove the filter assembly (key 75, Figure 9), and blow through it to check for filter clogging. If necessary, to clean or replace filter parts in a standard P590 Series filter assembly, remove the following as shown in Figure 16: filter body (key 1), machine screw (key 4), spring washer (key 6), gasket (key 7), washers (key 5) and filter element (key 2). Upon reassembly, one of the two washers (key 5) must go between the filter element (key 2) and filter head (key 3) and the other must go between the filter element (key 2) and gasket (key 7).
9. If the lower casing (key 29, Figure 9) was removed, install a new body gasket (key 16) and, with a disk or O-ring seat, slide the valve carrier (key 26) into the casing (key 29). Then slide the entire assembly into the valve body (disk or O-ring seat) and secure with the union nut (key 14). Secure the lever (key 9) to the valve carrier (key 26) with the retaining ring or cotter pin (key 28).
10. Loosely reassemble the diaphragm (key 11, Figure 9) and diaphragm plate (key 10) so that the bolt holes (key 11) and loading connection hole in the diaphragm can be properly aligned with the corresponding holes in the lower casing (key 29) when the lever (key 9) is fitted properly into the pusher post assembly (key 8). When this orientation is made, install the collar (key 6) and tighten the diaphragm rod (key 4) into the pusher post (key 8).

11. In order for the regulator to operate properly, the assembled collar (key 6), diaphragm (key 11), diaphragm plate (key 10), pusher post assembly (key 8) and diaphragm rod (key 4) must be mounted on the ball of the lever (key 9) so that the pusher post (key 8) orientation is as shown in Figure 9.
12. Install the upper casing (key 56, Figure 9) and secure it to the lower casing (key 29) with the twelve cap screws (key 12) torque 580 to 920 in-lbs / 65.5 to 104 N•m and hex nuts (key 13). Put lower casing (key 29) back on body and install union nut (key 14).

CAUTION

To avoid part damage due to over compressing the main spring seat (key 2), always use main spring seat 1E242724092 with main spring 0W019127022.

13. Thread the main spring seat (key 2) to the bottom of the diaphragm rod (key 4) threads and then back out 1 revolution.
14. Install a new spring case gasket (key 57, Figure 9), the spring case (key 1) and the four cap screws (key 58) with 340 to 420 in-lbs / 38.4 to 47.5 N•m of torque, making sure the indicator stem, O-ring and gaskets (keys 103, 111 and 108, Figure 6) are installed, if used.
15. Connect the loading tubing, then refer to the Startup section for putting the regulator into operation.

Type 61L, 61LD, 61LE (Low) or 61H (High Pressure) Pilot

This procedure is to be performed if changing the control spring for one of a different range or if inspecting, cleaning or replacing any other pilot parts. Key numbers are referenced in Figure 9 through 15.

1. Remove the closing cap (key 46), if used, and unscrew the adjusting screw (key 45) to relieve control spring compression.
2. Disconnect the loading tubing (key 53) and pilot supply tubing (key 24).
3. Unscrew the eight cap screws (key 47) and remove the pilot assembly from the lower casing (key 29).
4. Use the projecting prong in the relay valve body (key 39) as the restraining member and remove the diaphragm nuts (key 13, Figure 9 and key 51, Figure 11). Separate the parts and inspect the diaphragms (keys 30 and 40) and O-ring seal (key 33). Replace if worn or damaged.
5. Unscrew the bleed orifice (key 52, Figure 11) from the yoke (key 37). Also to be removed with the bleed orifice are the relay disk assembly (key 48) and bleed valve (key 50). These parts can be unthreaded for inspection and replacement, if necessary.
6. When reassembling the pilot, the relay disk holder assembly (key 48, Figure 11) and both diaphragms (key 30, Figure 11 and key 40, Figure 12) should be tightened on the yoke (key 37) after it is placed in the body.

Note

Before putting the relay spring case over the diaphragm, make certain the yoke is square with respect to the prong in the relay body. (The yoke can bind on the prong if it is not square.)

7. Use care in reassembly to be sure the edges of the diaphragms (key 30, Figure 11 and key 40, Figure 12) slip properly into the recess on the lower casing (key 29, Figure 9) and relay valve body (key 39). With the pilot in place, check to see if it can be rocked. If it does not rock, it is in place and the diaphragms (key 30, Figure 11 and key 40, Figure 12) are free of wrinkles. With both diaphragms firmly in place, install the cap screws (key 47, Figure 9) using torque 150 in-lbs / 16.9 N•m of torque. Tighten using a crisscross pattern to avoid placing a strain on the unit. Set the pilot control spring (key 43) according to the adjustment information in the Startup section.
8. Reinstall the closing cap (key 46, if used). If you have a plastic closing cap, be sure that you have a vent (key 60) in place of the pipe plug installed in the low-pressure pilot spring case (key 44).

Type 61HP (Extra High Pressure) Pilot

This procedure is to be performed if changing the control spring for one of a different range, or if inspecting, cleaning or replacing any other pilot parts. Key numbers are referenced in Figure 18 unless otherwise specified.

1. Unscrew the adjusting screw (key 45) to relieve control spring compression.
2. Disconnect the loading tubing (key 53, Figures 9 and 18) and pilot supply tubing (key 24, Figure 9).

3. Remove the six cap screws (key 123) which fasten the spring case (key 44), spring seat (key 68) and control spring (key 43) to the pilot body (key 39).
4. Unscrew the diaphragm nut (key 128) and remove a diaphragm plate (key 41A), diaphragm (key 40) and another diaphragm plate (key 41B).
5. Unscrew the eight cap screws (key 47) and remove the pilot body (key 39) and gasket (key 126). Remove six cap screws (key 35), seal washers and the flange adaptor (key 125).
6. Unscrew the relief valve body (key 119) and remove a diaphragm plate (key 41C), diaphragm (key 30) and another diaphragm plate (key 41D). Inspect the diaphragm inserts (key 150) and both diaphragms (keys 30 and 40). Replace if worn or damaged.
7. The relief valve assembly can be further disassembled for inspection by unscrewing the relief valve cap (key 118).
8. Four machine screws (key 130) hold both yoke caps (keys 37 and 116) to the yoke legs (key 31). Separate these parts to expose the pilot valve.
9. Unscrew the inlet orifice (key 38) to inspect its seat, the inlet valve plug (key 117) and valve spring (key 124).

Note

Make certain that the yoke assembly is square with respect to the cross member of the body casting so that it will not bind on the body.

10. When reassembling, screw in the inlet orifice (key 38) all the way and secure the yoke caps (keys 37 and 116) to the yoke legs (key 31). Replace two diaphragm plates (keys 41B and 41D), the diaphragms (keys 30 and 40) and inserts, two more diaphragm plates (keys 41A and 41C), the diaphragm nut (key 128) and the relief valve assembly.
11. Assemble the control spring (key 43) and spring seat (key 68) into the body and spring case (key 44), being careful that the diaphragms (keys 30 and 40) are free of wrinkles and properly in place, and evenly installing the cap screws (key 123) in a crisscross pattern to avoid placing a strain on the unit. Install the body flange adaptor (key 125) with seal washers (key 126) and cap screws (key 47). Install a new gasket and secure the pilot to the lower casing (key 29) with eight cap screws (key 47). Set the control spring (key 43) according to the adjustment information in the Startup section.

Converting the Pilot

Note

A complete pilot assembly rather than individual parts may be ordered for the following conversion procedure. When a low-pressure pilot is ordered for field conversion of a high-pressure pilot or vice versa, the replacement pilot assembly comes complete with a pilot cover (key 132, Figure 9). Remove this cover before installing the replacement pilot on the existing regulator. The cover can then be installed on the removed pilot to form a complete Type 61 (low or high pressure) pilot for use elsewhere.

When changing one pilot construction (low pressure, high pressure or extra high pressure) for another, all parts attached to the lower casing (key 29, Figure 9) may need to be replaced with those appropriate for the desired construction. At the very least, when changing from a low to high-pressure pilot or vice versa, everything below the lower pilot diaphragm (key 40, Figure 9) except the cap screws and the hex nut (keys 47 and 13, Figure 9) will need to be replaced. Actuator and main valve parts may remain unchanged unless a change in service conditions requires a change in seat construction, main spring or main spring seat. See the Parts List sections for obtaining the appropriate conversion parts.

Main Valve Trim with Disk or O-ring Seat

This procedure is to be performed if inspecting, cleaning or replacing trim parts. Part key numbers for a Type 99 regulator with disk or O-ring seat are referenced in Figures 9 and 10 and part key numbers for the disk seat unique to the 1000 psig / 69.0 bar maximum inlet regulator are referenced in Figure 17.

Note

All trim maintenance may be performed with the valve body (key 17, Figure 9 or 17) in the line and with the elbow (key 23), pilot supply tubing (key 24) and pilot supply regulator (if used) attached to the valve body unless the valve body itself will be replaced.

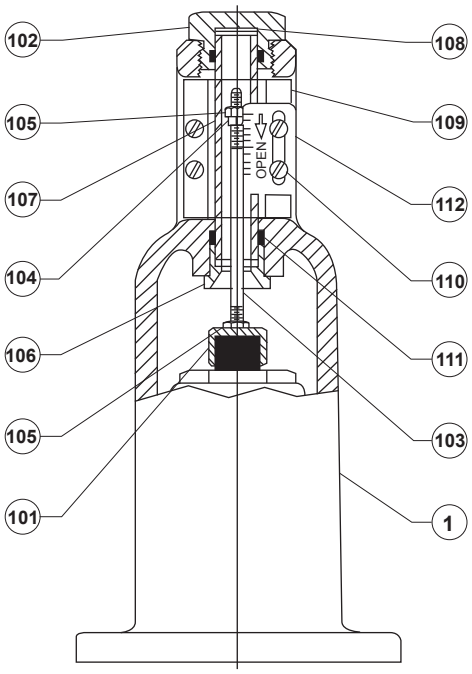


Figure 6. *Travel Indicator Assembly*

1. Disconnect the pilot supply tubing (key 24) and downstream control line.
2. Loosen the union nut (key 14, Figure 9) and remove the lower casing (key 29) with the cap screw (key 22) or disk and holder assembly (key 18, Figure 17) on disassembly or reassembly. A thin-walled socket may be used to remove the orifice.
3. Access to the disk or O-ring (key 19, Figure 9) can be gained by removing the cap screw (key 22) and retainer (key 21), while on the 1000 psig / 69.0 bar maximum inlet regulator the entire disk and holder assembly (key 18, Figure 17) is removed as a unit. If necessary, the holder (key 18, Figure 9 or 17) or adaptor (key 157, Figure 17) can be removed by taking out the cotter pin (key 25, Figure 9 or 17).
4. Install a new body gasket (key 16, Figure 9) and a new disk, O-ring or disk and holder assembly as necessary. Then slide the entire assembly into the valve body (key 17) and secure with the union nut (key 14).
5. Connect the pilot supply tubing (key 24) and downstream control line, then refer to the Startup section for putting the regulator into operation.

Parts Ordering

A serial number is assigned to each regulator, and it is stamped on both the actuator and pilot nameplates. If the pilot is replaced, the new pilot will have its own serial number different from the main valve serial number. Always indicate one or both serial numbers when communicating with your local Sales Office. When ordering a replacement part, be sure to include the complete eleven-character part number.

Parts List

Key	Description	Part Number
	Repair kits include parts for regulator with composition trim only, keys 7, 11, 16, 19, 20 and 57. Also included are parts for pilot, keys 30, 33, 38, 40, 48, 49, 50, 52, 71, 117, 126, 129, 150, 153 and P590 Series filter, keys 2 and 7.	
	With low-pressure pilot	
	7/8 in. / 22 mm orifice	R99LX000012
	1-1/8 in. / 29 mm orifice	R99LX000022
	With high-pressure pilot	
	7/8 in. / 22 mm orifice	R99HX000012
	1-1/8 in. / 29 mm orifice	R99HX000022
	With extra high-pressure pilot	
	7/8 in. / 22 mm orifice	R99HPX00012
	1-1/8 in. / 29 mm orifice	R99HPX00022

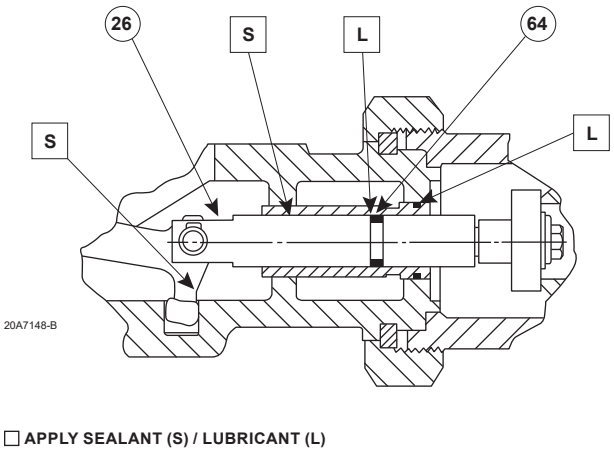


Figure 7. *O-ring Stem Seal*

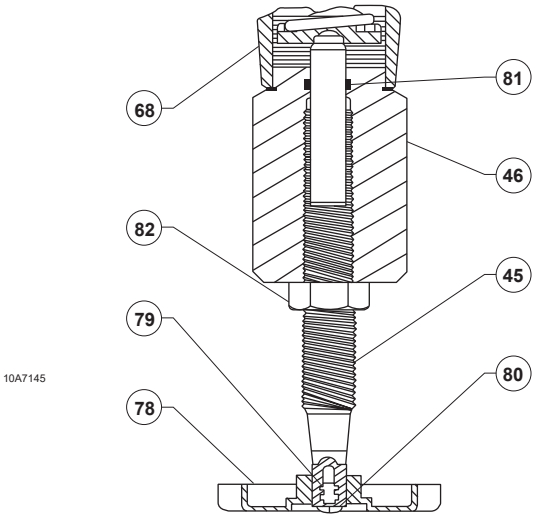


Figure 8. *O-ring Sealed Handwheel*

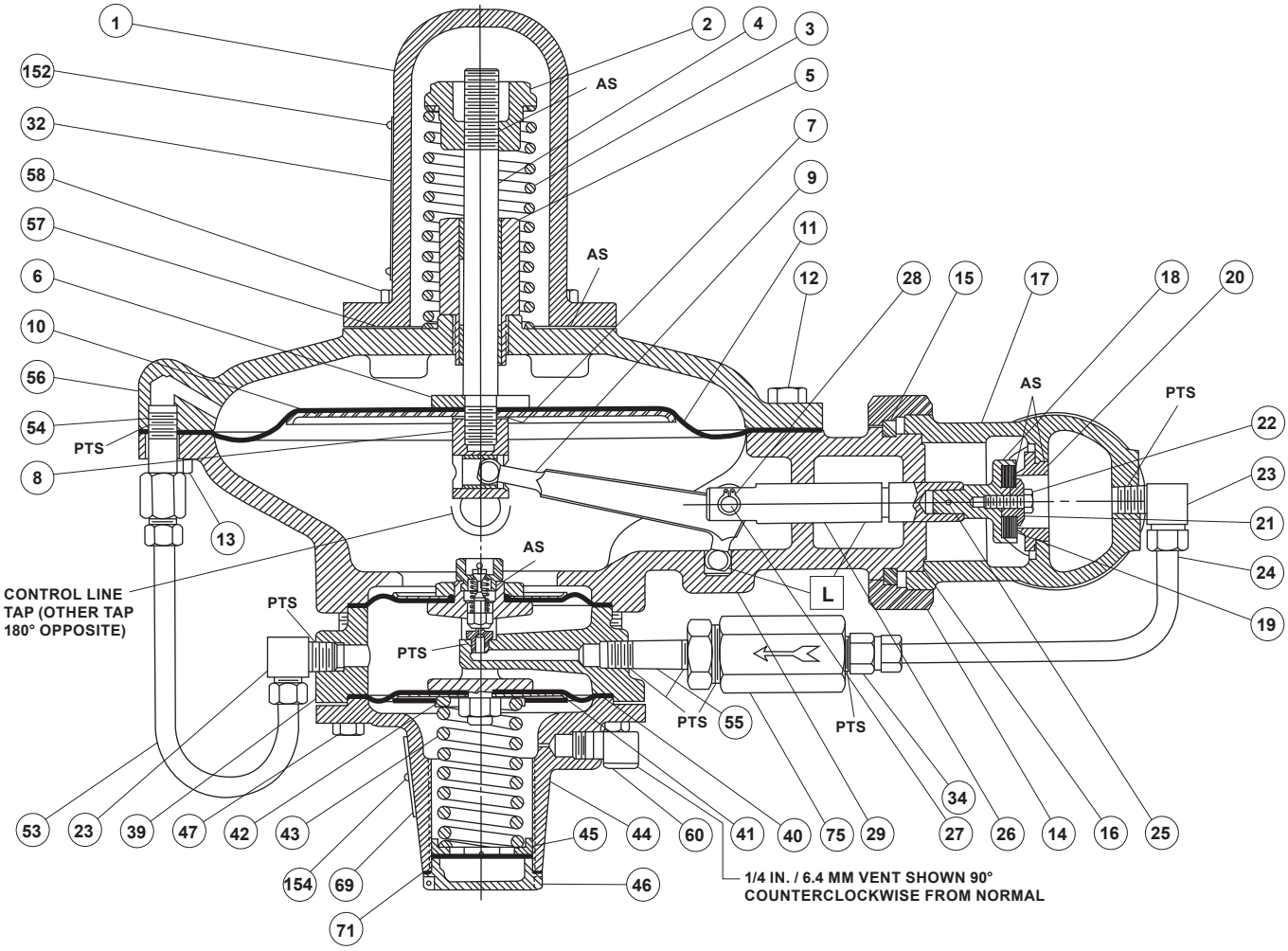
Travel Indicator Assembly (Figure 6)

Key	Description	Part Number
	Complete Assembly (includes individual parts listed below)	20A7146X0C2
1	Spring Case, Cast iron	2L296219012
101	Indicator Stem Adaptor, Aluminum	1R395909012
102	Indicator Cap, Aluminum	1L290809012
103	Indicator Stem, Aluminum	1L296509022
104	Disk Nut, Plastic	1F730506992
105	Machine Screw Nut, Plated steel (2 required)	1A342024152
106	Retainer, Aluminum	1L291009012
107*	Indicator Window, Glass	1L296706992
108*	Gasket	
	Neoprene (CR) (2 required)	1L291103012
	Fluorocarbon (FKM) (2 required)	1L2911X0012
109	Indicator Cover, Plastic (2 required)	1L296405032
110	Machine Screw, Plated steel (8 required)	1A899028982
111*	O-ring	
	Nitrile (NBR) (2 required)	1E591406992
	Fluorocarbon (FKM) (2 required)	1E5914X0062
112	Indicator Scale, Stainless steel	1J511638982

Actuator and Main Body Assembly (Figures 7, 9 and 17)

Key	Description	Part Number
1	Standard Spring Case without travel indicator, Cast iron	1B883119012
2	Main Spring Seat	
	250 psid / 17.2 bar d maximum allowable pressure drop, Cast iron	1B883219042
	1000 psid / 69.0 bar d maximum allowable pressure drop, Plated steel	1E242724092
3	Main Spring	
	25 psid / 1.7 bar d maximum allowable pressure drop	1C277127022
3	Main Spring (continued)	
	50 psid / 3.4 bar d maximum allowable pressure drop	1N801927022
	250 psid / 17.2 bar d maximum allowable pressure drop	1B883327022
	1000 psid / 69.0 bar d maximum allowable pressure drop–requires main spring seat 1E242724092	0W019127022
4	Diaphragm Rod, 416 Stainless steel	1B883435232
5	Diaphragm Rod Guide Assembly	
	Brass with Bronze insert	1D9712000A2
	316 Stainless steel	1B883535072
6	Collar	
	Brass	1B883614012
	316 Stainless steel	1B883635072
7*	Pusher Post Gasket	
	Composition - for standard construction	1B883704022
8	Pusher Post Assembly	
	Brass with Bronze insert	1D9714000A2
	316 Stainless steel	1B883835072
9	Lever, Plated Steel	2F823423072
10	Diaphragm Plate, Plated steel	1B989225072
11*	Diaphragm	
	Nitrile (NBR)	1B884102052
	Fluorocarbon (FKM)	1N378902312
12	Cap Screw, Plated steel (12 required)	1B884224052
13	Hex Nut, Plated steel (13 required)(1)	1A340324122
14	Union Nut, Ductile Iron	0Z0176X0032
15	Body Snap Ring, Plated steel	0Y095828982
16*	Body Gasket	
	Composition	1A348004032
17	Valve Body	
	2 NPT	
	Cast iron	1C254619012
	Steel	2N153522012
	Brass	1C254612012
	NPS 2 / DN 50 CL125 FF flanged, Cast iron	2D986519012
	NPS 2 / DN 50 CL250 RF flanged, Cast iron	2D986619012
	NPS 2 / DN 50 CL150 RF flanged, Steel	2E275622012
	NPS 2 / DN 50 CL300 RF flanged, Steel	2E275722012

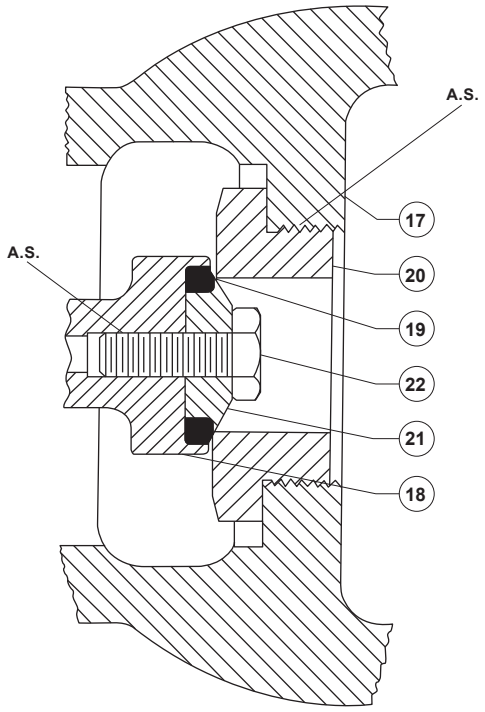
*Recommended Spare Part
1. 12 required for Type 99HP.



COMPLETE REGULATOR SHOWING TYPE 61L PILOT AND DISK SEAT

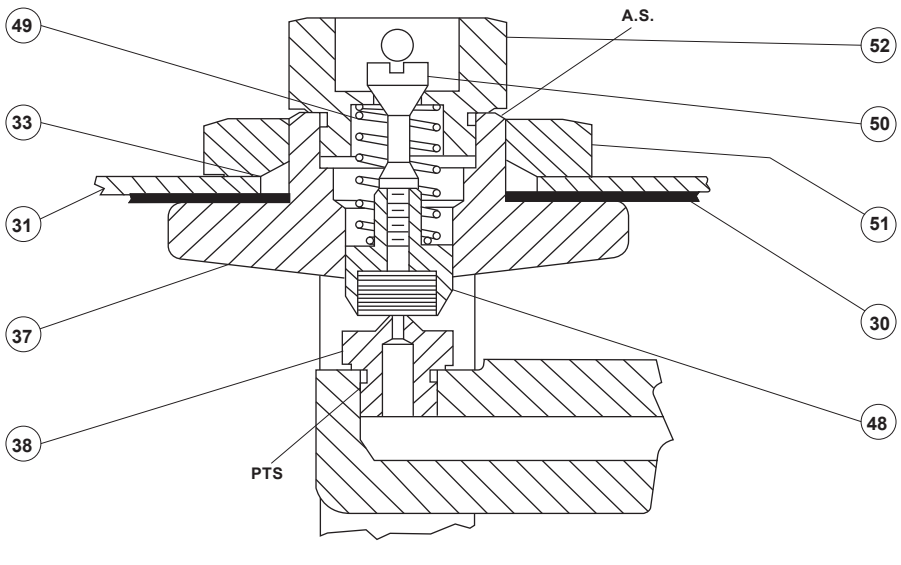
AS – APPLY ANTI-SEIZE COMPOUND
PTS – APPLY PIPE THREAD SEALANT
☐ APPLY LUBRICANT (L)

Figure 9. *Type 99 Regulator with Type 61L (Low) or 61H (High Pressure) Pilot*



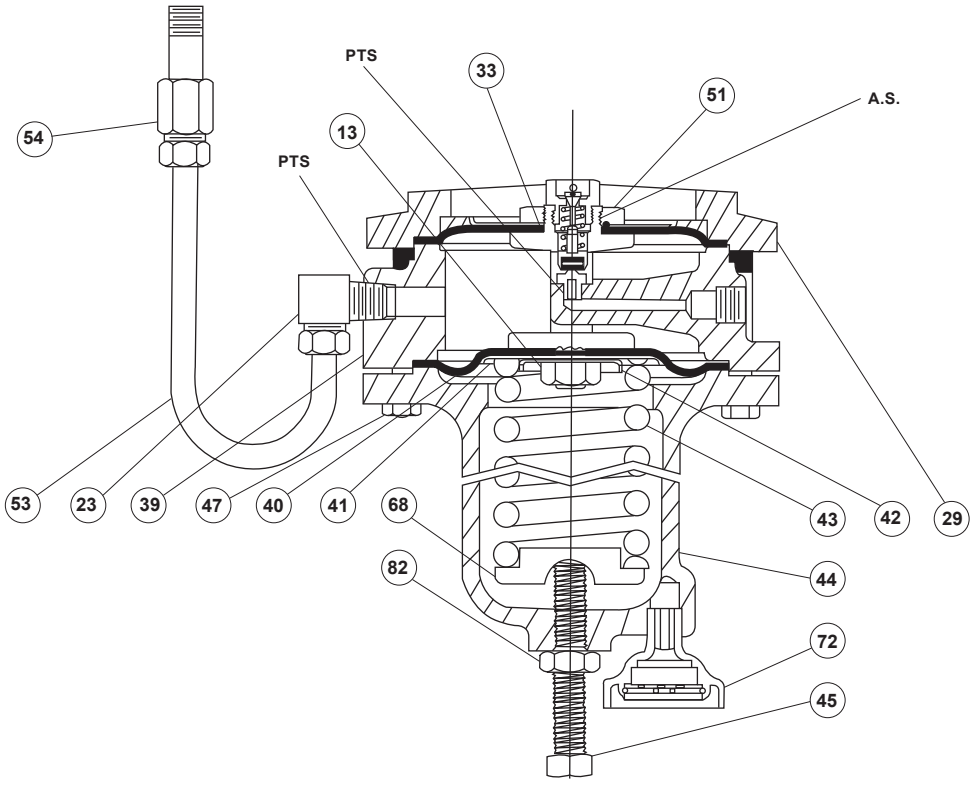
A.S. - APPLY ANTI-SEIZE COMPOUND

Figure 10. *O-ring Seat Detail for Type 99 Regulator with Type 61L (Low Pressure) or 61H (High Pressure)*



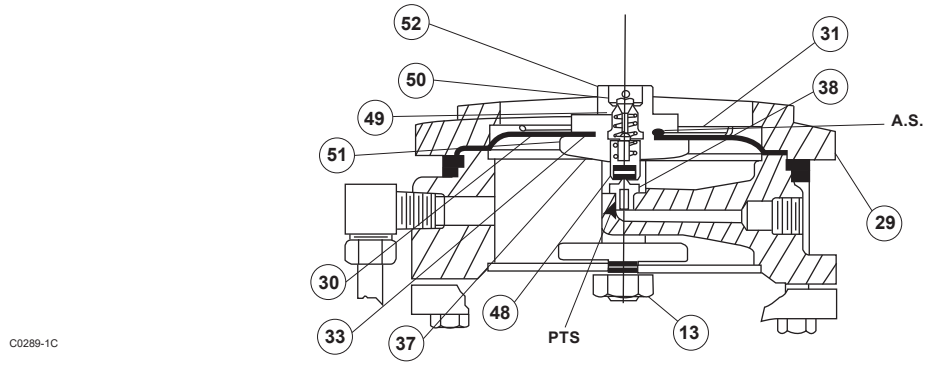
A.S. - APPLY ANTI-SEIZE COMPOUND
PTS - APPLY PIPE THREAD SEALANT

Figure 11. *Pilot Relay Assembly for Type 99 Regulator with Type 61L (Low Pressure) or 61H (High Pressure) Pilot*



A.S. - APPLY ANTI-SEIZE COMPOUND
PTS - APPLY PIPE THREAD SEALANT

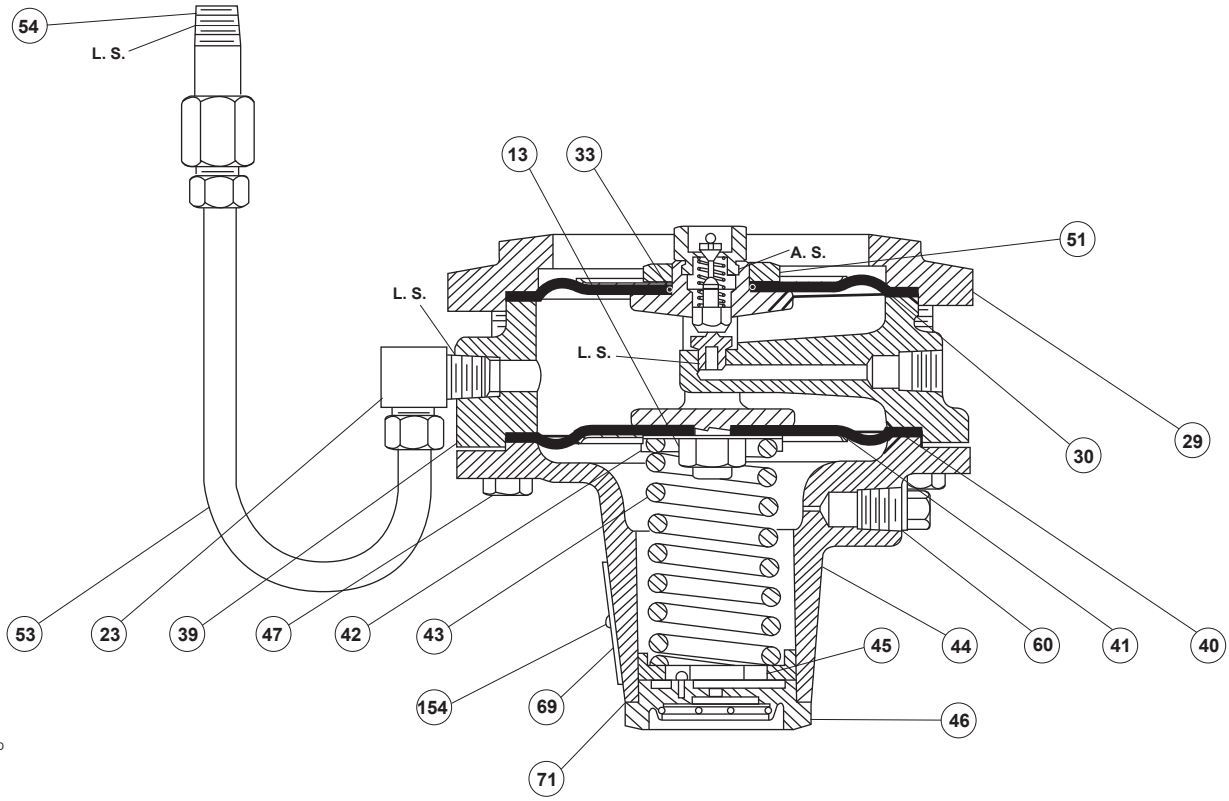
Figure 12. *Pilot Relay Assembly for Type 99 Regulator with Type 61H (High Pressure) Pilot Parts*



PILOT RELAY AND COVER ASSEMBLY

A.S. - APPLY ANTI-SEIZE COMPOUND
PTS - APPLY PIPE THREAD SEALANT

Figure 13. *Pilot Relay and Cover Assembly for Type 99 Regulator with Type 61L (Low Pressure) or 61H (High Pressure) Pilot*



A.S. – APPLY ANTI-SEIZE COMPOUND
L.S. – APPLY LEAD SEAL COMPOUND

Figure 14. *Pilot Relay Assembly for Type 99 Regulator with Type 61L (Low Pressure) Pilot Parts*

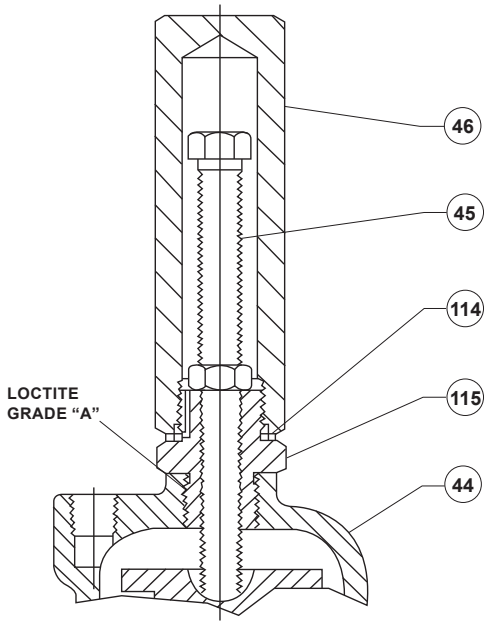
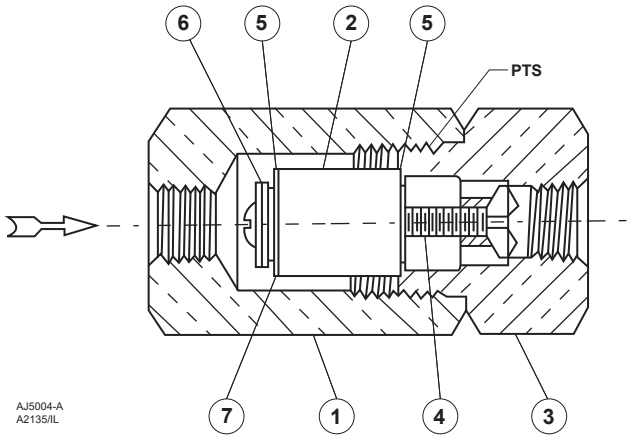


Figure 15. *Sealed Adjusting Screw Assembly for Type 99 Regulator with Type 61H (High Pressure) Pilot Parts*

Actuator and Main Body Assembly (Figures 7, 9 and 17) (continued)

Key	Description	Part Number
18	Disk Holder	
	Disk seat	
	Brass	1B884314012
	316 Stainless steel	1B884335072
	O-ring Seat	
	7/8 in. / 22 mm orifice	
	Brass	1E603214012
	316 Stainless steel	1E603235072
	1-1/8 in. / 29 mm orifice	
	Brass	1E342414012
	316 Stainless steel	1E342435072
18*	Disk Holder Assembly for 1000 psig / 69.0 bar maximum inlet regulator, Nylon (PA)/	
	316 Stainless steel	1C1860000B2
19*	Disk	
	25 psid / 1.7 bar d maximum allowable pressure drop	
	Nitrile (NBR)	1C158703332
	250 psid / 17.2 bar d maximum allowable pressure drop	
	Neoprene (CR)	1C997403032
	Fluorocarbon (FKM)	1C9974X0012
	400 psid / 27.6 bar d maximum allowable pressure drop	
	Nylon (PA)	1E480603152
	Polytetrafluoroethylene (PTFE)	1C997406242
	1000 psig / 69.0 bar maximum inlet regulator, Nylon (PA)	1C185903152
19*	O-ring	
	7/8 in. / 22 mm orifice	
	Nitrile (NBR)	1D237506992
	Fluorocarbon (FKM)	1D237506382
	1-1/8 in. / 29 mm orifice	
	Nitrile (NBR)	1H8498X0012
	Fluorocarbon (FKM)	1H8498X0032
20*	Orifice	
	Disk seat for all regulators	
	7/8 in. x 3/8 in. / 22 x 9.5 mm orifice	
	Brass	1N878114012
	316 Stainless steel	1N8781X0012
	7/8 in. x 1/2 in. / 22 x 13 mm orifice	
	Brass	1C942314012
	316 Stainless steel	1C942335072
	7/8 in. x 5/8 in. / 22 x 16 mm orifice	
	Brass	1C942414012
	316 Stainless steel	1C9424X0012
	3/4 in. / 19 mm orifice	
	Brass	1C780414012
	316 Stainless steel	1C780435072
	7/8 in. / 22 mm orifice	
	Brass	1C394714012
	316 Stainless steel	1C394735072
	1-1/8 in. / 29 mm orifice	
	Brass	1B884414012
	316 Stainless steel	1B884435072
	1/2 in. / 13 mm disk seat for 1000 psig / 69.0 bar maximum inlet regulator, 416 Stainless steel	14A8410X012
	O-ring seat for all regulators	
	7/8 in. / 22 mm orifice	
	Brass	1E603014012
	316 Stainless steel	1E603035072
	1-1/8 in. / 29 mm orifice	
	Brass	1E342514012
	316 Stainless steel	1E342535072

*Recommended Spare Part



PTS – APPLY PIPE THREAD SEALANT

Figure 16. *Standard P590 Series Filter Assembly*

Key	Description	Part Number
21*	Retainer	
	Disk seat	
	All except 3/4 in. / 19 mm or 1-1/8 in. / 29 mm orifice or 1000 psig / 69.0 bar maximum inlet regulator	
	Brass	1C394814012
	303 Stainless steel	1C394835032
	3/4 in. / 19 mm orifice	
	Brass	1C780314012
	316 Stainless steel	1C7803X0012
	1-1/8 in. / 29 mm orifice	
	Brass	1B884514012
	316 Stainless steel	1B884535072
	O-ring seat for all regulators	
	7/8 in. / 22 mm orifice	
	Brass	1E603114012
	316 Stainless steel	1E603135072
	1-1/8 in. / 29 mm orifice	
	Brass	1E342614012
	316 Stainless steel	1E342635072
22	Cap Screw, Plated steel	1A391724052
25	Cotter Pin, 316 Stainless steel	1B108438992
26	Valve Carrier	
	Brass	1E597114072
	416 Stainless steel	1E597135132
27	Lever Pin	
	316 Stainless steel	1B884935162
	303 Stainless steel	1C911635032
28	Retaining Ring for brass trim, Stainless steel (2 required)	1B8850X0012
	Cotter Pin for Stainless steel trim, 316 Stainless steel (2 required)	1A866537022
29	Lower Casing, Cast iron	
	Standard	4B983719012
	Lower Casing Assembly for use with O-ring stem seal, Cast iron with Stainless steel guide bushing	
	Complete with Nitrile (NBR) O-ring	2R7230000A2
	Complete with Fluorocarbon (FKM) O-ring	2R7230X0022
32	Regulator Nameplate, Aluminum	- - - - - - - - - -
56	Upper Casing, Cast iron	3B887619012
57*	Spring Case Gasket	
	Composition	1B8877X0012

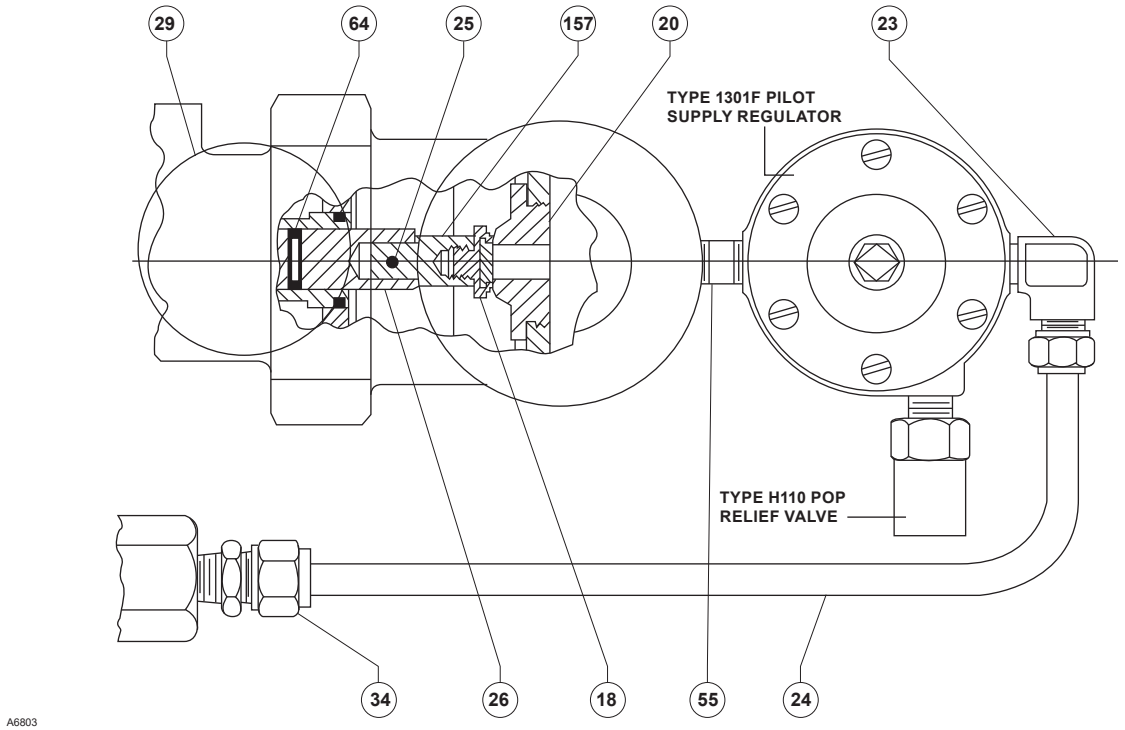


Figure 17. *1000 psig / 69.0 bar Maximum Inlet Regulator Partial Detail*

Actuator and Main Body Assembly (Figures 7, 9 and 17) (continued)

Key	Description	Part Number
58	Cap Screw, Plated steel (4 required)	1A675124052
64*	O-ring (for use only with O-ring stem seal)	
	Nitrile (NBR)	1E220206992
	Fluorocarbon (FKM)	1R620106382
73	Pipe plug, Plated steel (not shown)	1A767524662
75	Standard P590 Series Filter Assembly (parts listed under separate heading)	
	Type P594-1, Brass	FSP594-1
	Type P593-1, Aluminum	FSP593-1
152	Drive Screw, 18-8 Stainless steel (4 required for low-pressure pilot and 6 required for high-pressure pilot)	1A368228982
157	Adaptor, Brass	14A8411X012
159	Nameplate (for use only with O-ring stem seal and extra high-pressure pilot)	
	Alloy 1100 (not shown)	- - - - - - - - - -

Standard P590 Series Filter Assembly (Figure 16)

Key	Description	Part Number
1	Filter Body	
	Type P594-1, Brass	1E312414012
	Type P593-1, Aluminum	1E3124X0022
2*	Filter Element, Cellulose	1E312606992
3	Filter Head	
	Type P594-1, Brass	1E312514012
	Type P593-1, Aluminum	1E3125X0022
4	Machine Screw	
	Type P594-1, Brass	1J500218992
	Type P593-1, Aluminum	1J500209012
5	Washer (2 required)	
	Type P594-1, Brass	1J500018992
	Type P593-1, Aluminum	1J500010062
6*	Spring Washer, Plated carbon steel	1H885128982
7*	Gasket, Composition	1F826804022

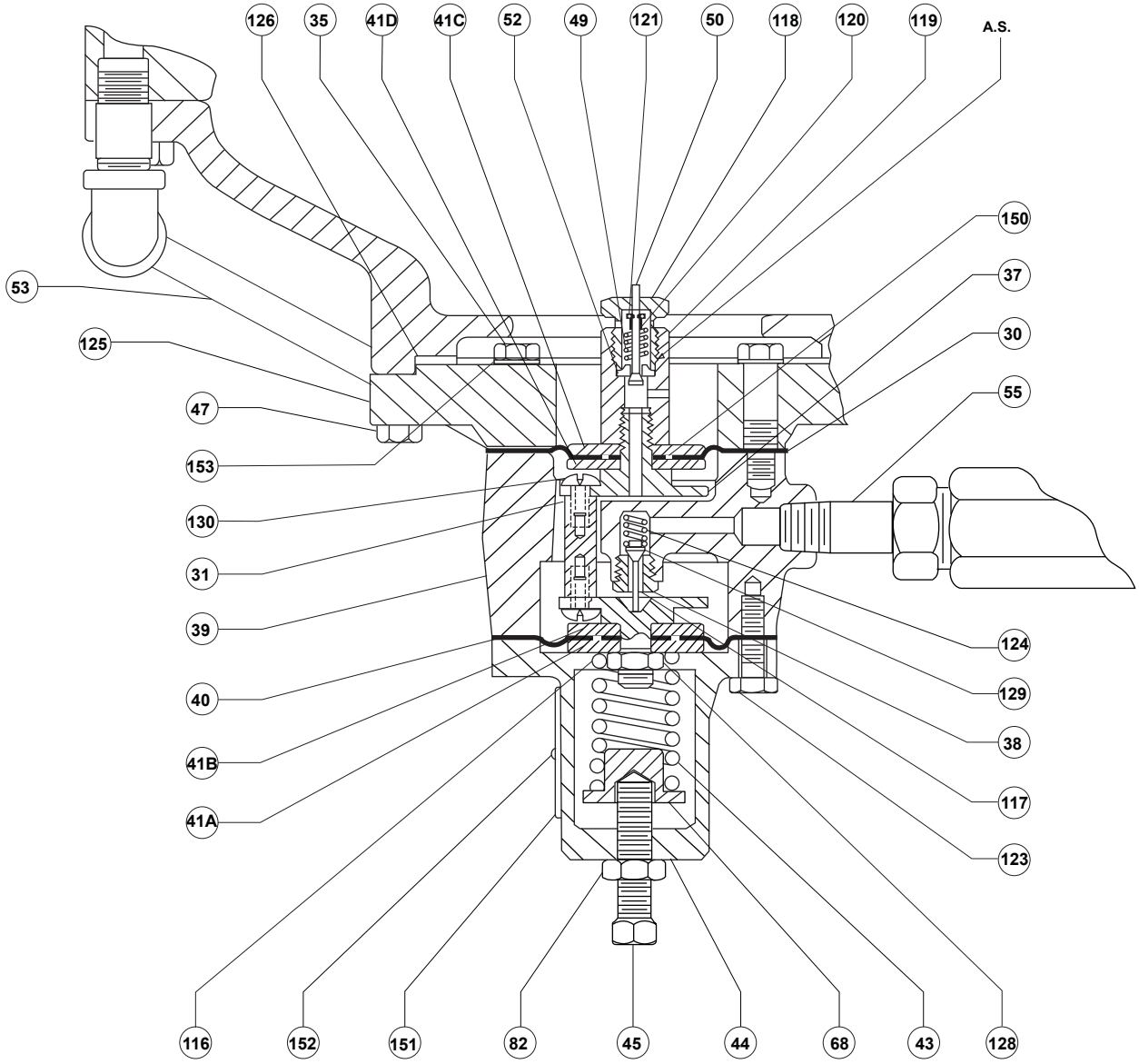
*Recommended Spare Part

Pilot and Tubing Parts[1] Low or High-Pressure Pilot (Figures 8, 10, 11, 12, 13, 14 and 15)

Key	Description	Part Number
23	Elbow (2 required)	- - - - - - - - - -
24	Pilot Supply Tubing, disk or O-ring main valve seat	- - - - - - - - - -
30*	Upper Relay Diaphragm	
	Nitrile (NBR)	1B885202052
	Fluorocarbon (FKM)	1N162802332
31	Upper Relay Diaphragm Plate, Plated steel	
	For use with all low-pressure pilots except Type 61LE	1B989325072
	For use with all high-pressure pilots and Type 61LE low-pressure pilot	1D558425072
33*	O-ring Seal	
	Nitrile (NBR)	1B885506992
	Fluorocarbon (FKM)	1B8855X0012
34	Connector	- - - - - - - - - -
37	Yoke	
	Zinc	1D662544012
38	Relay Orifice, Stainless steel	
	For use with 25 psi / 1.7 bar maximum allowable pressure drop actuator main spring	1D373735032
	For use with all other main springs	1C520135032
39	Relay Valve Body, Cast iron	2J581919012
40*	Lower Relay Diaphragm	
	Low-pressure pilot	
	Nitrile (NBR)	1B886002052
	Fluorocarbon (FKM)	1N536102332
	High-pressure pilot	
	Neoprene (CR)	1B894202192
	Fluorocarbon (FKM) (2 required)	1N162702302
41	Lower Relay Diaphragm Plate, Plated steel	
	Low-pressure pilot	1B989425072
	High-pressure pilot	1D558325072
42	Spring Seat, Plated steel	
	Low-pressure pilot	1B886225072
	High-pressure pilot	1D558525072
43	Control Spring, Plated steel	
	For use only with Type 61LD low-pressure pilot	
	2 to 4 in. w.c. / 5 to 10 mbar, Orange	1B558527052
	3 to 12 in. w.c. / 7 to 30 mbar, Unpainted	1C680627222
	For use with all low-pressure pilots	
	0.25 to 2 psig / 0.02 to 0.14 bar, Red	1B886327022
	1 to 5 psig / 0.07 to 0.35 bar, Yellow	1J857827022
	2 to 10 psig / 0.14 to 0.69 bar, Blue	1B886427022
	5 to 15 psig / 0.35 to 1.0 bar, Brown	1J857927142
	10 to 20 psig / 0.69 to 1.4 bar, Green	1B886527022
	For use with high-pressure pilot	
	10 to 65 psig / 0.69 to 4.5 bar, Green stripe	0Y066427022
44	Spring Case, Cast iron	
	Low-pressure pilot	1B983919012
	High-pressure pilot	
	Standard	1B984119012
	For use with closing cap (not shown)	1H232619012
45	Adjusting Screw	
	Low-pressure pilot	
	Standard, Zinc	1B537944012
	Handwheel-style, Plated steel	1J496428982
	O-ring sealed handwheel assembly, Brass	1R759414012
	Brass Cap with external sealed adjusting screw, Plated steel	1D995448702
	High-pressure pilot	
	Standard, Plated steel	1A279128982
	For use with closing cap,	1H236514012
	Plated steel	1J881524102
	Type 662	18B3500X022
46	Closing Cap	
	Low-pressure pilot	
	For use with standard low-pressure pilot, Plastic	T11069X0012
	For use with standard low-pressure pilot, Steel	1E422724092
	For use with handwheel-style low-pressure pilot, Brass (not shown)	1A926114012
	For use with O-ring sealed handwheel, Brass	1R759314012
	High-pressure pilot	
	For use with high-pressure pilot with spring case 1H232619012, Brass (not shown)	1H236514012
47	Cap Screw, Plated steel (8 required)	1B989624052
48*	Relay Disk Assembly	
	Brass/Nitrile (NBR)	1B8868000A2
	303 Stainless steel/Nitrile (NBR)	1B8868000B2
	Brass/Fluorocarbon (FKM)	1B8868X0012
	303 Stainless steel/Fluorocarbon (FKM)	1B8868X0022
49	Bleed Valve Spring, Stainless steel	
	For use with low-pressure pilot with relay orifice 1D373735032 or bleed valve 1H951635132	1E643637022
	For use with all low and high-pressure pilots	
	Inlet pressure up to 250 psig / 17.2 bar	1C911537022
	Inlet pressure over 250 psig / 17.2 bar	1N859137022
50	Bleed Valve, Stainless steel	
	For use with Type 61LD low-pressure pilot with bleed valve spring 1E643637022	1H951635132
	For use with all low and high-pressure pilots	1D986735132
51	Diaphragm Nut	
	Brass	1B989514012
	316 Stainless steel	1B989535072
52*	Bleed Orifice, 316 Stainless steel	1B887335032
53	Loading Tubing	- - - - - - - - - -
54	Connector	- - - - - - - - - -
55	Pipe Nipple (1 required for 90º orientation and 2 required with SST tubing)	- - - - - - - - - -
59	Pipe plug, Steel (not shown)	- - - - - - - - - -
60	Type Y602-12 Vent Assembly (low-pressure pilot only)	27A5516X012
68	Spring Seat	
	Handwheel-style low-pressure pilot, Zinc-plated steel, (not shown)	1J618124092
	High-pressure pilot, Zinc-plated steel	16A9812X012
69	Pilot Nameplate	- - - - - - - - - -
71*	Closing Cap Gasket (for use only with low-pressure pilot), Neoprene (CR)	1P753306992
72	Type Y602-1 Vent Assembly (for use only with standard high-pressure pilot spring case)	17A6570X012
78	Handwheel (for use only with handwheel-style low-pressure pilot), Zinc	1J496144012
79	Machine Screw (for use only with handwheel-style low-pressure pilot), Plated steel	16A5763X012
80	Lockwasher	
	For use only with handwheel-style low-pressure pilot, Steel	1A352332992
	For use with Brass cap with external sealed adjusting screw	1V205699012
81*	O-ring (for use only with O-ring sealed handwheel assembly) low-pressure pilot, Nitrile (NBR)	1D541506992
82	Hex nut	
	For use only with O-ring sealed handwheel assembly low-pressure pilot	1A351124122
	For use with Brass cap with external sealed adjusting screw, Zinc	1A353724122
	For use with high-pressure pilot, Plated steel	1A352424122

*Recommended Spare Part

1. An entire pilot assembly may be ordered from your local Sales Office by specifying a Type 61L, 61H or 61HP pilot for field conversion.



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A.S. – APPLY ANTI-SEIZE COMPOUND

Figure 18. *Type 61HP (Extra High Pressure) Pilot*

Pilot and Tubing Parts[1] Low or High-Pressure Pilot (Figures 8, 10, 11, 12, 13, 14 and 15) (continued)

Key	Description	Part Number
114*	Gasket (for use only with high-pressure pilot with spring case 1H232619012), Steel/ Composition	1B487099202
115	Adaptor (for use only with high-pressure pilot with spring case 1H232619012), Steel	1J881624092
132	Pilot Cover (used only with complete replacement pilot assembly for field conversion)	
	Cast iron	2C518619012
	Stainless steel (For high-pressure pilot only)	2V518619012
154	Drive Screw (for use only with low-pressure pilot), 18-8 Stainless steel (2 required)	1A368228982

Type 61HP (Extra High Pressure) Pilot (Figure 18)

Key	Description	Part Number
23	Elbow	15A6002X292
24	Pilot Supply Tubing	----------
30*	Diaphragm	
	Neoprene (CR) /Nylon (PA)	13A9840X012
	Fluorocarbon (FKM)/Nomex®	13A9840X022
31	Yoke Leg, 416 Stainless steel (2 required)	13A9838X012
34	Connector (3 required)	
	For use with all standard regulators	
	Brass	1D692214012
	316 Stainless steel	15A6002X602
	For use with 1000 psig / 69.0 bar maximum inlet regulator, Steel	15A6002XW22
35	Cap Screw, Plated steel (6 required)	1A930424052
36	Elbow, Plated steel	1B860828992
37	Lower Yoke Cap, 416 Stainless steel	13A9837X012
38	Inlet Orifice, 303 Stainless steel	1D318135032
39	Pilot Body, Cast iron	33A9845X012
40*	Diaphragm	
	Neoprene (CR)	13A9841X022
	Fluorocarbon (FKM)/Nomex[2]	13A9841X012
41	Diaphragm Plate, 416 Stainless steel (4 required)	13A9839X012
43	Control Spring, Plated steel	
	35 to 100 psig / 2.4 to 6.9 bar, Blue	1D387227022
44	Spring Case, Cast iron	
	Standard	2P969419012
45	Adjusting Screw, Plated steel	
	Standard	1C216032992
47	Cap Screw, Plated steel (8 required)	1B787724052
49	Relief Valve Spring, Stainless steel	1C374037022
50*	Relief Valve Plug, 316 Stainless steel	1K377535162
52*	Bleed Orifice	
	Brass	1B329014012
	Stainless steel	1K377635162
53	Loading Tubing	----------
55	Pipe Nipple (2 required)	
	Plated steel	1C488226232
	Stainless steel	1C488238982
57	Adaptor	14A8411X012
60	Pipe plug, Steel (not shown)	1A649528982
68	Spring Seat, Plated steel	10A3963X012
82	Hex Nut, Plated steel	1A352224122
92	Pipe Tee (For gauge tap only)	----------
113	Pipe Nipple (For gauge tap only)	----------
116	Yoke Cap, 416 Stainless steel	13A9836X012
117*	Inlet Valve Plug	
	316 Stainless steel/Nitrile (NBR)	1D5604000B2
	304 Stainless steel/Fluorocarbon (FKM)	1N3798000C2
118	Relief Valve Cap	
	Brass	1D904914012
	303 Stainless steel	1D904935072
119	Relief Valve Body	
	Brass	1D904814012
	316 Stainless steel	1D904835072
120	Spring Seat	
	Brass	1K377718992
	302 Stainless steel	1K377735072
121	Spring Seat Washer	
	Brass	1B495118992
	316 Stainless steel	1K377835072
122	Pipe Bushing, Plated steel (not shown)	1C379026232
123	Cap Screw, Plated steel (6 required)	1P327028982
124	Valve Spring, 316 Stainless steel	1B797937022
125	Flange Adaptor, Cast Iron	23A9846X012
126*	Gasket, Composition	0U0365X0022
128	Diaphragm Nut, Plated steel	1A346524122
129	Valve Spring Seat, 316 Stainless steel	1L251135072
130	Machine Screw, 303 Stainless steel (4 required)	1A866935032
131	Pipe plug, Steel (not shown)	1A369224492
150*	Diaphragm Insert (2 required)	
	Nitrile (NBR)	13A9842X012
	Fluorocarbon (FKM)	13A9842X022
151	Pilot Nameplate	----------
152	Drive Screw, 18-8 Stainless steel (2 required)	1A368228982
153*	Seal Washer, Nitrile (NBR)/Plated steel (6 required)	13A9849X012

*Recommended Spare Part
Nomex® is a mark owned by E.I. du Pont de Nemours and Co.
1. An entire pilot assembly may be ordered from your local Sales Office by specifying a Type 61L, 61H or 61HP pilot for field conversion.
2. 3 required for 90º orientation.

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