

February 2016

161 Series Pilots for Pilot-Operated Pressure Reducing Regulators



WARNING

Failure to follow these instructions or to properly install and maintain this equipment could result in an explosion, fire and/or chemical contamination 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. (Emerson™) 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.

Installation, operation and maintenance procedures performed by unqualified personnel may result in improper adjustment and unsafe operation. Either condition may result in equipment damage or personal injury. Only a qualified person shall install or service the 161 Series regulator.



W7430

TYPE 161AY



W6505

TYPE 161EB

Figure 1. 161 Series Pilot

Introduction

Scope of the Manual

This manual provides installation, startup, maintenance and parts ordering information for the 161 Series Pilots used together with pilot-operated pressure reducing regulators in low and high-pressure applications. For information on mounting on

pilot-operated regulators, monitoring systems and installations, refer to full product literature:

Type EZR: D102600X012

Type EZL: D103091X012



161 Series

Specifications

The Specifications section lists pressure limitations and other specifications for all models of 161 Series pilots. Please note that the pilot control spring range is marked on the spring case of 161 and 161EB Series pilots and on the nameplate of 161AY Series pilots.

Outlet (Control) Pressure Ranges See Table 1 Proportional Bands See Table 1 Maximum Inlet Pressure⁽¹⁾ See Table 2	Pilot Flow Coefficients See Table 3 Options Type 252 Pilot supply filter Pilot Spring Case Vent 1/4 NPT (internal)
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1. The pressure/temperature limits in this Instruction Manual and any applicable standard or code limitation should not be exceeded.

Table 1. Outlet (Control) Pressure Ranges, Proportional Bands and Pilot Control Spring Information

PILOT TYPE	OUTLET (CONTROL) PRESSURE RANGE		PROPORTIONAL BAND ⁽¹⁾⁽²⁾⁽³⁾		PILOT CONTROL SPRING INFORMATION					
					Part Numbers	Color Code	Wire Diameter		Free Length	
	psig	bar	psig	bar			In.	mm	In.	mm
161 or 161M	5 to 15	0.34 to 1.03	2	0.14	1E392527022	Yellow	0.148	3.76	2.00	50.8
	10 to 125	0.69 to 8.62	2	0.14	1K748527202	Red	0.192	4.88	2.19	55.6
	120 to 300	8.3 to 20.7	6	0.41	15A9258X012	Green	0.243	6.17	1.88	47.8
161AY, 161AYM or 161AYW	6 to 15 in. w.c. ⁽⁴⁾	15 to 37 mbar ⁽⁴⁾	1 in. w.c	2 mbar	1B653927022	Olive Green	0.105	2.67	3.75	95.2
	0.5 to 1.2 ⁽⁵⁾	0.03 to 0.08 ⁽⁵⁾	1 in. w.c	2 mbar	1B537027052	Yellow	0.114	2.90	4.31	109
	1.2 to 2.5 ⁽⁶⁾	0.08 to 0.17 ⁽⁶⁾	0.5	0.03	1B537127022	Green	0.156	3.96	4.06	103
	2.5 to 4.5	0.17 to 0.31	0.5	0.03	1B537227022	Light Blue	0.187	4.75	3.94	100
161EB or 161EBM	4.5 to 7	0.31 to 0.48	0.5	0.03	1B537327052	Black	0.218	5.54	3.98	101
	5 to 15	0.34 to 1.03	0.5	0.03	17B1260X012	White	0.120	3.05	3.75	95.2
	10 to 40	0.69 to 2.76	0.5	0.03	17B1262X012	Yellow	0.148	3.76	3.75	95.2
	30 to 75	2.07 to 5.17	0.6	0.04	17B1259X012	Black	0.187	4.75	4.00	102
	70 to 140	4.83 to 9.65	1.3	0.09	17B1261X012	Green	0.225	5.71	3.70	94.0
	130 to 200	8.96 to 13.8	1.5	0.10	17B1263X012	Blue	0.262	6.66	3.85	97.8
	200 to 350	13.8 to 24.1	3	0.21	17B1264X012	Red	0.294	7.47	4.22	107

1. Proportional band includes outlet pressure drop plus hysteresis (friction), but does not include lockup.
 2. Proportional band was determined with a pressure drop ranging from 50 to 150 psig / 3.4 to 10.3 bar. Approximately double the proportional band if the pressure drop is less than 50 psig / 3.4 bar.
 3. With Type 112 restrictor set on 2.
 4. The spring ranges for the Type 161AYW is 3 to 12 in. w.c. / 7.5 to 30 mbar.
 5. The spring ranges for the Type 161AYW is 11 to 25 in. w.c. / 27 to 62 mbar.
 6. The spring ranges for the Type 161AYW is 0.9 to 2.5 psig / 0.06 to 0.17 bar.

Table 2. Pilot Pressure Ratings

TYPE	MAXIMUM INLET PRESSURE		MAXIMUM EMERGENCY OUTLET PRESSURE OR MAXIMUM EMERGENCY SENSE PRESSURE ⁽¹⁾		MAXIMUM BLEED (EXHAUST) PRESSURE FOR MONITOR PILOTS	
	psig	bar	psig	bar	psig	bar
161	1500	103	1200	82.7	----	
161AY	150	10.3	150	10.3		
161EB	1500	103	1200	82.7		
161M	1500	103	1200	82.7	1500	103
161AYM or 161AYW	150	10.3	150	10.3	150	10.3
161EBM	1500	103	1200	82.7	1500	103

1. Maximum pressure to prevent the casings from bursting during abnormal operation (leaking to atmosphere and internal parts damage may occur).

Table 3. Pilot Flow Coefficients

161AY SERIES				161EB SERIES			
Orifice Size	C _g	C _v	C ₁	Orifice Size	C _g	C _v	C ₁
3/32 in. / 2.4 mm	6.9	0.20	35	1/8 in. / 3.18 mm	8.5	0.28	30.4
1/8 in. / 3.2 mm	12.3	0.35	35				
1/4 in. / 6.4 mm	50	1.43	35				

Product Description

The 161 Series pilots are mainly used in natural gas, air or other non-corrosive gas applications. For applications that have high pressure drops, using a Type 161AYM or 161EBM monitor pilot will increase the accuracy of the regulator.

161 Series pilot models are the following:

Type 161—Downstream pressure range from 5 to 300 psig / 0.34 to 20.7 bar. Pilot bleed exhausts downstream through the sense (control) line.

Type 161M—Downstream pressure range from 5 to 300 psig / 0.34 to 20.7 bar. A static sensing (control) line is isolated from pilot bleed (exhaust). The Type 161M is used in working monitor and other application that require a sense (control) line isolated from pilot bleed (exhaust).

Type 161AY—Low-pressure pilot with an outlet pressure range from 6 in. w.c. to 7 psig / 15 mbar to 0.48 bar. Pilot bleeds (exhausts) downstream through the sense (control) line.

Type 161AYM—The monitor version of the Type 161AY pilot. The pilot bleed (exhaust) is isolated from the sense (control) line. This pilot is used in monitoring systems requiring an isolated pilot bleed (exhaust).

Type 161AYW- A version of the Type 161AY used solely as the upstream monitor pilot on a working monitor setup.

Type 161EB—High accuracy pilot with an outlet pressure range from 5 to 350 psig / 0.34 to 24.1 bar. Pilot bleeds (exhausts) downstream through the sense (control) line.

Type 161EBM—The monitor version of the Type 161EB pilot. The pilot bleed (exhaust) is isolated from the sense (control) line. This pilot is used in monitoring systems requiring an isolated pilot bleed (exhaust).

Principle of Operation

As long as the outlet (control) pressure is above the outlet pressure setting, the pilot valve plug or disk remains closed. Force from the main spring,

in addition to inlet pressure bleeding through the Type 112 restrictor, provides downward loading pressure to keep the main valve diaphragm and plug assembly tightly shutoff. When the outlet pressure decreases below the pilot outlet pressure setting, the pilot plug or disk assembly opens. Loading pressure bleeds downstream through the pilot faster than it can be replaced through the Type 112 restrictor. This reduces loading pressure on top of the main valve diaphragm and plug assembly and lets the unbalanced force between inlet and loading pressure overcome the main spring force to open the regulator diaphragm and plug assembly.

As the outlet pressure rises toward the outlet pressure setting, it compresses the pilot diaphragm against the pilot control spring and lets the pilot valve plug close. Loading pressure begins building on the regulator diaphragm and plug assembly. The loading pressure, along with force from the main spring, pushes the diaphragm and plug assembly onto the knife-edged seat, producing tight shutoff.

Note

For applications requiring extremely tight control, using a Type 161AYM or 161EBM monitor pilot will increase the accuracy of the regulator.

Installation



WARNING

Personal injury or equipment damage, due to bursting of pressure-containing parts may result if this regulator is overpressured or is installed where service conditions could exceed any rating of the adjacent piping or piping connections. To avoid such injury or damage, provide pressure-relieving or pressure-limiting devices to prevent service conditions from exceeding those limits. Also, be sure the installation is in compliance with all applicable codes and regulations. Additionally, physical damage to the regulator could break

the pilot off the main valve, causing personal injury and property damage due to bursting of pressure-containing parts. To avoid such injury and damage, install the regulator in a safe location.

1. Use qualified personnel when installing, operating and maintaining pilots. Before installing, inspect pilot and tubing, for any shipment damage or foreign material that may have collected during crating and shipment. Make certain that body is clean and the pipelines are free of foreign material.



WARNING

In hazardous or flammable gas service, vented gas may 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.

2. Pilots have a 1/4 NPT vent connection in the spring case. To remotely vent gas from the spring case, remove the screened vent and connect 1/4 in. / 6.4 mm piping or tubing. It should vent to a safe location, have as few elbows as possible and have a screened vent on its exhaust. Install the regulator and any remote vent spring or tubing so that the vent is protected from condensation, freezing or substance that may clog it.



CAUTION

To avoid freeze-up because of pressure drop and moisture in the gas, use anti-freeze practices, such as heating the supply gas or adding a de-icing agent to the supply gas.

3. Run a 3/8 in. / 9.5 mm outer diameter or larger pilot supply line from the upstream pipeline to the filter inlet, bushing the line down to fit the 1/4 NPT filter connection. Do not make the upstream pipeline connection in a turbulent area, such as near a nipple, swage or elbow. If the maximum pilot inlet pressure could exceed the pilot rating, install a separate pressure reducing regulator in the pilot supply line. Install a hand valve in the pilot

supply line and provide vent valves to properly isolate and relieve the pressure from the regulator.

4. Attach a 1/2 in. / 13 mm piping or tubing downstream control line to the 1/2 NPT control line connection on the actuator casings. Connect the other end of the control line to the pipeline downstream of the regulator. Do not attach the control line near any elbow, swage, block valve or any other location that might cause turbulence. Install a full port ball valve in the control line to shut off the control pressure when using the bypass.

Startup and Adjustment

Pre-Startup Considerations

Each regulator is factory-set for the outlet pressure specified on the order. If no setting was specified, outlet pressure was factory-set at the mid-range of the pilot control spring. Before beginning the startup procedure in this section, make sure the following conditions are in effect:

- Block valves isolate the regulator
- Vent valves are closed
- A bypass, if any, is in operation

In all cases, check the control spring setting to make sure it is correct for the application.



CAUTION

Be sure to slowly introduce pressure into the system to prevent downstream overpressure due to potential rapid pressure increase. Pressure gauges should always be used to monitor downstream pressure during startup. Procedures used in putting this regulator into operation must be planned accordingly if the downstream system is pressurized by another regulator or by a manual bypass.

Pilot Adjustment

For 161 Series pilots, remove the pilot closing cap (key 16, Figures 4 through 6 or key 22, Figure 7) and, on 161EB Series only, loosen the locknut (key 12, Figure 4). Turn the adjusting screw (key 11, Figures 4 through 6 or key 35, Figure 7) into the

spring case (key 2, Figures 4 through 6 or key 3, Figure 7) to increase the downstream pressure. Turn the adjusting screw out of the spring case to decrease the downstream pressure.

Shutdown



CAUTION

If pilot supply pressure is shut down first, the downstream system may be subjected to full inlet pressure.

1. If the pilot setting must be disturbed, be sure to keep some tension on the spring. This will prevent trapping inlet pressure during blowdown.
2. Slowly close the valves in the following order:
 - a. Inlet block valve
 - b. Outlet block valve
 - c. Control line valve(s), if used.
3. Open the vent valves to depressurize the system.

Maintenance

Pilot parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement of parts depends upon the severity of service conditions or the requirements of local, state and federal regulations. Due to the care Emerson™ takes in meeting all manufacturing requirements (heat treating, dimensional tolerances, etc.), use only replacement parts manufactured or furnished by Emerson.

All O-rings, gaskets and seals should be lubricated with a good grade of general-purpose grease and installed gently rather than forced into position. Be certain that the nameplates are updated to accurately indicate any field changes in equipment, materials, service conditions or pressure settings.



WARNING

To avoid personal injury resulting from sudden release of pressure, isolate the pilot from all pressure and cautiously release trapped pressure from the pilot before attempting disassembly.



W4570-1

Figure 2. 161EB Series Pilot Trim Removal/Installation

Note

This procedure covers all 161EB Series pilots. Types 161EB and 161EBM are rated for outlet pressure settings over 200 psig / 13.8 bar. Types 161EB and 161EBM pilots rated for outlet pressure settings under 200 psig / 13.8 bar do not require a diaphragm limiter.

161 and 161EB Series Pilots (Figures 4 through 6)

Trim Parts

1. As shown in Figure 2, remove the body plug (key 3) to let the plug spring (key 6) and valve plug (key 4) drop freely from the body.
2. Inspect the removed parts and body plug O-ring (key 15), replace as necessary and make sure the plug seating surfaces are free from debris.
3. Sparingly apply lubricant to the body plug O-ring (key 15) and the threads of the body plug (key 3). Install the body plug O-ring over the body plug.
4. Stack the plug spring (key 6) and valve plug (key 4) on the body plug (key 3). Install the body plug with stacked parts into the body (key 1).

Diaphragm Parts

1. Remove the closing cap (key 16), loosen the locknut (key 12) and back out the adjusting screw (key 11) until compression is removed from the control spring (key 9).
2. Remove the machine screws (key 13, not shown) and separate the spring case (key 2) from the body (key 1). Remove the control spring seat

161 Series

(key 8) and the control spring (key 9). If used, remove the diaphragm limiter (key 10) and inspect the diaphragm limiter O-ring (key 23). Replace if necessary.

3. Remove the diaphragm assembly (key 7) and inspect the diaphragm.
4. On Type 161EBM pilots, inspect the stem guide seal assembly (key 19) and, if damaged, replace the complete assembly. Inspect the outer O-ring (key 22) and replace if necessary.
5. Install the diaphragm assembly (key 7) and push down on it to see if the valve plug (key 4) strokes smoothly and approximately 1/16 in. / 1.6 mm.

Note

In step 6, if installing a control spring with a different range, be sure to replace the spring range indicated on the spring case with the new spring range. A diaphragm limiter (key 10) and other listed parts are required with the highest spring range.

6. Stack the control spring (key 9), the control spring seat (key 8), if used and the diaphragm limiter (key 10) onto the diaphragm assembly (key 7). Make sure that, if used, the diaphragm limiter is installed bevelled side up. Sparingly apply lubricant to the control spring seat.
7. Install the spring case (key 2) on the body (key 1) with the vent (key 18) oriented to allow for wrenches, needed for connecting outlet piping and to prevent clogging or entrance of moisture. Install the machine screws (key 13) and, using a crisscross pattern torque them to 5 to 7 ft-lbs / 6.8 to 9.4 N•m for stainless steel constructions and 2 to 3 ft-lbs / 2.7 to 4.1 N•m for aluminum constructions.

Note

Spring case vent may be mounted in any orientation convenient to your application, but plastic vent (key 18) should be oriented downward.

8. When all maintenance is complete, refer to the Startup and Adjustment section to put the regulator back into operation and adjust the pressure setting. Tighten the locknut (key 12), replace the closing cap gasket (key 17) if necessary and install the closing cap (key 16).

161AY Series Pilots (Figure 7)

Body Area

Use this procedure to gain access to the disk assembly, orifice and body O-ring. All pressure must be released from the diaphragm casing and the disk assembly must be open, before these steps can be performed.

1. Remove the cap screws (key 2) and separate the diaphragm casing (key 4) from the body (key 1).
2. Remove body seal O-ring (key 11) and the backup ring (key 50). Inspect the body seal O-ring and replace if necessary.
3. Inspect and replace the orifice (key 5) if necessary. Lubricate the threads of the replacement orifice with a good grade of light grease and install with 29 to 37 ft-lbs / 39 to 50 N•m of torque.
4. On Types 161AY and 161AYM, remove the cotter pin (key 15) if it is necessary to replace the disk assembly (key 13) or the throat seal O-ring (key 31) of a Type 161AYM. On a Type 161AYW, to replace the disk assembly (key 13), bleed assembly (key 57), O-ring (key 53), washer (key 51) or spring (key 52), remove the groove pin (key 54).
5. For a Type 161AYM inspect the throat seal O-ring (key 31) and remove the machine screw (key 33). Replace O-ring if necessary.
6. On Types 161AY and 161AYM, install the disk assembly (key 13) and secure it with the cotter pin (key 15). On a Type 161AYW, install the bleed assembly (key 57), washer (key 51), O-ring (key 53) and spring (key 52) prior to installing the disk assembly (key 13) and securing it with the groove pin (key 54).
7. Place backup ring (key 50) into the body (key 1) then place the body seal O-ring (key 11) into the body.
8. Place the diaphragm casing (key 4) on the body (key 1). Secure the diaphragm casing to the body with the cap screws (key 2).

Diaphragm and Spring Case Area

Use this procedure to change the control spring and to inspect, clean or replace part in the spring case and diaphragm assembly.

To Change the Control Spring:

1. Remove the closing cap (key 22) and turn the adjusting screw (key 35) counterclockwise until all compression is removed from the control spring (key 6).

2. Change the control spring (key 6) to match the desired spring range.
3. Replace the adjusting screw (key 35).
4. Install the replacement closing cap gasket (key 25) if necessary and reinstall the closing cap (key 22).
5. If the spring was changed, be sure to change the stamped spring range on the nameplate.

To Disassemble and Reassemble the Diaphragm Parts

1. Remove the closing cap (key 22) and turn adjusting screw (key 35) counterclockwise to remove adjusting screw, baffle plate (key 56) and control spring (key 6).
2. Remove the spring case hex nuts (key 23, not shown), cap screws (key 24) and spring case (key 3).
3. Remove the diaphragm (key 10) and attached parts by tilting them so that the pusher post (key 8) slips off the lever assembly (key 16). To separate the diaphragm (key 10) from the attached parts, unscrew the machine screw (key 38) from the pusher post (key 8).
4. Inspect the pusher post (key 8) and the body seal O-ring (key 11), replace if required.
5. Remove hex nut (key 21) to separate the diaphragm (key 10) and attached parts.
6. To replace the lever assembly (key 16), remove the machine screws (key 17). To replace the stem (key 14) or access the stem seal O-ring (key 30) also perform Body Area Maintenance procedure steps 1 and 4 and pull the stem out of the diaphragm casing (key 4).
7. Install the stem (key 14) into the guide insert (key 18) and perform Body Area Maintenance procedure steps 6 through 8 as necessary.
8. Install the lever assembly (key 16) into the stem (key 14) and secure the lever assembly with the machine screws (key 17).
9. Install the parts on the pusher post in the order listed below:
 - Pusher Post (key 8)
 - Pusher Post Connector (key 40)
 - Connector Seal O-ring (key 49)
 - Diaphragm Head (key 7)
 - Diaphragm (key 10), pattern side up
 - Diaphragm Head (key 7)
 - Hex Nut (key 21) — Tighten the hex nut 9 to 11 ft-lbs / 12 to 15 N•m to secure parts to the pusher post connector (key 40)

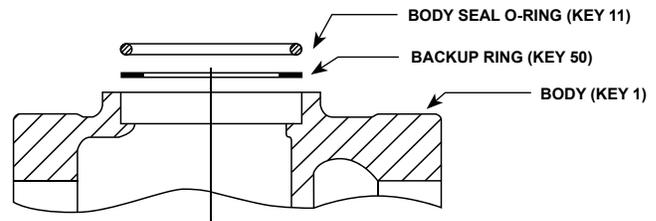


Figure 3. Expanded View of the Body Area Showing the O-ring and Backup Ring Placement

- Overpressure Spring (key 39)
 - Spring Holder (key 37)
 - Machine Screw (key 38)
10. Insert and tighten the machine screw (key 38) with a torque of 1 to 3 ft-lbs / 1.3 to 4.1 N•m to secure the diaphragm parts to the pusher post (key 8).
 11. Install the assembled parts in the diaphragm casing (key 4). Make sure the lever (key 16) fits in the pusher post (key 8) and that the holes in the diaphragm (key 10) align with the holes in the diaphragm casing.
 12. Place the spring case (key 3) on the diaphragm casing (key 4) so the vent assembly (key 26) is oriented correctly and secure with the cap screws (key 24) and hex nuts (key 23, not shown) finger tight only.
 13. Insert the control spring (key 6) into the spring case (key 3), followed by the baffle plate (key 56) and adjusting screw (key 35).
 14. Turn the adjusting screw (key 35) clockwise until there is enough spring (key 6) force to provide proper slack to the diaphragm (key 10). Using a crisscross pattern, tighten the cap screws (key 24) and hex nuts (key 23, not shown) to 14 to 17 ft-lbs / 19 to 23 N•m of torque. To adjust the outlet pressure to the desired setting, refer to Startup and Adjustment section.
 15. Install a replacement closing cap gasket (key 25) if necessary and then install the closing cap (key 22).

Parts Ordering

When corresponding with your local Sales Office about this equipment, reference the equipment serial number or FS number found on a nameplate attached to the bonnet. When ordering replacement parts, reference the eleven digit part number of each needed part found in the parts list.

161 Series

Parts List

161 and 161EB Series Pilots (Figures 4 through 6)

Key	Description	Part Number
	Type 161 Pilot Parts Kit (included are keys 4, 6, 7 and 15) For 5 to 15 or 10 to 125 psig / 0.34 to 1.03 or 0.69 to 8.62 bar control spring range For 120 to 300 psig / 8.27 to 20.7 bar control spring range	R161X000012
	Type 161 Pilot Parts Kit (included are keys 4, 6, 7, 15 and 17) For pressure loading with 5 to 15 or 10 to 125 psig / 0.34 to 1.03 or 0.69 to 8.62 bar control spring range	R161X000022
	Type 161M Pilot Parts Kit (included are keys 4, 6, 7, 15, 17, 19 and 22) For 5 to 15 or 10 to 125 psig / 0.34 to 1.03 or 0.69 to 8.62 bar control spring range For 120 to 300 psig / 8.27 to 20.7 bar control spring range For pressure loading with 5 to 15 or 10 to 125 psig / 0.34 to 1.03 or 0.69 to 8.62 bar control spring range	R161MX00012 R161MX00022
	Parts Kit, (included are keys 4, 6, 7 and 15) Type 161EB, Nitrile (NBR) 5 to 200 psig / 0.34 to 13.8 bar 200 to 350 psig / 13.8 to 24.1 bar Type 161EBM, Nitrile (NBR) 5 to 200 psig / 0.34 to 13.8 bar 200 to 350 psig / 13.8 to 24.1 bar	R161X000012 R161X000022 R161MX00012 R161MX00022
1	Body Assembly Types 161 and 161EB Stainless steel Aluminum (Type 161 only) Types 161M and 161EBM Stainless steel	1B7971X0252 1B7971X0292 30B8715X012
2	Spring Case Types 161 and 161M Aluminum (Type 161 only) Stainless steel Types 161EB and 161EBM, Stainless steel	25A6220X012 28A9277X012 27B9722X012
3	Body Plug Aluminum (Type 161 only) Stainless steel	1B797509032 1B7975X0052
4*	Valve Plug Nitrile (NBR) with Stainless steel stem Fluorocarbon (FKM) with Stainless steel stem	20B9389X052 20B9389X062
6	Plug Spring, Stainless steel	1E701337022
7*	Diaphragm Assembly, Diaphragm with Stainless steel diaphragm plate	See Table 4 or 5
8	Upper Spring Seat, Plated steel	See Table 4 or 5
9	Control Spring	See Table 4 or 5
10	Diaphragm Limiter, Stainless steel	See Table 4 or 5
11	Adjusting Screw, Plated Steel	See Table 4 or 5
12	Locknut For Types 161 and 161M, Stainless steel For Types 161EB and 161EBM, Carbon Steel	1A9463X0042 1D667728982
13	Machine Screw, (6 required) Types 161 and 161M, Stainless steel spring case For 5 to 300 psi / 0.34 to 20.7 bar For 250 to 600 psi / 17.2 to 41.4 bar Type 161, Aluminum spring case Types 161EB and 161EBM, Stainless spring case	1V4360X0022 T12980T0012 10B6189X022 1V4360T0012
14	Pipe Plug For Aluminum body, (Type 161 only), Plated steel For Stainless steel body, Stainless steel Types 161 and 161EB	1A767524662 1A767535072

Key	Description	Part Number
15	Body Plug O-ring, Nitrile (NBR)	1F113906992
16	Closing Cap Nylon (PA) Types 161 and 161M Types 161EB and 161EBM Metal for pressure loading Types 161 and 161M Types 161EB and 161EBM	23B9152X012 24B1301X012 1H2369X0012 17B1406X012
17*	Closing Cap Gasket, Pressure loading for metal closing cap only, Composition Types 161 and 161M Types 161EB and 161EBM	15A6218X012 1C659804022
18	Type Y602-12 Vent Assembly, Plastic	27A5516X012
19*	Stem Guide Seal Assembly (Type 161M only) Stainless steel seal and seal retainer with Nitrile (NBR) rubber O-ring	10B8711X012
22	O-ring (Types 161M and 161EBM), Nitrile (NBR)	10A0904X012
23	O-ring (Types 161 and 161M), Nitrile (NBR)	10A7777X012
26	Gauge (Type 161EB), Stainless steel	11B9639X032
38	Lower Spring Seat, (Types 161EB and 161EBM) Plastic	18B1248X012

Types 161AY, 161AYM and 161AYW Pilots (Figure 7)

Key	Description	Part Number
	Parts Kit (included are keys 10, 11, 12, 13, 15, 30, 31, 33, 48 and 49)	RY690AX0012
1	Body, Cast iron	1E987119012
2	Cap Screw, Zinc-plated steel (2 required)	1C856228992
3	Spring Case Assembly, Ductile iron	13B0109X042
4	Lower Casing, Ductile iron Type 161AY Types 161AYM and 161AYW	17B5352X012 47B3063X012
5	Orifice, Stainless steel 3/32 in. / 2.4 mm 1/4 in. / 6.3 mm 1/8 in. / 3.2 mm	0R044135032 0B042035032 1A936735032
6	Control Spring, Steel	See Table 1
7	Diaphragm Head, Stainless steel	17B9723X032
8	Pusher Post, Stainless steel	27B5354X012
10*	Diaphragm Nitrile (NBR) Fluorocarbon (FKM)	37B9720X012 23B0101X052
11*	Body Seal Nitrile (NBR) Fluorocarbon (FKM)	1H993806992 1H9938X0012
12*	Insert Seal Nitrile (NBR) Fluorocarbon (FKM)	1B885506992 1B8855X0012
13*	Disk Assembly Types 161AY and 161AYM Nitrile (NBR) Fluorocarbon (FKM) Type 161AYW Nitrile (NBR)	1C4248X0202 1C4248X0052 14A0632X012
14	Stem, Stainless steel Types 161AY and 161AYM Type 161AYW	17B3423X012 27B5279X012
15*	Cotter Pin (Types 161AY and 161AYM only), Stainless steel	1A866537022
16	Lever Assembly, Stainless steel	1B5375000B2
17	Machine Screws, Stainless steel (2 required)	19A7151X022
18	Guide Insert, Stainless steel Types 161AY and 161AYM Type 161AYW	27B4028X022 27B4029X012
21	Hex Nut, Steel	1A354024122

*Recommended Spare Part

Table 4. Types 161 and 161M Pilot Part Numbers (keys 7, 8, 9, 10 and 11)

KEY	PART NAME	OUTLET (CONTROL) PRESSURE RANGE AND SPRING COLOR CODE		
		5 to 15 psig / 0.34 to 1.03 bar, Yellow	10 to 125 psig / 0.69 to 8.62 bar, Red	120 to 300 psig / 8.27 to 20.7 bar, Green
7	Diaphragm Assembly, Standard, Nitrile (NBR)	17B9055X022	17B9055X022	17B9055X032
	Diaphragm Assembly, Pressure-Loaded, Nitrile (NBR)	17B9055X012	17B9055X012	-----
	Diaphragm Assembly, Standard, Fluorocarbon (FKM)	17B9055X062	17B9055X062	17B9055X052
	Diaphragm Assembly, Pressure-Loaded, Fluorocarbon (FKM)	17B9055X042	17B9055X042	-----
8	Upper Spring Seat	1B798525062	1B798525062	1K155828982
9	Spring	1E392527022	1K748527202	15A9258X012
10	Diaphragm Limiter	-----	-----	10B4407X012
11	Adjusting Screw	10B6190X012	10B7192X012	10B6190X012

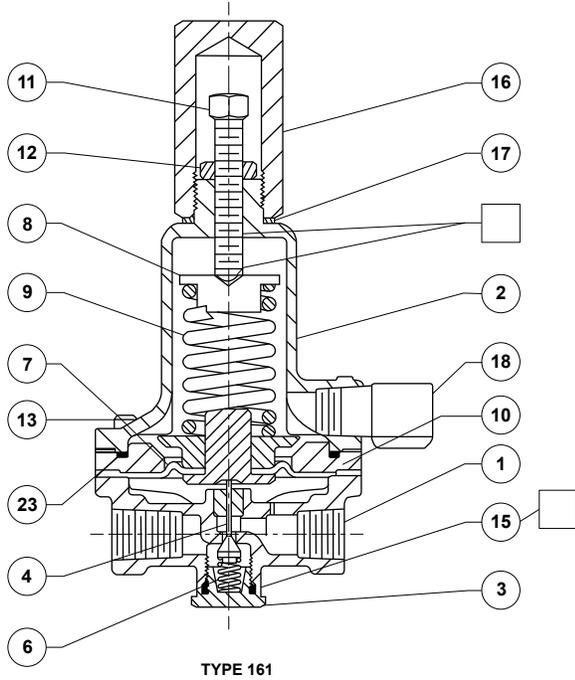
Table 5. Types 161EB and 161EBM Pilot Part Numbers (keys 7, 8, 9, 10 and 11)

KEY	PART NAME	OUTLET (CONTROL) PRESSURE RANGE AND SPRING COLOR CODE					
		5 to 15 psig / 0.34 to 1.03 bar, White	10 to 40 psig / 0.69 to 2.76 bar Yellow	30 to 75 psig / 2.07 to 5.17 bar Black	70 to 140 psig / 4.83 to 9.65 bar, Green	130 to 200 psig / 8.96 to 13.8 bar, Blue	200 to 350 psig / 13.8 to 24.1 bar, Red
7	Diaphragm Assembly, Standard, Nitrile (NBR)	17B9055X022	17B9055X022	17B9055X022	17B9055X022	17B9055X022	-----
	Diaphragm Assembly, Pressure-Loaded, Nitrile (NBR)	17B9055X012	17B9055X012	17B9055X012	17B9055X012	-----	-----
	Diaphragm Assembly, High-Pressure, Nitrile (NBR)	-----	-----	-----	-----	-----	17B9055X032
	Diaphragm Assembly, Standard, Fluorocarbon (FKM)	17B9055X062	17B9055X062	17B9055X062	17B9055X062	17B9055X062	-----
	Diaphragm Assembly, Pressure-Loaded, Fluorocarbon (FKM)	17B9055X042	17B9055X042	17B9055X042	17B9055X042	-----	-----
	Diaphragm Assembly, High-Pressure, Fluorocarbon (FKM)	-----	-----	-----	-----	-----	17B9055X052
8	Upper Spring Seat	17B0515X012	17B0515X012	17B0515X012	17B0515X012	17B0515X012	17B0515X012
9	Spring	17B1260X012	17B1262X012	17B1259X012	17B1261X012	17B1263X012	17B1264X012
10	Diaphragm Limiter	-----	-----	-----	-----	-----	10B4407X012
11	Adjusting Screw	10B3081X012	10B3081X012	10B3081X012	10B3081X012	10B3081X012	10B3080X012

Types 161AY, 161AYM and 161AYW Pilots (Figure 7) (continued)

Key	Description	Part Number	Key	Description	Part Number
22	Closing Cap Plastic (standard) Steel	T13524T0062 1E422724092	33*	Machine Screw (Type 161AYM only) Stainless steel	18A0703X022
23	Hex Nut, Steel (8 required)	1A352724122	35	Adjusting Screw, Cast Zinc	1B537944012
24	Cap Screw, Steel (8 required)	1A352524052	37	Spring Holder, Steel	1R982025072
25	Closing Cap Gasket, for steel closing cap, Neoprene (CR)	1P753306992	38	Machine Screw, Stainless steel	10B6189X022
26	Vent Assembly Spring Case Down (Type Y602-1) Spring Case Up (Type Y602-11) Spring Case Sideways (Type Y602-12)	17A6570X012 17A5515X012 27A5516X012	39	Overpressure Spring, Stainless steel	1B541327022
30*	Stem Seal O-ring (Type 161AYM only) Nitrile (NBR) Fluorocarbon (FKM)	1H2926G0012 1H2926X0022	40	Pusher Post Connector, Stainless steel	27B7982X012
31*	Throat Seal (Type 161AYM only) Nitrile (NBR) Fluorocarbon (FKM)	1D682506992 1D6825X0012	46	Nameplate	-----
			47	Drive Screw, Stainless steel (2 required)	1A368228982
			48*	Post Seal Nitrile (NBR) Fluorocarbon (FKM)	1D687506992 1N430406382
			49*	Connector Seal Nitrile (NBR) Fluorocarbon (FKM)	13A1584X012 13A1584X022
			50	Backup Ring, Stainless steel	18B3446X012
			51	Washer, (Type 161AYW only) Carbon steel plated	14A0633X012

161 Series

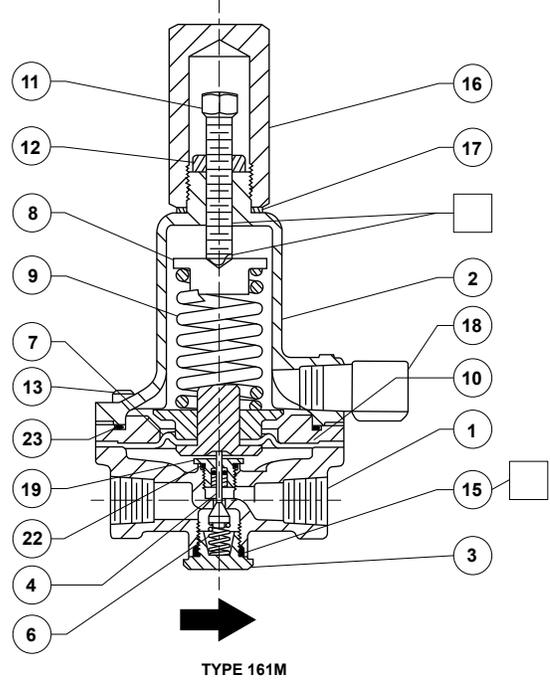


TYPE 161

32B0707

□ APPLY LUBRICANT
PARTS NOT SHOWN: KEYS 14, 28 AND 34

Figure 4. Type 161 Monitor Pilot Assembly

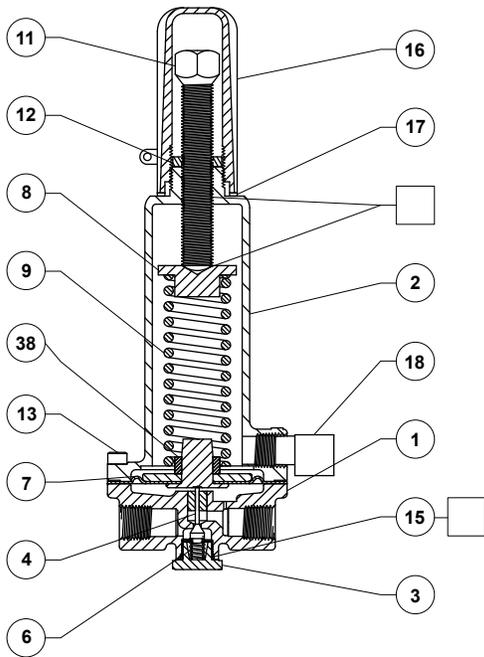


TYPE 161M

32B0708_D

□ APPLY LUBRICANT
PARTS NOT SHOWN: KEY 25

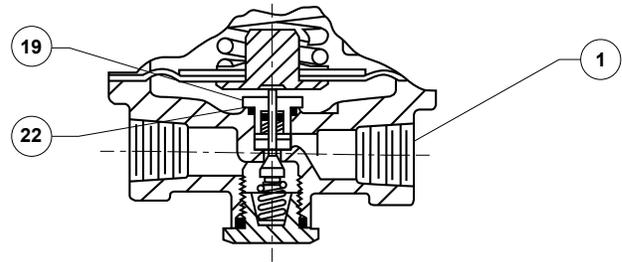
Figure 5. Type 161M Monitor Pilot Assembly



TYPE 161EB

37B1208

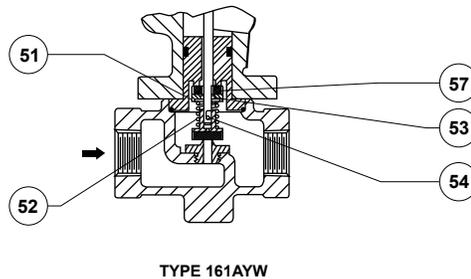
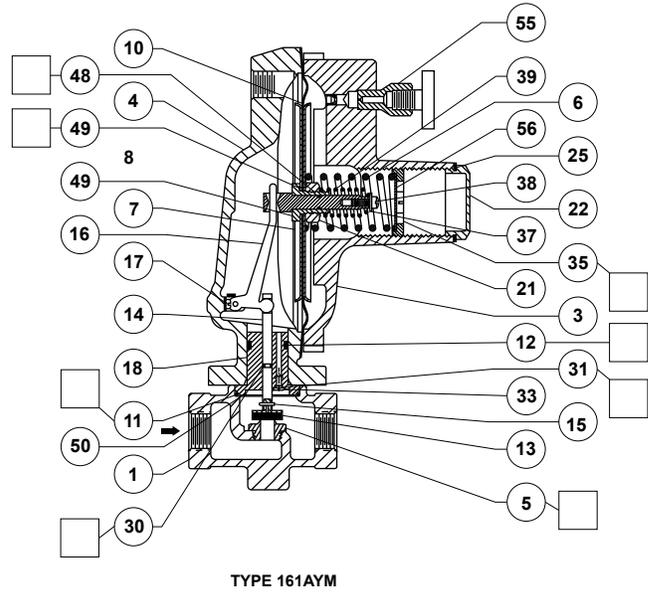
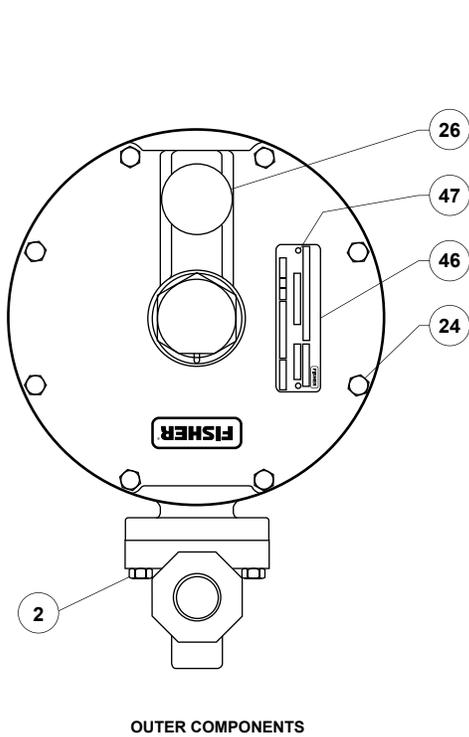
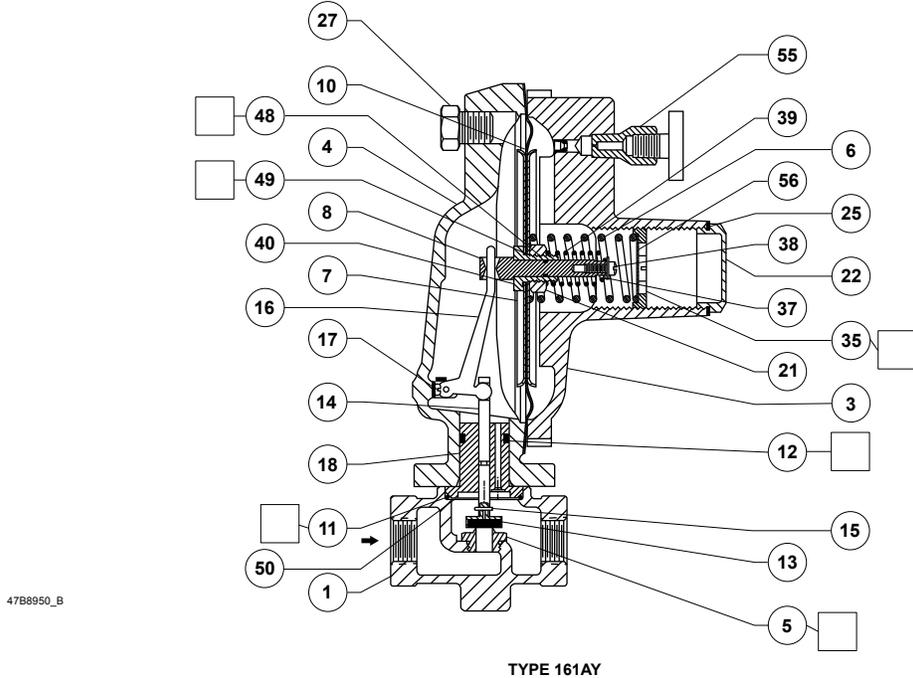
□ APPLY LUBRICANT
PARTS NOT SHOWN: KEYS 14, 28 AND 34



TYPE 161EBM

37B2946_B

Figure 6. 161EB Series Monitor Pilot Assemblies



47B8951_B

□ APPLY LUBRICANT
PARTS NOT SHOWN: KEY 23

47B3689B

Figure 7. 161AY Series Monitor Pilot Assembly

161 Series

Types 161AY, 161AYM and 161AYW Pilots (Figure 7) (continued)

Key	Description	Part Number	Key	Description	Part Number
52	Spring, (Type 161AYW only) 302 Stainless steel	1U550637022	55	Restriction (Types 161AY and 161AYM only), Brass	1D483514012
53*	O-ring, (Type 161AYW only) Nitrile (NBR)	1D191706992	56	Baffle Plate (Types 161AY and 161AYM only), Stainless steel	11B4292X012
54*	Groove Pin, (Type 161AYW only) 303 Stainless steel	1D799138992	57*	Bleed Assembly, (Type 161AYW only) 303 Stainless steel/Nitrile (NBR)	14A0636X012

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