# Type 399A Pilot-Operated Pressure-Reducing Regulator

## Contents



W6524/IL

*Figure 1. Type 399A Easy Joe® Regulator with a Type 161 Pilot and Type 112 Restrictor*







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April 1999

**Errata Sheet**
**for**

Type 399A Pilot-Operated Pressure Reducing Regulator
Form 5321, March 1996



The pilot for the Type 399A regulator has been changed from a Type 161Y and 161YM to a Type 161AY and 161AYM. The Type 161AY is a direct replacement for the Type 161Y and the Type 161AYM replaces the Type 161YM. The pilot is used for set pressure ranges of 6-inches w.c. to 7 psig (15 mbar to 0,48 bar). A sliding pusher post has been added to the construction to enable the pilot to be rated to 150 psig (10,3 bar) on the outlet. This errata sheet provides maintenance, and parts ordering information for the new pilot. Please refer to the Type 399A-161-112 Instruction Manual for information on installation and principle of operation. **Each bullet on this errata sheet refers to a section of the Type 399A-161-112 instruction manual (form 5321) that needs to be replaced with the information on this sheet.**

- Replace the Scope of Manual on page 2 with the following:

This instruction manual provides installation, startup, adjustment, shutdown, maintenance, and parts ordering infromation for the Type 399A Easy Joe® pressure-reducing regulator complete with Type 112 restrictor and Type 161, 161M, 161AY, 161AYM, 161H, 161EB, 161EBM, 161EBH, or 161EBHM pilot. Any accessories used with this regulator are covered in other manuals.

- Replace the Type 161Y and 161YM paragraphs under the Product Description section on page 2 with the following:

**Type 161AY—**Downstream pressure range from 6-inches w.c. to 7 psig (15 mbar to 0,48 bar). Pilot bleed exhausts downstream through the sense (control) line. A sliding pusher post is standard to prevent internal damage during startup or when overpressure conditions occur.

**Type 161AYM—**Downstream pressure range from 6-inches w.c. to 7 psig (15 mbar to 0,48 bar). A static sensing (control) line is isolated from pilot bleed (exhaust). The Type 161AYM is used in working monitor and other applications that require a sensing line isolated from pilot bleed (exhaust). A sliding pusher post is standard to prevent internal damage during startup or when overpressure conditions occur.

- Replace the first paragraph of the Specifications section on page 3 with the following:

Specifications for the Type 399A regulator are found in tables 1 through 6. The control spring range for an individual pilot as it comes from the factory is marked on the spring case of Type 161, 161M, 161H, 161HM, 161EB, 161EBM, 161EBH, and 161EBHM pilots and on the closing cap of Type 161AY and 161AYM pilots. Other information for an individual main valve appears on the nameplate.

- Replace the Type 161Y or 161YM pilot reference in "Table 1. Specifications" on page 2 with Type 161AY or 161AYM.



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• Replace the Type 161Y or 161YM information in "Table 3. Outlet (Control) Pressure Ranges and Typical Proportional Bands" on page 4 with the following information:

| PILOT TYPE | OUTLET CONTROL PRESSURE RANGE | PROPORTIONAL BAND(1) WITH RESTRICTOR SET AT 2 | PILOT CONTROL SPRING | | | |
|---|---|---|---|---|---|---|
| | | | Part Number | Color Code | Wire Diameter, Inches (cm) | Free Length, Inches (cm) |
| 161AY or 161AYM | 6 to 15-inches w.c. (15 to 37 mbar) | 1-inch w.c.(2) (2,5 mbar)(2) | 1B653927022 | Olive drab | 0.105 (0,267) | 3.75 (9,53) |
| | 0.5 to 1.2 psig (0,034 to 0,083 bar) | 1-inch w.c.(2) (2,5 mbar)(2) | 1B537027052 | Yellow | 0.114 (0,290) | 4.31 (10,95) |
| | 1.2 to 2.5 psig (0,083 to 0,17 bar) | 0.5 psig(2) (0,034 bar)(2) | 1B537127022 | Light green | 0.156 (0,396) | 4.13 (10,49) |
| | 2.5 to 4.5 psig (0,17 to 0,3 bar) | 0.5 psig(2) (0,034 bar)(2) | 1B537227022 | Light blue | 0.187 (0,475) | 3.94 (10,0) |
| | 4.5 to 7 psig (0,3 to 0,5 bar) | 0.5 psig(2) (0,034 bar)(2) | 1B537327052 | Black | 0.218 (0,554) | 4.13 (10,49) |

• Replace the Type 161Y and 161YM references in Installation section beginning on page 5 with Type 161AY and Type 161AYM respectively.

• Replace the Type 161Y or 161YM information in "Table 6. 161 Series Pilot Pressure Ratings" on page 7 with the following information:

| PILOT TYPE NUMBER | BODY AND SPRING CASE MATERIAL | DIAPHRAGM ASSEMBLY | MAXIMUM INLET PRESSURE FOR TYPE 161AY AND MAXIMUM INLET AND BLEED (EXHAUST) PRESSURES FOR TYPE 161AYM | MAXIMUM OUTLET PRESSURE FOR TYPE 161AY AND MAXIMUM SENSE PRESSURE FOR TYPE 161AYM |
|---|---|---|---|---|
| 161AY or 161AYM | Ductile iron | All | 150 psig (10,3 bar) | 150 psig (10,3 bar) |

• Replace the Type 161Y and 161YM captions in "Figure 3. Installation Schematics" on page 8 with Type 161AY and Type 161AYM respectively.

• Add the following paragraph to the Pilot Adjustment section on page 15:

The Type 161AY and 161AYM pilots have been adjusted at the factory to provide approximately the reduced pressure requested on the order. The pressure setting may be adjusted to a value within the outlet pressure range shown in table 3. To adjust the pressure setting, perform the following steps (key numbers are referenced in figure 23):

**WARNING**

To avoid personal injury, property damage, or equipment damage caused by bursting of pressure containing parts or explosion of accumulated gas, never adjust the control spring to produce an outlet pressure higher than the upper limit of the outlet pressure range for that particular spring. If the desired outlet pressure is not within the range of the control spring, install a spring of the proper range.

1. Remove the closing cap (key 22).

2. Turn the adjusting screw (key 35) clockwise to increwase outlet pressure or counterclockwise to decrease outlet pressure.

3. After making the adjustment and replace the closing cap. The closing cap can be wired to the spring case assembly (key 3) to discourage tampering.

- Replace the Type 161Y and 161YM Pilot Maintenance section beginning on page 23 with the following:

## Type 161AY or 161AYM Pilot

Key numbers are referenced in figure 23.

### *Body Area*

1. Remove the cap screws (key 2) and separate the diaphragm casing (key 4) from the body (key 1).

2. Remove the body seal O-ring (key 11) and the backup ring (key 50) from the body (key 1). Inspect the body seal O-ring and replace if necessary. See the expanded view of the body area in figure 23.

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 foot-pounds (39 to 50 N•m) of torque.

4. Remove the cotter pin (key 15) if it is necessary to replace the disk assembly (key 13) or throat seal of a Type 161AYM.

5. For a Type 161AYM, inspect the throat seal O-ring (key 31) and remove the machine screw (key 33). Replace the O-ring if necessary.

6. Install the disk assembly (key 13) and secure it with the cotter pin (key 15).

7. Place the backup ring (key 50) into the body (key 1). Next, 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*

**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 the adjusting screw (key 35) counterclockwise to remove the adjusting screw, baffle plate (key 56) and the 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) plus 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 diaphragm casing (key 4) 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 (key 8) 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) — Torque the hex nut 9 to 11 foot-pounds (12 to 15 N•m) to secure parts to the pusher post connector (key 40)
- 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 foot-pounds (1 to 4 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 that the lever (key 16) fits in the pusher post (key 8) and that the holes in the diaphragm align with the holes in the diaphragm casing.

12. Place the spring case (key 3) on the diaphragm casing (key 4) so that the vent assembly (key 26) is correctly oriented, and secure with the cap screws (key 24) and hex nuts (key 23, not shown) fingertight 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 control spring (key 6) force to provide proper slack to the diaphragm (key 10). Using a criss-cross pattern, finish tightening the cap screws (key 24) and hex nuts (key 23, not shown) to 14 to 17 foot-pounds (19 to 23 N•m) of torque. To adjust the outlet pressure to the desired setting, refer to Startup and Adjustment in the Instruction Manual.

15. Install a replacement closing cap gasket (key 25) if necessary, and then install the closing cap (key 22).

## To Convert Constructions

### *The Type 161AY to the Type 161AYM:*

New parts required: Keys 30, 31 and 33

1. Remove the pipe plug (key 27) from the diaphragm casing (key 4).

2. Refer to steps 1 and 4 in the Body Area Maintenance section of this errata sheet to remove the disk assembly (key 13).

3. Insert the throat seal O-ring (key 31, figure 23) and one machine screw (key 33).

4. Insert the stem seal O-ring (key 30) by following steps 1 through 3, and 6 through 8 in the Disassemble/Reassemble section of Diaphragm and Spring Case Area Maintenance of this errata sheet. Reassemble by following the appropriate steps.

*The Type 161AYM to the Type 161AY:*

New part required: key 27

1. Insert pipe plug (key 27) in the diaphragm casing (key 4).

2. Follow steps 1 through 3, and 6 through 8 in the Disassemble/Reassemble section of Diaphragm and Spring Case Area Maintenance of this errata sheet to remove the stem seal O-ring (key 30).

3. Refer to steps 1 and 4 in the Body Area Maintenance section of this errata sheet to remove the disk assembly (key 13).

4. Remove the throat seal O-ring (key 31) and one machine screw (key 33). Reassemble following steps 6 through 8 in the Body Area Maintenance section of this errata sheet.

- Replace the Type 161Y and 161YM Parts List section on page 37 with the following:

## Type 161AY and 161AYM

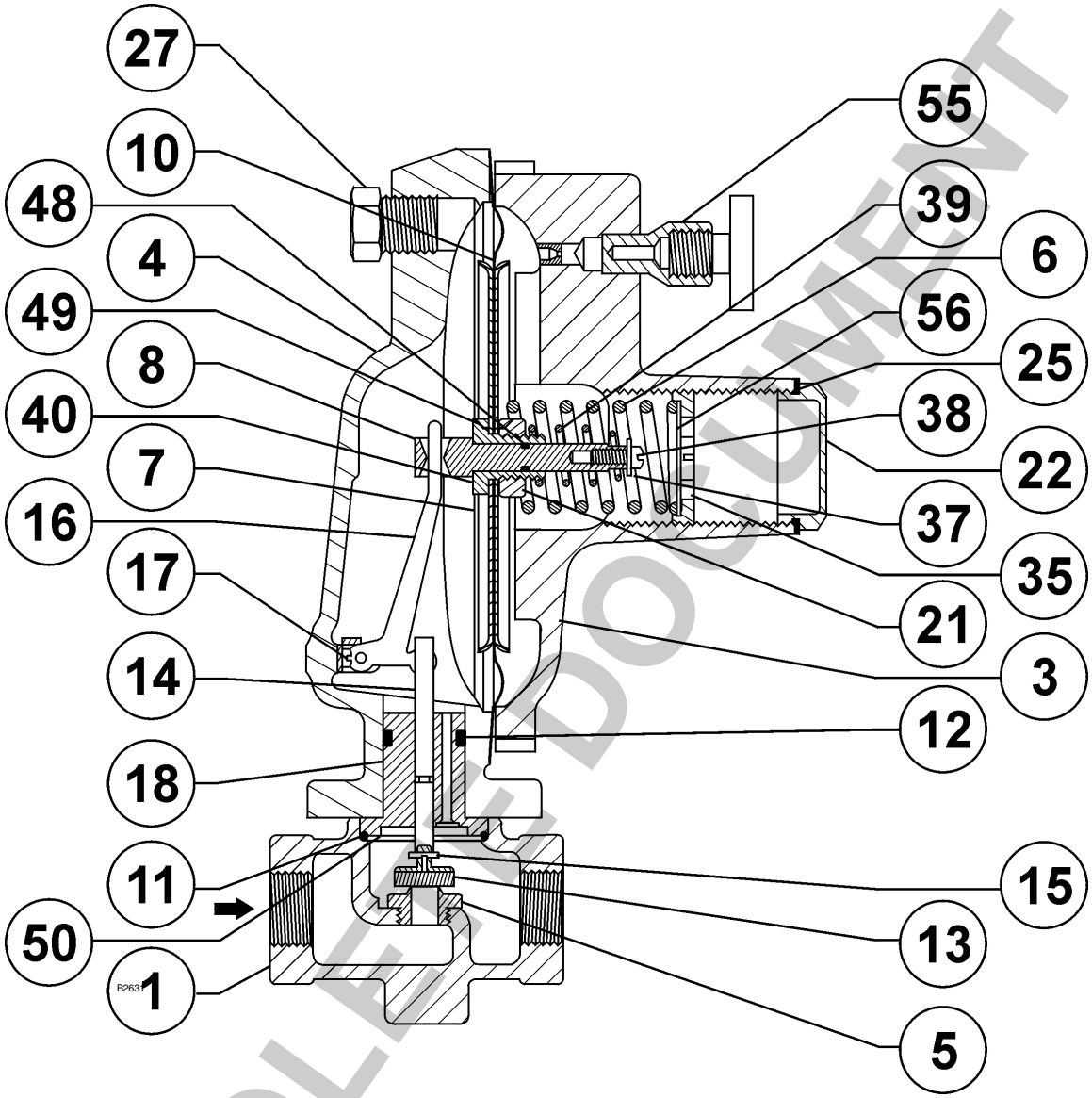
| Key | Description | Part Number |
|---|---|---|
| | Spare Parts, Nitrile (includes keys 10, 11, 12, 13, 15, 30, 31, 33, 48, and 49) | RY690AX0012 |
| 1 | Body | |
| | Cast Iron | 1E987119012 |
| 2 | Cap Screw, 2 required | 1C856228992 |
| 3 | Spring Case Assembly | |
| | Ductile Iron | 13B0109X042 |
| 4 | Diaphragm Casing | |
| | Ductile Iron | 47B3063X012 |
| 5 | Orifice | |
| | 3/32-inch (2,38 mm)(standard) | 0R044135032 |
| | 1/4-inch (6,35 mm)(fast response) | 0B042035032 |
| 6 | Spring | |
| | 6 to 15-inches w.c. (15 to 37 mbar) | 1B653927022 |
| | 0.5 to 1.2 psig (0,034 to 0,083 bar) | 1B537027052 |
| | 1.2 to 2.5 psig (0,083 to 0,17 bar) | 1B537127022 |
| | 2.5 to 4.5 psig (0,17 to 0,3 bar) | 1B537227022 |
| | 4.5 to 7 psig (0,3 to 0,48 bar) | 1B537327052 |
| 7 | Diaphragm Head, 2 required | 17B9723X032 |
| 8 | Pusher Post | 27B5354X012 |
| 10* | Diaphragm | |
| | Molded Nitrile (NBR) | 37B9720X012 |
| | Fluoroelastomer (FKM) | 23B0101X052 |
| 11* | Body Seal O-Ring | |
| | Nitrile | 1H993806992 |
| | Fluoroelastomer | 1H9938X0012 |
| 12* | Insert Seal O-Ring | |
| | Nitrile | 1B885506992 |
| | Fluoroelastomer | 1B8855X0012 |
| 13* | Disk Assembly | |
| | S30300 Stainless steel with Nitrile (NBR) | 1C4248X0202 |
| | Fluoroelastomer (FKM) | 1C4248X0052 |
| 14 | Stem | 17B3423X012 |
| 15* | Cotter Pin | 1A866537022 |
| 16 | Lever Assembly | 1B5375000B2 |
| 17 | Machine Screw, 2 required | 19A7151X022 |
| 18 | Guide Insert | 27B4028X012 |
| 21 | Hex Nut | 1A354024122 |
| 22 | Closing Cap | |
| | Plastic (Standard) | T11069X0012 |
| | Steel | 1E422724092 |
| 23 | Hex Nut, 8 required (not shown) | 1A352724122 |
| 24 | Cap Screw, 8 required | 1A352524052 |
| 25* | Closing Cap Gasket | |
| | Steel closing cap only | 1P753306992 |
| 26 | Vent Assembly | |
| | Spring Case Up (standard) | 17A5515X012 |
| 27 | Pipe Plug | 1A369224492 |
| 30* | Stem Seal O-Ring | |
| | Nitrile | 1H2926G0012 |
| | Fluoroelastomer | 1H2926X0022 |
| 31* | Throat Seal O-Ring | |
| | Nitrile | 1D682506992 |
| | Fluoroelastomer | 1D6825X0012 |
| 33 | Machine Screw | 18A0703X022 |
| 35 | Adjusting Screw | 1B537944012 |
| 37 | Spring Holder | 1R982025072 |
| 38 | Machine Screw | 10B6189X022 |
| 39 | Overpressure Spring | 1B541327022 |
| 40 | Pusher Post Connector | 27B7982X012 |
| 46 | Nameplate | ---------- |
| 47 | Drive Screw, 2 required | 1A368228982 |
| 48* | Post Seal O-Ring | |
| | Nitrile | 1D687506992 |
| | Fluoroelastomer | 1N430406382 |
| 49* | Connector Seal O-Ring | |
| | Nitrile | 13A1584X012 |
| | Fluoroelastomer | 13A1584X022 |
| 50 | Backup Ring, stainless steel | 18B3446X012 |
| 55 | Restriction | 1D483514012 |
| 56 | Baffle Plate | 11B4292X012 |

*Recommended Spare Parts

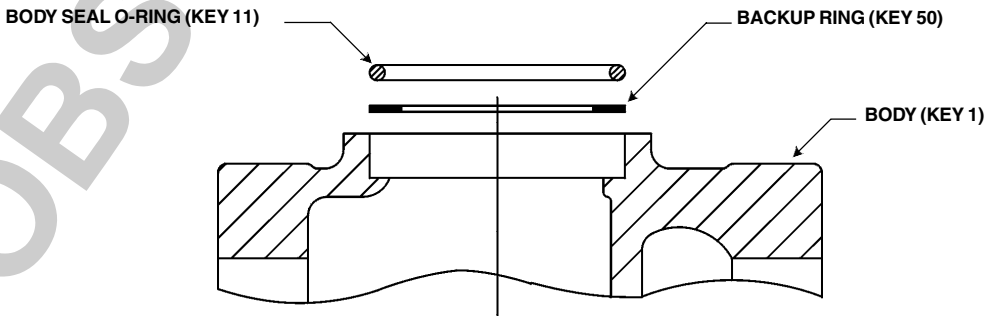
- Replace the Type 161Y and 161YM Mounting Parts Heading on page 38 with the following:

## Type 161AY and 161AYM Mounting Parts (figure 24)

- Replace "Figure 23. Types 161Y and 161YM Pilots" on page 38 with the following:

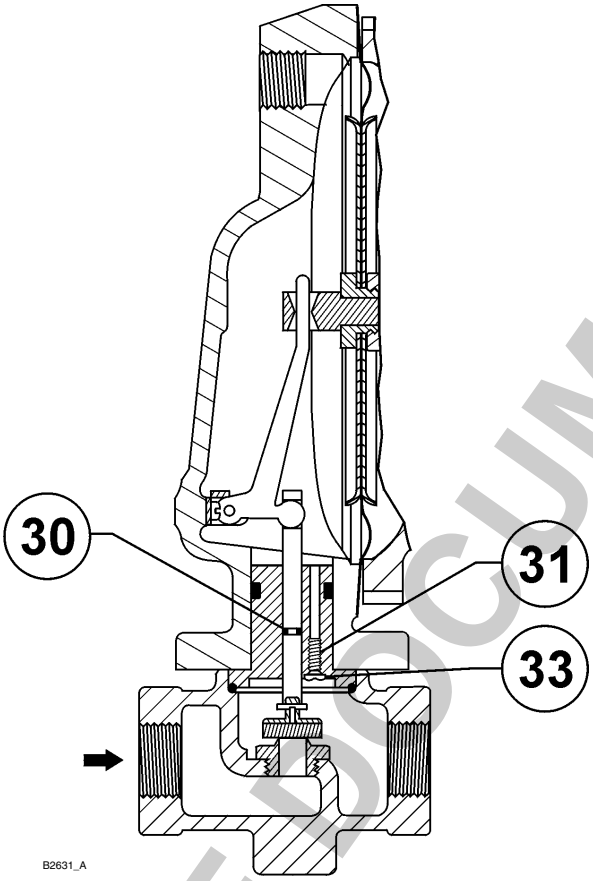



TYPE 161AY PILOT ASSEMBLY

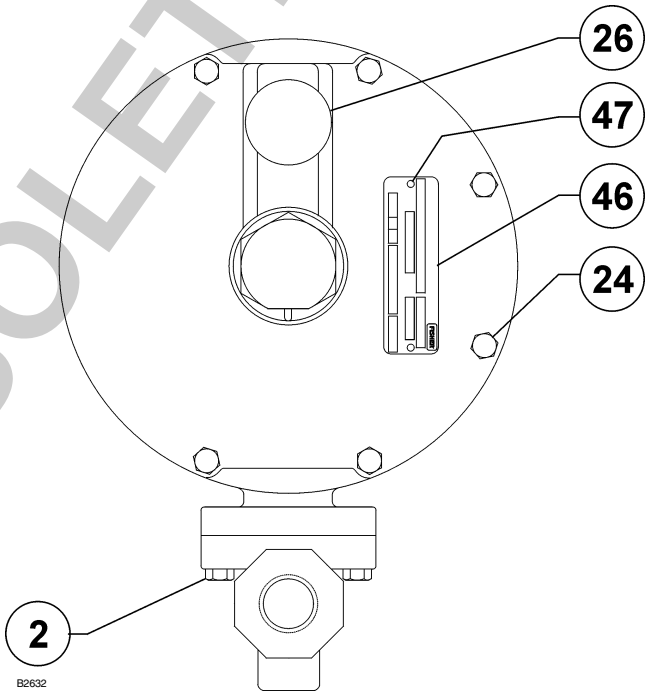



EXPANDED VIEW OF BODY AREA SHOWING THE
BODY SEAL O-RING AND BACKUP RING PLACEMENT

*Figure 23. Type 161AY and 161AYM Pilot Assemblies*




**TYPE 161AYM PILOT ASSEMBLY**




**TYPE 161AY AND 161AYM PILOT EXTERIOR ASSEMBLY**

*Figure 23. Type 161AY and 161AYM Pilot Assemblies*

*Table 1. Specifications*

**Type 399A Main Valve Body Sizes, End Connection Styles, and Ratings(1)**

See table 2

**Maximum Inlet Pressures and Pressure Drops(1)**

**Type 399A Main Valve:** See table 2
**161 Series Pilots:** See tables 3 and 6
**Type 112 Restrictor:** 1500 psig (103.4 bar)

**Outlet (Control) Pressure Ranges**

See table 3

**Diaphragm Pressure Differentials**

See table 5

**Main Valve Flow Direction**

Up through cage port and out through cage slots

**Approximate Proportional Bands**

See table 3

**Material Temperature Capabilities(1)**

See table 4

**Pilot and Restrictor Connections**

See table 3

**Pilot Spring Case Vent**

**Type 161, 161M, 161H, 161HM, 161EB, 161EBM, 161EBH or 161EBHM:** 1/4-inch NPT female with removable Type Y602-12 vent assembly
**Type 161Y or 161YM:** 1/4-inch NPT female with removable Type Y602-11 vent assembly

**Shipping Weights (including Pilot and Restrictor)**

See table 7

1. The pressure/temperature limits in this manual and any applicable standard or code limitation for valve should not be exceeded.



# Introduction

## Scope of Manual

This instruction manual provides installation, maintenance, and parts ordering information for the Type 399A **Easy Joe**® pressure-reducing regulator complete with Type 112 restrictor and Type 161, 161M, 161Y, 161YM, 161H, 161HM, 161EB, 161EBM, 161EBH, or 161EBHM pilot. Any accessories used with this regulator are covered in other manuals.

## Product Description

The Type 399A pressure-reducing regulator for air or gas service (figure 1) includes a Type 112 restrictor and a 161 Series pilot. The fabric-reinforced main valve diaphragm moves in response to the pilot loading pressure to control downstream pressure. Shutoff (lockup) is achieved by applying full inlet pressure to the loading chamber to close the diaphragm against the slotted cage.

Descriptions of the pilot configurations covered in this instruction manual are as follows:

**Type 161** Downstream pressure range from 5 to 300 psig (0.34 to 21 bar). Pilot bleed exhausts downstream through the sense (control) line.

**Type 161M** Downstream pressure range from 5 to 300 psig (0.34 to 21 bar). A static sensing (control) line is isolated from pilot bleed (exhaust). The Type 161M is used in working monitor and other applications that require a sensing line isolated from pilot bleed (exhaust).

**Type 161Y** Downstream pressure range from 5 inches of water column (w.c.) to 7 psig (12 mbar to 0.48 bar). Pilot bleed exhausts downstream through the sense (control) line. An internal relief valve is standard to prevent internal damage during start-up or when over-pressure conditions occur.

**Type 161YM** Downstream pressure range from 5 inches of water column (w.c.) to 7 psig (12 mbar to 0.48 bar). A static sensing (control) line is isolated from pilot bleed (exhaust). The Type 161YM is used in working monitor and other applications that require a sensing line isolated from pilot bleed (exhaust). An internal relief valve is standard to prevent internal damage during start-up or when over-pressure conditions occur.

**Type 161H and 161HM** The Type 161H (pressure reducing pilot) and 161HM (monitor pressure reducing pilot for working monitor or separate bleed applications) are a modification of the Type 161 and 161M pilots with increased setpoint capabilities (250 to 600 psig/17.2 to 41.4 bar) for the Type 399A or for other appropriate applications. The modification utilizes a standard Type 161/161M pilot spring, spring case, and body incorporating a reduced diaphragm area by the addition of a diaphragm limiter and a new diaphragm subassembly. The Type 161H/161HM is only available in a stainless steel construction.

*Table 2. Type 399A Body Sizes, End Connection Styles, and Maximum Pressures*

| MAIN VALVE BODY MATERIAL | MAIN VALVE BODY SIZE, INCHES | END CONNECTION STYLE(1) | U.S. UNITS, PSIG | | | | | | METRIC UNITS, BAR | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Max Inlet Pressure and Outlet Pressure | | | Max Pressure Drop | | | Max Inlet Pressure and Oulet Pressure | | | Max Pressure Drop | | |
| | | | Structural Design rating | Operating | | | | | Structural Design rating | Operating | | | | |
| | | | | For 0 to 150°F Dia□ phragm | For □20 to 150°F Dia□ phragm | For 0 to 150°F Dia□ phragm | For □ 20 to 150°F Dia□ phragm | For 100°F Max with E55 Partial Coat Dia-phragm | | For □ 18 to 66°C Dia□ phragm | For □ 29 to 66°C Dia□ phragm | For □ 18 to 66°C Dia□ phragm | For □ 29 to 66°C Dia□ phragm | For 38°C Max with E55 Partial Coat Dia-phragm |
| Cast Iron | 1, 1-1/4 x 1, 1-1/2 x 1, 2, 2 x 1 | NPT screwed | 400 | 400 | 400 | 400 | 400 | 1050 [750(3)] | 27.6 | 27.6 | 27.6 | 27.6 | 27.6 | 72.4 [51.7(3)] |
| | 1, 1-1/2 x 1, 2, 2 x 1, 3, 4, 6 | Class 125B FF<br>Class 250B RF | 200<br>500 | 200<br>500 | 200<br>400 | 200<br>500 | 200<br>400 | 1050 [750(3)] | 13.8<br>34.5 | 13.8<br>34.5 | 13.8<br>27.6 | 13.8<br>34.5 | 13.8<br>27.6 | 72.4 [51.7(3)] |
| WCB steel | 1, 1-1/4 x 1, 1-1/2 x 1, 2, 2 x 1 | NPT screwed or SW | 1480(2) | 1050 | 400 | 750 | 400 | 1050 [750(3)] | 102.0(2) | 72.4 | 27.6 | 51.7 | 27.6 | 72.4 [51.7(3)] |
| | 1, 1-1/2 x 1, 2, 2 x 1, 3, 4, 4 x 2, 6 x 4, 8 x 4 | Class 150 RF<br>Class 300 RF | 285<br>740 | 285<br>740 | 285<br>400 | 285<br>740 | 285<br>400 | 1050 [750(3)] | 19.6<br>51.0 | 19.6<br>51.0 | 19.6<br>27.6 | 19.6<br>51.0 | 19.6<br>27.6 | 72.4 [51.7(3)] |
| | | Class 600 RF or BW | 1480(2) | 1050 | 400 | 750 | 400 | 1050 [750(3)] | 102.0(2) | 72.4 | 27.6 | 51.7 | 27.6 | 72.4 [51.7(3)] |
| | 6, 8 x 6, 12 x 6 | Class 150 RF<br>Class 300 RF | 285<br>740 | 285<br>740 | 285<br>400 | 285<br>500 | 285<br>400 | 800 [500(3)] | 19.6<br>51.0 | 19.6<br>51.0 | 19.6<br>27.6 | 19.6<br>34.5 | 19.6<br>27.6 | 102 [34.5(3)] |
| | | Class 600 RF or BW | 1480(2) | 800 | 400 | 500 | 400 | 800 [500(3)] | 102.0(2) | 55.2 | 27.6 | 34.5 | 27.6 | 102 [34.5(3)] |

1. Rating and end connections for other than ANSI standards, such as, DIN standards, can usually be provided; consult the Fisher sales office or sales representative.
**2. The main valve body and bonnet are designed to withstand an inlet pressure of up to 1480 psig (102.0 bar).** However, the main valve diaphragm should be inspected if inlet pressure exceeds 1050 psig (72.4 bar).
3. Maximum pressure drop for E55 standard diaphragm at 150°F (66°C)

**Type 161EB** Similar to the Type 161, but with a taller spring/spring case, providing higher accuracy. Downstream pressure range from 5 to 350 psig (0.34 to 24.1 bar). Pilot bleed exhausts downstream through the sense (control) line.

**Type 161EBM** Similar to the Type 161M, but with a taller spring/spring case, providing higher accuracy. Downstream pressure range from 5 to 350 psig (0.34 to 24.1 bar). A static sensing (control) line is isolated from pilot bleed (exhaust). The Type 161EBM is used in working monitor and other applications that require a sensing line isolated from pilot bleed (exhaust).

**Type 161EBH and 161EBHM** Similar to the Type 161H and 161HM, but with a taller spring/spring case, providing higher accuracy. The Type 161EBH (pressure reducing pilot) and 161EBHM (monitor pressure reducing pilot for working monitor or separate bleed applications) are a modification of the Type 161EB and 161EBM pilots with increased setpoint capabilities (250 to 700 psig/17.2 to 48.3 bar) for the Type 399A or for other appropriate applications. The modification utilizes a standard Type 161EB/161EBM pilot spring, spring case, and body incorporating a reduced diaphragm area by the addition of a diaphragm limiter and a new diaphragm subassembly.

Refer to figure 3 for pilot port function and connection size.

### *Filter Type Options*

There are three filter type options available for the Type 399A.

**No Filter** Should only be used when the upstream system is extremely clean.

**Type P594-1** Compact design for relatively clean systems. Rated for 1400 psig (96.5 bar).

**Type 254E** Large capacity with drip pot for dirty systems. Rated for 2400 psig (165 bar).

## Specifications

Specifications for the Type 399A regulator are found in tables 1 through 6. The control spring range for an individual pilot as it comes from the factory is marked on the spring case of Type 161, 161M, 161H, 161HM, 161EB, 161EBM, 161EBH and 161EBHM pilots and on the closing cap of Type 161Y & 161YM pilots. Other information for an individual main valve appears on the nameplate.

Additionally, Type 399A diaphragm and cage markings are explained in figure 2.

*Table 3. Outlet (Control) Pressure Ranges and Typical Proportional Bands*

| PILOT TYPE BODY | U.S. UNITS, INCHES OF WATER COLUMN OR PSIG | | METRIC UNITS, BAR | | PILOT CONTROL SPRING | | |
|---|---|---|---|---|---|---|---|
| | Outlet (Control) Pressure Range | Typical Proportional Band(1) with Restrictor Set on 2 | Outlet (Control) Pressure Range | Typical Proportional Band(1) with Restrictor Set on 2 | | | |
| | All Sizes | | All Sizes | | Color Code Part Numbers | Wire Diameter Inch (cm) | Free Length Inch (cm) |
| 161Y or 161YM | 5 to 15 wc | 1 wc(2) | .012 to .037 | .003(2) | Olive drab 1B653927022 | 0.105 (0.267) | 3.75 (9.53) |
| 161Y or 161YM | 11 to 28 wc | 1 wc(2) | .026 to .067 | .003(2) | Yellow 1B537027052 | 0.114 (0.290) | 4.31 (10.95) |
| | 1 to 2.5 psig | 0.5 psig(2) | .069 to 1.73 | .034(2) | Light green 1B537127022 | 0.156 (0.396) | 4.13 (10.49) |
| | 2.5 to 4.5 psig | 0.5 psig(2) | 1.73 to 0.3 | .034(2) | Light blue 1B5372227022 | 0.187 (0.475) | 3.94 (10.00) |
| | 4.5 to 7 psig | 0.5 psig(2) | 0.3 to 0.5 | .034(2) | Black 1B537327052 | 0.218 (0.554) | 4.13 (10.49) |
| 161 or 161M | 5 to 15 psig | 2 psig(2) | 0.34 to 1.0 | 0.14(2) | Yellow 1E392527022 | 0.148 (0.376) | 2.00 (5.08) |
| | 10 to 125 psig | 2 psig(2) | 0.69 to 8.6 | 0.14(2) | Red 1K748527202 | 0.187 (0.475) | 2.19 (5.56) |
| | 120 to 300 psig | 6 psig(2) | 8.3 to 20.7 | 0.41(2) | Green 15A9258X012 | 0.243 (0.617) | 1.88 (4.78) |
| 161H or 161HM | 250 to 600 psig | 12 psig(3) | 17.2 to 41.4 | 0.82(3) | Green 15A9258X012 | 0.243 (0.617) | 1.88 (4.78) |
| 161EB or 161EBM | 5 to 15 psig | 0.5 psig(2) | 0.34 to 1.03 | 0.03(2) | White 17B1260X012 | 0.120 (0.305) | 3.75 (9.53) |
| | 10 to 40 psig | 0.5 psig(2) | 0.69 to 2.76 | 0.07(2) | Yellow 17B1262X012 | 0.148 (0.376) | 3.75 (9.53) |
| | 30 to 75 psig | 0.6 psig(2) | 2.07 to 5.17 | 0.14(2) | Black 17B1259X012 | 0.187 (0.475) | 4.00 (10.16) |
| | 70 to 140 psig | 1.3 psig(2) | 4.83 to 9.65 | 0.21(2) | Green 17B1261X012 | 0.225 (0.572) | 3.70 (9.40) |
| | 130 to 200 psig | 1.5 psig(2) | 8.96 to 13.8 | 0.26(2) | Blue 17B1263X012 | 0.262 (0.665) | 3.85 (9.78) |
| | 200 to 350 psig | 3 psig(2) | 13.8 to 24.1 | 0.41(2) | Red 17B1264X012 | 0.294 (0.747) | 4.22 (10.72) |
| 161EBH or 161EBHM | 250 to 450 psig | 3.5 psig(3) | 17.2 to 31.0 | 0.45(3) | Blue 17B1263X012 | 0.262 (0.685) | 3.85 (9.78) |
| | 400 to 700 psig | 7 psig(3) | 27.6 to 48.3 | 0.48(3) | Red 17B1264X012 | 0.294 (0.747) | 4.22 (10.72) |

1. Typical proportional band includes outlet pressure droop plus hysteresis (friction), but does not include lockup.
2. Proportional band was determined with a pressure drop ranging from 50 to 150 psig (3.45 to 10.3 bar). Approximately double the proportional band if the pressure drop is less than 50 psig (3.45 bar).
3. Proportional band was determined with a pressure drop ranging from 100 to 300 psig (6.89 to 20.7 bar). Approximately double the proportional band if the pressure drop is less than 100 psig (20.7 bar).

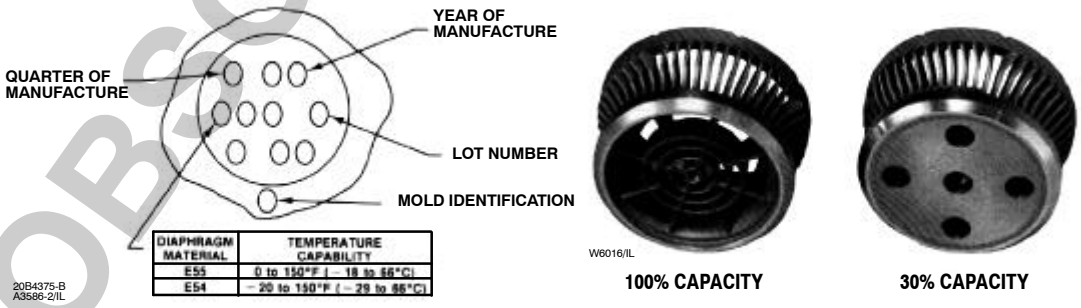



*Figure 2. Diaphragm and Cage Markings*

*Table 4. Type 399A Diaphragm Material Selections*

| TYPICAL APPLICATIONS | | STANDARD SELECTION FOR PRESSURE REDUCTION | | COLD TEMPERATURES OR RELIEF | WIDE-OPEN OR ON/OFF | HIGH TEMPERATURE OR NATURAL GAS HAVING HIGH AROMATIC HYDROCARBON CONTENT(1) |
|---|---|---|---|---|---|---|
| **Material Designation** | | E55 Full Coat | E55 Partial Coat(2) | E54 | H3 | E66 |
| **Elastomer Type** | | Nitrile | Nitrile | Nitrile | Epichloro hydrin | Fluoroelastomer |
| **Temperature Range (inlet gas temperature)** | **°F** | 0 to 150 | 0 to 150 | -20 to 150 | 10 to 150 | 40 to 250 |
| | **°C** | -18 to 66 | -18 to 66 | -29 to 66 | -12 to 66 | 4 to 121 |
| **Maximum Inlet Pressure** | **Psig** | 1050 | 1050 | 400 | 750 | 750 |
| | **Bar** | 72 | 72 | 28 | 52 | 52 |
| **Maximum Pressure Drop** | **Psid** | 750 | 1050(3) | 400 | 750 | 400 |
| | **Bar** | 52 | 72(3) | 28 | 52 | 28 |
| **Natural Gas With:** Up to 3% Aromatic Hydrocarbon Content | | Excellent | Excellent | Good | Excellent | Excellent |
| 3-15% Aromatic Hydrocarbon Content | | Fair | Fair | Poor | Good | Excellent |
| 15-50% Aromatic Hydrocarbon Content | | NR | NR | NR | Poor | Excellent |
| Up to 3% $H_2S$ (hydrogen sulfide or sour gas) | | Fair | Fair | Fair | Fair | Good |
| Up to 3% Ketone | | Fair | Fair | Fair | Fair | Fair |
| Up to 10% Alcohol | | Good | Good | Good | Good | Fair |
| 10-50% Alcohol | | Fair | Fair | Fair | Fair | NR |
| Up to 3% Synthetic Lube | | Fair | Fair | Fair | Fair | Good |
| 3-50% Synthetic Lube | | Not Recommended | Not Recommended | Not Recommended | Not Recommended | Consult Factory |
| Up to 100% Petroleum Based Lube | | Good | Good | Good | Good | Good |
| Air or Nitrogen | | Good | Good | Good | Good | Good |

1. Shutoff performance is degraded by loss of memory of fluoroelastomer over time. Fluoroelastomer is harder than a standard nitrile diaphragm.
2. Partial coat diaphragm is used to minimize pressure permeability at higher pressure ranges.
3. Partial coat E55 diaphragm at maximum 100°F (66°C). 6-inch size rated at 800 psig (55 bar).

# Installation

**WARNING**

**Personal injury, equipment damage, or leakage due to escaping gas or bursting of pressure-containing parts may result if this regulator is overpressured or is installed where service conditions could exceed the limits given in tables 1 and 2, 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.**

**Additionally, physical damage to the regulator could break the pilot off the main valve, causing personal injury and property damage due to escaping gas. To avoid such injury and damage, install the regulator in a safe location.**

## All Installations

When properly installed and maintained, a Type 399A regulator normally bleeds no gas to atmosphere while operating, allowing it to be installed in a pit or other enclosed location without an elaborate venting system. This regulator can also be installed in a pit subject to flooding, by venting the pilot spring case above the maximum possible flood level so that the pilot setting can be referenced to atmospheric pressure.

**Note**

**The Type 399A inlet strainer is intended to filter only large occasional particles. If the gas stream will carry continuous solids, appropriate clean out or filtration outside the regulator is recommended.**

*Table 5. Diaphragm Pressure Differentials*[1]

| MAIN VALVE BODY SIZE, INCHES | PERCENT CAPACITY CAGE | U.S. UNITS, PSIG | | METRIC UNITS, BAR | |
|---|---|---|---|---|---|
| | | Minimum Differential Pressure Required to Achieve Percent of Main Valve Opening | Crack Pressure Required to Start Diaphragm Opening | Minimum Differential Pressure Required to Achieve Percent of Main Valve Opening | Crack Pressure Required to Start Diaphragm Opening |
| 1 | 100 | 42 | 15 | 2.9 | 1.0 |
| 1-1/4 x 1 | 30 | 70<br>50[2] | 15 | 4.8<br>3.4[2] | 1.0 |
| | 60 | 65<br>55[2] | | 4.5<br>3.8[2] | |
| | 100 | 55<br>50[2] | | 3.8<br>3.4[2] | |
| 1-1/2 x 1 | 30 | 70<br>50[2] | 15 | 4.8<br>3.4[2] | 1.0 |
| | 60 | 65<br>55[2] | | 4.5<br>3.8[2] | |
| | 100 | 65<br>60[2] | | 4.5<br>4.1[2] | |
| 2 x 1 | 30 | 110<br>60[2] | 15<br>5 | 7.6<br>4.1[2] | 1.0<br>0.34 |
| | 60 | 70<br>60[2] | 15<br>5 | 4.8<br>4.1[2] | 1.0<br>0.34 |
| | 100 | 80<br>60[2] | 15<br>5 | 5.5<br>4.1[2] | 1.0<br>0.34 |
| 2 or 4 x 2 | 100 | 20 | 7 | 1.4 | 0.48 |
| 3 | 100 | 20 | 3 | 1.4 | 0.20 |
| 4, 6 x 4 or 8 x 4 | 100 | 18 | 4 | 1.2 | 0.27 |
| 6, 8 x 6 or 12 x 6 | 100 | 10 | 2 | 0.68 | 0.14 |

1. For additional information on percent travels at lower differential, and the corresponding capacity, consult your Fisher sales office or sales representative.
2. Minimum differential with motion indicator removed.

1. Only personnel qualified through training and experience should install, operate, and maintain a regulator. Before installation, make sure that there is no damage to, or debris in, the regulator. Also make sure that all tubing and piping are clean and unobstructed.

2. A Type 399A regulator may be installed in any orientation, as long as flow through the regulator matches the direction of the arrow on the main valve body.

**CAUTION**

**When installing a Type 399A trim package in an existing E Series body, damage can result if flow is not in the correct direction.**

**Make sure that, after the Type 399A trim is installed, body flow is up through the cage port and out through the cage slots. Change the existing flow arrow if necessary.**

**Type 399A trim package for customer assembly in an existing E Series body has not been pressure tested at the factory. After assembly, check for shutoff and leakage to atmosphere.**

**Be sure to follow the pressure rating of whichever has the lower-rated material the bonnet or the body. For example, if an iron bonnet is used with a steel body, the pressure rating of the iron body and bonnet must be followed because they have a lower pressure rating than does the steel body.**

*Table 6. 161 Series Pilot Pressure Ratings*

| PILOT TYPE NUMBER | BODY AND SPRING CASE MATERIAL | DIAPHRAGM ASSEMBLY | MAXIMUM INLET PRESSURE FOR TYPE 161, 161Y, 161H, 161EB OR 161EBH OR MAXIMUM INLET AND BLEED (EXHAUST) PRESSURES FOR TYPE 161M, 161YM, 161HM, 161EBM OR 161EBHM | MAXIMUM OUTLET PRESSURE FOR TYPE 161, 161Y, 161H OR 161EB OR 161EBH OR MAXIMUM SENSE PRESSURE FOR TYPE 161M, 161YM, 161HM, 161EBM OR 161EBHM |
|---|---|---|---|---|
| Type 161 or Type 161M | Stainless Steel | Pressure Load Diaphragm Assembly (5 to 125 psig only) (0.34 to 8.6 bar) 1/32 inch thick diaphragm | 1500 psig (103 bar) | 330 psig (23 bar) |
| | | Standard Diaphragm Assemblies, 1/16 inch thick diaphragm | 1500 psig (103 bar) | 750 psig (52 bar) |
| Type 161H or 161HM | Stainless Steel | High Pressure Assembly (1/16-inch thick) with diaphragm limiter | 1500 psig (103 bar) | 750 psig (52 bar) |
| Type 161 | Aluminum | All | 400 psig (27 bar) | 330 psig (23 bar) |
| Type 161Y or Type 161YM | Cast Iron | All | 150 psig (10 bar) | 100 psig (7 bar) |
| Type 161EB or 161EBM | Stainless Steel body<br>Aluminum spring case | Diaphragm Assembly (5 to 140 psig) (0.34 to 9.7 bar) set point ranges 1/32 inch thick diaphragm | 1500 psig (103 bar) | 330 psig (23 bar) |
| | | Diaphragm Assemblies, (130 to 350 psig) (8.96 to 24.1 bar) set point ranges 1/16 inch thick diaphragm | 1500 psig (103 bar) | 750 psig (52 bar) |
| Type 161EBH or 161EBHM | Stainless Steel body<br>Aluminum spring case | High Pressure Assembly (1/16-inch thick) with diaphragm limiter | 1500 psig (103 bar) | 750 psig (52 bar) |

*Table 7. Shipping Weights (Including Pilot and Restrictor)*

| MAIN VALVE BODY SIZE, INCHES | U.S. UNITS, POUNDS | | | | | | | METRIC UNITS, KILOGRAMS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cast Iron Main Valve Body | | | WCB Steel Main Valve Body | | | | Cast Iron Main Valve Body | | | WCB Steel Main Valve Body | | | |
| | NPT Screwed | Class 125B FF | Class 250B RF | NPT Screwed, SW or BW | Class 150 RF | Class 300 RF | Class 600 RF | NPT Screwed | Class 125B FF | Class 250B RF | NPT Screwed, SW or BW | Class 150 RF | Class 300 RF | Class 600 RF |
| 1 | 21 | 20 | 27 | 20 | 22 | 26 | 30 | 10 | 9 | 12 | 9 | 10 | 12 | 14 |
| 1-1/4 x 1 | 21 | | | 20 | | | | 10 | | | 9 | | | |
| 1-1/2 x 1 | 38 | 36 | 43 | 37 | 39 | 42 | 47 | 17 | 17 | 20 | 17 | 18 | 19 | 22 |
| 2 | 50 | 48 | 57 | 49 | 52 | 56 | 63 | 23 | 22 | 26 | 22 | 24 | 25 | 29 |
| 2 x 1 | 50 | 48 | 57 | 49 | 52 | 56 | 63 | 23 | 22 | 26 | 22 | 24 | 25 | 29 |
| 3 | | 89 | 106 | 103 | 107 | 110 | 123 | | 40 | 48 | 47 | 49 | 50 | 56 |
| 4 | | 142 | 157 | 141 | 147 | 161 | 194 | | 64 | 71 | 64 | 67 | 73 | 88 |
| 6 | | 205 | 225 | 200 | 210 | 235 | 350 | | 94 | 103 | 91 | 96 | 107 | 160 |
| 4 X 2 | | | | 135 | 141 | 155 | 190 | | | | 61 | 64 | 70 | 86 |
| 6 X 4 | | | | 270 | 280 | 292 | 394 | | | | 122 | 127 | 132 | 179 |
| 8 X 4 | | | | 390 | 461 | 515 | 600 | | | | 177 | 209 | 234 | 272 |
| 8 X 6 | | | | 600 | 571 | 625 | 680 | | | | 272 | 260 | 284 | 308 |
| 12 X 6 | | | | 1160 | 994 | 1102 | 1590 | | | | 526 | 451 | 500 | 721 |

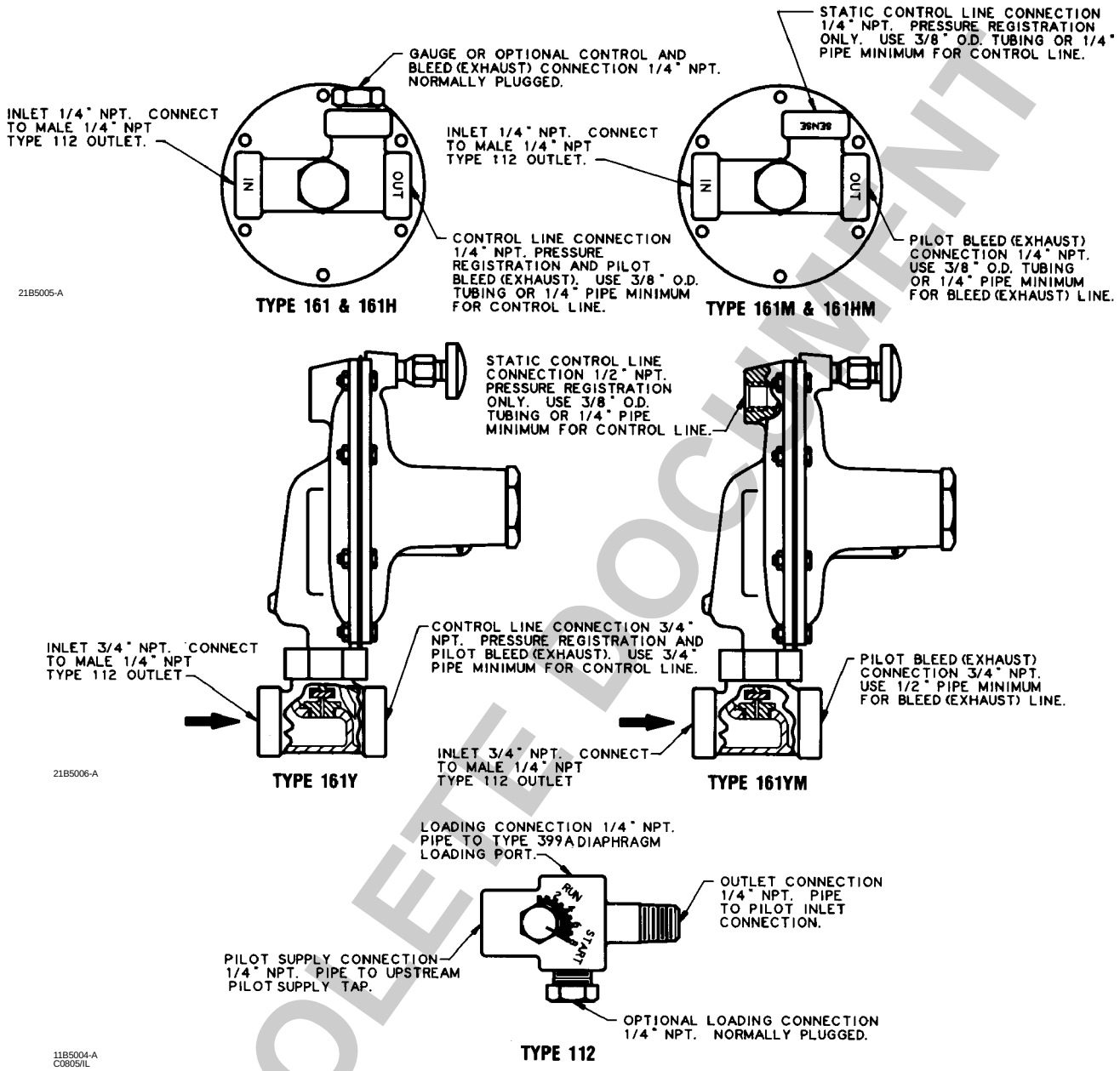
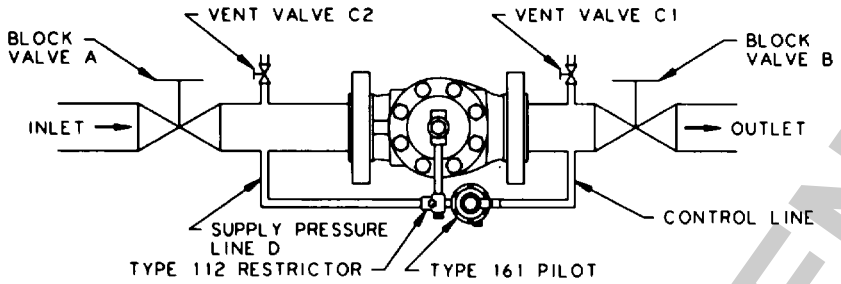
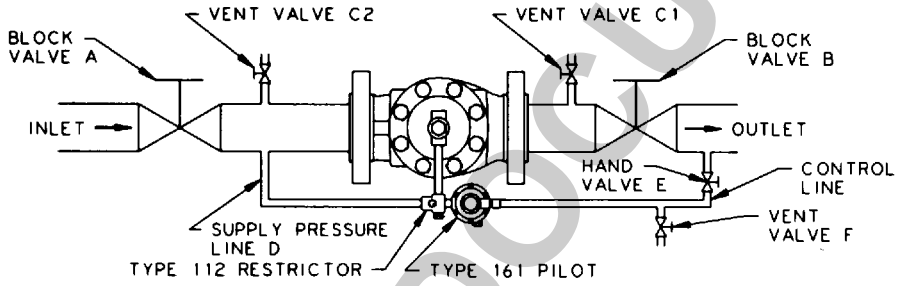



*Figure 3. Installation Schematics*



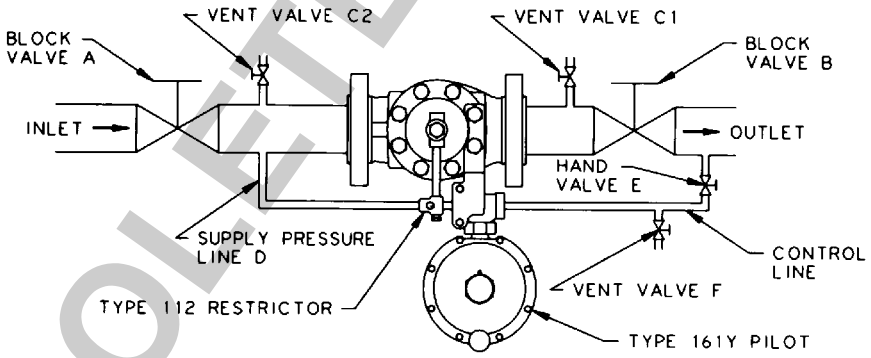

CONTROL LINE **UPSTREAM** OF BLOCK VALVE B

**TYPE 399A-*161*-112**
**or**
**TYPE 399A-*161EB*-112**




CONTROL LINE **DOWNSTREAM** OF BLOCK VALVE B

**TYPE 399A-*161*-112**
**or**
**TYPE 399A-*161EB*-112**




CONTROL LINE **DOWNSTREAM** OF BLOCK VALVE B

43B213□A/IL

**TYPE 399A-*161Y*-112**

**Typical Single Regulator Installation**

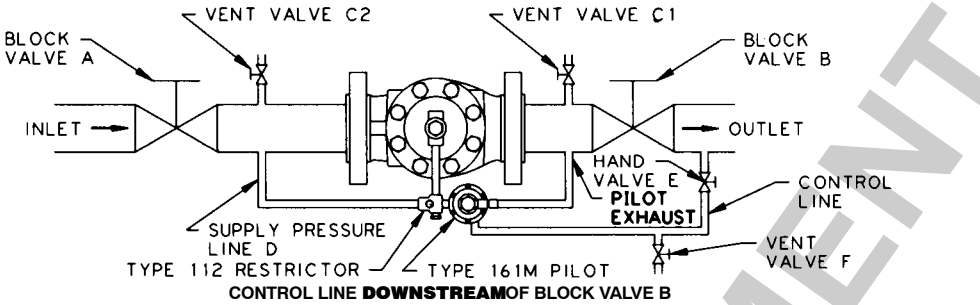
*Figure 3. Installation Schematics (Continued)*

3. The standard pilot mounting position is as shown in figure 1. Other mounting positions are available by rotating the bonnet (key 2, figure 18).

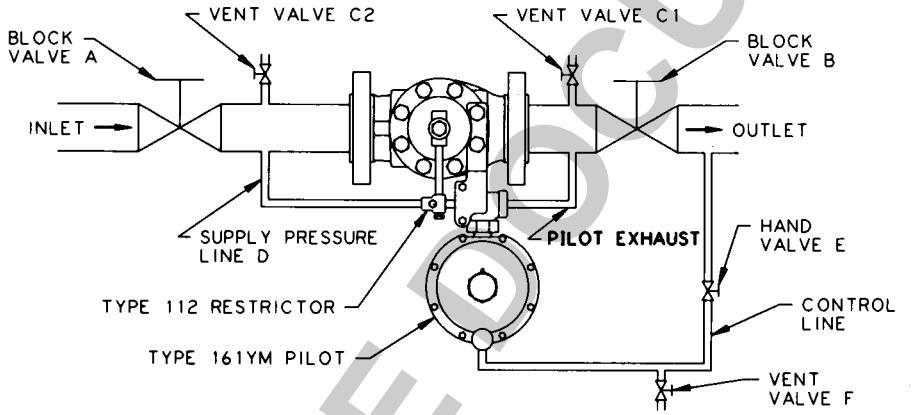
4. Apply a good grade of pipe compound to the male pipeline threads for a screwed body, or use suitable line gaskets for a flanged body. Use approved piping procedures when installing the regulator.

**WARNING**

**A regulator may vent some gas to the atmosphere. 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**




**TYPE 399A□*161*□112**
**or**
**TYPE 399A-*161EB*-112**




43B8213□A/IL

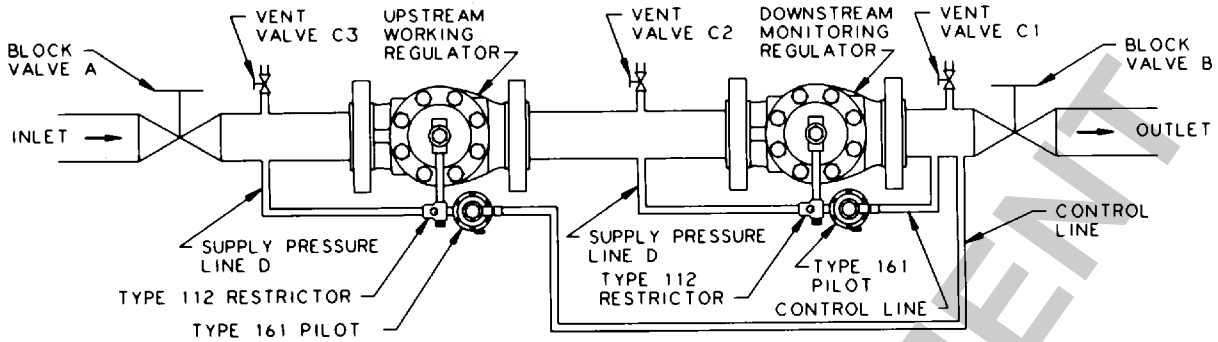
**TYPE 399A-*161YM*-112**

**Typical Single Regulator Installation**
*Figure 3. Installation Schematics (Continued)*

**remote, safe location away from air intakes or any hazardous location. The vent line or stack opening must be protected against condensation or clogging.**

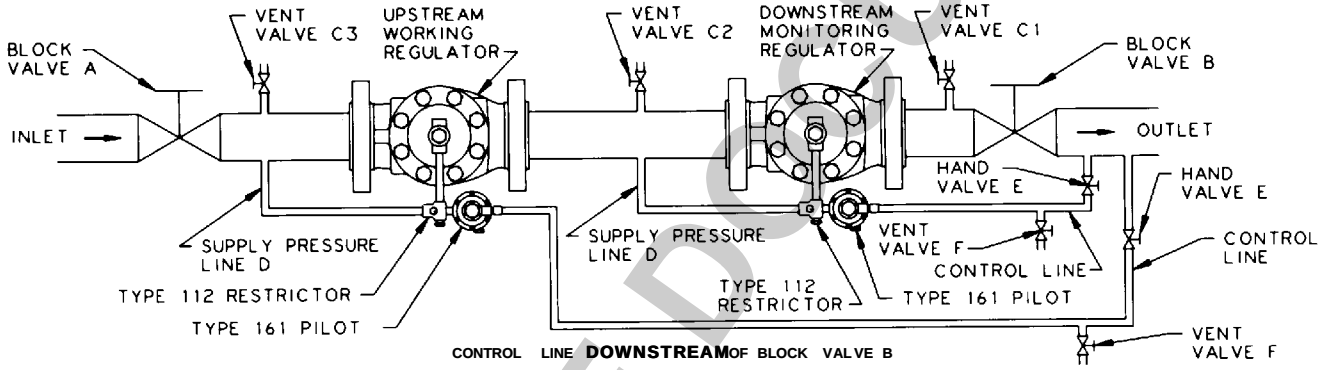
**Type 161Y and 161YM pilots have internal relief (11 to 17 inches w.c. over set point) and a stabilizing restrictor in the vent. This internal relief may open during start-up or any over-pressure condition relieving gas out the vent. Therefore, the vent must be piped to a safe location.**

5. A clogged pilot spring case vent may cause the regulator to function improperly. To keep this vent from being plugged (and to keep the spring case from collecting moisture, corrosive chemicals, or other foreign material) point the vent down, orient it to the lowest possible point on the spring case or otherwise protect it, and inspect the vent regularly to make sure it has not been plugged. To remotely vent a spring case, remove the 161 Series vent and install obstruction-free tubing or piping into the 1/4-inch NPT vent tapping. Provide protection on a remote vent by installing a screened vent cap into the remote end of the vent pipe. A vent restriction (key 79, figure 24) was added to the Type 161Y pilot to enhance low flow stability.



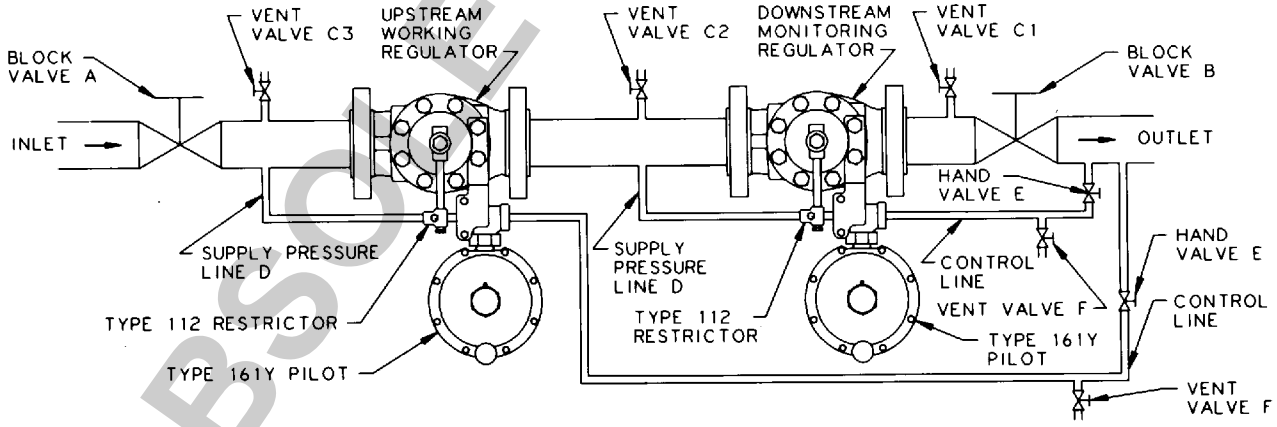

CONTROL LINE **UPSTREAM** OF BLOCK VALVE B

**TYPE 399A- *161* -112 AND TYPE 399A- *161*- 112**
**or**
**TYPE 399A- *161EB* -112 AND TYPE 399A- *161EB*- 112**




CONTROL LINE **DOWNSTREAM** OF BLOCK VALVE B

**TYPE 399A- *161* -112 AND TYPE 399A- *161* -112**
**or**
**TYPE 399A- *161EB* -112 AND TYPE 399A- *161EB* -112**



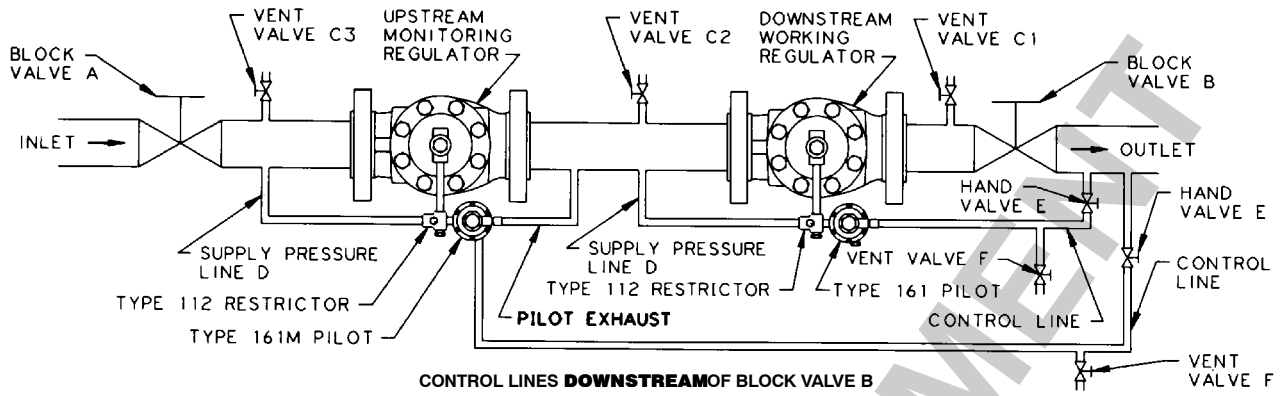

CONTROL LINE **DOWNSTREAM** OF BLOCK VALVE B

43B8214 A/IL

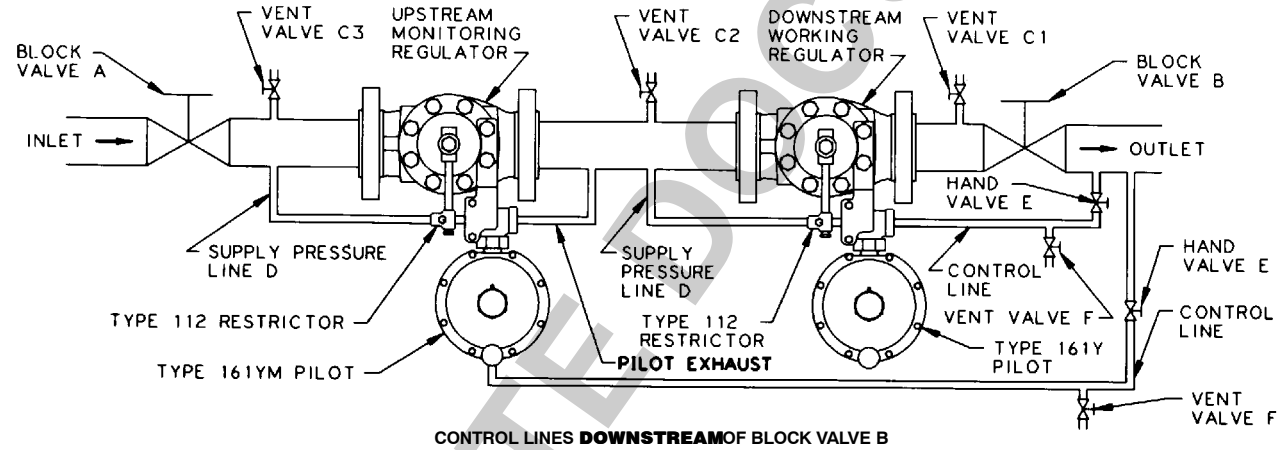
**TYPE 399A- *161Y* -112 AND TYPE 399A- *161Y* -112**

**Typical Wide-Open Downstream (Standby) Monitoring Installations**

*Figure 3. Installation Schematics (Continued)*




**TYPE 399A-*161M*-112 AND TYPE 399A-*161*-112**
**OR**
**TYPE 399A-*161EBM*-112 AND TYPE 399A-*161EB*-112**




33B8215-A/IL

**TYPE 399A-*161YM*-112 AND TYPE 399A-*161Y*-112**

**Typical Wide-Open Upstream (Standby) Monitoring Installations**

*Figure 3. Installation Schematics (Continued)*



**CAUTION**

**In monitoring installations, the pilot supply pressure for the downstream regulator should be tapped between the two regulators. To avoid supply line freezeup because of pressure drop and moisture in the gas, use antifreeze practices such as heating or adding alcohol to the supply gas.**

6. As shown in figure 3, run a supply pressure line D from the upstream pipeline to the restrictor inlet (use 3/8-inch outer diameter tubing or 1/4-inch pipe minimum). Install a Type 254E or similar filter to keep the supply source from clogging the restrictor or pilot, and inspect and clean this filter regularly to make sure it has not been plugged. Do not make the upstream pipeline connection in a turbulent area, such as near a nipple, swage, or elbow.

7. Run a downstream pressure control line (as shown in the appropriate figure 3 drawing) to the pilot control line connection (figure 3). Also, with a Type 161M, 161HM, 161EBM, 161EBHM or 161YM pilot run a downstream exhaust bleed line to the downstream bleed line connection (figure 3) in the pilot body assembly. Restrictions in the control line can prevent proper pressure registration. Avoid a long line, or a line with a reduced port valve in it. Connect the other end of the control line at a minimum of 4 to 8 pipe diameters downstream of the regulator, in a straight run of pipe.

*Table A. Type 399A Working Monitor Performance*

| MONITORING PILOT | | | MINIMUM PRESSURE AT WHICH MONITOR PILOT CAN BE SET WITH A RESTICTOR SETTING OF 2 |
|---|---|---|---|
| Construction | Spring Range Psig (Bar) | Spring Part Number | |
| 161M-1 | 5 to 15 psig (0.3 to 1 bar) | 1E392527202 | 2 psig (0.14 bar) over normal distribution pressure |
| 161M-2 | 10 to 125 psig (0.7 to 8.6 bar) | 1K748527022 | 2 psig (0.14 bar) over normal distribution pressure |
| 161M-3 | 120 to 300 psig (8.3 to 20.7 bar) | 15A9258X012 | 6 psig (0.4 bar) over normal distribution pressure |
| 161EBM-1 | 5 to 15 psig (0.3 to 1.0 bar) | 17B1260X012 | 0.5 psig (0.03 bar) over normal distribution pressure |
| 161EBM-2 | 10 to 40 psig (0.7 to 2.8 bar) | 17B1262X012 | 0.5 psig (0.03 bar) over normal distribution pressure |
| 161EBM-3 | 30 to 75 psig (2.0 to 5.2 bar) | 17B1259X012 | 0.6 psig (0.04 bar) over normal distribution pressure |
| 161EBM-4 | 70 to 140 psig (4.8 to 9.7 bar) | 17B1261X012 | 1.3 psig (0.09 bar) over normal distribution pressure |
| 161EBM-5 | 130 to 200 psig (9.0 to 13.8 bar) | 17B1263X012 | 1.5 psig (0.1 bar) over normal distribution pressure |
| 161EBM-6 | 200 to 350 psig (13.8 to 24.1 bar) | 17B1264X012 | 3 psig (0.21 bar) over normal distribution pressure |
| 161EBHM-1 | 250 to 450 psig (17.2 to 31.0 bar) | 17B1263X012 | 3.5 psig (0.24 bar) over normal distribution pressure |
| 161EBHM-2 | 400 to 700 psig (27.6 to 48.3 bar) | 17B1264X012 | 7 psig (0.48 bar) over normal distribution pressure |

*Table B. Minimum Pressure Drop Requirments for Type 399A Working Monitor Installation When Using Equal Sized Type 399As(1)*

| BODY SIZE, INCHES | MINIMUM PRESSURE DROP ACROSS EACH REGULATOR PSIG (BAR) | MINIMUM PRESSURE DROP ACROSS STATION PSIG (BAR) |
|---|---|---|
| 1 | 42 psig (2.9 bar) | 84 psig (5.8 bar) |
| 2 | 20 psig (1.4 bar) | 40 psig (2.7 bar) |
| 3 | 20 psig (1.4 bar) | 40 psig (2.7 bar) |
| 4 | 18 psig (1.2 bar) | 36 psig (2.5 bar) |
| 6 | 10 psig (0.69 bar) | 28 psig (1.9 bar) |

1. When using different sized regulators or a combination of Type 399A and other elastomeric style regulators, you must add the minimum pressure drop for each regulator to determine the total drop across the station.

## Considerations in Working Monitor Installations:

1. On working monitor installations, the working monitor regulator is always upstream and acts as a first-stage regulator through the working pilot during normal operation. This arrangement allows the working monitor s performance to be observed at all times. Then, should the second-stage regulator fail open, the working monitor regulator assumes the entire pressure reduction function of the system through the monitoring pilot.

2. Pilot supply pressure for the downstream Type 399A regulator must be made directly upstream of the Type 399A using intermediate pressure.

3. The Type 399A working monitor is not recommended for industrial sites or systems with minimal downstream volume due to possible instability.

4. Table A gives the spread between normal distribution pressure and the minimum pressure at which the monitor pilot can be set to take over if the working regulator fails open.

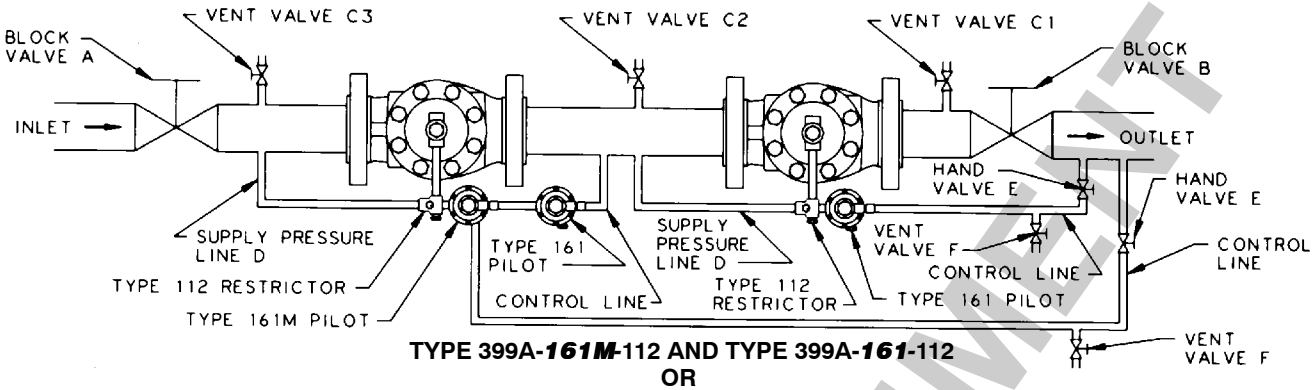
5. Table B shows the minimum differential requirements across the working monitor station. Since we are actually using a first-stage and second-stage pressure reduction you must add the minimum differential for each regulator to establish the required pressure drop across the station.

The Type 161, 161EB, 161H and 161EBH pilots, and the sense ports on the 161M, 161EBM, 161HM and 161EBHM pilots, are rated for 1200 psig under emergency conditions and they maintain the 750 psig rating for continuous service. During the 1200 psig emergency condition, there could be gas leakage from the diaphragm through the spring case seal. The pressure integrity of the Type 161 and 161H pilots will not be compromised at 1200 psig (see table 6).

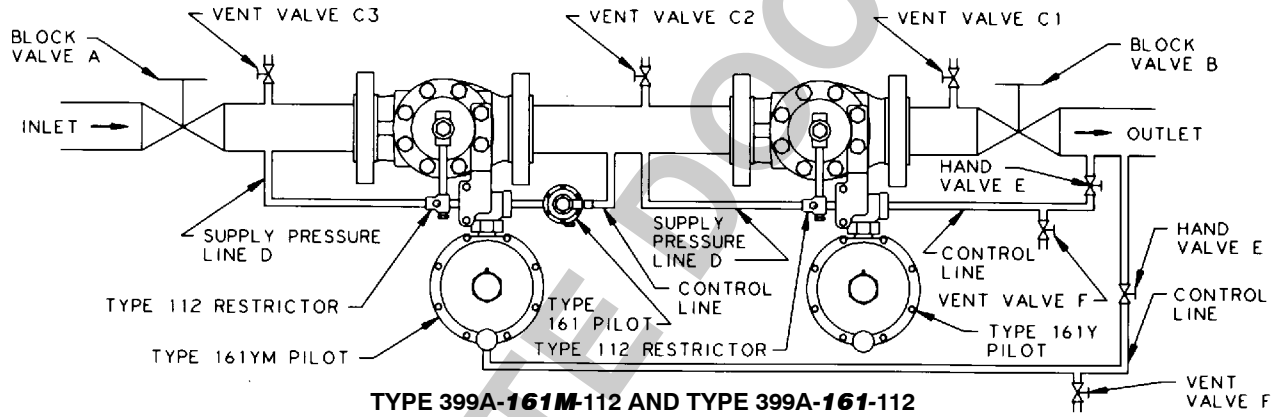
The emergency rating is applicable to the working monitor application and, specifically, to the upstream regulator failing open, which would cause the intermediate pressure to go to full inlet pressure. The sensing port (Types 161M and 161HM) or outlet port (Types 161 and 161H) of the pilot controlling intermediate pressure must be able to withstand the potential 1200 psig. The other two pilot diaphragm connections are not at risk because they are connected to downstream pressure, which is protected pressure, meaning a single failure will not cause this pressure to exceed the MAOP +10%.

**Typical Working Monitor Installations**

*Figure 3. Installation Schematics (Continued)*




**TYPE 399A-*161M*-112 AND TYPE 399A-*161*-112**
**OR**
**TYPE 399A-*161EBM*-112 AND TYPE 399A-*161EB*-112**
**POUNDS TO POUNDS WORKING MONITOR**




**TYPE 399A-*161M*-112 AND TYPE 399A-*161*-112**
**OR**
**TYPE 399A-*161EBM*-112 AND TYPE 399A-*161EB*-112**
**POUNDS TO INCHES WORKING MONITOR**

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**Typical Working Monitor Installations**
*Figure 3. Installation Schematics (Continued)*

## Wide-Open Monitor Installations

1. Follow the procedures in the All Installations section, and then continue with step 2 of this section.

2. A wide-open monitoring installation using Type 399A regulators should be arranged so that the upstream regulator is the working regulator and is set at the normal control pressure, and the downstream regulator is the monitoring regulator. Pilot supply for the downstream monitoring regulator must be obtained from between the two regulators as shown in figure 3, to prevent main valve diaphragm damage from excessive supply pressure. With this arrangement, the downstream monitoring regulator diaphragm changes position with every load change. This eliminates having the diaphragm take a set due to being forced wide open for long periods of time.

The Type 399A monitor regulator diaphragm will stroke as the intermediate pressure increases and decreases due to changes in the flow rate. By stroking the monitor diaphragm, the possibility of the diaphragm being held in a full open position for extended periods of time, potentially causing the diaphragm to take a set , is eliminated. Diaphragms taking a set is a possible occurrence in elastomeric style regulators that are used as wide-open upstream monitors.

The station minimum pressure drop requirement, for sizing purposes, is the sum of the pressure drop for each requlator. System lockup pressure is equal to the setpoint of the working regulator pilot.

## Working Monitor Installations

1. Follow the procedures in the All Installations section, and then continue with step 2 of this section.

2. On working monitor installations, the working monitor regulator is always upstream and acts as a first-stage regulator by using the working pilot during normal operation. This arrangement allows the working monitor s performance to be observed at all times. Then, should the downstream second-stage regulator fail-open, the upstream working monitor regulator assumes the entire pressure reduction function of the system through the monitoring pilot taking control of downstream pressure.

# Startup and Adjustment

**Note**

**The maximum inlet pressure for a specific construction is given in table 2. Use pressure gauges to monitor inlet pressure, outlet pressure, and any intermediate pressure during startup.**

## Startup for Both Single-Regulator and Monitoring Installations

1. All block valves and vent valves (as shown in figure 3) are closed.

2. Back out the pilot adjusting screw(s).

3. As shown in figure 4, turn the Type 112 restrictor(s) to the START position.

4. **SLOWLY OPEN** the valves shown in figure 3, in the following order:

   a. Pilot supply and control line valve(s) E if used,
   b. Inlet block valve A, and
   c. Outlet block valve B.

5. Turn the restrictor(s) to RUN position 2.

6. **For a single regulator,** set the pilot to the desired outlet (control) pressure according to the pilot adjustment procedure.

7. **For a wide-open downstream monitor installation,** adjust the upstream working regulator pilot until intermediate pressure is equal to inlet pressure. Adjust the downstream monitoring regulator pilot to the desired monitoring takeover pressure. Reduce the upstream working regulator pilot setting to normal control pressure.

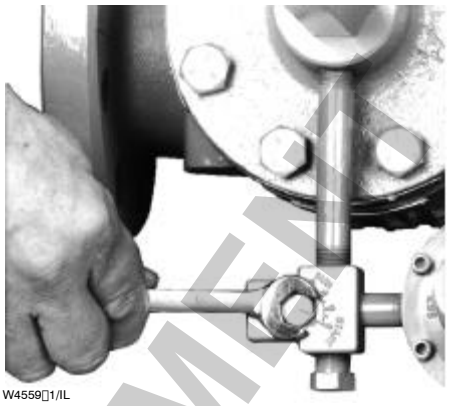



*Figure 4. Restrictor Adjustment*

8. **For a wide-open upstream monitor installation,** adjust the downstream working pilot wide open. Adjust the upstream monitoring regulator pilot to the desired monitor takeover pressure. Reduce the downstream working regulator pilot setting to normal control pressure.

9. **For a working monitor installation,** set the upstream working monitor override pilot adjusting screw to a safe maximum pressure setting. Adjust the upstream working pilot to the desired intermediate pressure setting. Adjust the downstream working regulator pilot to a pressure setting slightly above the desired override pressure setting. Adjust the upstream working monitor override pilot to its desired set point. The set point of the override pilot should be approximately one proportional band greater than the downstream system pressure (see table 3 for proportional band values). Finally, establish final desired downstream pressure by adjusting the downstream working regulator pilot.

## Pilot Adjustment

Remove the pilot closing cap (key 16, figures 20 and 21 or key 3, figure 23) and loosen the locknut (for Type 161, 161M, 161H, 161HM, 161EB, 161EBM, 161EBH, or 161EBHM only, key 12, figures 20 and 21). Turn the adjusting screw (key 11, figures 20 and 21 or key 2, figure 23) into the spring case to increase the downstream pressure. Turn the adjusting screw out of the spring case to decrease the downstream pressure. When the required downstream pressure is maintained for several minutes, tighten the locknut (for Type 161, 161M, 161H, 161HM, 161EB, 161EBM, 161EBH, or 161EBHM only) to lock the adjusting screw in position and replace the pilot closing cap.

## Type 112 Restrictor Adjustment

The Type 112 adjustable restrictor (figure 4) controls regulator proportional band (outlet pressure droop)

and speed of response. The restrictor can be used to fine tune the regulator for maximum performance by decreasing the restrictor setting for tighter control (increased opening speed and decreased closing speed); or increasing the restrictor setting for maximum stability (decreased opening speed and increased closing speed). A lower setting also provides a narrower proportional band for better accuracy. The START position has the largest flow passage and should be used during startup and shutdown. The 0 setting has the smallest (minimum) flow passage; at no point of rotation will the Type 112 restrictor be completely shut off.

### Shutdown for Both Single-Regulator and Monitoring Installations

**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 spring setting in the pilot. This will prevent trapping inlet pressure during blow down.

2. Close the valves shown in figure 3, in the following order: (1) inlet block valve A, (2) outlet block valve B, and if used (3) control line valve(s) E.

3. Open the vent valves from downstream to upstream in the following order: (1) C1, (2) C2, (3) C3, and, if used, (4) vent valve(s) F.

## Principle of Operation

As long as the outlet (control) pressure is above the pressure setting, the the pilot valve plug remains closed (figure 5). Inlet pressure bleeding through the Type 112 restrictor provides loading pressure to keep the Type 399A diaphragm tightly shut off.

When the outlet pressure decreases below the pilot control spring setting, the pilot valve plug 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 Type 399A diaphragm and lets the inlet pressure unbalance open the Type 399A diaphragm from the bottom.

As the outlet pressure rises toward the pressure setting, it compresses the pilot diaphragm against the pilot control spring and lets the pilot valve plug close. Loading pressure again builds up to close the Type 399A diaphragm. The diaphragm support moves with the diaphragm to provide motion indication and to support the diaphragm when open.

The motion indicator can be used to determine the position of the diaphragm support when inspecting the regulator, but the motion indicator cannot be used to estimate flow. The diaphragm is free to flex a small amount and allow initial flow before it contacts the diaphragm support and moves the indicator assembly. Also, the diaphragm has some additional travel available after the indicator assembly and diaphragm support have traveled fully.

A downstream wide-open monitoring system (figure 3) reduces pressure and throttles while the upstream working regulator is in operation. Due to the Type 399A regulator flow-to-open design, the downstream monitoring regulator opens only far enough to pass the required flow and changes position with each flow rate change. The upstream working regulator automatically supplies the correct intermediate pressure required to keep the downstream monitoring regulator open to the correct position. This arrangement offers continual movement of the diaphragm in the downstream monitoring regulator and allows it to take control at any time.

The working monitor regulator is always upstream and acts as a first-stage regulator by using the working pilot during normal operation. This arrangement allows the working monitor s performance to be observed at all times. Then, should the downstream seconds-stage regulator fail-open, the upstream working monitor regulator assumes the entire pressure reduction function of the system through the monitoring pilot taking control of the downstream pressure.

## Maintenance

Regulator parts are subject to normal wear and must be inspected periodically and replaced as necessary. Due to the care Fisher takes in meeting all manufacturing requirements (heat treating, dimensional tolerances, etc.), use only replacement parts manufactured or furnished by Fisher.

The frequency of inspection and replacement depends upon the severity of service conditions and upon applicable codes and government regulations. Table 9 lists various regulator problems and possible solutions for them.

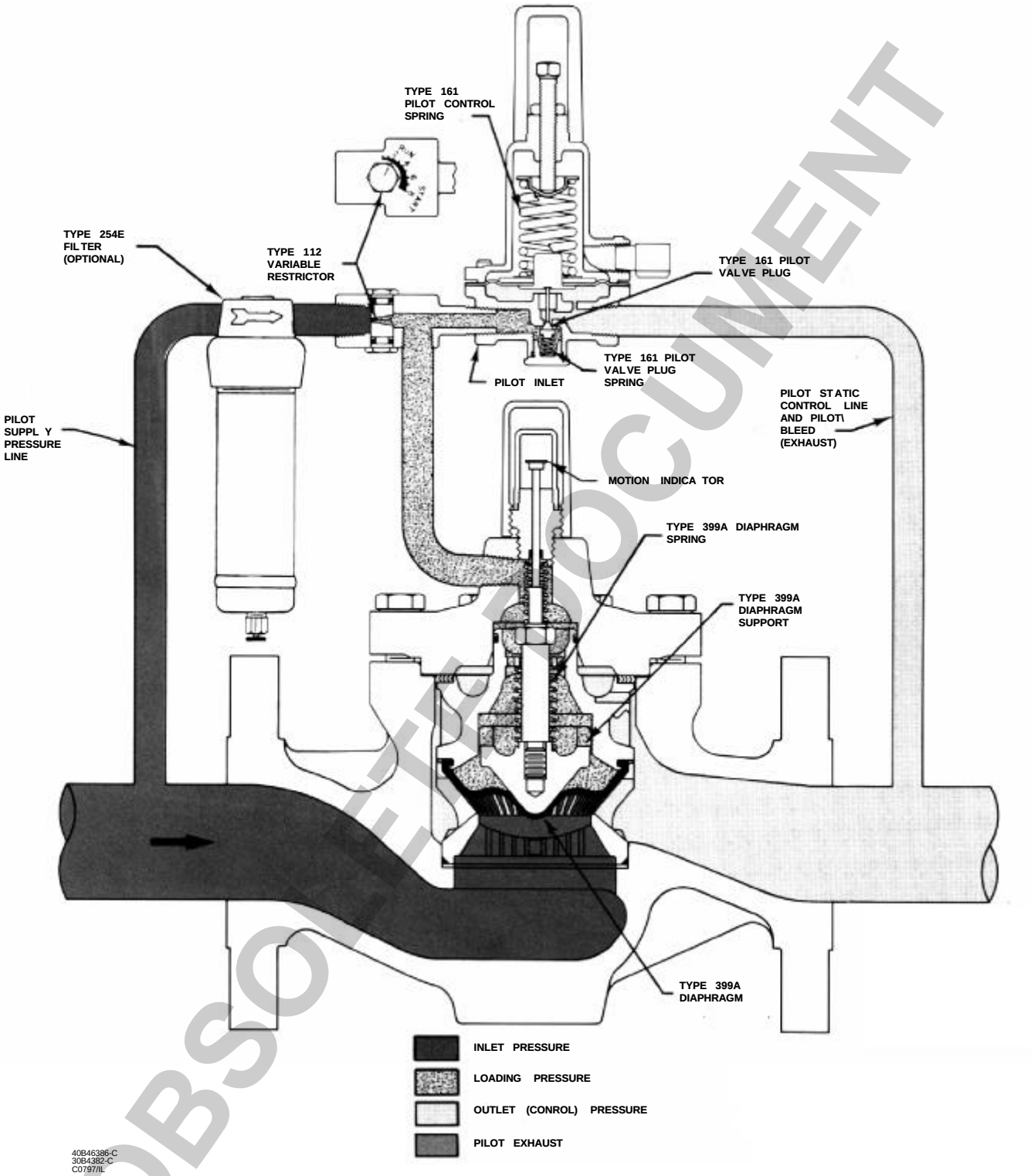
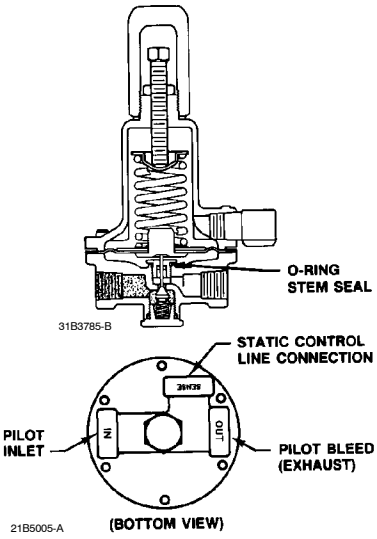
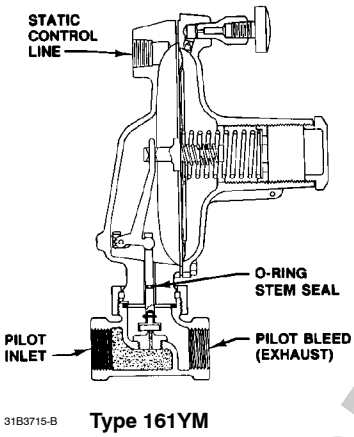




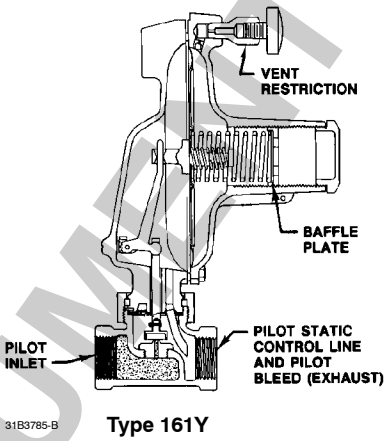

*Figure 5. Principle of Operation Schematic*



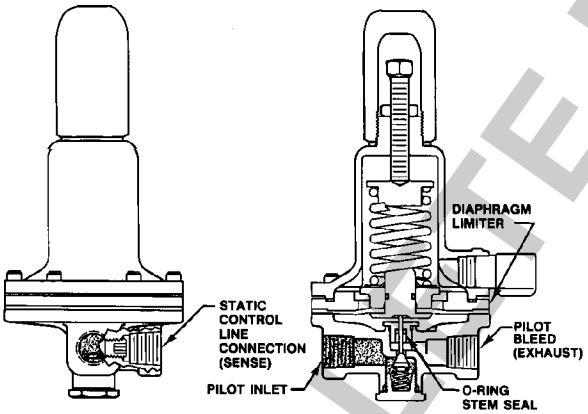

Type 161M, 161EBM



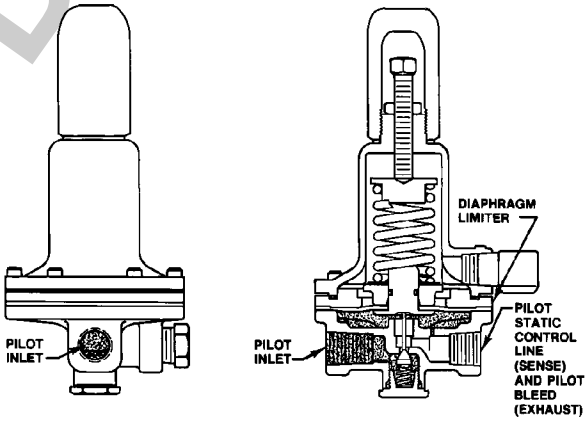

Type 161YM




Type 161Y




Type 161HM, 161EBHM




Type 161H, 161EBH

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32B0711-A
A6794/IL



**WARNING**

**Avoid personal injury or damage to property from sudden release of pressure or uncontrolled gas or other process fluid. Before starting to disassemble, carefully release all pressures according to the shutdown procedure. Use gauges to monitor inlet, loading, and outlet pressures while releasing these pressures.**

## Type 399A Main Valve

### *Trim Parts*

Instructions are given for complete disassembly and assembly. Key numbers are referenced in figure 18 unless otherwise noted.

**Note**

**The regulator may remain in the pipeline during maintenance procedures unless the main valve body (key 1) is replaced or removed for repairs.**

**Disassembly**

1. Remove the cap screws (key 3). Pry up the bonnet (key 2) from the body (key 1), as shown in figure 6.

2. As shown in figure 7, lift off the bonnet. **In a 2 x 1-inch body size** also remove the bonnet adapter and O-ring (keys 74 & 77). The cage retainer (key 10), cage (key 7), and other trim parts will normally come out with the bonnet (use care when removing the cage assembly because it may separate and fall). If they don t, remove the cage retainer from the body and remove the cage by using a hex head cap screw (1/4 x 20 x 4 1/2 inches long, figure 8).

3. **With a 1-1/4 x 1, 1-1/2 x 1, or 2 x 1-inch body size,** remove the orifice adaptor (key 76) and orifice adaptor O ring (key 78) from the body. **With a 4 x 2, 6 x 4, or 12 x 6-inch body size,** also remove the cage adaptor (key 65) from the body. **With a 8 x 6-inch body size,** also remove the cage adaptor (key 65) and cage adaptor O rings (keys 66 and 67) from the body.

4. Pull the cage O-ring (key 8) and inlet strainer (key 23) or shim (key 23) out of the body. Inspect (replace if needed) the cage O ring, inlet strainer or shim, flat sheet bonnet gasket, and the body cavity.

5. Using a soft mallet as shown in figure 9, tap the cage (key 7) to remove it from the diaphragm (key 9).

6. As shown in figure 10, push firmly on the diaphragm (key 9) until a gap opens between the diaphragm bead and the lip of the cage retainer (key 10). Begin at the gap and peel the diaphragm from the cage retainer. Check the diaphragm for damage, and replace if necessary.

7. Remove the cage retainer (key 10) from the bonnet (key 2) by twisting and pulling it out, see figure 11. **With a 2 x 1-inch body size,** also remove the cage retainer adapter ( Key 75). Check the cage retainer O-ring and spiral wound bonnet gasket (keys 14 and 6), replace if necessary.

8. A functional check of the cage retainer (key 10) and diaphragm support (key 11) can be done by manually stroking the diaphragm support. If disassembly is needed, separate the cage retainer bolt (key 13) and the diaphragm support (key 11) as shown in figure 12.

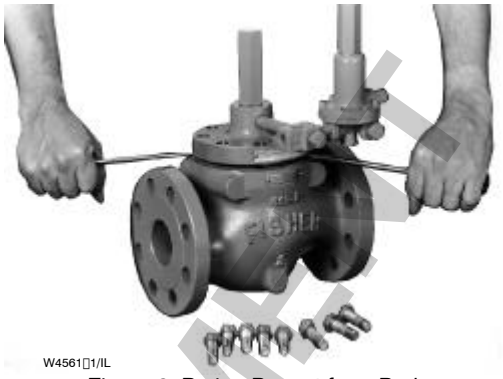

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*Figure 6. Prying Bonnet from Body*


W4562/IL

*Figure 7. Removing Bonnet and Attached Parts*

W6015/IL

*Figure 8. Removing Cage with Cage Removal Tool*

*Table 9. Maintenance Tips*

| PROBLEM | POSSIBLE SOLUTION (SEE FIGURE 5 FOR PARTS LOCATION) |
|---|---|
| Outlet pressure suddenly rises above set point and approaches inlet pressure | ● If motion indicator is in up position, check restrictor and pilot supply filter for plugging<br>● If motion indicator is in down position, check main valve for debris or diaphragm damage |
| Outlet pressure suddenly falls below set point | If motion indicator is in down position, check pilot for plugging |
| Outlet pressure normal at low flow but falls below set point at high flow | ● Check main valve inlet strainer for plugging<br>● Check inlet pressure at high flow condition<br>● Check sizing calculations to be sure main valve body size is large enough for load<br>● Check for undersized or restricted control line (use the minimum size given in All Installations step 7)<br>● Adjust restrictor to a lower setting |
| Outlet pressure cycles | Adjust restrictor to a higher setting |
| Gas escapes from pilot spring case | Replace pilot diaphragm assembly |
| Gas escapes from motion indicator | Replace indicator stem O□ring, if indicator is not desired, vent loading pressure, remove and discard motion indicator, and install 3/8□inch NPT pipe plug in its place. |
| Outlet pressure approaches inlet pressure when no flow required | ● Check main valve O□rings for damage or improper installation<br>● Check cage and diaphragm surfaces for erosion or trapped debris<br>● Check pilot valve plug and seat for seating surface damage or debris |
| Regulator will not open | ● Check for clogged control line<br>● Make sure control line is installed and open<br>● Check for ruptured diaphragm |
| Icing in pilot system | ● Remove pilot body plug and check body cavity for ice or moisture<br>● Heat pilot supply gas or add alcohol to it |
| High lockup pressure with slow shutdown | Check for debris on main valve or pilot seat |
| High lockup pressure with fast shutdown | Adjust restrictor to a higher setting |



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*Figure 9. Removing Cage from Diaphragm.*

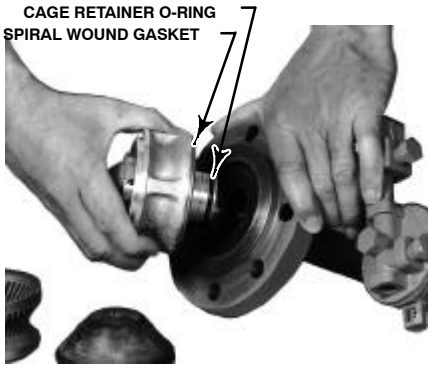


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*Figure 11. Removing Cage Retainer from Bonnet*

W4556□1/IL

*Figure 10. Removing Diaphragm from Cage Retainer*

W5651/IL

*Figure 12. Separating Cage Retainer Bolt from Diaphragm Support*


W4567/IL

**INLET STRAINER**


W6014/IL

**INLET STRAINER REPLACEMENT SHIM**

*Figure 13. Installing Inlet Stainer or Shim and Cage O-Ring*


W4569/IL

*Figure 14. Installing Bonnet Plus Attaching Parts*

**Assembly**

1. Apply lubricant (key 27) to all O-rings and gaskets before installing them.

2. As shown in figure 13, install the inlet strainer (key 23) or shim (key 23) **then** the cage O-ring (key 8) into the body (key 1). **With a 1-1/4 x1, 1-1/2 x 1-inch body size,** install the orifice adapter and orfice adapter O-ring (keys 76 & 78) **first, then** install the strainer or shim and the O-ring. **With a 4 x 2, 6 x 4, or 12 x 6-inch body size,** also install the cage adapter (key 65) into the body. **With a 8 x 6-inch body size,** also install the cage adapter O-rings (keys 66 and 67) onto the cage adapter (key 65) and then install the cage adapter into the body.

**Note**

**The cage O-ring (key 8) must be installed on top of the inlet strainer (key 23) or the shim (key 23).**

3. Install the cage (key 7) and flat sheet bonnet gasket (key 5) into the body. A restricted-capacity cage has the percentage restriction stamped as shown in figure 2.

4. Apply lubricant to the inside bead of the diaphragm (key 9). With the identification side (figure 2) of the diaphragm facing the cage retainer (key 10), snap the diaphragm over the lip of the cage retainer. Apply additional lubricant to the outside edge of the diaphragm (key 9) to provide smooth installation into the tight-fitting cage.

5. As shown in figure 14, install the diaphragm (key 9), cage retainer (key 10), cage retainer O-ring (key 14) and spiral wound bonnet gasket (key 6) into the body (key 1).

6. Install the bonnet (key 2) by pushing it down over the top of the cage retainer (key 10). Rotate the bonnet for proper pilot mounting. **With a 2 x 1-inch body size,** install the bonnet adapter and bonnet O-ring (keys 74 & 77), then install the cage retainer adapter (key 75) before installing the bonnet.

**Note**

**The cage and diaphragm are pressed into place when the bonnet bolting is tightened.**

7. Lubricate the cap screws (key 3) with lubricant and secure the bonnet with them. Using an even criss-cross pattern, tighten the cap screws to 100 foot-pounds (136 N·m)for a 1 or 1-1/4 x 1-inch body, 80 foot-pounds (110 N·m)for a 1-1/2 x 1, 2 x 1, 2 or 4 x 2-inch body, 130 foot-pounds (175 N·m)for a 3-inch body, 190 foot-pounds (260 N·m)for a 4 or 6 x 4-inch body, or 400 foot-pounds (542 N·m)for a 6, 8 x 6 or 12 x 6-inch body.

### *Motion Indicator Assembly*

Motion indicator assembly key numbers are referenced in figure 18. The indicator assembly can be removed and installed without removing the bonnet (key 2) from the body (key 1).

1. Remove the indicator protector (key 22), indicator stem guide (key 19), and indicator scale (key 21).

2. Compress the indicator spring (key 16) and remove the indicator disk (key 20). Separate the indicator stem (key 15), indicator spring, and stem O-ring retainer (key 17) from the indicator stem guide (key 19).

3. Remove the indicator stem O-ring (key 18) and check it for damage.

4. Apply lubricant to the indicator stem O-ring (key 18), and reassemble the indicator as shown in figure 19.

5. Install the indicator assembly, indicator scale (key 21), and indicator protector (key 22) into the bonnet.

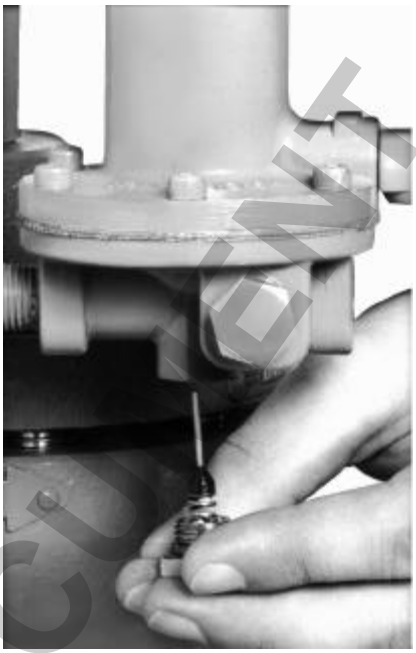

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*Figure 15. Pilot Trim Removal/Installation*

## Type 161, 161M, 161EB or 161EBM Pilot

Key numbers are referenced in figure 20 unless otherwise noted.

### *Trim Parts*

1. As shown in figure 15, remove the body plug (key 3) to let the plug spring (key 6), and plug/stem assembly (key 4) drop freely from the body on the Type 161 and 161EB only. On the Type 161M and 161EBM pilots use needle nose pliers to remove the plug/stem assembly.

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 or 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. As shown in figure 15, stack the plug spring (key 6), and plug/stem assembly (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) and separate the spring case (key 2) from the body assembly (key 1). Remove the control spring seat (key 8), the control spring (key 9), and, if used, the diaphragm limiter (key 10).

3. Remove the diaphragm assembly (key 7) and inspect the diaphragm.

4. To gain access to the stem guide seal O-ring of the Type 161M and 161EBM pilots, remove and 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 plug/stem assembly (key 4) strokes smoothly and approximately 1/16 inch (2 mm).

**Note**

**In step 6, if installing a control spring of a different range from the one that was removed, be sure to delete the spring range originally appearing on the spring case and indicate the new spring range. A diaphragm limiter (key 10), as well as other parts given in the Type 161 or 161M Pilot parts list section, is required with the highest-range spring.**

6. As shown in figure 16, stack the control spring (key 9), the control spring seat (key 8), and, if used, the diaphragm limiter (key 10) onto the diaphragm assem-

bly (key 7). Make sure that, if used, the diaphragm limiter is installed beveled 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 foot-pounds (7 to 9 N□m)for stainless steel constructions and 2 to 3 foot-pounds (3 to 4 N□m)for aluminum constructions.

**Note**

**Spring case vent may be mounted in any orientation convenient to your application.**

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).

## Type 161Y or 161YM Pilot

Key numbers are referenced in figure 23 unless otherwise noted.

### *Trim Parts*

1. Unscrew the union ring (key 19) from the body (key 28) and remove the lower casing assembly (key 20) and snap ring (key 17). With a Type 161Y, the lower casing assembly (key 20) must be tipped toward the body outlet to allow removal clearance for the pitot tube (key 76).

2. Inspect and replace the orifice (key 27) if necessary. Lubricate the threads of the replacement orifice and install with 29 to 37 foot□pounds (39 to 50 N□m)of torque.

3. Remove the cotter pin or groove pin (key 14) if it is necessary to replace the disk assembly (key 25).

4. To replace or reposition the Type 161Y pitot tube (key 76), remove the pitot tube screws (key 77), install the pitot tube so that it points into the outlet of the body (key 28) after the lower casing assembly (key 20) is installed, and secure with the pitot tube screws (key 77).

5. Install the disk assembly (key 25) and secure it with the cotter pin or groove pin (key 14).

6. If necessary, install the replacement body gasket (key 16) into the body (key 14).

W4571/IL

*Figure 16. Diaphragm Part Removal/Installation*

7. Slide the union nut (key 19) as far as it will go onto the lower casing assembly (key 20). Install both halves of the split ring (key 17) into the slots of the lower casing assembly (key 20) and secure them by sliding the union nut down on the split ring.

8. Install the lower casing assembly (key 20) with the attached split ring (key 17) and union nut (key 19) so that the pitot tube (key 76, if used) fits into the outlet of the body (key 28), and the locating pin fits into one of the four slots spaced equally around the body opening.

9. Tighten the union nut (key 19) until the lower casing assembly (key 20) is secure on the body (key 28)

### *Diaphragm Parts*

1. Remove the closing cap (key 3) if used, and turn the adjusting screw (key 2) counterclockwise until all compression is removed from the control spring (key 1).

2. Remove the hex nuts (key 22, not shown), cap screws (key 21), spring case (key 23), and control spring (key 1).

3. Remove the diaphragm assembly (key 5), plus attached parts, by tilting them so that the relief valve seat (key 33) slips off the lever assembly (key 9). To separate the diaphragm or diaphragm assembly (key 5) from the attached parts, unscrew the relief valve spring holder (key 30) from the relief valve seat (key 33).

4. Remove the diaphragm gasket (key 78) and clean the gasket surface.

5. To replace the lever assembly (key 9), remove the machine screws (key 11).

To replace the valve stem (key 13) or the Type 161YM stem O-ring (key 15), also perform trim parts maintenance procedure steps 1 and 3, and pull the stem (key 13) out of the lower casing assembly (key 20). With a Type 161YM, grease the replacement stem O□ring

(key 15) with Lubriplate lubricant or equivalent and install it on the valve stem (key 13).

6. Install the valve stem (key 13) into the lower casing assembly (key 20) and perform trim parts maintenance procedure steps 5 through 10 as necessary.

7. Install the lever assembly (key 9) into the valve stem (key 13) and secure the lever assembly (key 9) with the machine screws (key 11).

**Note**

**The diaphragm parts installed in the following step must be matched to the control spring (key 1) that will be installed in step 11. Be sure to check that the part numbers of the diaphragm or diaphragm assembly (key 5) and relief valve spring (key 67) match the control spring (key 1) part number as given in the parts list.**

8. Coat the diaphragm gasket surface with a good grade of adhesive gasket sealer and install the diaphragm gasket (key 78).

9. Coat the relief valve spring holder (key 30) with a good grade of adhesive gasket sealer and install on it the relief valve spring (key 67) and diaphragm assembly (key 5), plus the relief valve guide (key 34, not shown) if the stainless steel construction is used. Secure the relief valve seat (key 33) to the relief valve spring holder with 30 to 45 foot-pounds (41 to 61 N□m) of torque.

10. Install the pusher post (key 8) or relief valve seat (key 33) plus attached diaphragm parts onto the lever assembly (key 9).

11. Install the spring case (key 23) and control spring (key 1) on the diaphragm case assembly (key 20) so that the vent assembly (key 65) is correctly oriented, and start the hex nuts (key 22, not shown) on the cap screws (key 21).

12. Turn the adjusting screw (key 2) clockwise until there is enough control spring (key 1) force to provide proper slack to the diaphragm or diaphragm assembly (key 5). Using a crisscross pattern, finish tightening the cap screws (key 21) and hex nuts (key 22, not shown) to 8 to 9 foot-pounds (10 to 12 N□m)of torque for stainless steel or 2 to 4 foot-pounds (3 to 5 N□m)of torque for aluminum.

13. Install a replacement closing cap gasket (key 35), if necessary, and then install the closing cap (key 3).

## Type 161H, 161HM, 161EBH or 161EBHM Pilot

Key numbers are referenced in figure 21 unless otherwise noted.

### *Trim Parts*

1. As shown in figure 15, remove the body plug (key 3) to let the plug spring (key 6), and plug/stem assembly (key 4) drop freely from the body on the Type 161H and 161EBH only. On the Type 161HM and 161EBHM pilots, use needle nose pliers to remove the plug/stem assembly.

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. As shown in figure 15, stack the plug spring (key 6), and plug/stem assembly (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) and separate the spring case (key 2) from the body assembly (key 1). Remove the control spring seat (key 8), the control spring (key 9), and the diaphragm limiter (key 10). Inspect the diaphragm limiter O-ring (key 23) and replace if necessary.

3. Remove the diaphragm assembly (key 7) and inspect the diaphragm.

4. To gain access to the stem guide seal O-ring of Type 161M, 161HM, 161EBM and 161EBHM pilots, remove and 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 plug/stem assembly (key 4) strokes smoothly and approximately 1/16-inch (2 mm).

**Note**

**In step 6, if installing a control spring of a different range from the one that was removed, be sure to delete the spring range originally appearing on the spring case and indicate the new spring range.**

6. As shown in figure 16, stack the control spring (key 9), the control spring seat (key 8) and the diaphragm limiter (key 10) onto the diaphragm assembly (key 7). Make sure that the diaphragm limiter is installed as shown in figure 21. 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 foot-pounds (7 to 9 N m)for stainless steel constructions and 2 to 3 foot-pounds (3 to 4 N m)for aluminum constructions.

**Note**

**Spring case vent may be mounted in any orientation convenient to your application.**

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).

### Type 112 Restrictor

Perform this procedure if replacing any of the groove valve O-rings or other parts. Key numbers are referenced in figure 19 unless otherwise noted.

1. Unscrew the groove valve (key 22) and retainer (key 23) just enough to loosen them, but do not completely separate.

2. As shown in figure 17, push on the retainer (key 23) to push the groove valve (key 22) out of the body (key 21). Then complete disassembly.

3. Replace the groove valve O-rings (key 24) if necessary, being sure to apply lubricant to the replacement O-rings before installing them in the groove valve and retainer.

4. Install the groove valve (key 22) into the same side of the body where the scale appears. Install the retainer into the opposite side of the body, and tighten until both are secure.

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*Figure 17. Pushing Groove Valve Up with Retainer*

5. When all maintenance is complete, refer to the Startup and Adjustment section to put the regulator back into operation.

## Parts Ordering

When corresponding with your Fisher sales office or sales representative about this equipment, always reference the equipment serial number or FS number that can be found on a nameplate attached to the bonnet (key 2, figure 18).

When ordering replacement parts, reference the key number of each needed part as found in the following parts reference.

## Parts List

### Type 399A Main Valve (figure 18)

| Key | Description | Part Number |
|---|---|---|
| | Parts Kit (included are a cage removel tool, keys 5, 6, 8, 9, 14, 18, and also includes keys 66 and 67 used with size 8 x 6 only) | |
| | E55 diaphragm material, 0 to 150°F ( 18 to 66°C) temperatures | |
| | For 1-inch body | R399AX00S12 |
| | For 1-1/4 x 1, 1-1/2 x 1 and 2 x 1-inch body | R399AX00S72 |
| | For 2 or 4 x 2-inch body | R399AX00S22 |
| | For 3-inch body | R399AX00S32 |
| | For 4, 6 x 4, or 8 x 4-inch body | R399AX00S42 |
| | For 6, 8 x6 or 12 x 6-inch body | R399AX00S62 |
| | E54 diaphragm material, 20 to 150°F ( 29 to 66°C) temperatures | |
| | For 1-inch body | R399AX00L12 |
| | For 2 or 4 x 2-inch body | R399AX00L22 |
| | For 3-inch body | R399AX00L32 |
| | For 4, 6 x 4 or For 8 x 4-inch body | R399AX00L42 |
| | For 6, 8 x 6 or 12 x 6-inch body | R399AX00L62 |
| 1 | Valve Body If you need a valve body as a replacement part, order by body size, serial number, and desired material. | |
| 2 | Bonnet | |
| | For 1-inch body, WCB steel | 30B7997X012 |
| | For 1 1/4 x 1-inch body | 30B7997X012 |
| | For 1-1/2 x 1 body | 34B8673X012 |

# Type 399A-161-112

| Key | Description | Part Number |
|---|---|---|
| 2 | Bonnet (cont'd) | |
| | For 2 x 1-inch body | 30B4342X022 |
| | For 2 and 4 x 2-inch body | |
| | Cast iron, 2-inch only | 30B4342X012 |
| | WCB steel | 30B4342X022 |
| | For 3-inch body | |
| | Cast iron | 30B4349X012 |
| | WCB steel | 30B4349X022 |
| | For 4, 6 x 4 and 8 x 4-inch body | |
| | Cast iron, 4-inch only | 30B4356X012 |
| | WCB steel | 30B4356X022 |
| | For 6, 8 x 6 and 12 x 6-inch body | |
| | WCB steel | 30B7996X022 |
| 3 | Cap Screw, pl steel | |
| | For 1-inch body (4 req'd) | 1R281124052 |
| | For 1-1/4 x 1-inch body (4 req'd) | 1R281124052 |
| | For 1-1/2 x 1-inch body (4 req'd) | 1R281124052 |
| | For 2 x 1-inch body (8 req'd) | 1A453324052 |
| | For 2 and 4 x 2-inch body (8 req'd) | 1A453324052 |
| | For 3-inch body (8 req'd) | 1A454124052 |
| | For 4, 6 x 4 and 8 x 4-inch body (8 req'd) | 1A440224052 |
| | For 6, 8x 6 and 12 x 6 inch body (12 req'd) | 1U513124052 |
| 5* | Flat Sheet Gasket, composition | |
| | For 1-inch body | 14A6785X012 |
| | For 1-1/4 x 1-inch body | 14A6785X012 |
| | For 1-1/2 x 1-inch body | 1R2859X0042 |
| | For 2 x 1-inch body | 14A5685X012 |
| | For 2 and 4 x 2-inch body | 14A5685X012 |
| | For 3-inch body | 14A5665X012 |
| | For 4, 6 x 4 and 8 x 4-inch body | 14A5650X012 |
| | For 6, 8 x 6 and 12 x 6-inch body | 14A6984X012 |
| *6 | Spiral Wound Gasket, composition/S31603 stainless steel | |
| | For 1-inch body | 1R286099282 |
| | For 1-1/4 x 1-inch body | 1R286099282 |
| | For 1-1/2 x 1-inch body | 1R286099282 |
| | For 2 x 1-inch body | 1R329799282 |
| | For 2 and 4 x 2-inch body | 1R329799282 |
| | For 3-inch body | 1R348299282 |
| | For 4, 6 x 4 and 8 x 4-inch body | 1R372299282 |
| | For 6, 8 x 6 and 12 x 6-inch body | 1U508599282 |
| 7 | Cage, heat treated stainless Cr Ni alloy | |
| | 100% capacity | |
| | For 1-inch body | 23B0940X012 |
| | For 2-inch body | 23B0921X012 |
| | For 3-inch body | 23B0941X012 |
| | For 4-inch body | 23B0942X012 |
| | For 6-inch body | 23B0943X012 |
| | 60% capacity | |
| | For 1-inch body | 23B8140X012 |
| | For 2-inch body | 23B8069X012 |
| | For 3-inch body | 23B8144X012 |
| | For 4-inch body | 23B8079X012 |
| | For 6-inch body | 23B8074X032 |
| | 30% capacity | |
| | For 1-inch body | 23B8140X022 |
| | For 2-inch body | 23B8069X022 |
| | For 3-inch body | 23B8144X022 |
| | For 4-inch body | 23B8079X022 |
| | For 6-inch body | 23B8074X012 |

| Key | Description | Part Number |
|---|---|---|
| 8* | Cage O-Ring, nitrile rubber | |
| | For 1-inch body | 14A5713X012 |
| | For 1-1/4 x 1-inch body | 14A5713X012 |
| | For 1-1/2 x 1-inch body, nitrile | 1H991206992 |
| | Fluoroelastomer | 1R397106382 |
| | For 2 x 1-inch body | 10B4428X012 |
| | For 2 and 4 x 2-inch body | 10B4428X012 |
| | For 3-inch body | 10B4366X012 |
| | For 4, 6 x 4 and 8 x 4-inch body | 10B4373X012 |
| | For 6 and 12 x 6-inch body | 1H862306992 |
| 9* | Diaphragm | See following table |
| 10 | Cage Retainer, aluminum | |
| | For 1-inch body | 30B8000X012 |
| | For 1-1/4 x 1-inch body | 30B8000X012 |
| | For 1-1/2 x 1-inch body | 30B8000X012 |
| | For 2 x 1-inch body | 30B8000X012 |
| | For 2 and 4 x 2-inch body | 30B4339X012 |
| | For 3-inch body | 30B4346X012 |
| | For 4, 6 x 4 and 8 x 4-inch body | 30B4353X012 |
| | For 6, 8 x 6 and 12 x 6-inch body | 30B7849X012 |
| 11 | Diaphragm Support, hard anodized aluminum | |
| | For 1-inch body | 10B8002X012 |
| | For 1-1/4 x 1-inch body | 10B8002X012 |
| | For 1-1/2 x 1-inch body | 10B8002X012 |
| | For 2 x 1-inch body | 10B8002X012 |
| | For 2 and 4 x 2 inch body | 20B4337X012 |
| | For 3-inch body | 20B4344X012 |
| | For 4, 6 x 4 and 8 x 4-inch body | 20B4351X012 |
| | For 6, 8 x 6 and 12 x 6-inch body | 20B7851X012 |
| 12 | Diaphragm Spring, steel | |
| | For 1-inch body | 14A9672X012 |
| | For 1-1/4 x 1-inch body | 14A9672X012 |
| | For 1-1/2 x 1-inch body | 14A9672X012 |
| | For 2 x 1-inch body | 14A9672X012 |
| | For 2 and 4 x 2 inch body | 1H893327012 |
| | For 3-inch body | 10B4400X012 |
| | For 4, 6 x 4 and 8 x 4-inch body | 10B4378X012 |
| | For 6, 8 x 6 and 12 x 6-inch body | 19A5976X012 |
| 13 | Cage Retainer Bolt, S30300 stainless steel | |
| | For 1-inch body | 10B8005X012 |
| | For 1-1/4 x 1-inch body | 10B8005X012 |
| | For 1-1/2 x 1-inch body | 10B8005X012 |
| | For 2 x 1-inch body | 10B8005X012 |
| | For 2 and 4 x 2-inch body | 10B4357X012 |
| | For 3-inch body | 10B4364X012 |
| | For 4, 6 x 4 and 8 x 4-inch body | 10B4371X012 |
| | For 6, 8 x 6 and 12 x 6-inch body (18-8 stainless steel) | 10B7854X012 |
| 14* | Cage Retainer O-Ring, nitrile rubber | |
| | For 1-inch body | 1V115706992 |
| | For 1-1/4 x 1-inch body | 1V115706992 |
| | For 1-1/2 x 1-inch body, nitrile | 1V115706992 |
| | Fluoroelastomer | 10A0042X012 |
| | For 2 x 1-inch body | 1V115706992 |
| | For 2 and 4 x 2-inch body | 1K117706992 |
| | For 3-inch body | 10A3800X012 |
| | For 4, 6 x 4 and 8 x 4-inch body | 1D226906992 |
| | For 6, 8 x 6 and 12 x 6-inch body | 1K181106992 |
| 15 | Indicator Stem, S31600 stainless steel | See following table |
| 16 | Indicator Spring, pl steel | See following table |
| 17 | Stem O-Ring Retainer, polyethylene | See following table |
| 18* | Indicator Stem O-Ring, nitrile rubber | See following table |
| 19 | Indicator Stem Guide, heat-treated stainless steel | See following table |
| 20 | Indicator Disk, Delrin(1) | 10B4359X022 |
| 21 | Indicator Scale, acrylic plastic | See following table |



* Recommended Spare Part.
1. Trademark of E. I. du Pont De Nemours Co.

Key 9. Diaphragm for Type 399A Main Valve

| DESCRIPTION | | BODY SIZE | | | | |
|---|---|---|---|---|---|---|
| | | 1-Inch | 2-inch | 3-inch | 4-inch | 6-inch |
| Nitrile E55 | Full Coat | 20B8003X022 | - - - | 20B4368X022 | 20B4375X022 | 20B7852X022 |
| | Partial Coat | 22B2810X012 | 22B2811X012 | 22B2812X012 | 22B2813X012 | 22B2814X012 |
| Nitrile E54 | Full Coat | 20B8003X012 | 20B4417X012 | 20B4368X012 | 20B4375X012 | 20B7852X012 |
| | Partial Coat | 22B2810X022 | 22B2811X022 | 22B2812X022 | 22B2813X022 | 22B2814X022 |
| Fluoroelastomer E66 | Partial Coat | 22B2810X032 | 22B2811X032 | 22B2812X032 | 22B2813X032 | 22B2814X032 |
| Epichlorohydrin H3 | Partial Coat | 22B2810X042 | 22B2811X042 | 22B2812X042 | 22B2813X042 | 22B2814X042 |

Key 15, 16, 17, 18, 19, 20 and 21. Motion Indicator Parts for Type 399A Main Valve

| KEY | DESCRIPTION | BODY SIZE | | |
|---|---|---|---|---|
| | | 1, 1-1/4 x 1, 1-1/2 x 1, 2, 2 x 1 & 4 x 2-inch | 3-inch | 4, 6, 6 x 4, 8 x 4, 8 x 6 & 12 x 6-inch |
| - - - | Complete Motion Indicator Assembly | 10B4360X0A2 | 10B4365X0A2 | 10B4372X0A2 |
| 15 | Indicator Stem | 10B4360X012 | 10B4365X012 | 10B4372X0A2 |
| 16 | Indicator Spring | 10B4413X012 | 10A4421X012 | 10B4379X012 |
| 17 | O-ring Retainer | 10B4422X012 | 10B4422X012 | 10B4422X012 |
| 18 | O-ring | 1D134606992 | 1D134606992 | 1D134606992 |
| 19 | Indicator Stem Guide | 20B4423X012 | 20B4423X012 | 20B4423X012 |
| 20 | Indicator Disk | 10B4359X022 | 19B4359X022 | 10B4359X022 |
| 21 | Indicator Scale | 10B4361X012 | 10B4361X012 | 10B4369X012 |

| Key | Description | Part Number |
|---|---|---|
| 22 | Indicator Protector | |
| | For 1, 1-1/4 x 1, 1-1/2 x 1, 2 x 1, 2, 3 and 4 x 2-inch body | 10B4362X012 |
| | For 4, 6, 6 x 4, 8 x 4, 8 x 6 and 12 x 6-inch body | 24B1301X012 |
| 23 | Inlet Strainer, 316 stainless steel | |
| | For 1-inch body | 20B8004X012 |
| | For 1-1/4 x 1-inch body | 20B8004X012 |
| | For 1-1/2 x 1-inch body | 20B8004X012 |
| | For 2 x 1-inch body | 20B8004X012 |
| | For 2 and 4 x 2-inch body | 10B4409X012 |
| | For 3-inch body | 20B4367X012 |
| | For 4, 6 x 4 and 8 x 4-inch body | 20B4374X012 |
| | For 6, 8 x 6 and 12 x 6-inch body | 20B7853X012 |
| 23 | Optional Shim, 18 8 stainless steel | |
| | For 1-inch body | 13B8061X012 |
| | For 1-1/4 x 1-inch body | 13B8061X012 |
| | For 1-1/2 x 1-inch body | 13B8061X012 |
| | For 2 x 1-inch body | 13B8061X012 |
| | For 2 and 4 x 2-inch body | 13B8062X012 |
| | For 3-inch body | 13B8063X012 |
| | For 4, 6 x 4 and 8 x 4-inch body | 13B8064X012 |
| | For 6, 8 x 6 and 12 x 6-inch body (S17400 stainless steel) | 13B8065X012 |
| 24 | Body Size/Serial Number Nameplate Aluminum | |
| 25 | Flow Arrow, 18-8 stainless steel | |
| | For 1-inch body only | 1V105938982 |
| | All other sizes | 1V106038982 |
| 26 | Drive Screw, 18-8 stainless steel (4 req'd) | 1A368228982 |
| 27 | Lubricant, , Dow Corning 33, (not furnished) | |
| | 1 gallon (3.8 1) can | 1M523906992 |
| 30 | Drain Plug (for use only with bottom tapped valve body), steel (not shown) | 1A771528992 |
| 63 | Pipe Plug, steel (2 req'd) | 1A767524662 |
| 64 | Pipe Plug | |
| | For 6, 8 x 6 and 12 x 6-inch body | 1A767524662 |
| 65 | Cage/Adaptor (not for 1, 2, 3, 4, or 6-inch body) | |
| | For 4 x 2-inch body | 23B8621X012 |
| | For 6 x 4-inch body | 23B8625X022 |
| | For 8 x 4-inch body | 23B8625X012 |
| | For 8 x 6-inch body | 23B8139X012 |
| | For 12 x 6-inch body | 23B8139X022 |

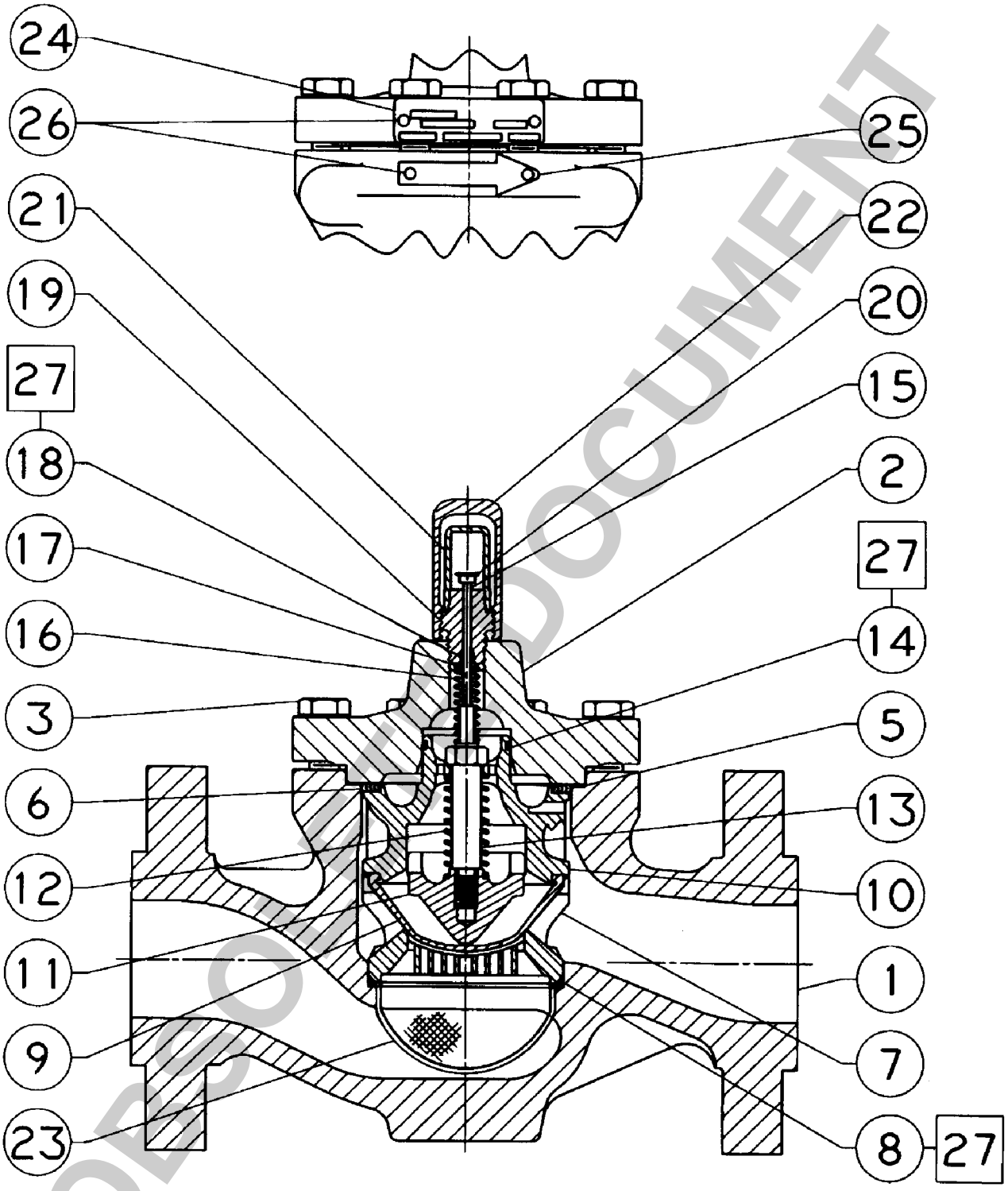
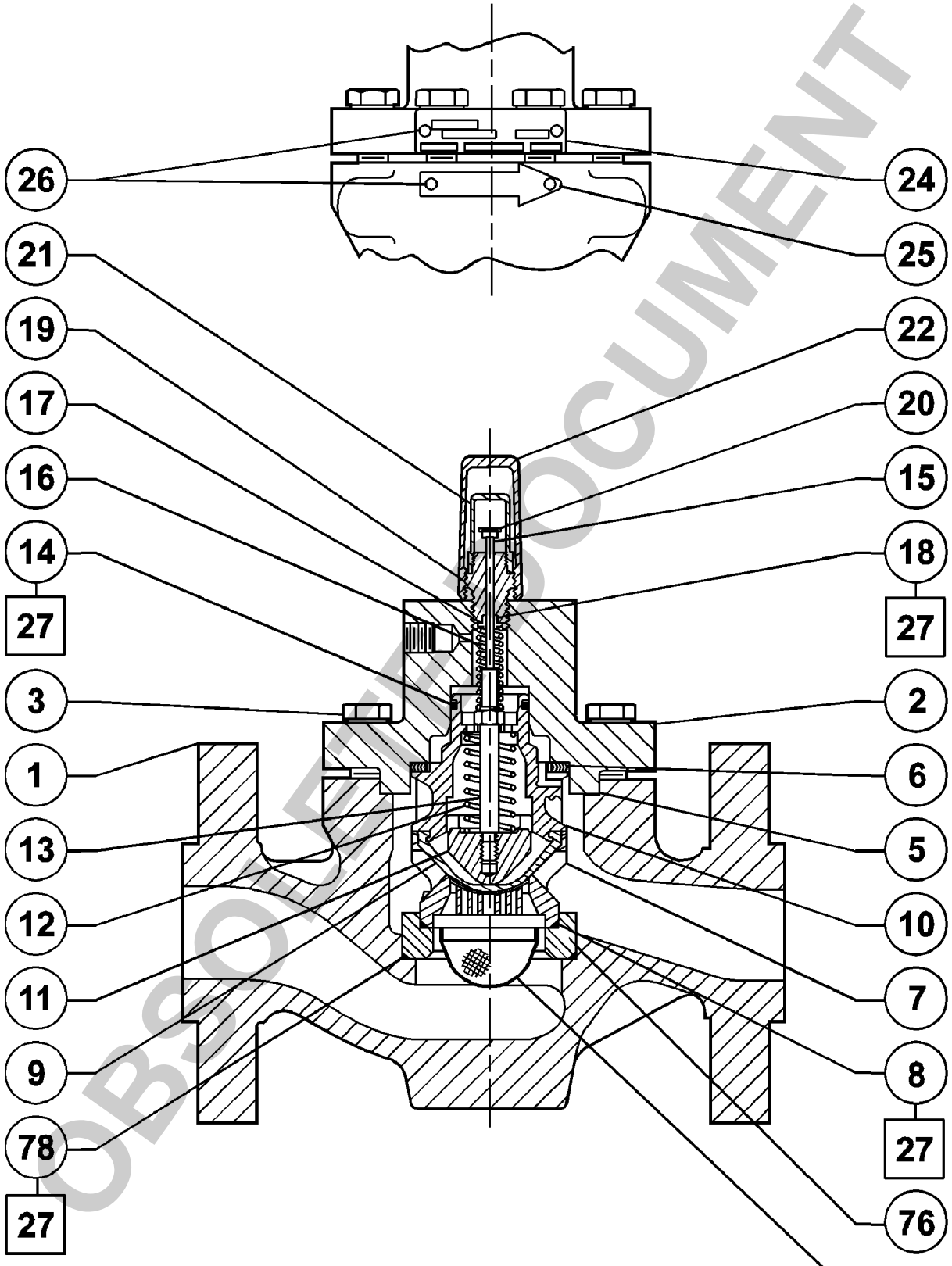





*Figure 18. Type 399A Main Valve Sizes: 1, 2, 3, 4, 6-inches*




☐ APPL Y LUB
PARTS NOT SHOWN: 29, 30, 33, 63

44B8883-A
C0802

*Figure 18. Type 399A Main Valve 1-1/4 x 1 and 1-1/2 x 1-Inch (Continued)*

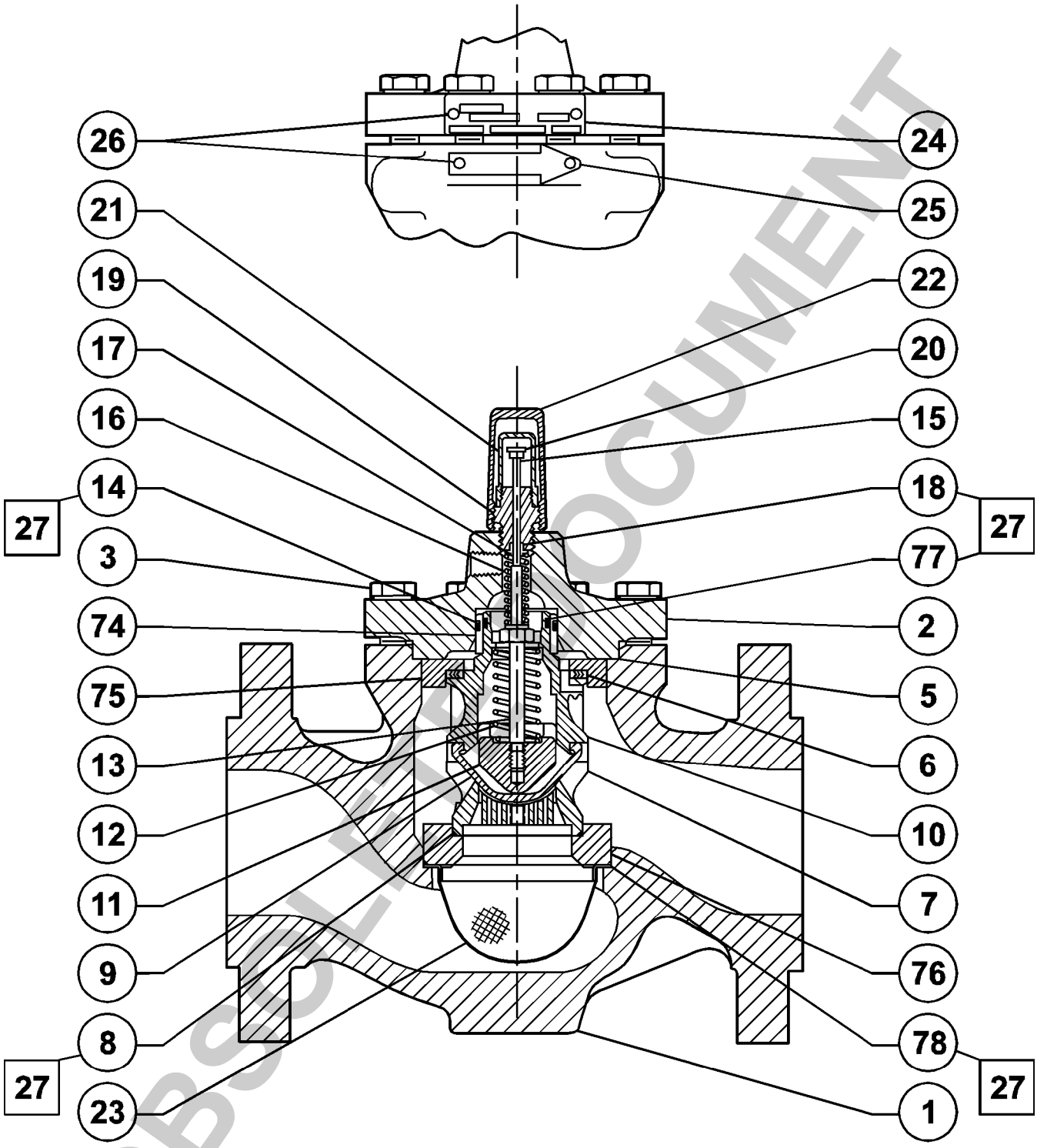





*Figure 18. Type 399A Main Valve 2 x 1-Inch (Continued)*

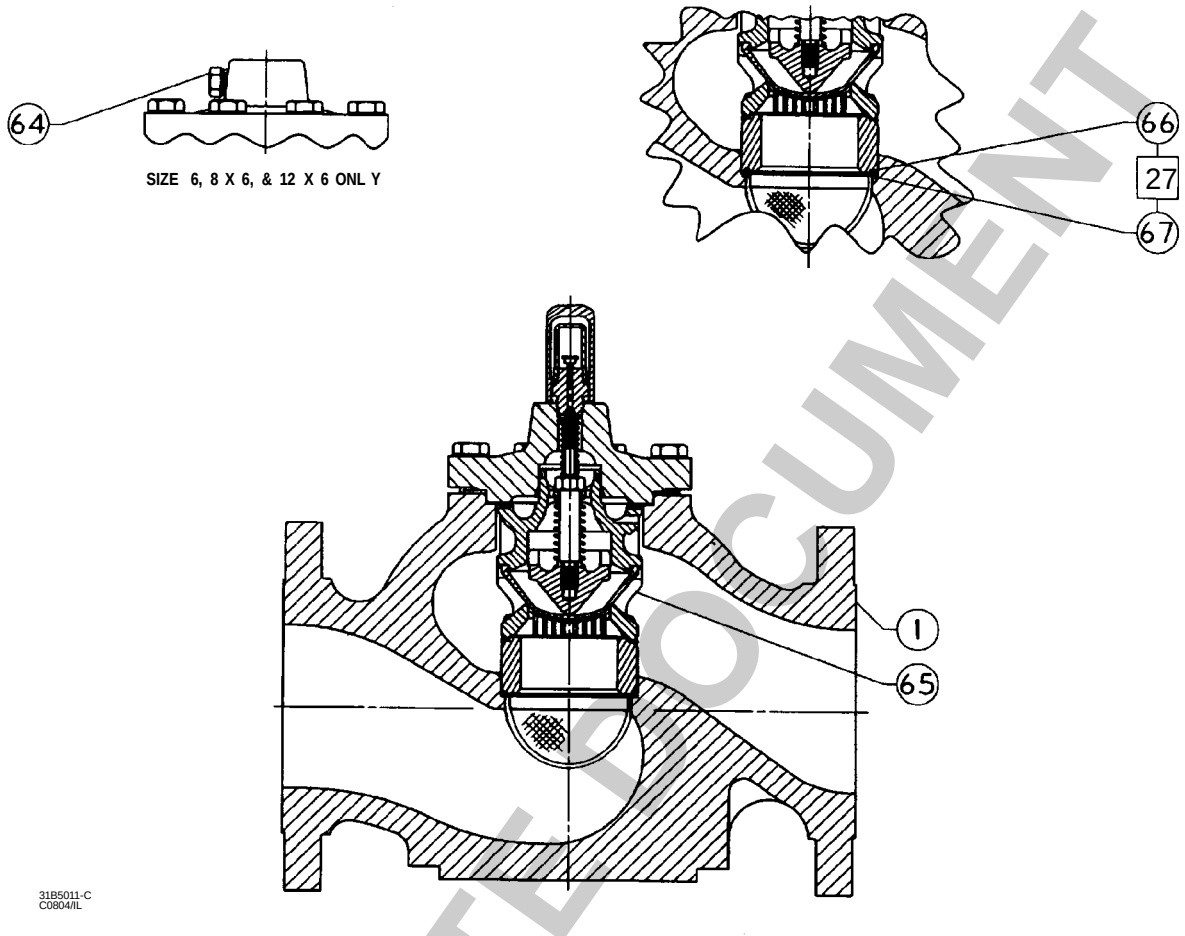



*Figure 18. Type 399A Main Valve (Continued)*

| Key | Description | Part Number |
|---|---|---|
| 66* | O-ring, For 8 x 6-inch body | |
| | Nitrile | 1D269206992 |
| | Fluoroelastomer | 1D2692X0022 |
| 67* | O-ring, For 8 x 6 inch body | |
| | Nitrile | 1V335006562 |
| | Fluoroelastomer | 1V3350X0012 |
| 74 | Bonnet Adapter, For 2 x 1-inch body | 14B2159X012 |
| 75 | Cage Retainer Adapter, For 2 x 1-inch body | 14B2160X012 |

| Key | Description | Part Number |
|---|---|---|
| 76 | Seat Ring Adapter | |
| | For 1-1/4 x 1-inch body | 14B8674X012 |
| | For 1-1/2 x 1-inch body | 14B8674X012 |
| | For 2 x 1-inch body | 14B2161X012 |
| 77 | Bonnet O-ring, For 2 x 1-inch body | |
| | Nitrile | 1V115706992 |
| | Fluoroelastomer | 10A0042X012 |
| 78 | Adapter O-ring, For 1-1/4, 1-1/2 x 1 and 2 x 1-inch bodies | |
| | Nitrile | 14A5713X012 |
| | Fluoroelastomer | 13A2351X012 |



*Recommended spare parts

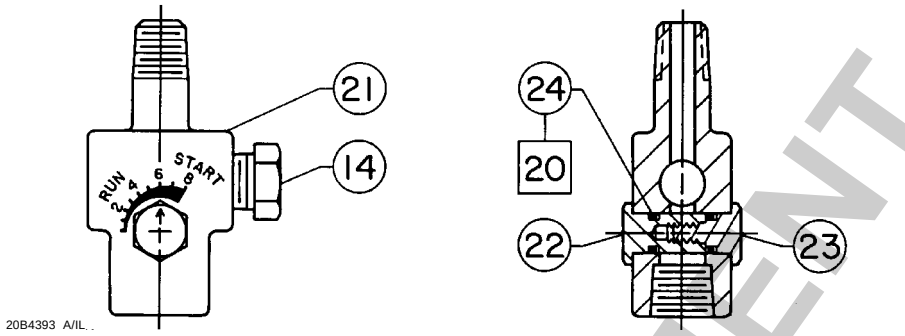



*Figure 19. Type 112 Restrictor*



## Type 112 Restrictor (figure 19)

| Key | Description | Part Number |
|---|---|---|
| 14 | Pipe Plug, S31600 stainless steel | 1A767535072 |
| 20 | Lubricant (not furnished) | |
| | Dow Corning 33, 1 gal. (3.8 1) can | 1M523906992 |
| 21 | Body, CB7Cu-2 stainless steel | 20B4429X012 |
| 22 | Groove Valve, S41600 stainless steel | 20B4403X012 |
| 23 | Retainer, S41600 stainless steel | 10B4402X012 |
| 24* | Groove Valve O-ring (2 req'd), fluoroelastomer | 1C8538X0052 |

## Type 161, 161M, 161H, 161HM, and 161EB Series Pilots (figures 20 and 21)

| Key | Description | Part Number |
|---|---|---|
| | Type 161 Pilot Parts Kit (included are keys 4, 6, 7, 15, and 17) | |
| | For 5 to 15 or 10 to 125 psig (0.34 to 1.0 or 0.69 to 8.6 bar) control spring range | R161X000012 |
| | For 120 to 300 psig (8.27 to 20.7 bar) control spring range | R161X000022 |
| | For pressure loading with 5 to 15 or 10 to 125 psig (0.34 to 1.0 or 0.69 to 8.6 bar) control spring range | R161X000032 |
| | 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 1.0 or 0.69 to 8.6 bar) control spring range | R161MX00012 |
| | For 120 to 300 psig (8.27 to 20.7 bar) control spring range | R161MX00022 |
| | For pressure loading with 5 to 15 or 10 to 125 psig (0.34 to 1.0 or 0.69 to 8.6 bar) control spring range | R161MX00032 |
| 1 | Body Assembly | |
| | Type 161, 161EB, 161H and 161EBH | |
| | CFM8 Stainless Steel | 1B7971X0252 |
| | Aluminum (Type 161 only) | 1B7971X0292 |
| | Type 161M 161EBM, 161HM and 161EBHM, CF8M stainless steel | 30B8715X012 |
| 2 | Spring Case | |
| | Type 161, 161H, 161M and 161HM | |
| | Aluminum (Type 161 only) | 25A6220X012 |
| | CF8M stainless steel | 28A9277X012 |
| | Aluminum (161EB Series only) | 34B9955X012 |
| 3 | Body Plug | |
| | Aluminum (Type 161 only) | 1B797509032 |
| | S30300 stainless steel | 1B7975X0052 |
| 4* | Plug/Stem Assembly, | |
| | nitrile w/stainless steel stem | 20B9389X052 |
| | Fluoroelastomer w/stainless steel stem | 20B9389X062 |
| 6 | Plug Spring, 302 stainless steel | 1E701337022 |
| 7* | Diaphragm Assembly, Neoprene diaphragm w/304 stainless steel diaphragm plate | See following table |
| 8 | Control Spring Seat, pl steel | See following table |
| 9 | Control Spring, Zn pl steel spring wire | See following table |
| 10 | Diaphragm Limiter, S30300 stainless steel | See following table |
| 11 | Adjusting Screw, pl steel | See following table |
| 12 | Locknut, Zn pl steel | 1A946335042 |
| | For 161EB Series | 17B1897X012 |
| 13 | Machine Screw, pl steel (6 req'd) | |
| | For aluminum spring case (Type 161 only) | 1H421728992 |
| | Type 161, 161M, stainless steel spring case, | 1D617032992 |
| | Type 161, aluminum spring case | 1H421728992 |
| | Type 161EB and 161EBM, Aluminum spring case | 1A7641X0022 |
| | Type 161EBH and 161EBHM Aluminum spring case | 1C8559X0022 |
| 14 | Pipe Plug | |
| | For aluminum body, pl steel (Type 161 only) | 1A767524662 |
| | For S31600 stainless steel body | |
| | Type 161, 161H, 161EB, 161EBH | 1A767535072 |
| 15* | Body Plug O Ring, nitrile rubber | 1F113906992 |
| 16 | Closing Cap | |
| | Nylon | T11069X0012 |
| | Type 161, 161M, 161H, 161HM | 23B9152X012 |
| | Type 161EB, 161EBM, 161EBH, 161EBHM | 24B1301X012 |
| | Metal, for pressure loading | |
| | Type 161 and 161M, | 1H2369X0012 |
| | 161EB and 161EBM | 17B1406X012 |
| 17* | Closing Cap Gasket, Pressure loading for metal closing cap only | |
| | For Type 161 and 161M | 15A6218X012 |
| | For 161EB and 161EBM | 1C659804022 |
| 18 | Type Y602-12 Vent Assembly, plastic | 27A5516X012 |
| 19* | Stem Guide Seal Assembly (Type 161M and 161HM, 161EBM and 161EBHM only), stainless steel seal and seal retainer w/nitrile rubber O-ring | 10B8711X012 |
| 20 | Lubricant, Dow Corning 33, Lub-10(3) | T13078T0012 |
| 21 | Lubricant, (not furnished) | |
| | Lub-5, 1 gal. (3.8 1) can | 1M523906992 |
| 22* | O-ring (for Type 161M and 161HM only) | 10A0904X012 |
| 23* | O-ring (for Type 161 and 161H only) | 10A7777X012 |
| | Type 161H and 161HM, Stainless Steel spring case | T12980T0012 |



* Recommended Spare Part.
3. Trademark of Dow Corning Corp

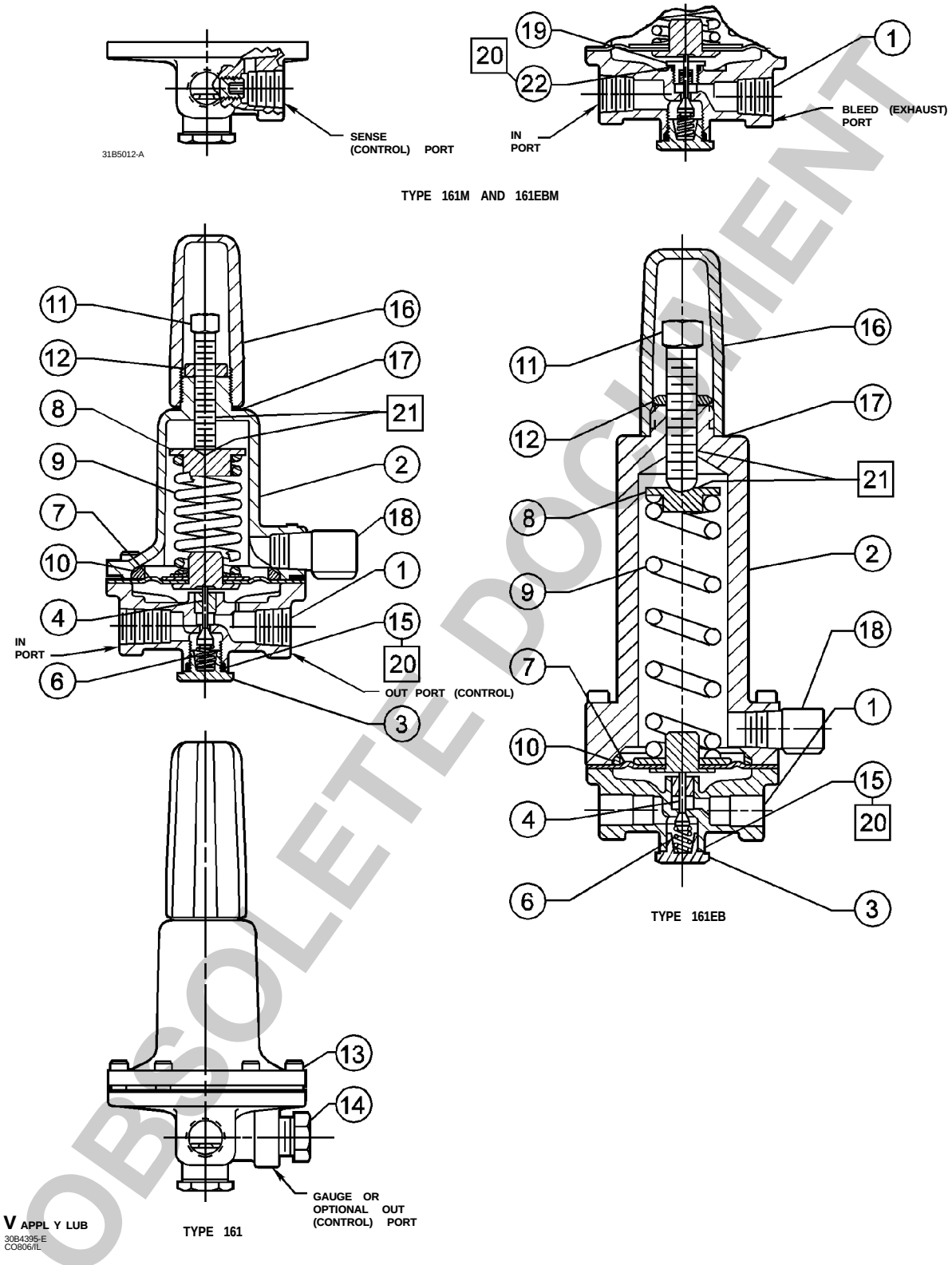



*Figure 20. Type 161, 161M, 161EB and 161EBM Pilots*

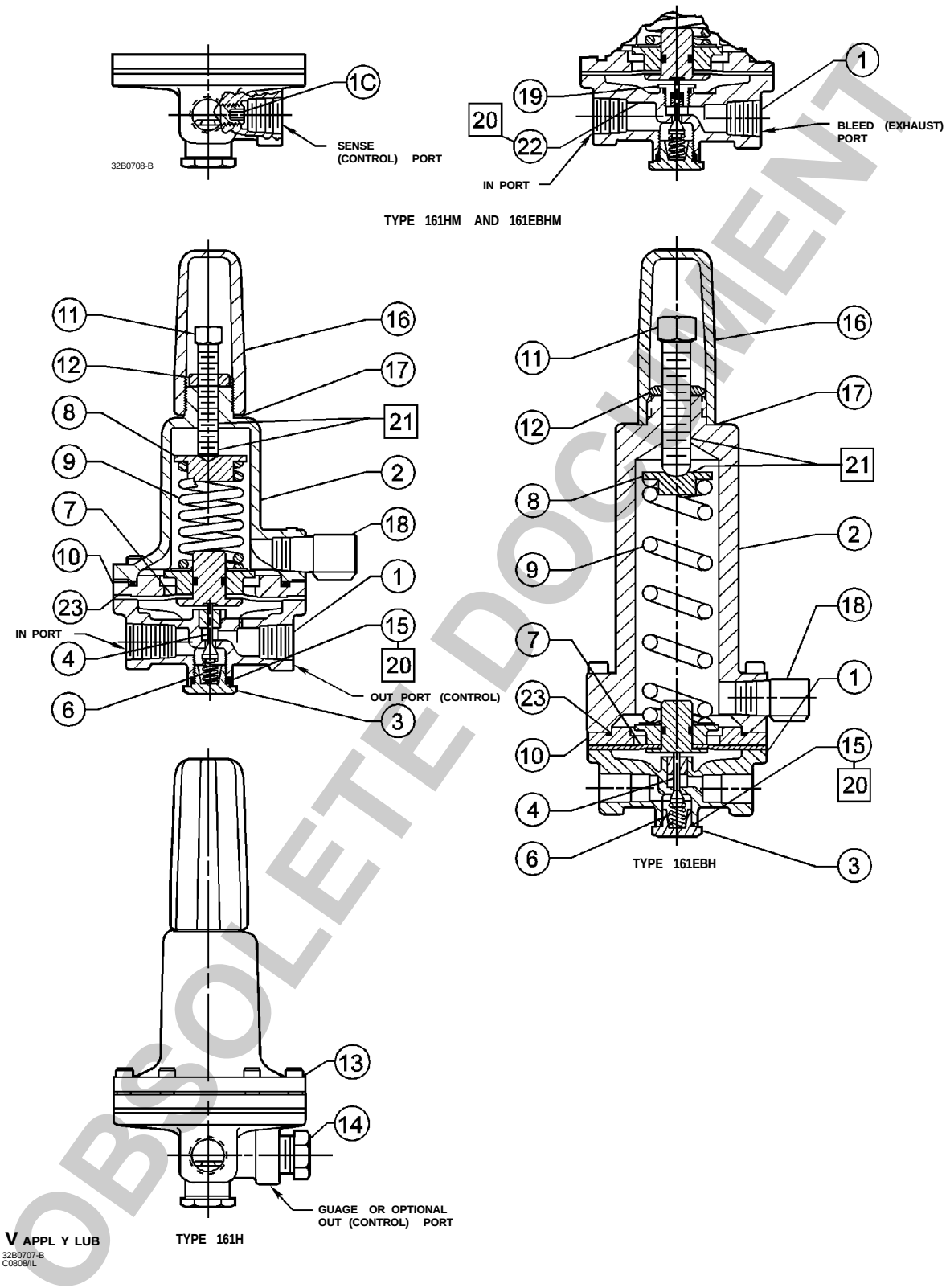



*Figure 21. Type 161H, 161HM, 161EBH and 161EBHM Pilots*

Keys 7, 8, 9, 10, and 11. Pilot Control Spring Range Parts (To Change Pilot Spring range) for Type 161, 161M, 161H and 161HM Pilots

| KEY | PART NAME | For 5 TO 15 PSIG (0.34 TO 1.0 BAR) CONTROL SPRING RANGE | | For 10 TO 125 PSIG (0.69 TO 8.6 BAR) CONTROL SPRING RANGE | |
|---|---|---|---|---|---|
| | | Description | Part Number | Description | Part Number |
| 7 | Diaphragm Assembly | Standard Assembly for stainless steel construction 1/16-inch thick diaph. 1-3/4 inch (45 mm) diaphragm plate diameter | 15A6216X222 | Standard Assembly for stainless steel construction 1/16-inch thick diaph. 1-3/4 inch (45 mm) diaphragm plate diameter | 15A6216X222 |
| | | Pressure Load Assy. standard for alumin num construction 1/32-inch thick diaph. 1-3/4 inch (45 mm) diaphragm plate diameter | 15A6216X262 | Pressure Load Assy. standard for alumin num construction 1/32-inch thick diaph. 1-3/4 inch (45 mm) diaphragm plate diameter | 15A6216X262 |
| 8 | Spring Seat | 1-3/32 inch (28 mm) diameter | 1B798525062 | 1-3/32 inch (28 mm) diameter | 1B798525062 |
| 9 | Spring | Yellow color code | 1E392527022 | Red color code | 1K748527202 |
| 10 | Diaphragm Limiter | Not used | | Not used | |
| 11 | Adjusting Screw | 1-5/8 inch (41 mm) length | 10B6190X012 | 2-inch (51 mm) length | 10B7192X012 |

Keys 7, 8, 9, 10, and 11. Pilot Control Spring Range Parts (To Change Pilot Spring range) for Type 161, 161M, 161H and 161HM Pilots

| KEY | PART NAME | FOR 120 TO 300 PSIG (1.4 TO 21 BAR) CONTROL SPRING RANGE (1) | | TYPE 161H AND 161HM PILOTS ONLY 250 TO 600 PSIG (17.2 TO 41.4 BAR) CONTROL SPRING RANGE (1) | |
|---|---|---|---|---|---|
| | | Description | Part Number | Description | Part Number |
| 7 | Diaphragm Assembly | Standard Assy. for all constructions 1/16-inch thick diaph. 1-1/2 inch (38 mm) diaphragm plate diameter | 15A6216X232 | Standard Assy. for all constructions 1/16-inch thick diaph. 1-1/2 inch (38 mm) diaphragm plate diameter | 12B0703X012 |
| 8 | Spring Seat | 7/8 (22 mm) diameter | 1K155828982 | 7/8 (22 mm) diameter | 1K155828982 |
| 9 | Spring | Green color code | 15A9258X012 | Green color code | 15A9258X012 |
| 10 | Diaphragm Limiter | Used | 10B4407X012 | Used | 22B0590X012 |
| 11 | Adjusting Screw | 1-5/8 inch (41 mm) length | 10B6190X012 | 1-5/8 inch (41 mm) length | 10B6190X012 |

1. For stainless steel pilot only.

Key 7. Pilot Control Spring Range Parts (To Change Pilot Spring range) for 161EB Series Pilots

| KEY | PART NAME | For 5 TO 15 PSIG (0.34 TO 1.0 BAR) CONTROL SPRING RANGE | | For 10 TO 40 PSIG (0.69 TO 2.75 BAR) CONTROL SPRING RANGE | |
|---|---|---|---|---|---|
| | | Description | Part Number | Description | Part Number |
| 7 | Diaphragm Assembly | Standard Assembly for stainless steel construction 1/32-inch thick diaph. 1-3/4 inch (45 mm) diaphragm plate diameter | 15A6216X262 | Standard Assembly for stainless steel construction 1/32-inch thick diaph. 1-3/4 inch (45 mm) diaphragm plate diameter | 15A6216X262 |
| | | For 30 to 75 PSIG (4.8 TO 9.7 BAR) CONTROL SPRING RANGE | | For 70 TO 140 PSIG (2.0 TO 5.2 BAR) CONTROL SPRING RANGE | |
| | | Standard Assembly for stainless steel construction 1/32-inch thick diaph. 1-3/4 inch (45 mm) diaphragm plate diameter | 15A6216X262 | Standard Assembly for stainless steel construction 1/32-inch thick diaph. 1-3/4 inch (45 mm) diaphragm plate diameter | 15A6216X262 |
| | | For 130 to 200 PSIG (4.8 TO 9.7 BAR) CONTROL SPRING RANGE | | For 200 TO 350 PSIG (13.8 TO 24.1 BAR) CONTROL SPRING RANGE | |
| | | Standard Assembly for stainless steel construction 1/16-inch thick diaph. 1-3/4 inch (45 mm) diaphragm plate diameter | 15A6216X222 | Standard Assembly for stainless steel construction 1/16-inch thick diaph. 1-1/2 inch (45 mm) diaphragm plate diameter | 15A6216X232 |
| | | For 250 to 450 PSIG (4.8 TO 9.7 BAR) CONTROL SPRING RANGE | | For 400 TO 700 PSIG (13.8 TO 24.1 BAR) CONTROL SPRING RANGE | |
| | | Standard Assembly for stainless steel construction 1/16-inch thick diaph. 1-3/4 inch (45 mm) diaphragm plate diameter | 12B0703X012 | Standard Assembly for stainless steel construction 1/16-inch thick diaph. 1-3/4 inch (45 mm) diaphragm plate diameter | 12B0703X012 |

Keys 8, 9, 10, and 11. For 161EB Series Pilot

| KEY | PART NAME | CONTROL SPRING RANGE AND SPRING COLOR | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 5 to 15 Psi White | 10 to 40 Psi Yellow | 30 to 75 Psi Black | 70 to 140 Psi Green | 130 to 200 Psi Blue | 200 to 350 Psi Red | 250 to 450 Psi Blue | 400 to 700 Psi Red |
| 8 | Spring Seat | 17B0515X012 | 17B0515X012 | 17B0515X012 | 17B0515X012 | 17B0515X012 | 17B0515X012 | 17B0515X012 | 17B0515X012 |
| 9 | Spring | 17B1260X012 | 17B1262X012 | 17B1259X012 | 17B1261X012 | 17B1263X012 | 17B1264X012 | 17B1263X012 | 17B1264X012 |
| 10 | Diaphragm Limiter | - - - | - - - | - - - | - - - | - - - | 10B4407X012 | 22B0590X012 | 22B0590X012 |
| 11 | Adjusting Screw | 17B1227X012 | 17B1227X012 | 17B1227X012 | 17B1227X012 | 17B1227X012 | 10B3081X012 | 10B3081X012 | 10B3081X012 |

Keys 8, 9, and 10. For Type 662 Kixcel

| KEY | PART NAME | CONTROL SPRING RANGE AND SPRING COLOR | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 5 to 15 Psi White | 10 to 40 Psi Yellow | 30 to 75 Psi Black | 70 to 140 Psi Green | 130 to 200 Psi Blue | 200 to 350 Psi Red | 250 to 450 Psi Blue | 400 to 700 Psi Red |
| 8 | Spring Seat | 17B0515X012 | 17B0515X012 | 17B0515X012 | 17B0515X012 | 17B0515X012 | 17B0515X012 | 17B0515X012 | 17B0515X012 |
| 9 | Spring | 17B1260X012 | 17B1262X012 | 17B1259X012 | 17B1261X012 | 17B1263X012 | 17B1264X012 | 17B1263X012 | 17B1264X012 |
| 10 | Diaphragm Limiter | - - - | - - - | - - - | - - - | - - - | 10B4407X012 | 22B0590X012 | 22B0590X012 |

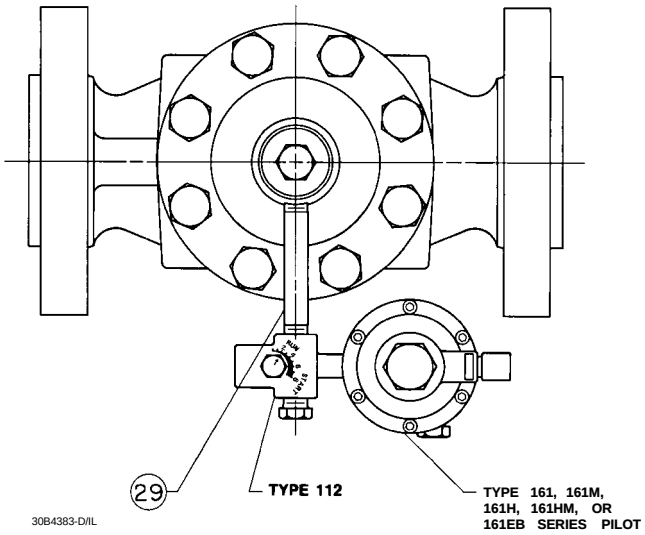



*Figure 22. Type 161, 161H, 161M, 161HM and 161EB Series Pilot Mounting Parts*

## Type 161, 161H, 161M, 161HM and 161EB Series Pilot Mounting Parts (figure 22)

| Key | Description | Part Number |
|---|---|---|
| 29 | Pipe Nipple, galvanized steel | |
| | For 1-inch main valve body | 1N584226232 |
| | For 2-inch main valve body | 1N624026232 |
| | For 3 or 4-inch main valve body | 1U264426232 |
| | For 4 x 2, 6, or 6 x 4-inch main valve body | 1C210026232 |

## Type 161Y or 161YM Pilot (figure 23)

| Key | Description | Part Number |
|---|---|---|
| | Parts Kit (included are keys 5, 16, 25, 35, 78 and also includes key 15 used with Type 161YM only) | |
| | For 5 to 28 w.c. ( 12 to 37 mbar) | R161YX00012 |
| | For 1 to 7 psig (69 to 500 mbar) | R161YX00022 |
| 1 | Control Spring, Zn pl steel spring wire | See following table |
| 2 | Adjusting Screw, Zn pl steel | 1B537944012 |
| 3 | Closing Cap, steel | 1E422724092 |
| 5* | Diaphragm & Head Assembly, nitrile diaphragm w/stainless steel diaphragm plate | See following table |
| 9 | Lever Assembly | |
| | Steel w/cd pl brass | 1B5375000A2 |
| | 302 stainless steel | 1B5375000B2 |
| 11 | Machine Screw, pl steel (2 req'd) | |
| | For aluminum or brass disk assy, pl steel | 1A331928982 |
| | For stainless steel disk assy, S30400 stainless steel | 1A866435042 |
| 13 | Valve Stem | |
| | For Type 161Y | |
| | For aluminum or brass disk assy, brass | 1A832714012 |
| | For stainless steel disk assy, 303 stainless steel | 1A832735172 |
| | For Type 161YM | |
| | For aluminum or brass disk assy, brass | 1E375514012 |
| | For stainless steel disk assy, 303 stainless steel | 1E375535172 |
| 14 | Cotter Pin | |
| 15* | O-ring, nitrile rubber (Type 161YM only) | 1H292606992 |
| 16* | Body Gasket, composition | 1A832504032 |
| 17 | Split Ring, cd pl steel | 1A832648722 |
| | For aluminum or brass disk assy, brass | 1A404018992 |
| | For stainless steel disk assy, 302 stainless steel | 1A866537022 |
| 19 | Union Nut, malleable iron | 1E471119062 |
| 20 | Lower Casing Assembly, ductile iron | |
| | For Type 161Y | 31B6601X022 |
| | For Type 161YM | 31B6600X022 |
| 21 | Cap Screw, pl steel (8 req'd) | 1A667824052 |
| 22 | Hex Nut, cd pl steel, not shown (8 req'd) | 1F601424122 |
| 23 | Spring Case Assembly, cast iron | 1B6365X0342 |
| 25* | Disk Holder Assembly | |
| | Brass disk holder & nitrile disk | 1A8328000C2 |
| | Stainless steel disk holder & nitrile disk | 1A8328000A2 |
| 27 | Orifice | |
| | Brass | |
| | 3/32-inch (2.4 mm) port diameter | 0R044114012 |
| | 1/4-inch (6.4 mm) port diameter | 0B042014012 |
| | S30300 stainless steel | |
| | 3/32-inch (2.4 mm) port diameter | 0R044135032 |
| | 1/4-inch (6.4 mm) port diameter | 0B042035032 |
| 28 | Body, 3/4 x 3/4-inch size, cast iron | 1D291119012 |
| 30 | Relief Valve Spring Holder, brass | 1C323114012 |
| | For brass disk assy, brass | 2B541944012 |
| | For stainless steel disk assy, S30300 stainless steel | 1D564835032 |
| 33 | Relief Valve Seat | |
| 34 | Relief Valve Guide, C36000 free-cutting brass (not shown) | 1D564914012 |
| 35* | Closing Cap Gasket, neoprene | 1P753306992 |
| 65 | Vent Assembly, plastic Type Y602-11 | 17A5515X012 |
| 67 | Relief Valve Spring, pl steel | See following table |
| 76 | Pitot Tube (for Type 161Y only) | |
| | For aluminum or brass disk assy, zinc | 2D837144012 |
| | For stainless steel disk assy, 304/302 stainless steel | 1D2916000A2 |
| 77 | Pitot Tube Machine Screw (4 req'd) | |
| | For aluminum or brass disk assy, cd pl steel | 1D884324502 |
| | For stainless steel disk assy, stainless steel | 1D968438992 |
| 78 | Diaphragm Gasket, Fluoroelastomer | 11B3691X022 |
| 79 | Restriction, Brass | 1D483514012 |
| 80 | Lubricant | T13078T0012 |
| 81 | Sealant | 1M523206992 |
| 83 | Baffle Plate, Stainless steel | 11B4292X012 |

Keys 1, 5, & 67. Control Spring, Diaphragm Assembly & Relief Valve Spring For Type 161Y and 161YM Pilots

| OUTLET PRESSURE | CONTROL SPRING COLOR | KEY 1 | KEY 5 | KEY 67 |
|---|---|---|---|---|
| | | Control Spring | Diaphragm Assembly | Relief Valve Spring |
| 5 to 15 inches wc (12 to 37 mbar) | Olive drab | 1B653927022 | 1B6425X0032 | 1C173427022 |
| 11 to 28 inches wc (26 to 67 bar) | Yellow | 1B537027052 | | |
| 1 to 2-1/2 psig (69 to 173 mbar) | Light green | 1B537127022 | 1B6424X0032 | 1B541327022 |
| 2-1/2 to 4-1/2 psig (0.2 to 0.3 bar) | Light blue | 1B537227022 | | |
| 4-1/2 to 7 psig (0.3 to 0.5 bar) | Black | 1B537327052 | | |



*Recommended Spare Part

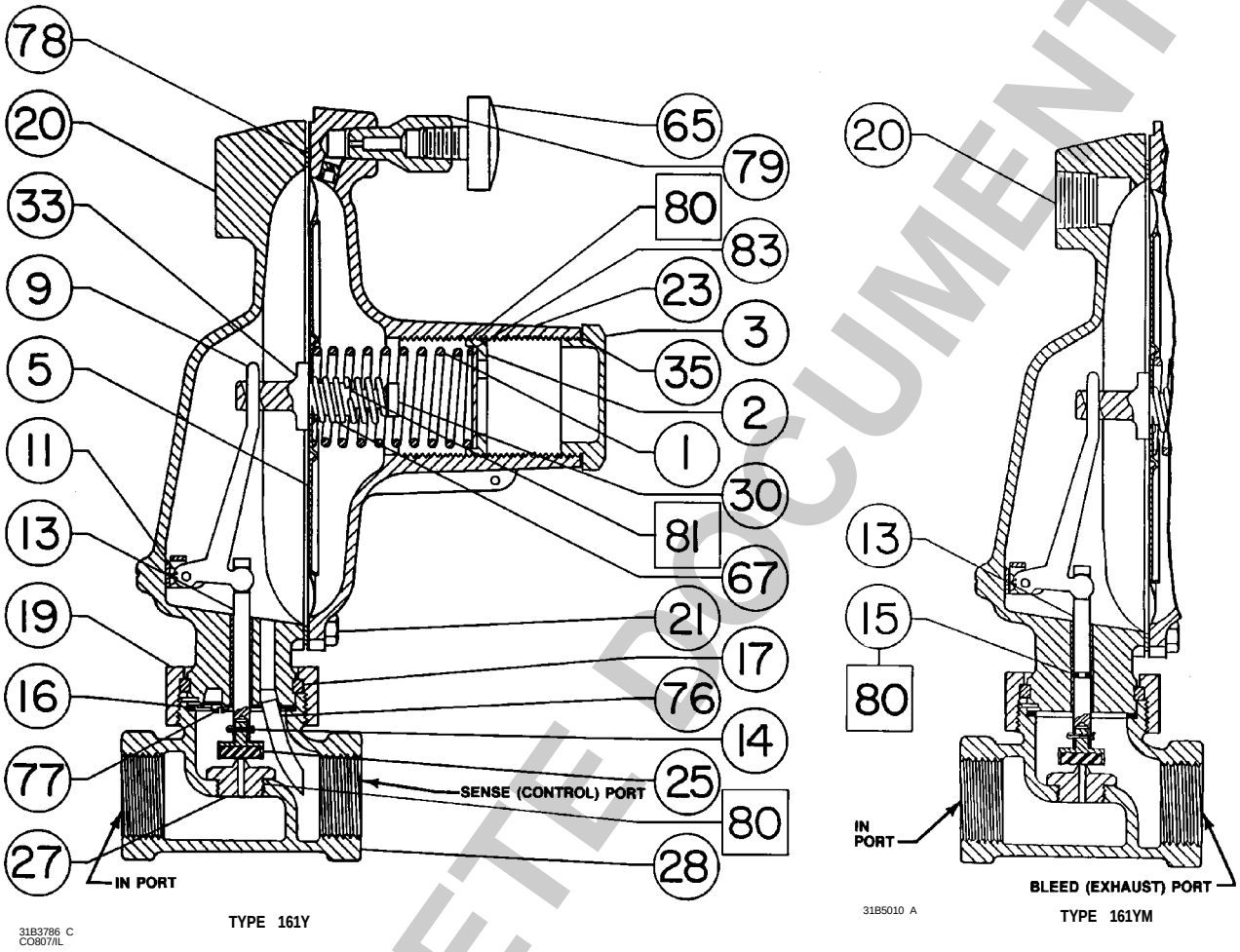



*Figure 23. Type 161Y and 161YM Pilots*



## Type 161Y and 161YM Pilot Mounting Parts (figure 24)

| Key | Description | Part Number |
|---|---|---|
| 29 | Pipe Nipple, Galvanized steel | |
| | For 2-inch main valve body | 1N624026232 |
| | For 3 and 4-inch main valve body | 1U264426232 |
| | For 4 x 2, 6, 6 x 4 and 8 x 4-inch main valve body | 1C210026232 |
| | For 8 x 6 and 12 x 6-inch main valve body | 19A7858X012 |
| 45 | Bushing, Galvanized steel | 1A3424X00A2 |
| 46 | Washer, pl steel (2 req'd) | 1D716228982 |
| 47 | Hex Nut, pl steel (2 req'd) | 1E944024112 |
| 48 | U Bolt, pl steel | 11B3469X012 |
| 49 | Mounting Bracket, steel | |
| | For 2 and 4 x 2-inch body | 31B3466X012 |
| | For 3-inch body | 31B3467X012 |
| | For 4, 6 x 4 and 8 x 4-inch body | 31B3468X012 |
| | For 6, 8 x 6 and 12 x 6-inch body | 31B4920X012 |
| 50 | Cap Screw, pl steel (2 req'd) | |
| | For 2 and 4 x 2-inch body | 1A344424052 |
| | For 3-inch body | 1A351224052 |
| | For 4, 6 x 4 and 8 x 4-inch body | 1A381024052 |
| | For 6, 8 x 6 and 12 x 6-inch body | 1A524824052 |

## Pounds to Pounds Working Monitor Pilot Mounting Parts (figure 25)

| Key | Description | Part Number |
|---|---|---|
| 29 | Pipe Nipple, galvanized steel | |
| | For 1-inch main valve body | 1N584226232 |
| | For 2-inch main valve body | 1N624026232 |
| | For 3 or 4-inch main valve body | 1U264426232 |
| | For 4 x 2, 6, 6 x 4 and 8 x 4-inch main valve body | 1C210026232 |
| 36 | Instruction Tag (not shown), plastic | 30B4414X012 |
| 38 | Pipe Nipple, galvanized steel | 1D239726232 |

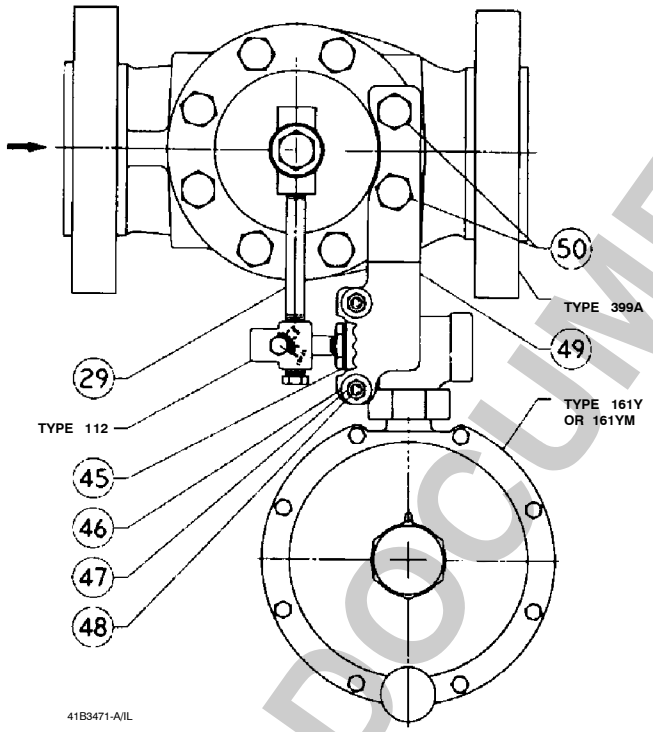



*Figure 24. Type 161Y and 161YM Mounting Parts*

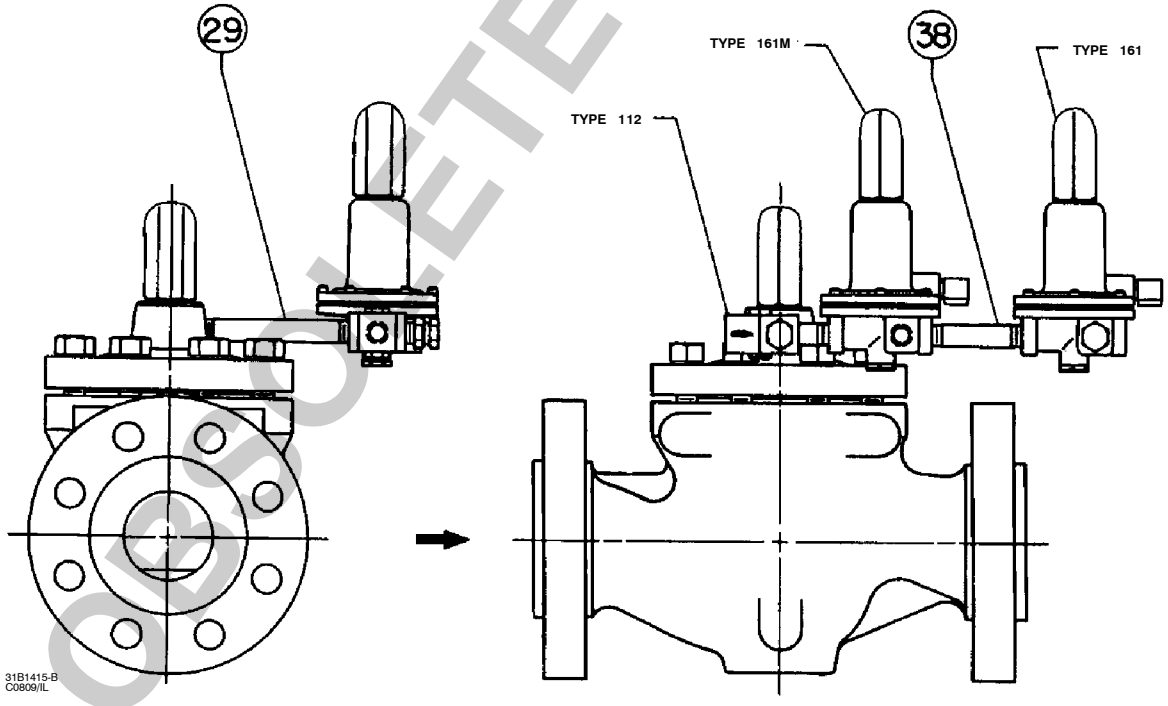



*Figure 25. Pounds to Pounds Working Monitor Mounting Parts*

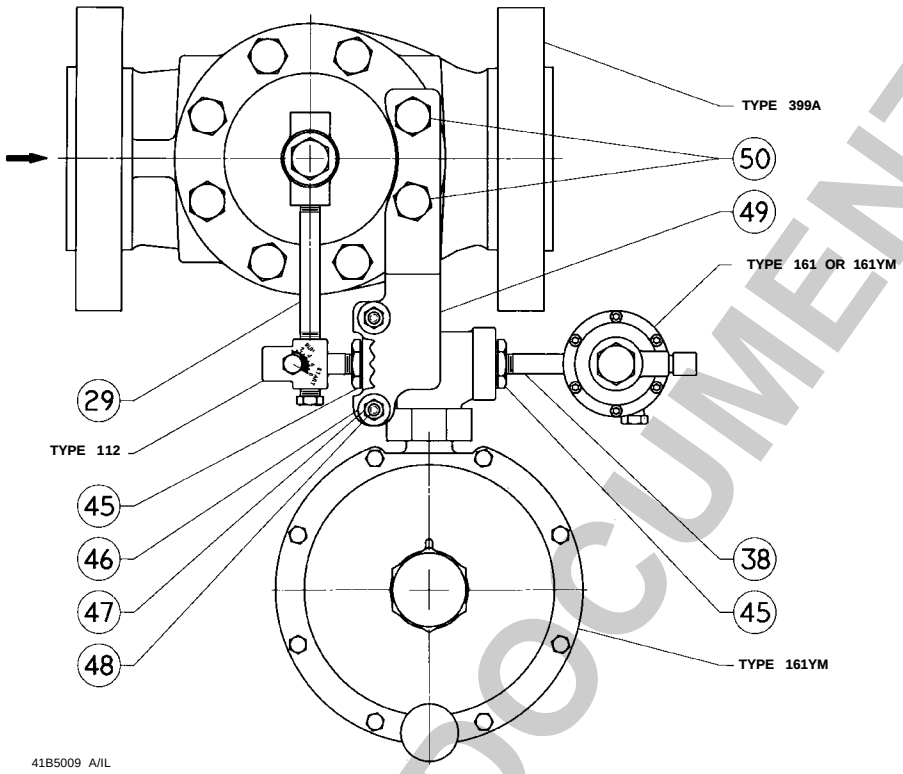



*Figure 26. Pounds to Inches Working Monitor Mounting Parts*

## Pounds to Inches Working Monitor Pilot Mounting Parts (figure 26)

| Key | Description | Part Number |
|---|---|---|
| 29 | Pipe Nipple, galvanized steel | |
| | For 1-inch main valve body | 1N584226232 |
| | For 2-inch main valve body | 1N624026232 |
| | For 3 or 4-inch main valve body | 1U264426232 |
| | For 4 x 2, 6, or 6 x 4-inch main valve body | 1C210026232 |
| 36 | Instruction Tag (not shown), plastic | 30B4414X012 |
| 38 | Pipe Nipple, galvanized steel | 1D239726232 |
| 45 | Bushing, galv steel (2 req'd) | 1A3424X00A2 |
| 46 | Washer, pl steel (2 req'd) | 1D716228982 |
| 47 | Hex Nut, pl steel (2 req'd) | 1E944024112 |
| 48 | U Bolt, pl steel | 11B3469X012 |
| 49 | Mounting Bracket, steel | |
| | For 2-inch body | 31B3466X012 |
| | For 3-inch body | 31B3467X012 |
| | For 4-inch body | 31B3468X012 |
| | For 6-inch body | 31B4920X012 |
| 50 | Cap Screw, pl steel (2 req'd) | |
| | For 2-inch body | 1A344424052 |
| | For 3-inch body | 1A351224052 |
| | For 4-inch body | 1A381024052 |
| | For 6-inch body | 1A524824052 |





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