

June 2024

Spence Back Pressure Regulators Equipped with Q Series Pilots

WARNING

Failure to follow these instructions or to properly install and maintain this equipment could result property damage and personal injury or death.

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

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

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

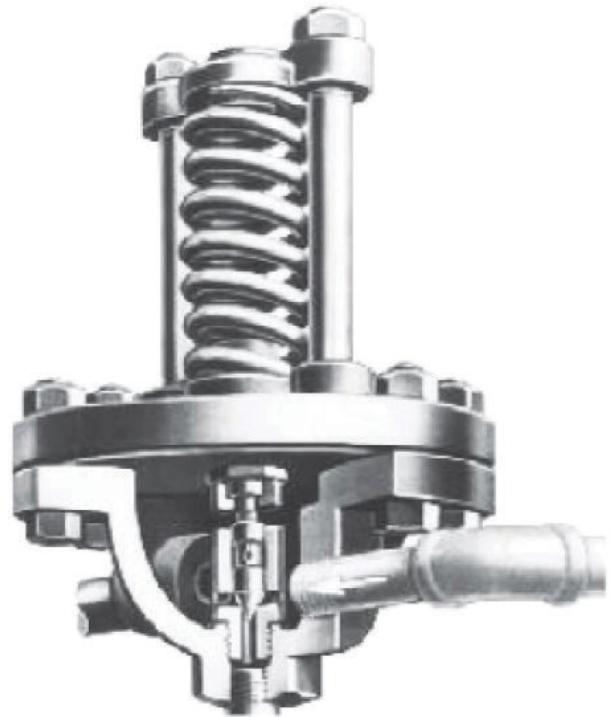


Figure 1. Q Series Pilot

Introduction

Scope of the Manual

This manual provides instructions for the installation, troubleshooting, maintenance, valve setting and parts ordering for Q Series pilots with E Series main valves.

Product Description

The Q Series pilot is separated from the main valve and connected to it with a male union. It is normally closed, designed with packless construction and interchangeable on all sizes of main valves. A strainer screen shall be built into the pilot inlet.

These regulators are designed to maintain a constant back pressure by discharging excess flow to a lower system pressure or atmosphere.

The EQ Series are intended primarily for steam service and provide dead-end shutoff.

A Spence back pressure regulator is not a safety valve and should never be used as such.

Q Series

Specifications

This section lists the specifications for the Q Series pilot. Factory specifications are stamped on the nameplate fastened on the regulator at the factory.

Available Types

Type Q: For ± 1 psig / 0.07 bar accuracy controlling back pressures between 3 and 150 psig / 0.21 and 10.3 bar.

Type Q2: For ± 2 psig / 0.14 bar accuracy controlling back pressures between 100 and 300 psig / 6.89 and 20.7 bar.

Type Q73: Air adjusted for ± 1 psig / 0.07 bar accuracy controlling back pressure at high retained pressures when available loading air is at low pressure. Delivery to loading pressure is 6-2/3 to 1 psig / 0.28 to 0.07 bar.

Available Size and End Connection Style

1/4 NPT / 6.4 mm

Maximum Inlet Pressure⁽¹⁾

150 psig / 10.3 bar

Maximum Operating Temperature⁽¹⁾

Cast Iron: 400°F / 204°C

Cast Steel: 500°F / 250°C

Spring Pressure Range

Type Q: 3 to 20 psig / 0.21 to 1.38 bar
5 to 50 psig / 0.35 to 3.45 bar
10 to 100 psig / 0.69 to 6.90 bar
20 to 150 psig / 1.38 to 10.3 bar

Type Q2: 100 to 300 psig / 6.90 to 20.7 bar

Construction Materials

Body: Cast iron and Cast steel

Disk, Seat and Diaphragm: Stainless steel

Spring: Steel

Approximate Weight

Type Q: 7 lbs / 3.2 kg

Type Q2: 10 lbs / 4.5 kg

Type Q73: 15 lbs / 6.8 kg

Options

Enclosed Spring Chamber

Adjusting Handle

High Pressure

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

Principle of Operation

Main valve is normally closed. Back pressure regulator responds to changes in upstream pressure. Pressure changes register to the pilot diaphragm through a control line. If the upstream pressure increases, pilot opens and fluid starts to fill the connecting tubing. Orifice coupling (No. 4A bleedport) restricts flow and builds pressure under the main valve diaphragm, opening the main valve. Opening of main valve relieves pressure in inlet pipe and control line, relaxing pressure on the pilot diaphragm. As pressure at the pilot diaphragm approaches a balance with control spring force, the regulator is under throttling operation. Once the pressure at pilot is less than the force of the control spring, the pilot closes and allows the main valve to close until an increase in back pressure occurs.

Installation



WARNING

Personal injury or system damage may result if this regulator is installed, without appropriate overpressure protection, where service conditions could exceed the limits given in the Specifications section and/or regulator nameplate.

Additionally, physical damage to the regulator may result in personal injury or property damage due to escaping of accumulated gas. To avoid such injury and damage, install the regulator in a safe location.

Under enclosed conditions or indoors, escaping gas may accumulate and be an explosion hazard. In this case, the vent should be piped outdoors.

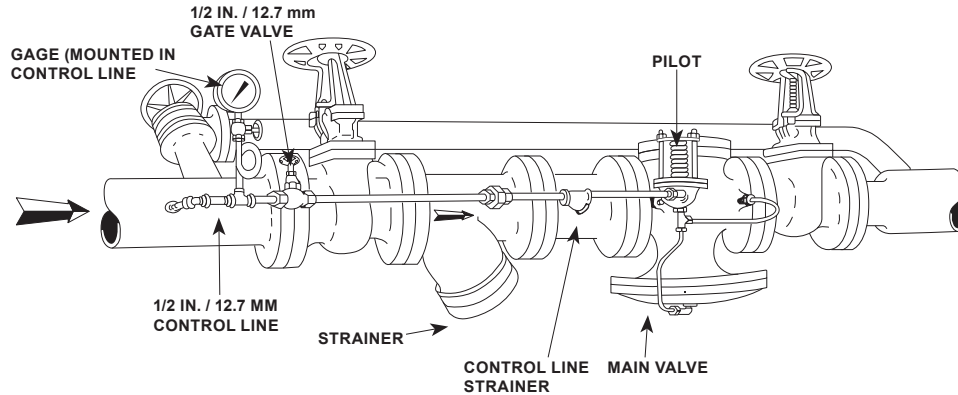


Figure 2. Installation of Back Pressure Regulator with Three-Valve Bypass and Strainers

Before Installation:

1. Install the main valve in a straight run of horizontal pipe. The diaphragm chamber must be down and the flow arrow pointing in the direction of flow. (See Figure 2)
2. Carefully clear the piping system of foreign matter at assembly.
3. Provide a three-valve bypass to facilitate inspection of the regulator.
4. Install a strainer ahead of the regulator.

Pilot Installation (See Figure 3)

1. Mount the Q Series pilot on either side of the main valve using the 1/4 in. / 6.4 mm blind nipple and union provided.
2. Install the provided fittings in their proper locations. These fittings are vital to the operation of the regulator and must be properly installed and unobstructed.
3. Install a 1/2 in. / 12.7 mm control pipe with gate valve to connect the pilot to the selected control point in the back pressure pipe. The control pipe transmits the back pressure signal to the pilot and also provides the small amount of fluid required to operate the main valve. The control pipe should be as short as practical, and must connect to the back pressure pipe at a point of minimum turbulence.

Note

Avoid selecting a control point near a turn or enlargement in pipe size. On steam service, install the control pipe so that a water leg or pocket will not occur. If necessary, install a float and thermostatic trap for drainage.

4. Insulation may be applied to the upper portion of the main valve (globe and flange). Do not insulate the diaphragm chamber, condensation chamber (if supplied) or any part of the pilot.

Start-up

1. Use the bypass valve to regulate the flow at normal back pressure.
2. Open the control pipe valve. Open the outlet stop valve wide.
3. Crack open the inlet stop valve. Put a small amount of compression on pilot control spring to close the pilot.
4. Gradually open the inlet stop valve and choke down on the bypass until the regulator is on the line.
5. Turn the control spring nuts slowly and evenly until the desired back pressure is reached. Compressing the pilot control spring increases the back pressure.

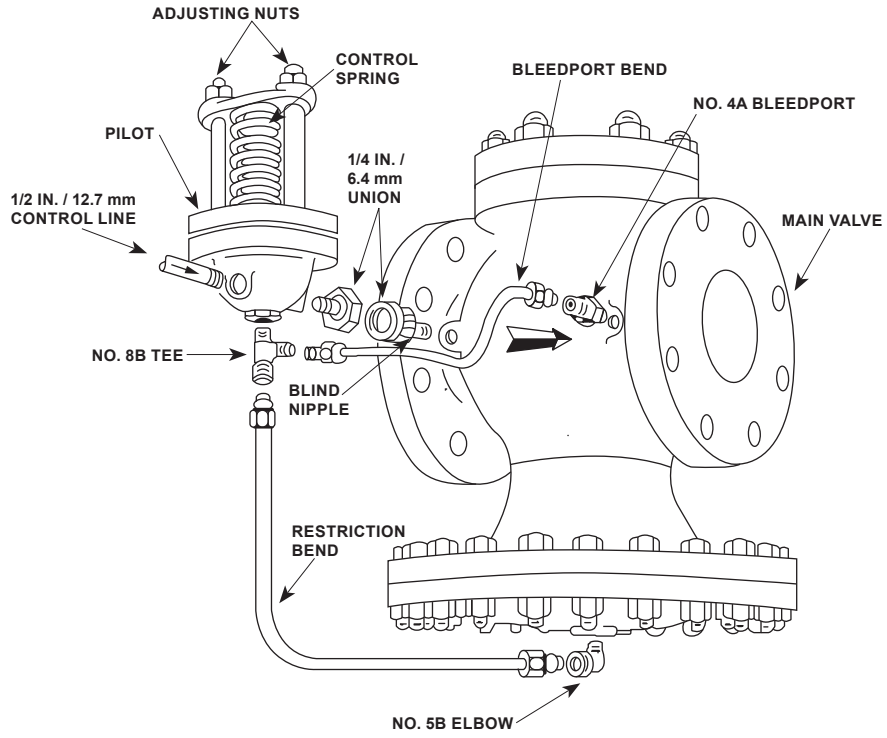


Figure 3. Pilot and Fittings Installation

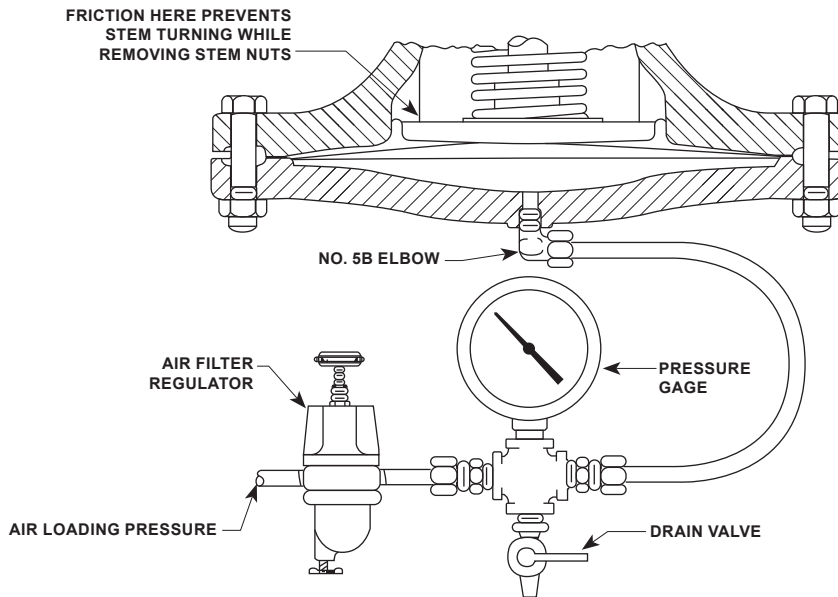


Figure 4. Air Loading Arrangement for Removing Stem Nuts

Dismantling

Pilot

1. Remove the compression on the control spring.
2. Remove the diaphragm bolts and lift off the cowl and diaphragm. As the diaphragm is lifted, the disk will be drawn out from its seat.

Main Valve

1. Remove the top flange.
2. Attach the adjustable pressure source as shown in Figure 4. Apply about 30 psig / 2.07 bar or 10 psig / 0.69 bar for Type E2 to jack open the valve.
3. Lift out the balance or dash pot cylinder if your valve is so equipped.
4. Remove the stem nuts after applying penetrating oil to the threads.
5. Lift out the piston, if so equipped.
6. Lift out the disk.
7. Remove the diaphragm loading pressure.
8. Remove the diaphragm bolts. The hood, diaphragms, main spring and stem, will drop from the valve.

Grinding In (Metal Seat and Disk Only)

1. Seats and disks never require more than a light touch-up using very fine (400 Grit) compound. Heavy grinding will damage the metal-to-metal seal.
2. The pilot disk is slotted for rotation with a screw driver.
3. Main valves are ground in with the main spring removed and one stem installed.
4. After grinding, disassemble and clean all parts with kerosene or trichloroethane.

Troubleshooting

Erratic Operation

1. Partial clogging of No. 4A fitting – Check fitting.
2. Steam service only: Water pocket in 1/2 in. / 12.7 mm control line – Provide for proper drainage.
3. Binding Pilot – Dismantle the pilot and check for scale or dirt buildup.

Excessive Back Pressure or Failure to Open

1. Inlet or outlet stop valve not fully open – Check.
2. Control pipe valve not open – Check.
3. Clogged strainer – Blow down strainer.
4. Pilot improperly adjusted – Check adjustment.
5. Missing No. 4A fitting – Check orifice.
6. Main valve diaphragm broken – Use auxiliary pressure to load diaphragm. If valve does not open with 30 psig / 2.07 bar or 10 psig / 0.69 bar for Type E2, then the diaphragm is broken.

Low Back Pressure or Failure to Close

1. Bypass valve leaking – Check.
2. Pilot improperly adjusted – Check adjustment.
3. Clogged No. 4A fitting – Check orifice.
4. Main valve or pilot valve hung open. Pinpoint the problem by closing the valve tight.
 - a. If the back pressure rises, pilot is hung open – Dismantle and clear.
 - b. If back pressure does not rise, main valve is hung open – Dismantle and clear.

Maintenance



WARNING

To avoid personal injury or property damage from sudden release of pressure, isolate the regulator from the pressure system and release all pressure from the pilot and main valve before performing maintenance operations.

1. Under normal conditions, periodic dismantling of the regulator is not recommended. A valve kept relatively free of dirt will function for years with minimal attention.
2. The following inspections should be made after the first ten days of operation and twice a year thereafter:
 - a. Check the No. 4A bleedport restriction for dirt accumulation. Clean as required.
 - b. Check the pilot for dirt accumulations on the upper surface of its pressure plate. Clean as required.
 - c. Inspect all joints for leakage. Keep bolts and fittings tight. Never allow a leak to persist.

Parts Ordering

When corresponding with your local Sales Office about Q Series pilot, always reference the assembly number. When ordering replacement parts, specify the complete character part number from the following parts list.

Parts List

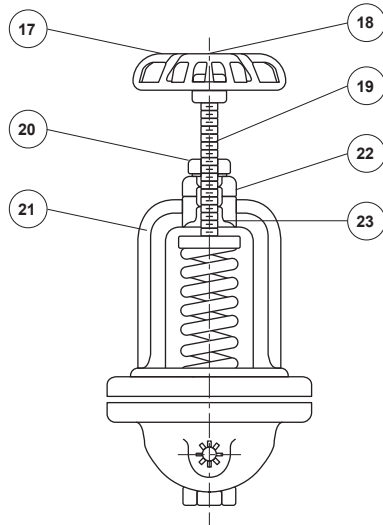
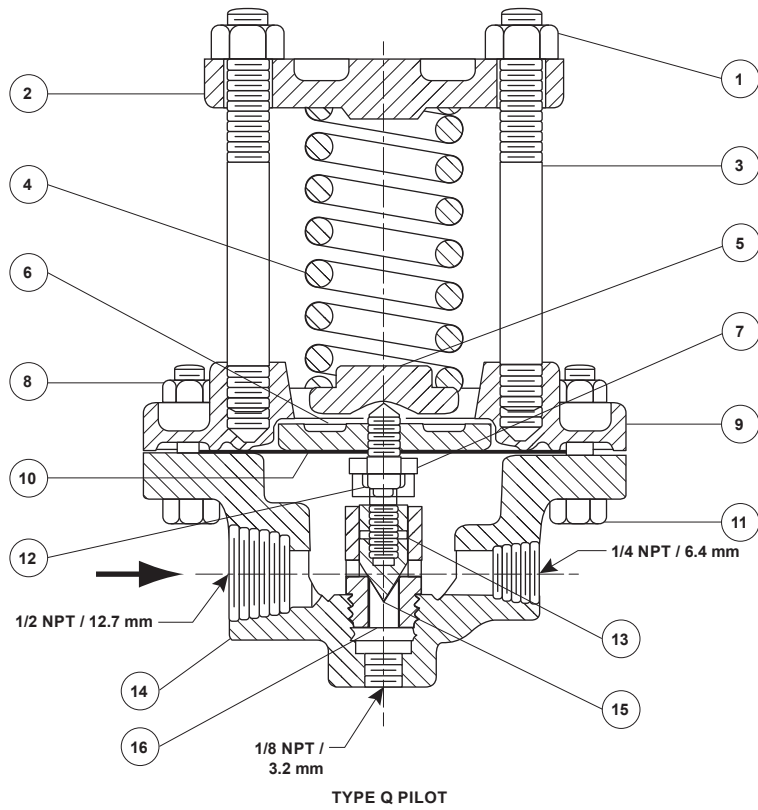
Key	Description	Part Number
1	Adjusting Nut, Steel	WAL05-02874-00
2	Spring Yoke, Iron	WAL05-06183-00
3	Standard, Stainless steel	WAL04-05219-00
4	Adjusting Spring, Steel 3 to 20 psi / 0.21 to 1.38 bar 5 to 50 psi / 0.35 to 3.45 bar 10 to 100 psi / 0.69 to 6.90 bar 20 to 150 psi / 1.38 to 10.3 bar	WAL05-05007-00 WAL05-05003-00 WAL05-05005-00 WAL05-05012-00
5	Spring Button, Steel	WAL04-01040-00
6	Pressure Plate, Steel	WAL04-03679-00
7	Diaphragm Screw, Stainless steel	WAL04-04823-00
8	Diaphragm Nut, Steel	WAL05-02871-00
9	Cowl, Iron	WAL04-01508-00
10 ^{*(1)}	Diaphragm, Stainless steel	WAL04-01623-00
11	Diaphragm Bolt, Steel	WAL05-04764-00
11	Diaphragm Nut, Steel	WAL05-02871-00
12	Disc Adjusting Scree, Stainless steel	WAL04-04761-00
13	Dowel Pin, Stainless steel	WAL05-03242-00
14	Body Iron Bronze Steel	WAL04-00737-00 WAL04-00739-00 WAL04-00738-00
15	Disc, Stainless steel	WAL04-01712-00
16	Seat Ring, Stainless steel	WAL04-04381-00
17	Handwheel, Mall Iron	WAL05-06139-00
18	Handwheel Nut, Steel	WAL05-02872-00
19	Adjusting Screw, Steel	WAL04-04752-00
20	Adjusting Screw, Locknut, Steel	WAL05-02952-00
21	Cowl Yoke Iron ⁽²⁾ Ductile iron ⁽³⁾	WAL04-06166-00 WAL04-06167-00
22	Yoke Bushing, Locknut, Steel	WAL05-02947-00
23	Yoke Bushing, Bronze	WAL04-01152-00
24	Adjusting Screw, Steel	WAL05-04860-00
25	Locknut, Steel	WAL05-02942-00
26	Spring Chamber Iron Bronze Steel	WAL04-01393-00 WAL04-01395-00 WAL04-01394-00
27	Padlock, Brass	WAL05-03204-00
28	Lock Pin, Steel	WAL04-03272-00
29	Lock Bar, Steel	WAL04-00436-00
30	Spring Yoke, Iron	WAL04-06182-00
30	Lock Pin, Steel	WAL04-03272-00
32	Diaphragm Nut, Steel	WAL05-02871-00

* Recommended Spare Parts

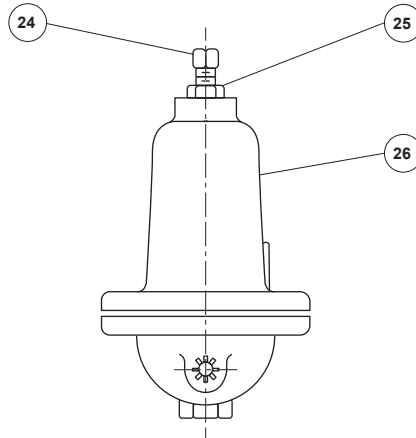
1. Requires 2 per set.

2. Applies to iron pilot.

3. Applies to Bronze and steel pilots.



ADJUSTING HANDWHEEL



ENCLOSED SPRING CHAMBER

Figure 5. Type Q Pilot Assembly

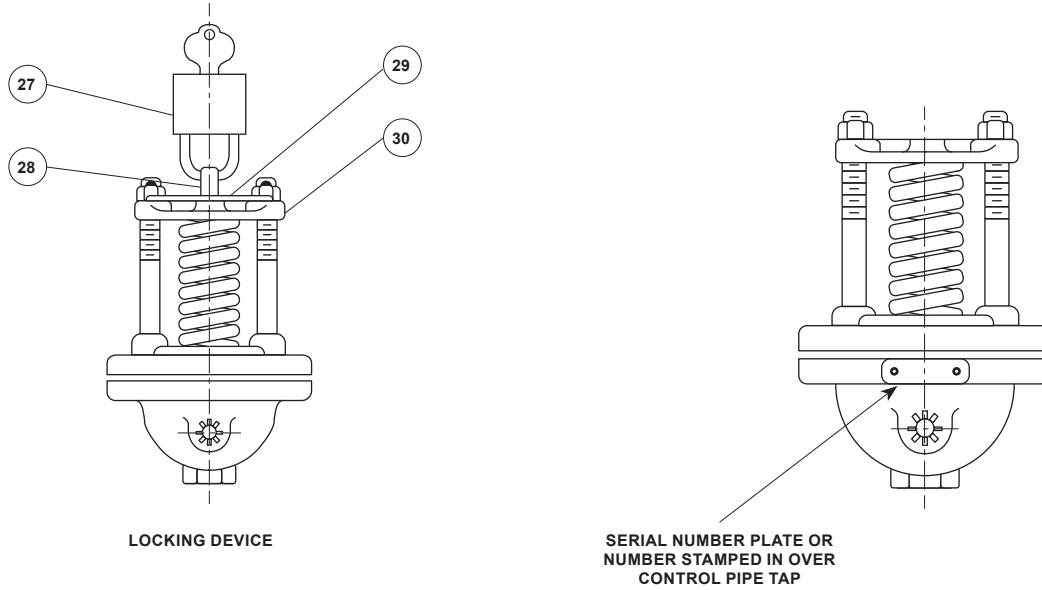


Figure 5. Type Q Pilot Assembly (continued)

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