

June 2024

## Spence Regulators with Type SP/P Pressure Safety Pilot



### WARNING

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

Regulator with Type SP/P Pressure Safety Pilot must be installed, operated and maintained in accordance with federal, state and local codes, rules and regulations and Emerson Process Management Regulator Technologies, Inc. (Emerson) instructions.

If the regulator vents gas or a leak develops in the system, service to the unit may be required. Failure to correct 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 Regulator with Type SP/P Pressure Safety Pilot.

### Introduction

#### Scope of the Manual

This manual provides instructions for the installation, troubleshooting, maintenance, valve setting and parts ordering for Regulator with Type SP/P Pressure Safety Pilot.

#### Product Description

Complete pressure regulator with safety pilot includes Type E Main Valve or Type D pilot and Type SP/P Safety Pilot.



Figure 1. Type E Main Valve with Type D Pilot and Type SP/P Pressure Safety Pilot



# Pressure Regulators with Type SP/P Safety Pilot

## Specifications

This section lists the specifications for the Spence™ regulators with Type SP/P Pressure Safety Pilot. Factory specifications are stamped on the nameplate fastened on the regulator at the factory.

### Type E Main Valve

#### Available Sizes

NPS 3/8, 1/2, 3/4, 1, 1-1/4, 1-1/2, 2, 2-1/2, 3, 4, 5, 6, 8, 10 and 12 / DN 10, 15, 20, 25, 32, 40, 50, 65, 80, 100, 125, 150, 200, 250 and 300

#### End Connection Styles

NPT, CL125, CL150, CL250, CL300 and CL600

#### Pressure Rating<sup>(1)</sup>

See Table 1

#### Temperature Rating<sup>(1)</sup>

See Table 1

#### Rated Flow Coefficient

See Table 2

#### Construction Materials

Cast Iron and Cast Steel

### Type D Pilot

#### Maximum Inlet Temperature<sup>(1)</sup>

Cast Iron: 450°F / 232°C

Steel: 750°F / 400°C

#### Maximum Inlet Pressure<sup>(1)</sup>

Cast Iron: 250 psig / 17.2 bar

Steel: 600 psig / 41.4 bar

### Pressure Ranges<sup>(1)</sup>

Type D: 3 to 150 psig / 0.21 to 10.3 bar

Type D2: 100 to 300 psig / 6.90 to 20.7 bar

Type D5: 1 to 25 psig / 0.07 to 1.72 bar

Type D120: 5 to 300 psig / 0.35 to 20.7 bar

### Construction Materials

Cast Iron and cast Steel

### Type SP/P Safety Pilot

#### Maximum Inlet Temperature<sup>(1)</sup>

Bronze: 500°F / 260°C

Steel: 750°F / 400°C

#### Maximum Inlet Pressure<sup>(1)</sup>

Bronze: 300 psig / 20.7 bar

Steel: 600 psig / 41.4 bar

### Pressure Ranges<sup>(1)</sup>

5 to 13 psig / 0.35 to 0.90 bar

13 to 30 psig / 0.90 to 2.07 bar

31 to 65 psig / 2.14 to 4.48 bar

66 to 120 psig / 4.55 to 8.27 bar

121 to 175 psig / 8.35 to 12.1 bar

### Construction Materials

Bronze and Cast steel

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

**Table 1. Type E Main Valve Pressure and Temperature Rating<sup>(1)</sup>**

MAIN VALVE MATERIAL	END CONNECTION	PRESSURE RATING		TEMPERATURE RATING	
		psig	bar	°F	°C
Cast Iron	250 NPT	250	17.2	406	207
	CL125	125	8.62	450	232
	CL250	250	17.2	450	232
Cast Steel	300 NPT	300	20.7	600	315
	CL150	150	10.3	500	260
	CL300	300	20.7	600	315
	CL600	600	41.4	600	315

1. Ratings based on maximum inlet conditions.

**Table 2. Type E Main Valve Rated Flow Coefficients**

SEAT FACTOR	VALVE SIZE, NPS / DN															
	3/8 / 10	1/2 / 15	3/4 / 20	1 / 25	1-1/4 / 32	1-1/2 / 40	2 / 50	2-1/2 / 65	3 / 80	4 / 100	5 / 125	6 / 150	8 / 200	10 / 250	12 / 300	
Full	1.5	2.8	5.4	8.8	14.1	19.8	31	44	74	109	169	248	444	706	1113	
Full 75%	----	2.1	4.0	6.6	10.6	14.8	23.3	33	56	82	127	186	333	530	835	
Full 50%	----	1.4	2.7	4.4	7.0	9.9	15.5	22	37	55	85	124	222	353	557	
Normal	0.65	1.5	4.8	7.5	10.4	14.6	17.6	24	43	78	115	151	249	377	631	
Normal 75%	----	----	----	----	----	----	----	18	33	59	87	114	187	283	474	
Normal 50%	----	----	----	----	----	----	----	12	22	39	58	76	125	189	316	

# Pressure Regulators with Type SP/P Safety Pilot

## Type E Main Valve

The Type E Main Valve is pilot-operated normally closed, single seat design featuring packless construction, balanced metal, diaphragms and protected main spring.

One or more pilot regulators are mounted to Type E main valve to fit with the specifications defined by the pressure regulating system.

## Type D Pilot

The Type D pilot is combined with Spence™ main valve to reduce a steady or varying initial pressure to a constant, adjustable delivery pressure.

## Type SP/P Pressure Safety Pilot

The purpose of the safety pilot is to prevent the pressure from building up on the house side in case of:

1. Failure of the Type D pilot in an open position on the primary pressure regulator.
2. Failure of the main valve in an open position on the secondary pressure regulator.

The safety pilot is purely a standby pilot used as a safety feature and under normal conditions does no regulation.

## Principle of Operation

### Regulator

The main spring and the initial pressure on top of the disk keeps the main valve close. The pilot, which is held open by its adjusting spring, receives high pressure steam from the inlet side of the main valve by means of the 1/4 in. / 6.35 mm nipple and union connecting it to the main valve. This high pressure steam flows through the pilot and discharges into the copper tubing tee. From this tee part of the steam flows through the bleedport (3/32 in. / 2.38 mm orifice) located on the outlet side of the main valve, and the rest flows down to the restriction (orifice size varies with valve size) to exert pressure on the main valve diaphragm and thus open the main valve.

As the delivery pressure builds up to the desired point, it reacts on the pilot diaphragm through the control pipe, thus throttling the pilot and the amount of steam flowing through it. As the amount of steam flowing through the pilot is throttled, some of the pressure

under the main valve diaphragm escapes through the bleedport and the main valve throttles down to the point where it is just passing enough steam to keep the delivery pressure at the desired point.

## Pressure Safety Pilot

The safety pilot inlet is connected to the restriction tee at bottom of primary main valve, which has a restriction on the Type D pilot side, but none on the safety pilot side. This means that when the safety pilot opens, it can always bleed off the pressure under the main valve diaphragm faster than the Type D pilot can build it up through the restriction, thus causing the primary main valve to close.

The control pipe of the safety pilot is connected to the house side and the safety pilot is set for a slightly higher pressure than is normally carried on the house side. If, for any reason, the house pressure builds up, the safety pilot will throttle the primary main valve to maintain the house pressure at the setting of the safety pilot.

## Installation



**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.**

**For regulator constructions with a spring case vent, the vent should be kept open to permit free flow of gas to the atmosphere. Protect openings against entrance of rain, snow, insects or any other foreign material that may plug the spring case vent or vent line.**

# Pressure Regulators with Type SP/P Safety Pilot

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## Adjustment

### Pilot Stem Adjustment

1. The length of pilot stem (key 24) is established with seat ring (key 25) removed from body (key 13).
2. Screw pusher plate (key 22) on stem (key 24) until valve spring (key 23) is compressed to a length of 3/4 in. / 19.1 mm.
3. Prick punch thread to lock position. Grind off any projection of stem (key 24) through upper end of pusher plate (key 22).
4. Using Copaltite, Smooth-on No. 3 or equal, plastic compound, screw the seat and disk assembly into body (key 13). Bellows assembly (key 10) if removed should be reassembled in the same manner.

### Pressure Stem Adjustment

1. Remove hood (key 16) and diaphragms (key 15).
2. Screw pressure plate (key 2) onto pressure stem (key 7) until stem is flush with the face. Prick punch thread to lock.
3. Turn down adjusting nut (key 8) until there is no compression on adjusting spring (key 6). Loosen lock set screw (key 21) in bonnet (key 11) and barrel locknut (key 9). Turn up locknut (key 9) to adjusting nut (key 8). Turn cowl assembly (key 20) so that pressure plate (key 2) extends 1/64 in. / 0.40 mm above the diaphragm seating surface. Or place gage #10082 across the diaphragm seating surface and adjust cowl assembly (key 20) so that pressure plate (key 2) is flush with gage.
4. Lock setting by turning barrel locknut (key 9) down on bonnet (key 11). Tighten barrel lock set screw (key 21).

### Adjustment of Delivery Pressure

In the case of the Type ED, increasing the spring compression of the pilot adjusting spring raises the delivery pressure and decreasing the spring compression lowers the delivery pressure.

In the case of the Type EW, moving the weight away from the pilot increases the delivery pressure, and moving the weight toward the pilot decreases the delivery pressure.

## Maintenance



**To avoid personal injury, property damage or equipment damage caused by sudden release of pressure or explosion of accumulated gas, do not attempt any maintenance or disassembly without first isolating the regulator from system pressure and relieving all internal pressure from the pilot.**

**Regulators that have been disassembled for repair must be tested for proper operation before being returned to service. Only parts manufactured by Emerson should be used for repairing this regulator.**

**Due to normal wear or damage that may occur from external sources, this regulator should be inspected and maintained periodically. The frequency of inspection and replacement of parts depends upon the severity of service conditions or the requirement of local, state and federal rules and regulations.**

# Pressure Regulators with Type SP/P Safety Pilot

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## Dismantling and Reassembling

### Main Valve

1. To completely dismantle the main valve, remove blind flange from top and then remove the bottom cover or hood.
2. Remove the diaphragms and then, remove the two stem nuts from the top one at a time by holding the pressure plate on the bottom with two screw drivers (don't use only one or you will probably bend the stem). The whole stem assembly will then come out through the bottom of the valve.
3. In cleaning and reassembling, clean stem with fine emery cloth till shiny.
4. Lap disk to seat and also lap disk to shoulder on stem with fine compound.
5. Tighten stem nuts one at a time, making sure that disk is butted up against shoulder on stem.
6. Wipe off diaphragms, making sure there is no dirt around the edges where they are pinched by the valve.
7. Tighten hood, working back and forth on opposite bolts. Do not start on one bolt and work around the circle or you will probably have a leak.

### Pilot (Type D)

1. Remove adjusting spring (or weight), and dismantle pilot at diaphragm joint.
2. Remove blind flange and screen. Holding the hexagon pusher plate at top end, remove the two stem nuts, one at a time.
3. Clean all parts thoroughly and lap disk to seat and stem shoulder with fine grinding compound.
4. Reassemble, making sure that disk is pulled up tight against stem shoulder.

### Safety Pilot

1. Remove the blind flange and using a 15/16 in. / 23.8 mm long socket, remove the seat and disk assembly.
2. Remove the stem nuts then clean all parts.
3. Lap disk to seat and stem shoulder with fine grinding compound and reassemble, making sure that disk is pulled up tight against stem shoulder.
4. To remove bellows seal, remove nuts at extreme ends of the standards and remove entire diaphragm assembly from body of pilot.
5. The bellows seal can then be unscrewed.

# Pressure Regulators with Type SP/P Safety Pilot

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## Troubleshooting

### If Regulator Fails to Open – or Fails to Open Sufficiently (Delivery Pressure Will Not Build Up):

1. Make sure that both inlet and outlet stop valves are open.
2. Try raising the delivery pressure by adjusting the setting of the pilot.
3. Make sure that the initial pressure is reaching the inlet of the regulator—blow down strainer ahead of regulator.
4. Close the stop valves and remove both copper tubing bends. Test operation of pilot by cracking open the inlet stop valve and observing discharge from pilot. Increase the pressure setting of pilot, if necessary, to get discharge. If discharge cannot be obtained, pilot is fouled with dirt and should be disassembled and cleaned. If pilot is badly fouled, main valve should also be examined. Remove blind flange from top of main valve and clean out all foreign matter.
5. Before replacing tubing bends, check the bleedport fitting to make sure it contains an orifice (3/32 in. / 2.38 mm). Also check the restriction ell at bottom of main valve and make sure it is not plugged. Blow out tubing bends before replacing them.
6. Should regulator function normally at low loads, but fail to maintain the delivery pressure on high loads, it probably is not big enough for the demand.

### If Regulator Fails to Close (Delivery Pressure Builds Up Too High):

1. If there is a bypass valve, make sure that it is not leaking.
2. Try lowering the delivery pressure by changing the pilot setting.
3. Close the stop valves and remove both tubing bends and inspect both the bleedport and restriction ell to make sure they are not obstructed. Remove **all** compression from the pilot adjusting spring and then crack the inlet stop valve. If steam issues from the pilot valve, the trouble is in the pilot. If steam issues from the bleedport opening, the trouble is in the main valve.

If trouble is in the pilot, it should be completely dismantled, cleaned and the disk lapped in with **FINE** grinding compound (never use coarse).

If trouble is in the main valve, remove blind flange from top and see if there is an obstruction between the seat and disk that keeps main valve from closing. If so, it may be possible to remove obstruction with long nose pliers or a piece of stiff wire. If obstruction cannot be removed, or is not visible, dismantle main valve completely, clean thoroughly and lap in disk with fine compound.

A tire pump and a 'snifter' valve can often be successfully used to remove an obstruction from between the seat and disk of the main valve. Replace the restriction ell with the 'snifter' valve and pump air pressure (10 to 20 psi / 0.69 to 1.38 bar) under the main valve diaphragm. This will open main valve wide and the obstruction can be removed with a piece of wire (do not use fingers).

# Pressure Regulators with Type SP/P Safety Pilot

## Parts Ordering

When corresponding with your local Sales Office about Spence™ Regulator with Type SP/P Pressure Safety Pilot, always reference the assembly number. When ordering replacement parts, specify the complete character part number from the following parts list.

## Parts List

### Type E Main Valve

See Type E Instruction Manual VCIMD-14961-EN

### Type D Pilot

See Type D Instruction Manual VCIMD-14966-EN

### Type SP/P Safety Pilot

Key	Description	Part Number
1	Diaphragm nut, Steel	WAL05-02871-00
2	Pressure Plate, Iron	WAL04-03654-00
3	Diaphragm Bolt, Steel	WAL05-04764-00
4	Pressure Plate Balls, Steel	WAL05-00553-00
5	Spring Buttons, Steel	WAL04-01059-00
6	Adjusting Spring, Steel	WAL05-05003-00
	5 to 30 psi / 0.34 to 2.06 bar	WAL05-05007-00
	31 to 65 psi / 2.14 to 4.48 bar	WAL05-05003-00
	66 to 120 psi / 4.55 to 8.28 bar	WAL05-05005-00
	121 to 175 psi / 8.34 to 12.06 bar	WAL05-05012-00
7	Pressure Stem, Brass	WAL04-05425-00
8	Barrel Adjusting Nut, Steel	WAL04-02908-00
9	Barrel Locknut, Steel	WAL04-02910-00
10	Bellows Assembly	
	Broze	WAL04-00010-00
	Stainless Steel	WAL04-00011-00

Key	Description	Part Number
11	Bonnet	
	Bronze	WAL04-00979-00
	Steel	WAL04-00980-00
12	Blind Flange and Bonnet Bolts, Steel	WAL05-04803-00
13	Body	
	Bronze	WAL04-00856-00
	Steel	WAL04-00857-00
14	Blind Flange	
	Bronze	WAL04-02153-00
	Steel	WAL04-02152-00
15	Diaphragm <sup>(1)(2)</sup> , Stainless steel	WAL04-01626-00
16	Hood, Iron	WAL04-02563-00
17	Cowl, Iron	WAL04-01543-00
18	Groove Pin, Steel	WAL05-03243-00
19	Barrel, Aluminum	WAL04-01262-00
20	Cowl Assembly	
	Including items, Iron	WAL00-00317-00
21	Barrel Lock Set Ser., Steel	WAL05-04874-00
22	Pusher Plate <sup>(2)</sup> , Steel	WAL04-03726-00
23	Valve Spring <sup>(2)</sup> , Inconel®	WAL05-04982-00
24	Valve Stem <sup>(2)</sup> , Stainless steel	WAL04-05379-00
25	Seat Ring <sup>(2)</sup> , Stainless steel	WAL04-04380-00
26	Disk <sup>(2)</sup> , Stainless steel	WAL04-01780-00
27	Pipe Plug, 1/8 NPT	
	Brass	WAL04-03770-00
	Steel	WAL04-03769-00
28	Stem Nuts <sup>(2)</sup> , Steel	WAL05-02888-00
29	Gasket <sup>(2)</sup> , Asbestos	WAL05-02378-00

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1. Use 2 diaphragms for delivery pressures up to 65 psi / 4.48 bar, 3 diaphragms for 66 to 175 psi / 4.48 to 12.06 bar.

2. These parts furnished in a repair kit - WAL08-09117-00, Bronze

WAL08-09118-00, Steel

# Pressure Regulators with Type SP/P Safety Pilot

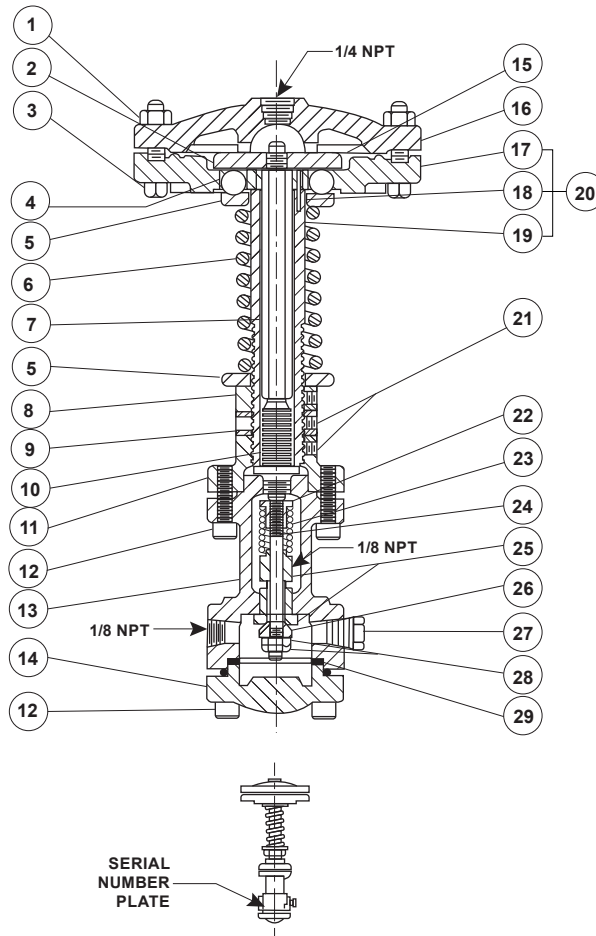


Figure 2. Pressure Safety Pilot Assembly

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