Spence™ Steam and Fluid Control Instruction Manuals

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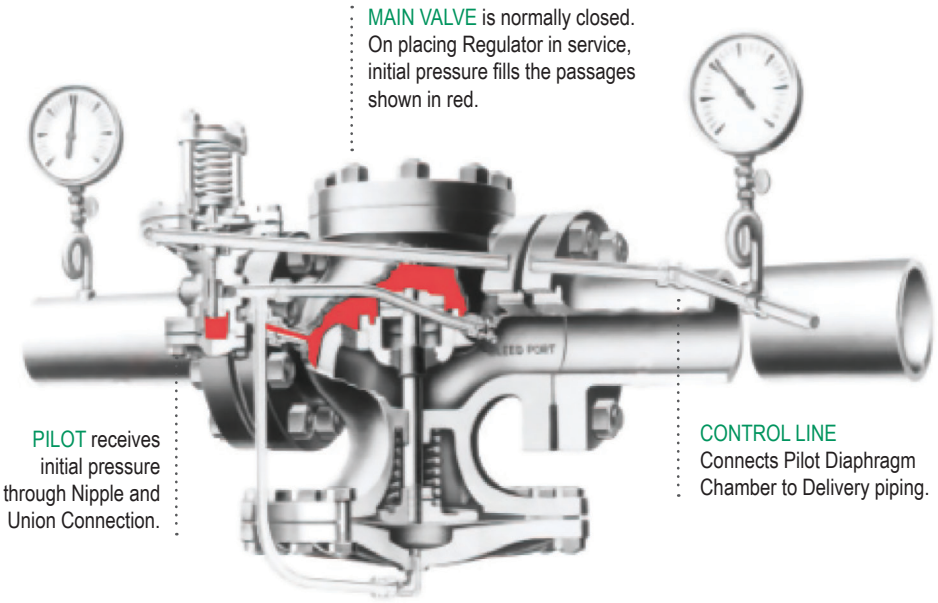
THE OPERATING CYCLE OF A SPENCE PRESSURE REGULATOR

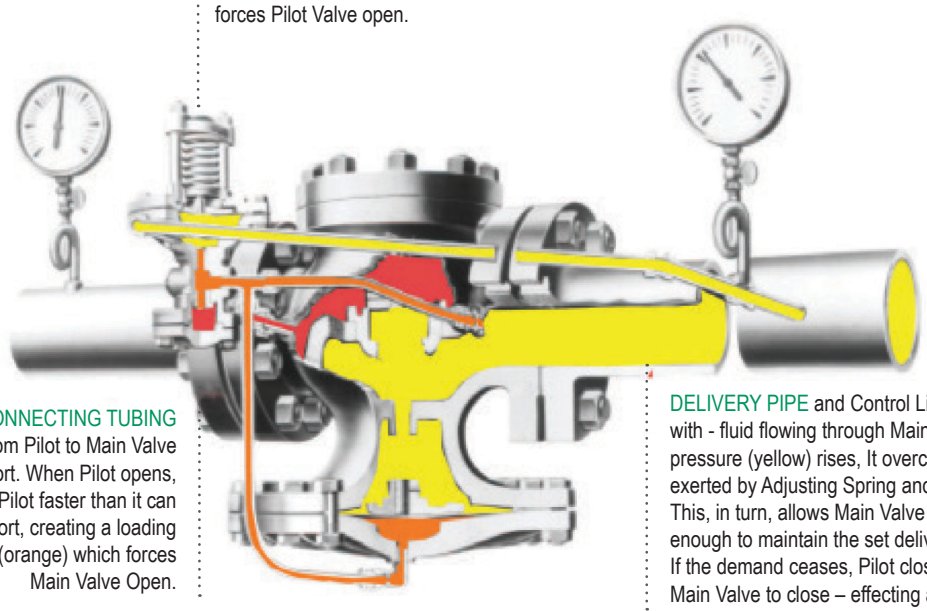
The basic Type ED has been selected to illustrate the operation of a SPENCE Pilot Operated Pressure Regulator. This presentation describes the successive steps in the mechanical cycle of the Regulator.



MAIN VALVE is normally closed. On placing Regulator in service, initial pressure fills the passages shown in red.

PILOT receives initial pressure through Nipple and Union Connection.

CONTROL LINE
Connects Pilot Diaphragm Chamber to Delivery piping.



ADJUSTING SPRING
when compressed, forces Pilot Valve open.

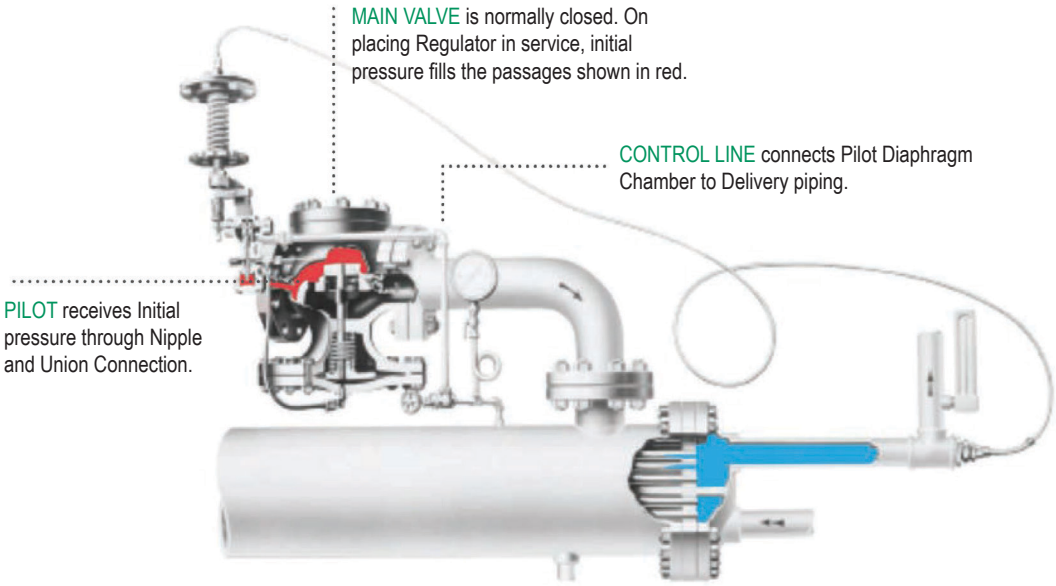
CONNECTING TUBING
Conducts fluid from Pilot to Main Valve Diaphragm and Bleed Port. When Pilot opens, Fluid flows through Pilot faster than it can escape at Bleed Port, creating a loading Pressure (orange) which forces Main Valve Open.

DELIVERY PIPE and Control Line are now being filled with - fluid flowing through Main Valve. As delivery pressure (yellow) rises, It overcomes the force exerted by Adjusting Spring and Pilot throttles. This, in turn, allows Main Valve to throttle just enough to maintain the set delivery pressure. If the demand ceases, Pilot closes, allowing the Main Valve to close – effecting a DEAD-END SHUTOFF.

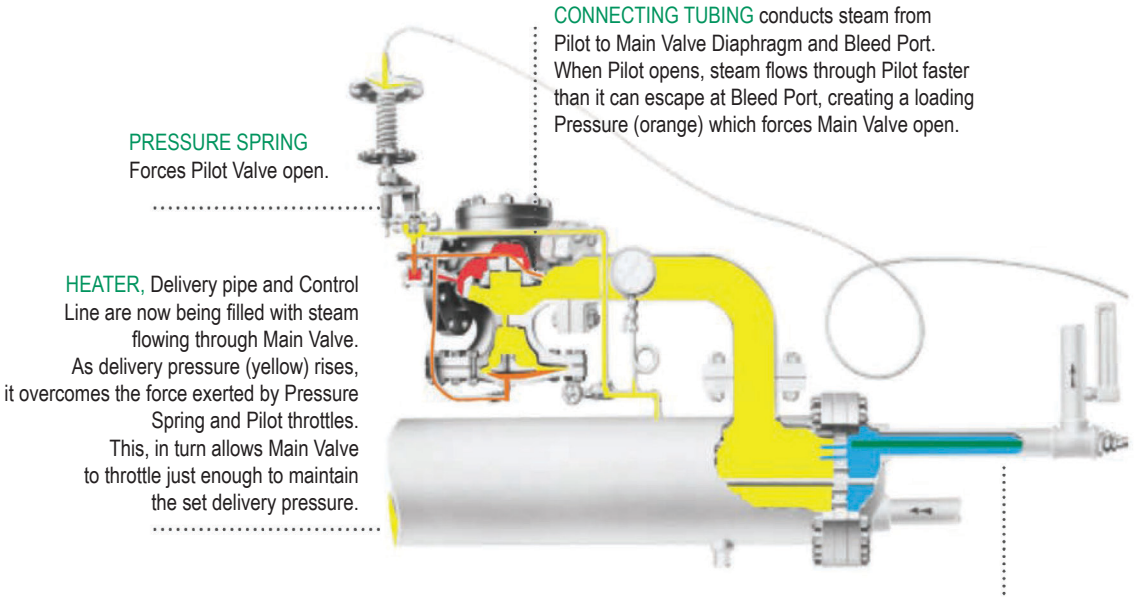
KEY HIGH PRESSURE MEDIUM PRESSURE LOW PRESSURE

THE OPERATING CYCLE OF A SPENCE TEMPERATURE REGULATOR

The Type ET134 has been selected to illustrate the operation of a SPENCE Pilot Operated Temperature Regulator. This presentation describes the successive steps in the mechanical cycle of the Regulator.

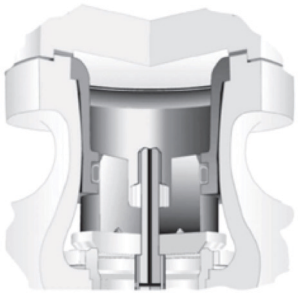


KEY INITIAL STEAM PRESSURE LOADING STEAM PRESSURE DELIVERY STEAM PRESSURE VAPOR PRESSURE FLUID HEATED



THERMOSTAT ELEMENT (vapor tension type) is connected into heater outlet. The rising temperature of the fluid (blue) being heated creates a Vapor pressure (green) on the Temperature Diaphragm. When this pressure has reached a point sufficient to overcome the Temperature Adjusting Spring, it Applies a force on the Lever so as gradually to decrease the spring loading on The Pressure Diaphragm. This produces a stem-by-step reduction in the Delivery pressure as the temperature rises through several degrees. If the desired temperature is exceeded, the vapor pressure on the Pilot Temperature Diaphragm overcomes the forces of the Spring. This allows Pilot and Main Valve to close tight.

MAIN VALVE OPTIONS



BALANCED CONSTRUCTION

There are installations where it is desirable to not have the inlet pressure forcing down on the Main Valve Disc. In these instances, the E Main Valve should be internally balanced. The balance parts allow the down-stream pressure to rest on top of the disc, thus allowing for finer adjustments in the Main Valve travel and a smoother operating regulator. The balance cylinder is suitable for 550°F max temperatures.

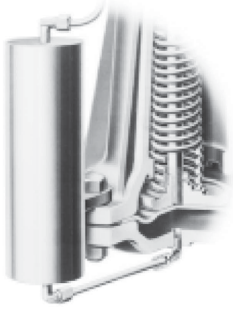
SECOWELD

The greatest weakness in a High Pressure Valve is the threaded joint between the Seat Ring and the body. A slight leak developing at this point will gradually erode the Body metal, thus accentuating the leak and eventually ruining the body. Various impractical schemes, such as welding the Seat Ring into the Body, have been tried to overcome this weakness. The invention SECOWELD solves this problem and, at the same time, provides an easily renewable Seat Ring. In the SECOWELD Design, a SECO Metal Bushing is welded to and thus sealed in the Body and, in turn, is threaded to take the Main Seat Ring, which is also of SECO Metal. As SECO Metal resists wire drawing, if slight leakage should occur, no damage can be done to the body or to the threads of either SECO Metal piece. Consult Factory for pricing and availability.

EZ CONNECTIONS

Provides the performance of a flanged connection with the simplicity of a union connection. Unlike conventional unions, EZ Connections do not require matched sets or springing pipe to clear cone tolerances and do not leak after just a few disassembly/reassembly cycles. Uniform end to end dimensions simplify rough-in schematics. Available on 1/2" through 2" threaded main valves in NPT, socketweld and threaded by socketweld connections.

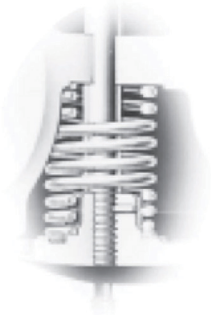
Consult Factory for pricing and availability.



CONDENSATION CHAMBER

A Condensation Chamber is recommended on the Type E5 Main Valve. A Condensation Chamber is also recommended on the Type E Main Valve when steam temperatures exceed 600°F. Any Main Valve discharging steam into a vacuum it is recommended to install a Condensation Chamber.

MAIN VALVE OPTIONS

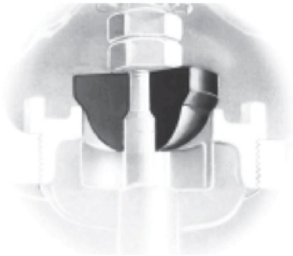


LOW DIFFERENTIAL PRESSURE (LP) MAIN SPRING

The E Series Main Valves provide superior regulation in a broad range of applications by utilizing a specialized Main Spring. When differential pressures between 10-50 psi are desired, E Main Valves should be equipped with the optional LP Main Spring. The LP Main Spring alone will achieve differential pressures to 15 psi. In order to attain differential pressures to 10 psi, optional 5B Open Elbow and 1/16" 4A Bleed Port are required.

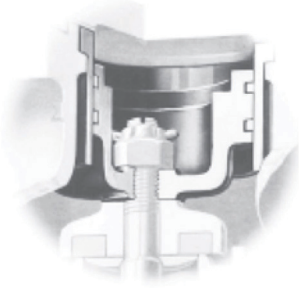
COMPOSITION DISC

In a Single Seat Main Valve, the Integral (all-metal) Disc is interchangeable with the Composition Disc Assembly. The Composition Disc is recommended for service on air, gas and water where absolutely tight shutoff is required and is available on Full and Normal seats and Parabolic valve plugs. The Composition Disc is suitable for pressures to 200 psi and temperatures to 200°F.



PARABOLIC DISC

In order to meet special flow requirements, any Spence Main Valve can be equipped with a Parabolic or other specially shaped Disc. Due to the fact that the Spence Main Valve is operated by a large, balanced Diaphragm and is nearly frictionless in operation, special Discs are not required on normal installations.



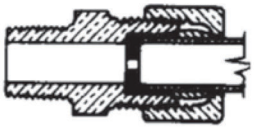
DASHPOT

In order to prevent water hammer, Dashpots are required in all single seat, normally closed Main Valves used on liquid service. Dashpots are neither necessary nor desirable on steam, air or gas service and are not required in double seat valves or in normally open single seat valves. Illustration shows Dashpot and Composition Disc for initial pressures of 200 psig and less. For initial pressures greater than 200 psig, standard metal to metal seat and disc are used.

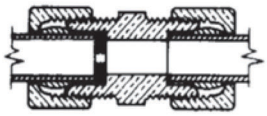
AUXILIARY FITTINGS

BLEED PORTS

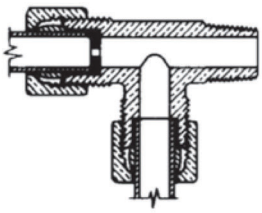
For steam, air and gas service, a 3/32” bleed port orifice is used for main valve sizes up to 8”. For 10” and 12” main valve sizes, a 1/8” bleed port orifice is used. If the initial pressure or pressure drop is less than 15 psig, the orifice is reduced to 1/16”. For liquids: fuel oil utilizes a 3/32” bleed port and all other fluids utilize a 1/16” bleed port regardless of pressure conditions. For main valve sizes up to 8” on long pressure drops, the orifice is sometimes increased to 1/8” to eliminate hunting or to make the valve close faster and open slower.



4A BLEED PORT



1A UNION BLEED PORT



8A BLEED PORT TEE

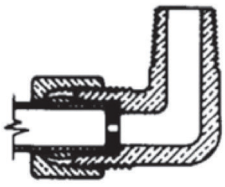
MAIN VALVE SIZE	OFFICE DRILL SIZE	DECIMAL EQUIVA-LENT
3/8	60	.0400
1/2	60	.0400
3/4	60	.0400
1	60	.0400
1 1/4	58	.0420
1 1/2	58	.0420
2	56	.0465
2-1/2	56	.0465
3	53	.0595
4	51	.0670
5	47	.0785
6	45	.0820
8	42	.0935
10	17	.1730
12	7	.2010

* Steam, Air & Gas.

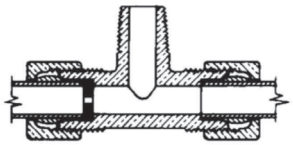
If the initial pressure or pressure drop is less than 15 psi, a No. 5A elbow with orifice removed is used

RESTRICTIONS

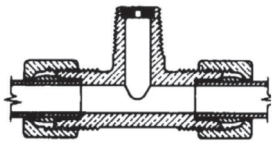
Spare restriction fittings can be supplied blank and drilled for a particular main valve according to the table. If the initial pressure or pressure drop is less than 15 psi, an open fitting is used. All back pressure valves employ an open fitting. For liquid services (except back pressure) the restriction orifice is 1/16” for all sizes of main valves.



5A RESTRICTION ELBOW

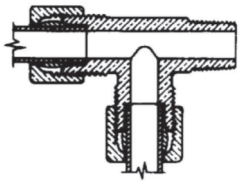


7A SAFETY PILOT RESTRICTION TEE

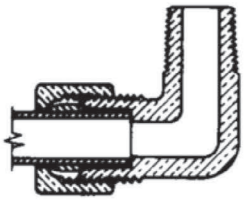


7C ANTI-FREEZE RESTRICTION TEE

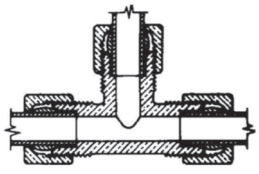
OPEN FITTINGS



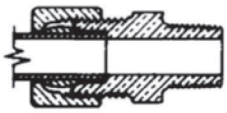
8B TEE



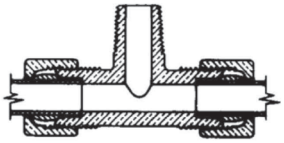
5B ELBOW



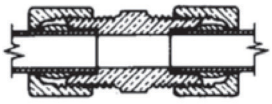
9B TUBING TEE



4B COUPLING



7B TEE



1B UNION

GENERAL DATA - TYPE E MAIN VALVE

CAST STEEL, IN.

VALVE SIZE	STEM NUT WRENCH[1]	BLIND FLANGE WRENCH (NPT/BSPT)			DIAPHRAGM JOINT WRENCH	DIAPHRAGM SIZE	VALVE SETTINGS	PRESSURE PLATE DOWEL PIN (DIAMETER X LENGTH)
		150#	300#	600#				
3/8	9/16	9/16			9/16	4-1/2	1/32	3/32 X 1/2
1/2	7/16	9/16		11/16	9/16	4-1/2	3/64	3/32 X 1/2
3/4	1/2	9/16		3/4	11/16	5-1/8	3/64	1/8 X 3/4
1	9/16	11/16		3/4	11/16	5-3/4	1/16	1/8 X 3/4
1-1/4	9/16	3/4		15/16	11/16	6-1/2	5/64	5/32 X 3/4
1-1/2	5/8[2]	7/8		15/16	11/16	7-1/4	3/32	5/32 X 3/4
2	5/8[2]	1-1/16		1-1/4	7/8	8-1/8	7/64	5/32 X 3/4
2-1/2	3/4	1-1/16		1-1/16	7/8	9	1/8	3/16 X 15/16
3	7/8	7/8		1-1/16	7/8	10	9/64	1/4 X 1-3/8
4	15/16	7/8		1-1/4	7/8	13	3/16	1/4 X 1-3/8
5	1-1/4	1-1/16		1-7/16	7/8	15	7/32	5/16 X 2
6	1-5/16[2]	1-1/16		1-7/16	1-1/16	17-1/2	9/32	5/16 X 2
8	1-1/2[2]	1-1/16		1-7/16	1-1/16	20	11/32	3/8 X 2-1/2
10	1-1/2[2]	1-1/4		- - - -	1-1/4	25	7/16	3/8 X 2-1/2
12	1-11/16	1-7/16		- - - -	1-7/16	30	9/16	3/8 X 2-1/2

1. Deep socket wrench recommended.
2. ASME Nut Standard changed - 5/8 in. to 11/16 in., 1-1/16 in. to 1-1/8 in., 1-1/4 in. to 1-5/16 in., 1-7/16 in. to 1-1/2 in. and 1-5/8 in. to 1-11/16 in. Both wrenches are required on these valves.

CAST STEEL, mm

VALVE SIZE	STEM NUT WRENCH[1]	BLIND FLANGE WRENCH (NPT/BSPT)			DIAPHRAGM JOINT WRENCH	DIAPHRAGM SIZE	VALVE SETTINGS	PRESSURE PLATE DOWEL PIN (DIAMETER X LENGTH)
		150#	300#	600#				
DN 10	14	14			14	114	0.8	2 X 13
DN 15	11	14		17	14	114	1.2	2 X 13
DN 20	13	14		19	17	130	1.2	3 X 19
DN 25	14	17		19	17	146	1.6	3 X 19
DN 32	14	19		24	17	165	2	4 X 19
DN 40	16[2]	22		24	17	184	2.4	4 X 19
DN 50	16[2]	27		32	22	206	2.8	4 X 19
DN 65	19	27		27	22	229	3.2	5 X 24
DN 80	22	22		27	22	254	3.6	6 X 35
DN 100	24	22		32	22	330	4.8	6 X 35
DN 125	32	27		37	22	381	5.6	8 X 50
DN 150	33[2]	27		37	27	444	7.1	8 X 50
DN 200	38[2]	27		37	27	508	8.7	9-1/2 X 63-1/2
DN 250	38[2]	32		- - - -	32	635	11	9-1/2 X 63-1/2
DN 300	43	37		- - - -	37	762	14	9-1/2 X 63-1/2

1. Deep socket wrench recommended.
2. ASME Nut Standard changed - 16 mm to 17 mm, 27 mm to 29 mm, 32 mm to 33 mm, 37 mm to 38 mm and 41 mm to 43 mm Both wrenches are required on these valves.

GENERAL DATA - TYPE E MAIN VALVE

CAST IRON, IN.

VALVE SIZE	STEM NUT WRENCH[1]	BLIND FLANGE WRENCH		DIAPHRAGM JOINT WRENCH	DIAPHRAGM SIZE	VALVE SETTINGS	PRESSURE PLATE DOWEL PIN (DIAMETER X LENGTH)
		125#	250#				
3/8	9/16	9/16		1/2	4-1/2	1/32	3/32 X 1/2
1/2	7/16	9/16		1/2	4-1/2	3/64	3/32 X 1/2
3/4	1/2	9/16		9/16	5-1/8	3/64	1/8 X 3/4
1	9/16	11/16		9/16	5-3/4	1/16	1/8 X 3/4
1-1/4	9/16	3/4		9/16	6-1/2	5/64	5/32 X 3/4
1-1/2	5/8[2]	7/8		9/16	7-1/4	3/32	5/32 X 3/4
2	5/8[2]	1-1/16		3/4	8-1/8	7/64	5/32 X 3/4
2-1/2	3/4	1-1/16	1-1/4	3/4	9	1/8	3/16 X 15/16
3	7/8	7/8	1-1/16	3/4	10	9/64	1/4 X 1-3/8
4	15/16	1-1/16	1-1/4	3/4	13	3/16	1/4 X 1-3/8
5	1-1/4	1-1/16	1-1/4	3/4	15	7/32	5/16 X 2
6	1-5/16[2]	1-1/16	1-1/4	15/16	17-1/2	9/32	5/16 X 2
8	1-1/2[2]	1-1/16	1-1/4	15/16	20	11/32	3/8 X 2-1/2
10	1-1/2[2]	1-7/16		1-1/4	25	7/16	3/8 X 2-1/2
12	1-11/16	1-7/16		1-5/16	30	9/16	3/8 X 2-1/2

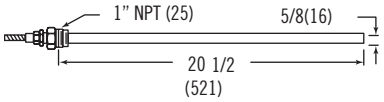
1. Deep socket wrench recommended.
2. ASME Nut Standard changed - 5/8 in. to 11/16 in., 1-1/16 in. to 1-1/8 in., 1-1/4 in. to 1-5/16 in., 1-7/16 in. to 1-1/2 in. and 1-5/8 in. to 1-11/16 in. Both wrenches are required on these valves.

CAST IRON, mm

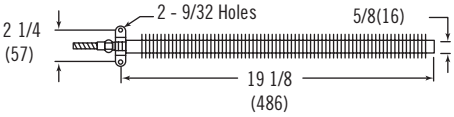
VALVE SIZE	STEM NUT WRENCH[1]	BLIND FLANGE WRENCH		DIAPHRAGM JOINT WRENCH	DIAPHRAGM SIZE	VALVE SETTINGS	PRESSURE PLATE DOWEL PIN (DIAMETER X LENGTH)
		125#	250#				
DN 10	14	14		13	114	0.8	2 X 13
DN 15	11	14		13	114	1.2	2 X 13
DN 20	13	14		14	130	1.2	3 X 19
DN 25	14	17		14	146	1.6	3 X 19
DN 32	14	19		14	165	2	4 X 19
DN 40	16[2]	22		14	184	2.4	4 X 19
DN 50	16[2]	27		19	206	2.8	4 X 19
DN 65	19	27	32	19	229	3.2	5 X 24
DN 80	22	22	27	19	254	3.6	6 X 35
DN 100	24	27	32	19	330	4.8	6 X 35
DN 125	32	27	32	19	381	5.6	8 X 50
DN 150	33[2]	27	32	24	444	7.1	8 X 50
DN 200	38[2]	27	32	24	508	8.7	9-1/2 X 63-1/2
DN 250	38[2]	37		32	635	11	9-1/2 X 63-1/2
DN 300	43	37		33	762	14	9-1/2 X 63-1/2

1. Deep socket wrench recommended.
2. ASME Nut Standard changed - 16 mm to 17 mm, 27 mm to 29 mm, 32 mm to 33 mm, 37 mm to 38 mm and 41 mm to 43 mm Both wrenches are required on these valves.

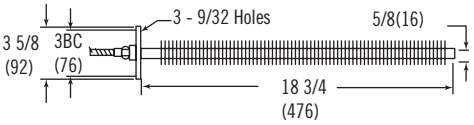
THERMOSTAT BULBS
FOR USE WITH T14, T124, T134 PILOTS



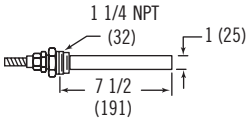
STYLE NO. 700 -Plain Bulb with 1" Union Connection.



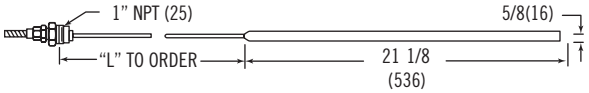
STYLE NO. 702-Finned Bulb with Wall Mounting Bracket.
For space heating.



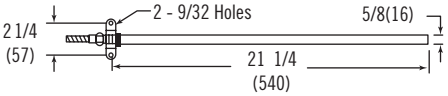
STYLE NO. 703-Finned Bulb with Duct Mounting Flange.
For forced warm air heating.



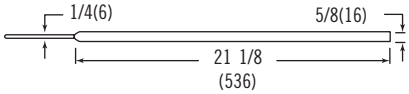
STYLE NO. 704-Plain Short Bulb with 1-1/4" Union Connection.
For installations where depth is limited.



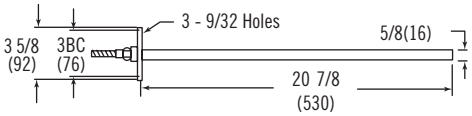
STYLE NO. 706-Plain Bulb with 1" Union Connection
and 1/4" OD Bendable Extension. Dimension "L" must be specified.



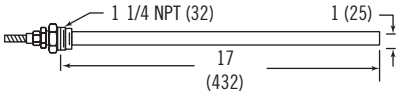
STYLE NO. 708-Plain Bulb with Wall Mounting Bracket.
Used for space heating when dust is a problem.



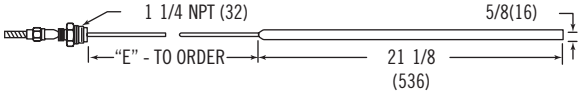
STYLE NO. 712-Plain Bulb with 1/4" OD Bendable Tubing
Cover for Capillar y. Used in open tanks or where a mounting
connection is not required



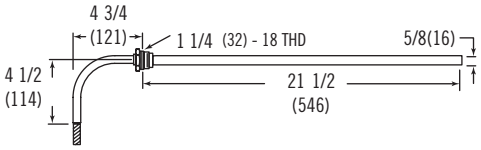
STYLE 713-Plain Bulb with Duct Mounting Flange.
For forced warm air heating when dust is a problem.



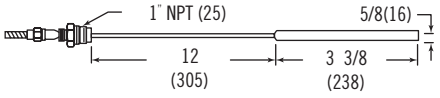
STYLE NO. 701-Large Plain bulb with 1-1/4 Union Connection.
Used on pilots having more than 30 feet of flexible tubing
and with dial thermometer having 20 to 120˚F range.



STYLE NO 731-Plain Bulb with Adjustment dimension.
Used in oil storage tanks or wherever it is desirable to change
position of bulb. Dimension "E" must be specified.

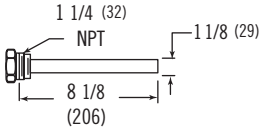


STYLE NO. 740-Sanitary Bulb for Milk Heaters. Threaded to fit standard
No. 23A Thermometer Ferrule. Stainless Steel Bulb and Flexible Tubing.

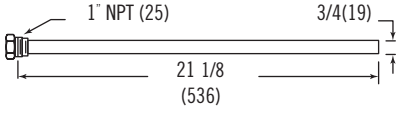


STYLE NO. 732-Special with 12" hole Extension.

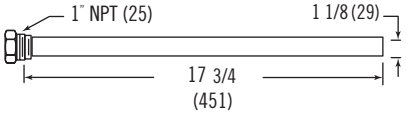
THERMOSTAT WELLS



727 WELL - Used with 704 Bulb

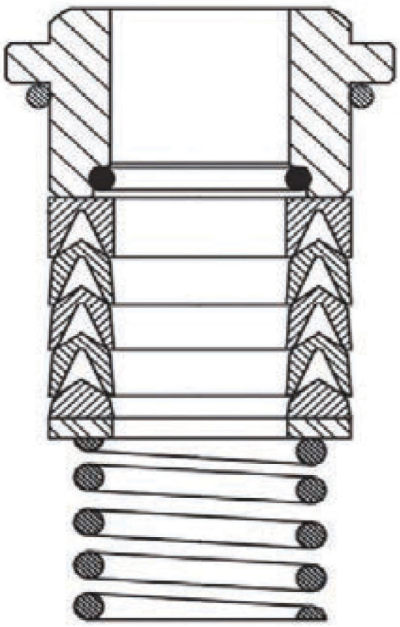


728 WELL - Used with 700 and 800 Bulb



729 WELL - Used with 701 and 801 Bulb

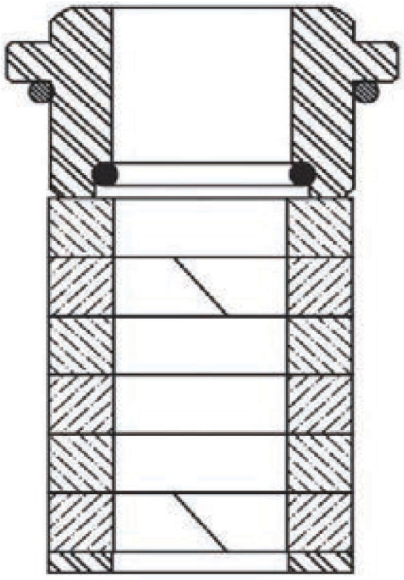
PACKING CONFIGURATIONS



LIVE-LOADED PTFE - V-RING (STANDARD)

Live-loaded PTFE V-ring packing provides the most maintenance free stem seal. The V-ring packing is both pressure energized and live-loaded by a 304 stainless steel spring to automatically compensate for packing wear. Maximum service temperature is 460°F (238°C). V-rings can be inverted for vacuum service.

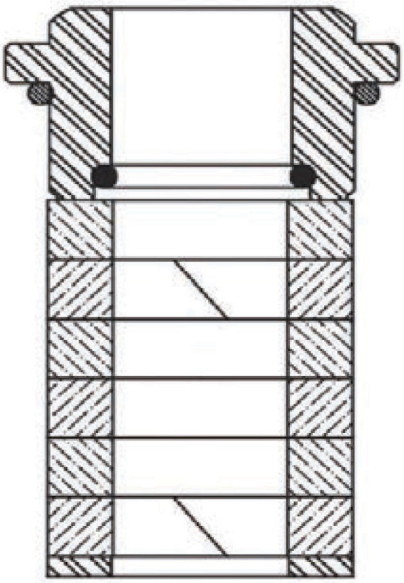
Available on Boss.



PTFE/GRAPHITE (OPTIONAL)

Split rings allow packing replacement without removal of actuator. Graphite impregnated PTFE provides 500°F (260°C) service temperature, better memory and sealing than pure PTFE rings, lowered stem hysteresis, and is ideal for fluids that contain suspended particles.

Available on Boss.



HIGH TEMPERATURE LAMINATED GRAPHITE (OPTIONAL)

Split rings allow packing replacement without removal of actuator. Precision die-cut laminated graphite rings provide a reliable, tight stem seal to operating temperatures of 800+°F (426°C).

Available on Boss.

Spence™ Type E Main Valve

⚠ WARNING

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

The Type E Main Valve must be installed, operated and maintained in accordance with federal, state and local codes, rules and regulations and Emerson instructions.

If the valve 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 Type E Main Valve.

⚠ WARNING

CALIFORNIA PROPOSITION 65

This product can expose you to chemicals including lead, nickel and cobalt which is known to the State of California to cause cancer, birth defects or other reproductive harm. For more information, go to www.P65Warnings.ca.gov.

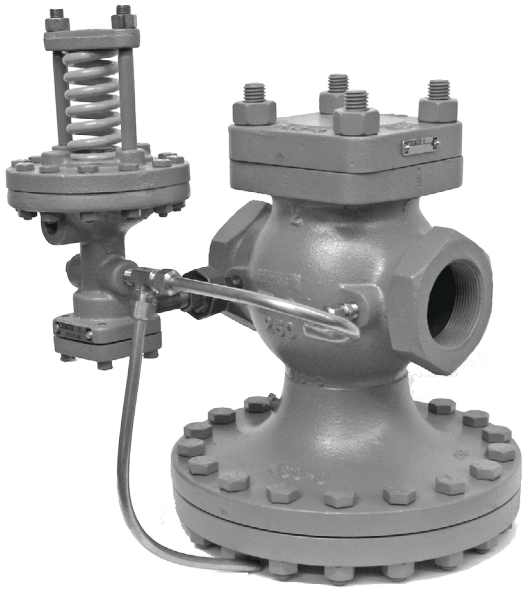


Figure 1. *Type ED Valve*

Introduction

Scope of the Manual

This manual provides instructions for the installation, troubleshooting, maintenance, valve setting and parts ordering for the Type E Main Valve Regulator.

Product Description

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.

Specifications

This section lists the specifications for the Type E Main Valve. Factory specifications are stamped on the nameplate fastened on the regulator at the factory.

Valve 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 or BSPT, CL125, CL150, CL250, CL300, CL600, PN16 RF, PN25 RF, PN40 RF and SWE

Maximum Cold Working Pressure
See Table 1

Maximum Inlet Pressure(1)
Metal to Metal Trim Style: See Table 1
Soft Trim Style (Composition)(2): 200 psig / 13.8 bar

Maximum Temperature(1)
Metal to Metal Trim Style: See Table 1
Soft Trim Style (Composition)(2): 200°F / 93°C

Rated Flow Coefficient
See Table 2

Configuration
Integral Mount, Side Mount

Certifications
PED and UKCA

Main Valve Material
Cast iron and Cast steel

Approximate Weight
See Table 3

1. The pressure/temperature limits in this Instruction Manual and any applicable standard or code limitation should not be exceeded.
2. Applicable for all body materials and end connection styles with standard trim type.

Table 1. *Type E Main Valve Pressure and Temperature Rating(1)*

BODY MATERIAL	TRIM TYPE	END CONNECTION	MAXIMUM COLD WORKING PRESSURE		MAXIMUM INLET PRESSURE AT MAXIMUM TEMPERATURE		MAXIMUM TEMPERATURE	
			psig	bar	psig	bar	°F	°C
Cast iron (ASTM A126 Class B)	Standard	NPT or BSPT	250	17.2	250	17.2	406	207
		CL125 FF	125	8.6	125	8.6	450	232
		CL250 RF	250	17.2	250	17.2	450	232
		PN16 RF	125	8.6	125	8.6	450	232
		PN25 RF	250	17.2	250	17.2	450	232
Cast steel (ASTM A216 Grade WCB)	Standard	NPT or BSPT	300	20.7	300	20.7	600	315
		CL150 RF	150	10.3	150	10.3	500	260
		CL300 RF	300	20.7	300	20.7	600	315
		PN16 RF	150	10.3	150	10.3	500	260
		PN25 RF	300	20.7	300	20.7	600	315
Steel Seco (ASTM A216 Grade WCB Cast Steel with Secoweld Seat)	Standard	NPT or BSPT	300	20.7	300	20.7	600	315
		CL300 RF	300	20.7	300	20.7	600	315
		CL600 RF	600	41.4	600	41.4	600	315
		PN25 RF	300	20.7	300	20.7	600	315
		PN40 RF	580	40	529	36.5	600	315
	High Temperature (up to 750°F / 399°C)	NPT or BSPT	300	20.7	300	20.7	750	400
		CL300 RF	300	20.7	300	20.7	750	400
		CL600 RF	600	41.4	600	41.4	750	400
		PN25 RF	300	20.7	300	20.7	750	400
		PN40 RF	580	40	469	32.4	750	400

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

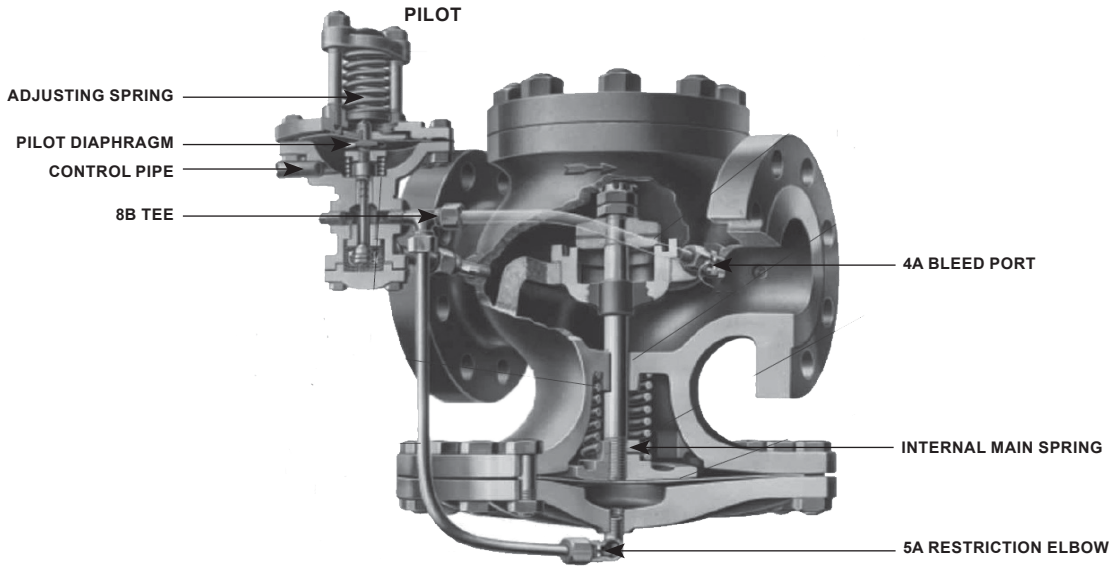


Figure 2. *Type E Main Valve Operational Schematic*

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

Table 3. *Type E Main Valve Approximate Weight*

VALVE SIZE		END CONNECTION STYLE											
		NPT		CL125		CL150		CL250		CL300		CL600	
NPS	DN	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg
3/8	10	14	6.35	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -
1/2	15	14	6.35	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	20	9.07
3/4	20	18	8.16	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	28	12.7
1	25	23	10.4	24	10.9	26	11.8	27	12.2	31	14.1	32	14.5
1-1/4	32	33	15.0	36	16.3	37	16.8	40	18.1	41	18.6	45	20.4
1-1/2	40	43	19.5	45	20.4	47	21.3	51	23.1	55	24.9	58	26.3
2	50	62	28.1	67	30.4	73	33.1	72	32.7	78	35.4	83	37.6
2-1/2	65	- - - -	- - - -	82	37.2	95	43.1	100	45.4	100	45.4	130	59.0
3	80	- - - -	- - - -	110	49.9	125	56.7	130	59.0	140	63.5	175	79.4
4	100	- - - -	- - - -	200	90.7	210	95.3	235	107	230	104	310	141
5	125	- - - -	- - - -	280	127	295	134	315	143	310	141	490	222
6	150	- - - -	- - - -	385	175	420	191	455	206	470	213	655	297
8	200	- - - -	- - - -	657	298	700	318	735	333	710	322	1070	485
10	250	- - - -	- - - -	1260	572	1240	562	1430	649	1300	590	- - - -	- - - -
12	300	- - - -	- - - -	2070	939	2060	934	2145	973	2140	971	- - - -	- - - -

Principle of Operation

The regulator is operated by initial steam or fluid pressure. It is normally closed, being held so by initial pressure on the disk and by an internal main spring, see Figure 2. When the pilot is opened (see pilot instructions), initial pressure flows through the pilot to the 8B tee. 4A bleed port restricts the flow and pressure builds under the diaphragm and opens the main valve. The 5A restriction elbow steadies the operation of the regulator.

Delivery pressure feeds back through the control pipe to the pilot diaphragm. As this pressure approaches a balance with the thrust of the adjusting spring, the pilot throttles the loading pressure. In turn, the main valve takes a position established by the loading pressure where just enough steam flows to maintain the set delivery pressure.

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.

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.

All pressure equipment should be installed in a non-seismic area; should not be exposed to fire; and should be protected from thunderbolt (lightning) strikes.

Note

As a general rule of thumb, tighten 1.5 to 3 turns past hand tight all NPT connections and use thread sealant with a temperature range up to 450ºF / 232ºC for cast iron constructions.

Planning

- Locate the valve in a straight run of horizontal pipe.
- Allow headroom above the valve for access through the blind flange.
- Provide clearance for stem withdrawal underneath.
- Prevent water hammer and erratic operation by installing traps to provide proper drainage before and after the valve and before secondary pressure relief valve or control valve.
- Avoid damaging effects of scale and dirt in the pipe lines by using a strainer as shown in Figure 3.
- Provide a 3-valve by-pass to facilitate inspection without interrupting service.
- To eliminate excessive noise and erratic regulation with steam and other compressible fluids, enlarge the delivery pipe size to effect a reasonable flow velocity at the reduced pressure. A tapered transition is recommended.
- If possible, avoid a sharp turn close to the regulator outlet and a bull-headed tee connection to the low pressure main.
- Install initial and delivery pressure gauges to indicate performance.
- If the pressure rating of the delivery system or connected equipment is less than the initial steam pressure, provide a safety valve.

Main Valve

- Flush the piping system thoroughly to clear it of welding beads, scale, sand, etc.
- Mount the main valve with diaphragm chamber down and arrow on body pointing in the direction of flow. Screwed end valves should be mounted in unions.

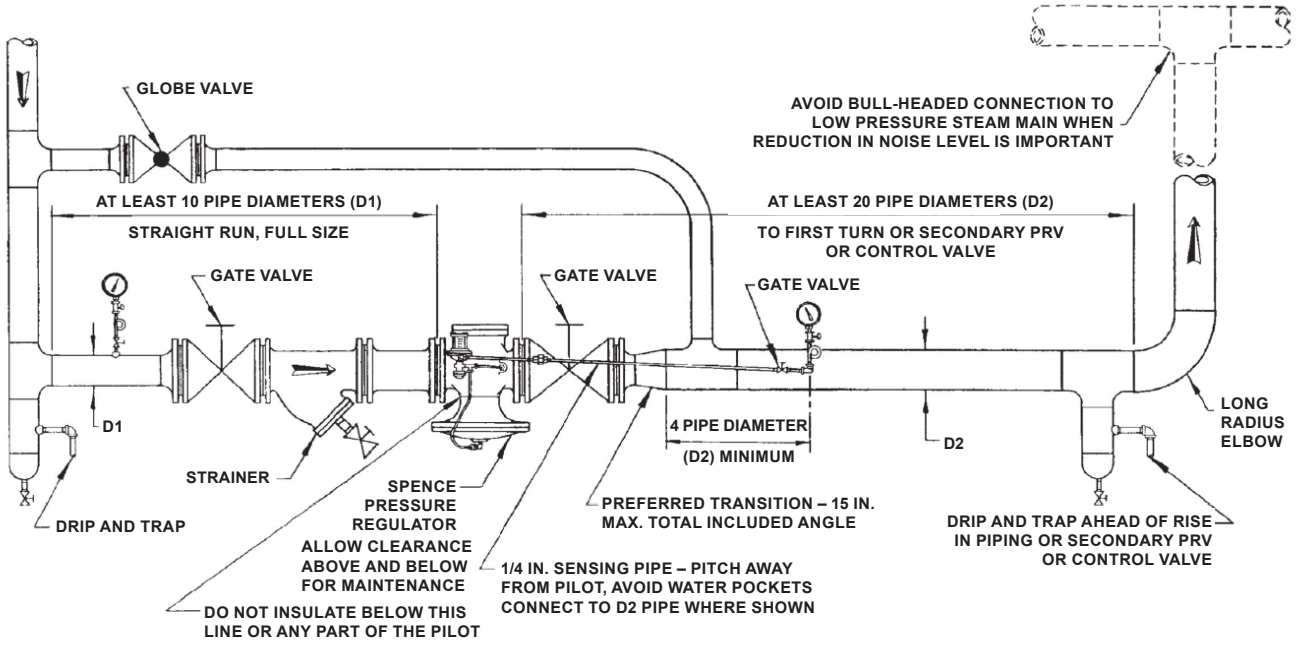


Figure 3. *Type E Main Valve Installation*

Pilot

For Side Mount Construction

1. Mount the pilot on either side of the main valve by means of 1/4 in. nipple and union provided.
2. Make this connection on the 1/4 in. pipe tap at the inlet of the main valve as shown in Figure 4.

For Integral Mount Construction

1. Remove blind flange on pilot and mount on blind flange of main valve using provided bolt.
2. Screw 4A bleed port fitting into the 1/8 in. pipe tap at the outlet of the main valve body. Note bleed orifice in this fitting is vital to operation of regulator.

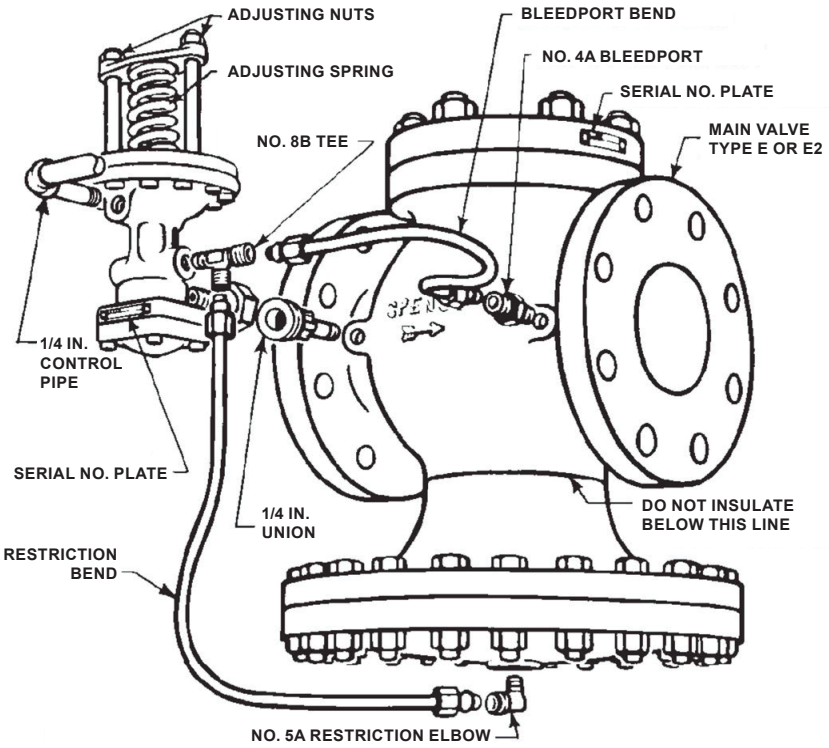


Figure 4. *Mounting Pilot on Type E Main Valve*

Note

As a general rule of thumb, tighten 1.5 to 3 turns past hand tight all NPT connections and use thread sealant with a temperature range up to 450ºF / 232ºC for cast iron constructions.

3. Screw 8B tee into 1/8 in. pipe tap in pilot. Select tap facing downstream.
4. Screw 5A restriction elbow containing restriction orifice into 1/8 in. pipe tap on the underside of main valve diaphragm chamber. If the initial pressure or pressure drop is less than 15 psi / 1.03 bar, use 5B open elbow.
5. Connect tubing bends as illustrated in Figure 4. Valves with condensation chamber are fitted up according to Figure 4.

Control Pipe

1. Use 1/4 in. pipe for this line which connect the pilot diaphragm chamber to the desired point of pressure control.
2. Take the control at a point of minimum turbulence. Avoid control immediately at the valve outlet or after a turn.
3. When the delivery pipe expands in size, select a spot at least 4 pipe diameters beyond the point of enlargement.
4. Pitch away from pilot to avoid erratic operation and excessive fouling.
5. Eliminate water pockets.
6. Locate delivery pressure gauge in control pipe to show pressure actually reaching pilot diaphragm.

Start-up and Setting

CAUTION

Never open a reducing valve without positive indication that the high side is clear of condensate.

1. On pressure reducing valves like Type E, use by-pass to fill the delivery system and raise pressure to slightly below normal required.
2. Close pilot by releasing compression on adjusting spring. See Figure 4.
3. Open 1/4 in. control pipe valve.
4. Crack outlet stop valve.
5. Crack inlet stop valve.
6. Blow down strainer.
7. Open inlet stop valve and gradually compress adjusting spring until the valve opens and takes control at desired pressure.
8. Alternately choke down on the by-pass and open outlet stop valve until the regulator is on the line. See individual instructions for other pilots.

Valve Setting

Valve setting is gauged at K to establish correct stem length and diaphragm position. Dimension K is supplied with each replacement stem. See Table 8 for K values. For metal diaphragm valves, K is cast on the upper face of pressure plate (key 17, Figure 6).

1. To install new stem (key 11), fasten disk (key 7) firmly on stem with stem nut.
2. Insert stem and disk assembly in valve and screw on pressure plate (key 17). Omit spring (key 13) for this operation.
3. Hold disk on seat and adjust position of pressure plate until valve setting K is reached.
4. Push pressure plate against stops in base (key 16).
5. Remove disk, drop out pressure plate and stem, drill and insert dowel pin (key 14) to lock the joint.

Grind off stem projection flush with face of pressure plate.

Troubleshooting

Failure to Close

If the main valve failed to close check the following possible causes to properly correct the problem.

- Adjusting spring on pilot may have been tampered with.
- Orifice in bleed port No. 4A may be plugged.
- By-pass valve may be leaking.
- On pressure regulators like Type E, the main valve or pilot may be held open by foreign matter in seat.

  To determine which valve leaks, follow these steps. Close stop valve and 1/4 in. control pipe valve.

  1. Remove bleed port bend so pilot will exhaust to atmosphere.
  2. Crack inlet stop valve. Steam will issue from 8B tee.
  3. Release compression on adjusting spring to see if pilot closes tight.
  4. Open and close several times to wash seat. Steam blowing back from bleed port means main valve disk is held open by foreign matter. Steam may wash the obstruction from the seat if the valve is made to open wide. This can be accomplished, even at light loads, if the control point is beyond the outlet stop valve.
  5. Reassemble bleed port bend and place regulator in operation.
  6. Slowly open and close outlet stop valve.

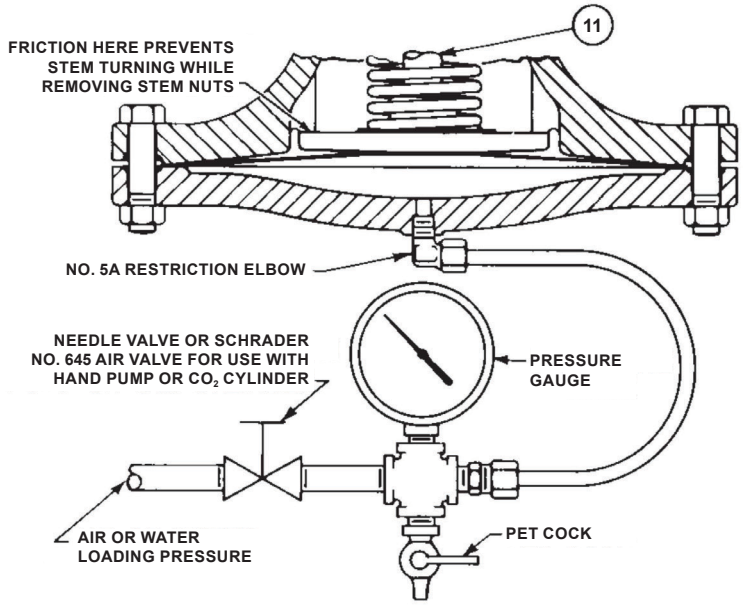


Figure 5. *Dismantling Main Valve*

Failure to Open

If the main valve failed to open check the following possible causes to properly correct the problem.

- Adjusting spring on pilot may have been tampered with.
- Initial pressure may be down due to partially closed supply valve, clogged strainer or other obstruction.
- Orifice in No. 5A restriction elbow may be plugged. No. 4A bleed port fitting may have been omitted and an open coupling substituted.
- Control pipe may be plugged. Most likely points of obstruction are at shut-off valve and entrance to delivery main.
- Main diaphragm may be broken. Test with air or water before dismantling.

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.

Inspection

Under normal conditions, complete dismantling is not recommended.

Check the following after operation. Then, schedule an inspection as required.

1. Inspect for dirt collected at 4A bleed port and 5A restriction elbow.
2. Inspect all joints for leakage. Keep bolts tight to avoid any leaks

Table 4. *Seat Ring Tools Part Numbers*

VALVE SIZE		DESCRIPTION: PORT	PART NUMBER OF COMPLETE WRENCH
NPS	DN		
2	50	New: Full and Normal	WAL08-05691-00
2-1/2	65	New: Full and Normal	WAL08-10111-00
3	80	New: Full and Normal	WAL08-09715-00
4	100	New: Full and Normal	WAL08-10113-00
5	125	New: Full and Normal	WAL08-10304-00
5	125	Old: Full	WAL08-00575-00
5	125	Old: Normal	WAL08-00587-00
6	150	New/Old: Full	WAL08-03948-00
6	150	New/Old: Normal	WAL08-00567-00
8	200	New/Old: Full	WAL08-00518-00
8	200	New/Old: Normal	WAL08-03949-00
Note: Old denotes to seat ring tools used on any valve made before 1984.			

Table 5. *Number of Diaphragm Required*

INITIAL PRESSURE		NUMBER OF DIAPHRAGMS PER SET
psig	bar	
10 to 250	0.69 to 17.2	2
251 to 400	17.3 to 27.6	3
401 to 600	27.6 to 41.4	4

Main Valve Maintenance (See Figure 5)

1. Connect a source of air or water pressure which can be adjusted by hand to the No. 5A restriction below.
2. Apply 50 to 60 psi / 3.45 to 4.14 bar to jack valve open and prevent stem from turning while removing stem nuts.
3. Use penetrating oil on the threads.

Seat Ring Maintenance

Note

These joints should be made up with high temperature gasket compound.

1. Remove old compound from body and seat ring with a wire brush.
2. Apply new compound sparingly to both parts, threads and shoulders. Let stand until tacky before assembling.

Grinding In

CAUTION

Seats and disks should never require more than the lightest touch up with very fine (400 grit) grinding compound. Heavy grinding will produce galling, wider seating surface and a groove in the disk, all of which tend to cause leakage.

1. Reface a damaged surface before attempting to grind it in.
2. Grind sparingly.
3. Main stem (key 11, Figure 6) is slotted for rotation with a screwdriver, valve spring (key 13) is omitted from the assembly during grinding.
4. Slip the stem into its normal position.
5. Apply compound to the disk. Place it on the stem and tighten with one stem nut.

Type E

Table 6. *Type E Main Valve Repair Kits*[1]

PORT TYPE	VALVE SIZE		MATERIAL	
	NPS	DN	Cast Iron	Cast Steel
Full Port	3/8	10	WAL07-07746-00	WAL24140
	1/2	15	WAL07-07747-00	WAL24141
	3/4	20	WAL07-07748-00	WAL24142
	1	25	WAL07-07749-00	WAL24144
	1-1/4	32	WAL07-07750-00	WAL24146
	1-1/2	40	WAL07-07751-00	WAL24148
	2	50	WAL07-07752-01	WAL24150
	2-1/2	65	WAL08-08148-01	WAL24152
	3	80	WAL08-08567-01	WAL24158
	4	100	WAL08-08568-01	WAL08-08567-00
	5	125	WAL08-09738-01	WAL58613
	6	150	WAL08-09720-00	WAL24157
Normal Port	1/2	15	WAL07-17637-00	WAL24140
	3/4	20	WAL08-10709-00	WAL24143
	1	25	WAL08-10386-00	WAL24145
	1-1/4	32	WAL08-10134-00	WAL24147
	1-1/2	40	WAL08-10710-00	WAL24149
	2	50	WAL08-10313-01	WAL24151
	2-1/2	65	WAL08-10325-00	WAL24153
	3	80	WAL08-09732-01	WAL24154
	4	100	WAL08-10387-01	WAL08-10941-00
	5	125	WAL08-10940-01	WAL08-10942-00
	6	150	WAL08-10981-00	WAL08-10943-00

Note: Contact factory for parabolic disk kits.

1. Gasket (key 4), stem nut (key 5), disk (key 7), seat ring (key 8), stem (key 11), spring (key 13), dowel pin (key 14), pressure plate (key 17) and diaphragm (key 20) are included in repair kits.

Table 7. *Key 12, Body Part Number*

END CONNECTION	MATERIAL	SIZE		PART NUMBERS
		NPS	DN	Body
PN 16	Cast Iron	1	25	ERAA50383
		1-1/4	32	ERAA50525
		1-1/2	40	ERAA50527
		2	50	ERAA50529
		2-1/2	65	ERAA50531
		3	80	ERAA50533
		4	100	ERAA50535
		5	125	ERAA50293
		6	150	ERAA50271
PN 25		1	25	ERAA50537
		1-1/4	32	ERAA50539
		1-1/2	40	ERAA50541
		2	50	ERAA50543
		2-1/2	65	ERAA50545
		3	80	ERAA50547
		4	100	ERAA50549
		5	125	ERAA50285
		6	150	ERAA50281
PN 16	Cast Steel	1	25	ERAA50565
		1-1/4	32	ERAA50567
		1-1/2	40	ERAA50569
		2	50	ERAA50571
		2-1/2	65	ERAA50577
		3	80	ERAA50579
		4	100	ERAA50581
PN 25		1	25	ERAA50565
		1-1/4	32	ERAA50567
		1-1/2	40	ERAA50569
		2	50	ERAA50589
		2-1/2	65	ERAA50591
		3	80	ERAA50593
		4	100	ERAA50595
PN 40	Secoweld	1/2	15	ERAA51144
		3/4	20	ERAA51145
		1	25	ERAA51146
		1-1/4	32	ERAA51147
		1-1/2	40	ERAA51148
		2	50	ERAA51150
		2-1/2	65	ERAA51151
		3	80	ERAA51152
		4	100	ERAA51153

Parts Ordering

When corresponding with your local Sales Office about the Type E Main Valve, always reference the assembly number. When ordering replacement parts, specify the complete character part number from the following parts list.

Parts List

Cast Iron Valve

Key	Description	Part Number
	Repair Kit	See Table 6
1	Stud, Steel	
	NPS 3/8, 1/2 and 3/4 / DN 10, 15 and 20 (4 required)	WAL05-05518-00
	NPS 1 / DN 25 (4 required)	WAL04-10118-00
	NPS 1-1/4 / DN 32 (4 required)	WAL05-05507-00
	NPS 1-1/2 / DN 40 (4 required)	WAL04-05443-00
	NPS 2 / DN 50 (4 required)	WAL04-10119-00
	NPS 2-1/2 / DN 65 (4 required)	
	CL125	WAL04-10119-00
	CL250, PN16 RF or PN25 RF	WAL04-05448-00
	NPS 3 / DN 80	
	CL125 (8 required)	WAL04-05443-00
	CL250, PN16 RF or PN25 RF	WAL04-10119-00
	NPS 4 / DN 100 (8 required)	
	CL125	WAL04-10119-00
	CL250, PN16 RF or PN25 RF	WAL04-05448-00
	NPS 5 / DN 125 (8 required)	
	CL125	WAL04-10120-00
	CL250, PN16 RF or PN25 RF	WAL04-05449-00
	NPS 6 / DN 150 (10 required)	
	CL125	WAL04-10120-00
	CL250, PN16 RF or PN25 RF	WAL04-05449-00
	NPS 8 / DN 200 (16 required)	
	CL125	WAL04-10120-00
	CL250, PN16 RF or PN25 RF	WAL04-10120-00
	NPS 10 / DN 250	
	CL125 and CL250 (12 required)	WAL05-05450-00
	NPS 12 / DN 300	
	CL125 and CL250 (16 required)	WAL05-05450-00
2	Nut, Steel	
	NPS 3/8, 1/2 and 3/4 / DN 10, 15 and 20 (4 required)	WAL05-02847-00
	NPS 1 / DN 25 (4 required)	WAL05-02851-00
	NPS 1-1/4 / DN 32 (4 required)	WAL05-02854-00
	NPS 1-1/2 / DN 40 (4 required)	WAL05-02856-00
	NPS 2 / DN 50 (4 required)	WAL05-02860-00
	NPS 2-1/2 / DN 65 (4 required)	
	CL125	WAL05-02860-00
	CL250, PN16 RF or PN25 RF	WAL05-02862-00
	NPS 3 / DN 80	
	CL125 (8 required)	WAL05-02856-00
	CL250, PN16 RF and PN25 RF (6 required)	WAL05-02860-00
	NPS 4 and 5 / DN 100 and 125 (8 required)	
	CL125	WAL05-02860-00
	CL250, PN16 RF and PN25 RF	WAL05-02862-00
	NPS 6 / DN 150 (10 required)	
	CL125	WAL05-02860-00
	CL250, PN16 RF and PN25 RF	WAL05-02862-00
	NPS 8 / DN 200 (16 required)	
	CL125	WAL05-02860-00
	CL250	WAL05-02862-00
	NPS 10 / DN 250	
	CL125 and CL250 (12 required)	WAL05-02864-00
	NPS 12 / DN 300	
	CL125 and CL250 (16 required)	WAL05-02864-00

Key	Description	Part Number
3	Blind Flange	
	NPS 3/8 and 1/2 / DN 10 and 15	WAL04-02213-01
	NPS 3/4 / DN 20	WAL04-02171-01
	NPS 1 / DN 25	WAL04-02173-00
	NPS 1-1/4 / DN 32	WAL04-02176-00
	NPS 1-1/2 / DN 40	WAL04-02178-00
	NPS 2 / DN 50	WAL04-02180-00
	NPS 2-1/2 / DN 65	
	CL125	WAL04-02185-00
	CL250, PN16 RF and PN25 RF	WAL04-02183-00
	NPS 3 / DN 80	
	CL125	WAL04-02157-00
	CL250, PN16 RF and PN25 RF	WAL04-02186-00
	NPS 4 / DN 100	
	CL125	WAL04-02158-00
	CL250, PN16 RF and PN25 RF	WAL04-02159-00
	NPS 5 / DN 125	
	CL125	WAL04-02160-00
	CL250, PN16 RF and PN25 RF	WAL04-02161-00
	NPS 6 / DN 150	
	CL125	WAL04-02165-00
	CL250, PN16 RF and PN25 RF	WAL04-02163-00
	NPS 8 / DN 200	
	CL125	WAL04-02167-00
	CL250, PN16 RF and PN25 RF	WAL05-02166-00
	NPS 10 / DN 250	
	CL125 and CL250	WAL04-02164-01
	NPS 12 / DN 300	
	CL125 and CL250	WAL04-02168-00
4*	Gasket, Non-Asbestos	
	Side Mount or Integral Mount	
	NPS 3/8 and 1/2 / DN 10 and 15	WAL05-18764-00
	NPS 3/4 / DN 20	WAL05-18765-00
	NPS 1 / DN 25	WAL05-18766-00
	NPS 1-1/4 / DN 32	WAL05-18767-00
	NPS 1-1/2 / DN 40	WAL05-18768-00
	NPS 2 / DN 50	WAL05-18769-00
	NPS 2-1/2 / DN 65	WAL05-18770-00
	NPS 3 / DN 80	WAL05-18771-00
	NPS 4 / DN 100	WAL05-18772-00
	NPS 5 / DN 125	WAL05-18774-00
	NPS 6 / DN 150	WAL05-18776-00
	NPS 8 / DN 200	WAL05-18778-00
	NPS 10 / DN 250	WAL05-18780-00
	NPS 12 / DN 300	WAL05-18781-00
	Side Mount Internally Balanced, 406°F / 208°C, Side Mount Internally Balanced, 550°F / 288°C or Side Mount with Dashpot	
	NPS 3/8 and 1/2 / DN 10 and 15	WAL05-02361-01
	NPS 3/4 / DN 20	WAL05-02381-01
	NPS 1 / DN 25	WAL05-02362-01
	NPS 1-1/4 / DN 32	WAL05-02382-01
	NPS 1-1/2 / DN 40	WAL05-02365-01
	NPS 2 / DN 50	WAL05-02366-01
	NPS 2-1/2 / DN 65	WAL05-02367-01
	NPS 3 / DN 80	WAL05-02369-01
	NPS 4 / DN 100	WAL05-02371-01
	NPS 5 / DN 125	WAL05-02372-01
	NPS 6 / DN 150	WAL05-02374-01
	NPS 8 / DN 200	WAL05-02375-01
	NPS 10 / DN 250	WAL05-02376-01
	NPS 12 / DN 300	WAL04-02377-01

*Included in repair kit.

Cast Iron Valve (continued)

Key	Description	Part Number
5*	Stem Nut, Steel	
	NPS 3/8 / DN 10	
	Full	WAL05-02968-00
	Normal	WAL05-02888-00
	NPS 1/2 / DN 15	WAL05-02968-00
	NPS 3/4 / DN 20	WAL05-02969-00
	NPS 1 and 1-1/4 / DN 25 and 32	WAL05-02970-00
	NPS 1-1/2 and 2 / DN 40 and 50	WAL05-02971-00
	NPS 2-1/2 / DN 65	WAL05-02972-00
	NPS 3 / DN 80	WAL05-02973-00
	NPS 4 / DN 100	WAL05-02974-00
	NPS 5 / DN 125	WAL04-02975-00
	NPS 6 / DN 150	WAL04-02976-00
	NPS 8 and 10 / DN 200 and 250	WAL04-02977-00
	NPS 12 / DN 300	WAL04-02978-00
6	Muffling Plate, Cast iron	
	Full	
	NPS 2 / DN 50	WAL04-03550-01
	NPS 2-1/2 / DN 65	WAL04-03515-00
	NPS 3 / DN 80	WAL04-03516-00
	NPS 4 / DN 100	WAL04-03518-00
	NPS 5 / DN 125	WAL04-03519-00
	NPS 6 / DN 150	WAL04-03520-00
	NPS 8 / DN 200	WAL04-03524-00
	NPS 10 / DN 250	WAL04-03538-00
	NPS 12 / DN 300	WAL04-03539-00
	Normal	
	NPS 2 / DN 50	WAL04-03550-01
	NPS 3 / DN 80	WAL04-03530-00
	NPS 4 / DN 100	WAL04-03532-00
	NPS 5 / DN 125	WAL04-03529-00
	NPS 6 / DN 150	WAL04-03522-00
	NPS 8 / DN 200	WAL04-03526-00
	NPS 10 / DN 250	WAL04-03545-00
	NPS 12 / DN 300	WAL04-03546-00
7*	Disk, Stainless Steel	
	Full	
	Metal, Standard	
	NPS 3/8 / DN 10	WAL04-01790-02
	NPS 1/2 / DN 15	WAL04-01800-02
	NPS 3/4 / DN 20	WAL04-01813-02
	NPS 1 / DN 25	WAL04-01832-02
	NPS 1-1/4 / DN 32	WAL04-01850-02
	NPS 1-1/2 / DN 40	WAL04-01870-02
	NPS 2 / DN 50	WAL04-01888-02
	NPS 2-1/2 / DN 65	WAL04-01906-01
	NPS 3 / DN 80	WAL04-01918-00
	NPS 4 / DN 100	WAL04-01931-00
	NPS 5 / DN 125	WAL04-01938-00
	NPS 6 / DN 150	WAL04-01995-00
	NPS 8 / DN 200	WAL04-01691-00
	NPS 10 / DN 250	WAL04-01953-00
	NPS 12 / DN 300	WAL04-01957-00
	Metal, 45% or 50%	
	NPS 1/2 / DN 15	WAL04-09987-00
	NPS 3/4 / DN 20	WAL04-10268-00
	NPS 1 / DN 25	WAL04-07071-00
	NPS 1-1/4 / DN 32	WAL04-08700-00
	NPS 1-1/2 / DN 40	WAL04-04585-00
	NPS 2 / DN 50	WAL04-09231-00
	NPS 2-1/2 / DN 65	WAL04-09232-00
	NPS 3 / DN 80	WAL04-08724-00
	NPS 4 / DN 100	WAL04-10824-00
	NPS 5 / DN 125	WAL04-10790-00
	NPS 6 / DN 150	WAL04-10987-00

Key	Description	Part Number
7*	Disk, Stainless steel (continued)	
	Full (continued)	
	Metal, 70% or 75%	
	NPS 1/2 / DN 15	WAL04-11368-00
	NPS 3/4 / DN 20	WAL04-11117-00
	NPS 1 / DN 25	WAL04-07401-01
	NPS 1-1/4 / DN 32	WAL04-10357-00
	NPS 1-1/2 / DN 40	WAL04-10898-00
	NPS 2 / DN 50	WAL04-02340-00
	NPS 2-1/2 / DN 65	WAL04-11118-00
	NPS 3 / DN 80	WAL04-08682-00
	NPS 4 / DN 100	WAL04-10583-00
	NPS 5 / DN 125	WAL04-11582-00
	NPS 6 / DN 150	WAL04-09601-00
	NPS 8 / DN 200	WAL04-11926-00
	NPS 10 / DN 250	WAL04-11432-00
	Soft Trim	
	NPS 3/8 and 1/2 / DN 10 and 15	WAL05-01714-00
	NPS 3/4 / DN 20	WAL05-01715-00
	NPS 1 / DN 25	WAL05-01716-00
	NPS 1-1/4 / DN 32	WAL05-01717-00
	NPS 1-1/2 / DN 40	WAL05-01718-00
	NPS 2 / DN 50	WAL05-01719-00
	NPS 2-1/2 / DN 65	WAL05-01721-00
	NPS 3 / DN 80	WAL05-01722-00
	NPS 4 / DN 100	WAL05-01724-00
	Stellite, Standard	
	NPS 1-1/2 / DN 40	WAL04-18782-00
	NPS 2-1/2 / DN 65	WAL04-01907-00
	NPS 3 / DN 80	WAL04-01919-00
	NPS 4 / DN 100	WAL04-01932-00
	NPS 6 / DN 150	WAL04-01996-00
	Normal	
	Metal, Standard	
	NPS 3/8 / DN 10	WAL04-01772-00
	NPS 1/2 / DN 15	WAL04-01790-02
	NPS 3/4 / DN 20	WAL04-01808-00
	NPS 1 / DN 25	WAL04-01823-02
	NPS 1-1/4 / DN 32	WAL04-01844-00
	NPS 1-1/2 / DN 40	WAL04-01862-02
	NPS 2 / DN 50	WAL04-01897-02
	NPS 2-1/2 / DN 65	WAL04-07072-00
	NPS 3 / DN 80	WAL04-07473-00
	NPS 4 / DN 100	WAL04-07121-00
	NPS 5 / DN 125	WAL04-08245-00
	NPS 6 / DN 150	WAL04-08247-00
	NPS 8 / DN 200	WAL04-02333-00
	NPS 10 / DN 250	WAL04-08265-00
	NPS 12 / DN 300	WAL04-01947-00
	Metal, 45% or 50%	
	NPS 2-1/2 / DN 65	WAL04-07818-00
	NPS 3 / DN 80	WAL04-06934-00
	NPS 4 / DN 100	WAL04-06972-01
	NPS 6 / DN 150	WAL04-02085-00
	NPS 8 / DN 200	WAL04-02092-00
	Metal, 70% or 75%	
	NPS 2-1/2 / DN 65	WAL04-07673-00
	NPS 3 / DN 80	WAL04-06619-00
	NPS 4 / DN 100	WAL04-07349-00
	NPS 5 / DN 125	WAL04-08618-00
	NPS 6 / DN 150	WAL04-09777-00

*Included in repair kit.

Cast Iron Valve (continued)

Key	Description	Part Number
7*	Disk, Stainless steel (continued)	
	Normal (continued)	
	Soft Trim	
	NPS 1/2 / DN 15	WAL05-01714-00
	NPS 3/4 / DN 20	WAL05-01715-00
	NPS 1 and 1-1/4 / DN 25 and 32	WAL05-01716-00
	NPS 1-1/2 and 2 / DN 40 and 50	WAL05-01717-00
	NPS 2-1/2 / DN 65	WAL05-01718-00
	NPS 3 / DN 80	WAL05-01719-00
	Stellite, Standard	
	NPS 1 / DN 25	WAL04-01824-00
	NPS 1-1/2 / DN 40	WAL04-01863-02
	NPS 3 / DN 80	WAL04-01916-00
	NPS 6 / DN 150	WAL04-01945-00
	NPS 8 / DN 200	WAL04-01950-00
8*	Seat Ring, Stainless steel	
	Full	
	Metal, Standard	
	NPS 3/8 / DN 10	WAL04-04109-01
	NPS 1/2 / DN 15	WAL04-04066-01
	NPS 3/4 / DN 20	WAL04-04075-01
	NPS 1 / DN 25	WAL04-04084-01
	NPS 1-1/4 / DN 32	WAL04-04092-01
	NPS 1-1/2 / DN 40	WAL04-04496-01
	NPS 2 / DN 50	WAL04-11544-00
	NPS 2-1/2 / DN 65	WAL04-11539-00
	NPS 3 / DN 80	WAL04-11484-00
	NPS 4 / DN 100	WAL04-11565-00
	NPS 5 / DN 125	WAL04-11700-01
	NPS 6 / DN 150	WAL04-15142-00
	NPS 8 / DN 200	WAL04-15144-00
	NPS 10 / DN 250	WAL04-15146-00
	NPS 12 / DN 300	WAL04-15153-00
	Metal, 45% or 50%	
	NPS 1/2 / DN 15	WAL04-04066-01
	NPS 3/4 / DN 20	WAL04-04075-01
	NPS 1 / DN 25	WAL04-04084-01
	NPS 1-1/4 / DN 32	WAL04-04092-01
	NPS 1-1/2 / DN 40	WAL04-04496-01
	NPS 2 / DN 50	WAL04-11544-00
	NPS 2-1/2 / DN 65	WAL04-11539-00
	NPS 3 / DN 80	WAL04-11484-00
	NPS 4 / DN 100	WAL04-11565-00
	NPS 5 / DN 125	WAL04-11700-01
	NPS 6 / DN 150	WAL04-15142-00

Key	Description	Part Number
8*	Seat Ring, Stainless steel (continued)	
	Full (continued)	
	Metal, 70% or 75%	
	NPS 1/2 / DN 15	WAL04-04066-01
	NPS 3/4 / DN 20	WAL04-04075-01
	NPS 1 / DN 25	WAL04-04084-01
	NPS 1-1/4 / DN 32	WAL04-04092-01
	NPS 1-1/2 / DN 40	WAL04-04496-01
	NPS 2 / DN 50	WAL04-11544-00
	NPS 2-1/2 / DN 65	WAL04-11539-00
	NPS 3 / DN 80	WAL04-11484-00
	NPS 4 / DN 100	WAL04-11565-00
	NPS 5 / DN 125	WAL04-11700-01
	NPS 6 / DN 150	WAL04-15142-00
	NPS 8 / DN 200	WAL04-15144-00
	NPS 10 / DN 250	WAL04-15146-00
	Soft Trim	
	NPS 3/8 / DN 10	WAL04-04109-01
	NPS 1/2 / DN 15	WAL04-04066-01
	NPS 3/4 / DN 20	WAL04-04075-01
	NPS 1 / DN 25	WAL04-04084-01
	NPS 1-1/4 / DN 32	WAL04-04092-01
	NPS 1-1/2 / DN 40	WAL04-04496-01
	NPS 2 / DN 50	WAL04-11544-00
	NPS 2-1/2 / DN 65	WAL04-11539-00
	NPS 3 / DN 80	WAL04-11484-00
	NPS 4 / DN 100	WAL04-11565-00
	Stellite, Standard	
	NPS 1-1/2 / DN 40	WAL04-18783-00
	NPS 2-1/2 / DN 65	WAL04-11654-00
	NPS 3 / DN 80	WAL04-11660-00
	NPS 4 / DN 100	WAL04-11670-00
	NPS 6 / DN 150	WAL04-15154-00
	Normal	
	Metal, Standard	
	NPS 3/8 / DN 10	WAL04-08270-00
	NPS 1/2 / DN 15	WAL04-04109-01
	NPS 3/4 / DN 20	WAL04-04069-01
	NPS 1 / DN 25	WAL04-04081-01
	NPS 1-1/4 / DN 32	WAL04-04087-01
	NPS 1-1/2 / DN 40	WAL04-04095-00
	NPS 2 / DN 50	WAL04-11545-00
	NPS 2-1/2 / DN 65	WAL04-11541-00
	NPS 3 / DN 80	WAL04-11537-00
	NPS 4 / DN 100	WAL04-11567-00
	NPS 5 / DN 125	WAL04-11702-01
	NPS 6 / DN 150	WAL04-15141-00
	NPS 8 / DN 200	WAL04-15143-00
	NPS 10 / DN 250	WAL04-15145-00
	NPS 12 / DN 300	WAL04-18023-00

*Included in repair kit.

Cast Iron Valve (continued)

Key	Description	Part Number
8*	Seat Ring, Stainless steel (continued)	
	Normal (continued)	
	Metal, 45% or 50%	
	NPS 2-1/2 / DN 65	WAL04-11541-00
	NPS 3 / DN 80	WAL04-11537-00
	NPS 4 / DN 100	WAL04-11567-00
	NPS 6 / DN 150	WAL04-15141-00
	NPS 8 / DN 200	WAL04-15143-00
	Metal, 70% or 75%	
	NPS 2-1/2 / DN 65	WAL04-11541-00
	NPS 3 / DN 80	WAL04-11537-00
	NPS 4 / DN 100	WAL04-11567-00
	NPS 5 / DN 125	WAL04-11702-01
	NPS 6 / DN 150	WAL04-15141-00
	Soft Trim	
	NPS 1/2 / DN 15	WAL04-04109-01
	NPS 3/4 / DN 20	WAL04-04069-01
	NPS 1 / DN 25	WAL04-04081-01
	NPS 1-1/4 / DN 32	WAL04-04087-01
	NPS 1-1/2 / DN 40	WAL04-04095-00
	NPS 2 / DN 50	WAL04-11545-00
	NPS 2-1/2 / DN 65	WAL04-11541-00
	NPS 3 / DN 80	WAL04-11537-00
	Stellite, Standard	
	NPS 1 / DN 25	WAL04-04082-01
	NPS 1-1/2 / DN 40	WAL04-04096-00
	NPS 3 / DN 80	WAL04-11662-00
	NPS 6 / DN 150	WAL04-15155-00
	NPS 8 / DN 200	WAL04-15157-00
9	Pipe Plug, 1/4 in., Steel	WAL04-03772-00
10	Pipe Plug 1/8 in., Steel (2 required)	WAL04-03769-00
11*	Stem, Stainless steel	
	Side Mount or Integral Mount	
	NPS 3/8 / DN 10	
	Full	WAL04-05306-01
	Normal	WAL04-05231-00
	NPS 1/2 / DN 15	WAL04-05306-01
	NPS 3/4 / DN 20	WAL04-05233-01
	NPS 1 / DN 25	WAL04-05237-02
	NPS 1-1/4 / DN 32	WAL04-05248-01
	NPS 1-1/2 / DN 40	WAL04-05251-02
	NPS 2 / DN 50	WAL04-05262-01
	NPS 2-1/2 / DN 65	WAL04-05260-02
	NPS 3 / DN 80	WAL04-05279-01
	NPS 4 / DN 100	WAL04-05282-02
	NPS 5 / DN 125	WAL04-05285-01
	NPS 6 / DN 150	WAL04-05288-01
	NPS 8 / DN 200	WAL04-05292-01
	NPS 10 / DN 250	WAL04-18329-00
	NPS 12 / DN 300	WAL04-05297-00
	Side Mount Internally Balanced, 406°F / 208°C	
	or Side Mount Internally Balanced,	
	550°F / 288°C	
	NPS 1/2 / DN 15	WAL04-06962-01
	NPS 1 / DN 25	WAL04-02095-00
	NPS 1-1/4 / DN 32	WAL04-07692-00
	NPS 1-1/2 / DN 40	WAL04-10475-00
	NPS 2 / DN 50	WAL04-05718-00
	NPS 2-1/2 / DN 65	WAL04-10589-00
	NPS 3 / DN 80	WAL04-03072-00
	NPS 4 / DN 100	WAL04-07306-00
	NPS 5 / DN 125	WAL04-07305-00
	NPS 6 / DN 150	WAL04-07304-00
	NPS 8 / DN 200	WAL04-07200-00

Key	Description	Part Number
12	Body	See Table 7
13*	Spring	
	Up to 600°F / 315°C	
	NPS 3/8 and 1/2 / DN 10 and 15, Steel	
	High Pressure	WAL05-09106-00
	Low Pressure	WAL05-05000-01
	NPS 3/4 / DN 20, Steel	
	High Pressure	WAL05-09107-00
	Low Pressure	WAL05-04987-01
	NPS 1 / DN 25, Steel	
	High Pressure	WAL05-09108-01
	Low Pressure	WAL05-04979-01
	NPS 1-1/4 and 1-1/2 / DN 32 and 40, Steel	
	High Pressure	WAL05-09110-00
	Low Pressure, Steel	WAL05-05010-01
	NPS 2 / DN 50	
	High Pressure, Steel	WAL05-09368-02
	Low Pressure, Stainless Steel	WAL05-04989-01
	NPS 2-1/2 / DN 65	
	High Pressure, Steel	WAL05-08257-02
	Low Pressure, Stainless Steel	WAL05-05021-01
	NPS 3 / DN 80	
	High Pressure, Steel	WAL05-09112-02
	Low Pressure, Stainless Steel	WAL05-05057-01
	NPS 4 / DN 100	
	High Pressure, Steel	WAL05-09114-02
	Low Pressure, Stainless Steel	WAL05-12267-00
	NPS 5 / DN 125	
	High Pressure, Steel	WAL05-09115-02
	Low Pressure, Stainless Steel	WAL05-12268-00
	NPS 6 / DN 150	
	High Pressure, Steel	WAL05-09116-01
	Low Pressure, Stainless Steel	WAL05-12269-00
	NPS 8 / DN 200	
	High Pressure, Steel	WAL05-09118-01
	Low Pressure, Stainless Steel	WAL05-12270-00
	NPS 10 / DN 250	
	High Pressure WAL05-09119-01	
	Low Pressure WAL05-12271-00	
	NPS 12 / DN 300	
	High Pressure WAL05-09120-00	
	Low Pressure WAL05-12271-00	
	Up to 750°F / 400°C, High Pressure	
	NPS 3/8 and 1/2 / DN 10 and 15	WAL05-11033-00
	NPS 3/4 / DN 20	WAL05-10520-00
	NPS 1 / DN 25	WAL05-10761-00
	NPS 1-1/4 / DN 32	WAL05-10434-00
	NPS 2 / DN 50	WAL05-10631-00
	NPS 2-1/2 / DN 65	WAL05-11034-00
	NPS 3 / DN 80	WAL05-09660-01
	NPS 4 / DN 100	
	High Pressure	WAL05-11533-00
	Low Pressure	WAL05-18791-00
	NPS 5 / DN 125	
	High Pressure	WAL05-11534-00
	Low Pressure	WAL05-18792-00
	NPS 6 / DN 150	WAL05-11535-00
	NPS 8 / DN 200	WAL05-11430-00

*Included in repair kit.

Cast Iron Valve (continued)

Key	Description	Part Number
14*	Dowel Pin, Steel	
	NPS 3/8 and 1/2 / DN 10 and 15	WAL05-03243-00
	NPS 3/4 and 1 / DN 20 and 25	WAL05-03245-00
	NPS 1-1/4, 1-1/2 and 2 / DN 32, 40 and 50	WAL05-03248-00
	NPS 2-1/2 / DN 65	WAL05-03252-00
	NPS 3 and 4 / DN 80 and 100	WAL05-03254-00
	NPS 5 and 6 / DN 125 and 150	WAL05-03258-00
	NPS 8, 10 and 12 / DN 200, 250 and 300	WAL05-03261-00
15	Diaphragm Bolt, Steel	
	NPS 3/8 and 1/2 / DN 10 and 15 (14 required)	WAL05-04771-00
	NPS 3/4 / DN 20 (12 required)	WAL05-04774-00
	NPS 1 / DN 25 (16 required)	WAL05-04774-00
	NPS 1-1/4 / DN 32 (16 required)	WAL05-04774-00
	NPS 1-1/2 / DN 40 (18 required)	WAL05-04775-00
	NPS 2 / DN 50 (18 required)	WAL05-04780-00
	NPS 2-1/2 / DN 65 (20 required)	WAL05-05486-00
	NPS 3 / DN 80 (20 required)	WAL05-05486-00
	NPS 4 / DN 100 (24 required)	WAL05-05487-00
	NPS 5 / DN 125 (28 required)	WAL05-05487-00
	NPS 6 / DN 150 (28 required)	WAL05-05483-00
	NPS 8 / DN 200 (32 required)	WAL05-05483-00
	NPS 10 / DN 250 (32 required)	WAL05-05488-00
	NPS 12 / DN 300 (32 required)	WAL05-05452-00
16	Base, Cast iron	
	NPS 3/8 and 1/2 / DN 10 and 15	WAL04-00475-00
	NPS 3/4 / DN 20	WAL04-00467-00
	NPS 1 / DN 25	WAL04-00476-00
	NPS 1-1/4 / DN 32	WAL04-00468-00
	NPS 1-1/2 / DN 40	WAL04-00472-00
	NPS 2 / DN 50	WAL04-00469-00
	NPS 2-1/2 / DN 65	WAL04-00471-00
	NPS 3 / DN 80	WAL04-00470-00
	NPS 4 and 5 / DN 100 and 125	WAL05-04528-00
	NPS 6 and 8 / DN 150 and 200	WAL05-04530-00
	NPS 10 / DN 250	WAL04-02307-00
	NPS 12 / DN 300	WAL04-06528-00
17*	Pressure Plate, Cast iron	
	NPS 3/8 and 1/2 / DN 10 and 15	WAL04-03695-00
	NPS 3/4 / DN 20	WAL04-03579-00
	NPS 1 / DN 25	WAL04-03580-00
	NPS 1-1/4 / DN 32	WAL04-03582-00
	NPS 1-1/2 / DN 40	WAL04-03581-00
	NPS 2 / DN 50	WAL04-03584-01
	NPS 2-1/2 / DN 65	WAL04-03583-00
	NPS 3 / DN 80	WAL04-03585-01
	NPS 4 / DN 100	WAL04-03587-00
	NPS 5 / DN 125	WAL04-03588-01
	NPS 6 / DN 150	WAL04-03589-02
	NPS 8 / DN 200	WAL04-03591-00
	NPS 10 / DN 250	WAL04-03590-00
	NPS 12 / DN 300	WAL04-03592-00

Key	Description	Part Number
18	Diaphragm Nut, Steel	
	NPS 3/8 and 1/2 / DN 10 and 15	WAL05-02872-00
	NPS 3/4, 1, 1-1/4 and 1-1/2 / DN 20, 25, 32 and 40	WAL05-02874-00
	NPS 2 / DN 50	WAL05-02877-00
	NPS 2-1/2, 3, 4 and 5 / DN 65, 80, 100 and 125	WAL05-02877-00
	NPS 6 and 8 / DN 150 and 200	WAL05-02881-00
	NPS 10 / DN 250	WAL05-15258-00
	NPS 12 / DN 300	WAL05-02883-00
19	Hood, Cast iron	
	NPS 3/8 and 1/2 / DN 10 and 15	WAL04-02569-00
	NPS 3/4 / DN 20	WAL04-02572-00
	NPS 1 / DN 25	WAL04-02573-00
	NPS 1-1/4 / DN 32	WAL04-02576-00
	NPS 1-1/2 / DN 40	WAL04-02577-00
	NPS 2 / DN 50	WAL04-02580-01
	NPS 2-1/2 / DN 65	WAL04-02581-00
	NPS 3 / DN 80	WAL04-02584-00
	NPS 4 / DN 100	WAL04-02588-01
	NPS 5 / DN 125	WAL04-02591-00
	NPS 6 / DN 150	WAL04-02593-00
	NPS 8 / DN 200	WAL04-02595-00
	NPS 10 / DN 250	WAL04-02597-00
	NPS 12 / DN 300	WAL04-02598-00
20*	Diaphragm, Stainless steel	
	NPS 3/8 / DN 10	WAL04-01629-01
	NPS 1/2 / DN 15	WAL04-01629-00
	NPS 3/4 / DN 20	WAL04-01662-00
	NPS 1 / DN 25	WAL04-01632-00
	NPS 1-1/4 / DN 32	WAL04-01664-00
	NPS 1-1/2 / DN 40	WAL04-01635-00
	NPS 2 / DN 50	WAL04-01638-00
	NPS 2-1/2 / DN 65	WAL04-01641-00
	NPS 3 / DN 80	WAL05-02038-00
	NPS 4 / DN 100	WAL05-01647-00
	NPS 5 / DN 125	WAL05-01649-00
	NPS 6 / DN 150	WAL05-01651-00
	NPS 8 / DN 200	WAL05-01653-00
	NPS 10 / DN 250	WAL04-02096-00
	NPS 12 / DN 300	WAL05-01656-00
	Repair Kit	See Table 6

*Included in repair kit.

Cast Steel Valve

Key	Description	Part Number
1	Stud, Steel	
	NPS 3/8 / DN 10 (4 required)	WAL05-05518-00
	NPS 1/2 / DN 15 (4 required)	
	NPT or BSPT	WAL05-05518-00
	CL600 or PN40 RF	WAL05-05506-00
	NPS 3/4 / DN 20 (4 required)	
	NPT or BSPT	WAL05-05518-00
	CL600 or PN40 RF	WAL05-05507-00
	NPS 1 / DN 25 (4 required)	
	NPT, BSPT, CL150, CL300, PN16 RF or PN25 RF	WAL05-05506-00
	CL600 or PN40 RF	WAL05-05507-00
	NPS 1-1/4 / DN 32 (4 required)	
	NPT, BSPT, CL150, CL300, PN16 RF or PN25 RF	WAL05-05507-00
	CL600 or PN40 RF	WAL05-05501-00
	NPS 1-1/2 / DN 40 (4 required)	
	NPT, BSPT, CL150, CL300, PN16 RF or PN25 RF	WAL05-05509-00
	CL600 or PN40 RF	WAL05-05501-00
	NPS 2 / DN 50 (4 required)	
	NPT, BSPT, CL150, CL300, PN16 RF or PN25 RF	WAL05-05510-00
	CL600 or PN40 RF	WAL05-05513-00
	NPS 2-1/2 / DN 65	
	CL150, CL300, PN16 RF or PN25 RF (4 required)	WAL05-18820-00
	CL600 or PN40 RF (8 required)	WAL05-05478-00
	NPS 3 / DN 80 (8 required)	
	CL150, CL300, PN16 RF or PN25 RF	WAL05-05509-00
	CL600 or PN40 RF	WAL05-05478-00
	NPS 4 / DN 100 (8 required)	
	CL150, CL300, PN16 RF or PN25 RF	WAL05-05509-00
	CL600 or PN40 RF	WAL05-05485-00
	NPS 5 / DN 125 (8 required)	
	CL150 or CL300	WAL05-05511-00
	CL600	WAL05-05475-00
	NPS 6 / DN 150	
	CL150 or CL300 (10 required)	WAL05-05519-00
	CL600 (12 required)	WAL05-05475-00
	NPS 8 / DN 200 (16 required)	
	CL150 or CL300	WAL05-05519-00
	CL600	WAL05-05476-00
	NPS 10 / DN 250, CL150 and CL300 (10 required)	WAL05-05454-00
	NPS 12 / DN 300, CL150 and CL300 (16 required)	WAL05-05450-00

Key	Description	Part Number
2	Nut, Steel	
	NPS 3/8 / DN 10 (4 required)	WAL05-02848-00
	NPS 1/2 / DN 15 (4 required)	
	NPT or BSPT	WAL05-02848-00
	CL600 or PN40 RF	WAL05-02852-00
	NPS 3/4 / DN 20 (4 required)	
	NPT or BSPT	WAL05-02848-00
	CL600 or PN40 RF	WAL05-02855-00
	NPS 1 / DN 25 (4 required)	
	NPT, BSPT, CL150, CL300, PN16 RF or PN25 RF	WAL05-02852-00
	CL600 or PN40 RF	WAL05-02855-00
	NPS 1-1/4 / DN 32 (4 required)	
	NPT, BSPT, CL150, CL300, PN16 RF or PN25 RF	WAL05-02855-00
	CL600 or PN40 RF	WAL05-02859-00
	NPS 1-1/2 / DN 40 (4 required)	
	NPT, BSPT, CL150, CL300, PN16 RF or PN25 RF	WAL05-02857-00
	CL600 or PN40 RF	WAL05-02859-00
	NPS 2 / DN 50 (4 required)	
	NPT, BSPT, CL150, CL300, PN16 RF or PN25 RF	WAL05-02861-00
	CL600 or PN40 RF	WAL05-02862-00
	NPS 2-1/2 / DN 65	WAL05-02861-00
	NPS 3 / DN 80	
	CL150, CL300, PN16 RF or PN25 RF (8 required)	WAL05-02857-00
	CL600 or PN40 RF (16 required)	WAL05-02861-00
	NPS 4 / DN 100	
	CL150, CL300, PN16 RF or PN25 RF (8 required)	WAL05-02857-00
	CL600 or PN40 RF (16 required)	WAL05-02862-00
	NPS 5 / DN 125	
	CL150 or CL300 (8 required)	WAL05-02861-00
	CL600 (16 required)	WAL05-02865-00
	NPS 6 / DN 150	
	CL150 or CL300 (10 required)	WAL05-02861-00
	CL600 (24 required)	WAL05-02865-00
	NPS 8 / DN 200	
	CL150 or CL300 (16 required)	WAL05-02861-00
	CL600 (32 required)	WAL05-02865-00
	NPS 10 / DN 250, CL150 and CL300 (10 required)	WAL05-02862-00
	NPS 12 / DN 300, CL150 and CL300 (16 required)	WAL05-02864-00

Cast Steel Valve (continued)

Key	Description	Part Number
3	Blind Flange, Cast iron	
	NPS 3/8 / DN 10	WAL04-02188-00
	NPS 1/2 / DN 15	
	NPT or BSPT	WAL04-02188-00
	CL600 or PN40 RF	WAL04-02189-00
	NPS 3/4 / DN 20	
	NPT or BSPT	WAL04-02190-00
	CL600 or PN40 RF	WAL04-02191-00
	NPS 1 / DN 25	
	NPT, BSPT, CL150, CL300, PN16 RF or PN25 RF	WAL04-02192-00
	CL600 or PN40 RF	WAL04-02193-00
	NPS 1-1/4 / DN 32	
	NPT, BSPT, CL150, CL300, PN16 RF or PN25 RF	WAL04-02194-00
	CL600 or PN40 RF	WAL04-02195-00
	NPS 1-1/2 / DN 40	
	NPT, BSPT, CL150, CL300, PN16 RF or PN25 RF	WAL04-02196-00
	CL600 or PN40 RF	WAL04-02197-00
	NPS 2 / DN 50	
	NPT, BSPT, CL150, CL300, PN16 RF or PN25 RF	WAL04-02198-00
	CL600 or PN40 RF	WAL04-02199-00
	NPS 2-1/2 / DN 65	
	CL150, CL300, PN16 RF or PN25 RF	WAL04-02184-00
	CL600 or PN40 RF	WAL04-02200-00
	NPS 3 / DN 80	
	CL150, CL300, PN16 RF or PN25 RF	WAL04-02201-00
	CL600 or PN40 RF	WAL04-02202-00
	NPS 4 / DN 100	
	CL150, CL300, PN16 RF or PN25 RF	WAL04-02204-00
	CL600 or PN40 RF	WAL04-02205-00
	NPS 5 / DN 125	
	CL150 or CL300	WAL04-02207-00
	CL600	WAL04-02208-00
	NPS 6 / DN 150	
	CL150 or CL300	WAL04-02209-00
	CL600	WAL04-02210-00
	NPS 8 / DN 200	
	CL150 or CL300	WAL04-02211-00
	CL600	WAL04-02212-00
	NPS 10 / DN 250, CL150 and CL300	WAL04-02216-00
	NPS 12 / DN 300, CL150 and CL300	WAL04-02217-00

Key	Description	Part Number
4*	Gasket, Non-Asbestos	
	Side Mount or Integral Mount	
	NPS 3/8 and 1/2 / DN 10 and 15	WAL05-18764-00
	NPS 3/4 / DN 20	WAL05-18765-00
	NPS 1 / DN 25	WAL05-18766-00
	NPS 1-1/4 / DN 32	WAL05-18767-00
	NPS 1-1/2 / DN 40	WAL05-18768-00
	NPS 2 / DN 50	WAL05-18769-00
	NPS 2-1/2 / DN 65	WAL05-18770-00
	NPS 3 / DN 80	WAL05-18771-00
	NPS 4 / DN 100	
	CL300	WAL05-18772-00
	CL600	WAL05-18773-00
	NPS 5 / DN 125	
	CL300	WAL05-18774-00
	CL600	WAL05-18775-00
	NPS 6 / DN 150	
	CL300	WAL05-18776-00
	CL600	WAL05-18777-00
	NPS 8 / DN 200	
	CL300	WAL05-18778-00
	CL600	WAL05-18779-00
	NPS 10 / DN 250	WAL05-18780-00
	NPS 12 / DN 300	WAL05-18781-00
	Side Mount Internally Balanced, 406°F / 208°C, Side Mount Internally Balanced, 550°F / 288°C or Side Mount with Dashpot	
	NPS 3/8 and 1/2 / DN 10 and 15	WAL05-02361-01
	NPS 3/4 / DN 20	WAL05-02381-01
	NPS 1 / DN 25	WAL05-02362-01
	NPS 1-1/4 / DN 32	WAL05-02382-01
	NPS 1-1/2 / DN 40	WAL05-02365-01
	NPS 2 / DN 50	WAL05-02366-01
	NPS 2-1/2 / DN 65	WAL05-02367-01
	NPS 3 / DN 80	WAL05-02369-01
	NPS 4 / DN 100	
	CL300	WAL05-02371-00
	CL600	WAL05-02396-00
	NPS 5 / DN 125	
	CL150 and CL300	WAL05-02372-01
	CL600	WAL05-02379-01
	NPS 6 / DN 150	
	CL150 and CL300	WAL05-02374-01
	CL600	WAL04-04628-01
	NPS 8 / DN 200	
	CL150 and CL300	WAL05-02375-01
	CL600	WAL04-04630-01
	NPS 10 / DN 250	WAL05-02376-01
	NPS 12 / DN 300	WAL04-02377-01

*Included in repair kit.

Cast Steel Valve (continued)

Key	Description	Part Number
5*	Stem Nut, Steel	
	NPS 3/8 / DN 10	
	Full	WAL05-02968-00
	Normal	WAL05-02888-00
	NPS 1/2 / DN 15	WAL05-02968-00
	NPS 3/4 / DN 20	WAL05-02969-00
	NPS 1 and 1-1/4 / DN 25 and 32	WAL05-02970-00
	NPS 1-1/2 and 2 / DN 40 and 50	WAL05-02971-00
	NPS 2-1/2 / DN 65	WAL05-02972-00
	NPS 3 / DN 80	WAL05-02973-00
	NPS 4 / DN 100	WAL05-02974-00
	NPS 5 / DN 125	WAL05-02975-00
	NPS 6 / DN 150	WAL05-02976-00
	NPS 8 and 10 / DN 200 and 250	WAL04-02977-00
	NPS 12 / DN 300	WAL04-02978-00
6	Muffling Plate, Cast iron	
	Full	
	NPS 2 / DN 50	WAL04-06892-00
	NPS 2-1/2 / DN 65	WAL04-09988-00
	NPS 3 / DN 80	WAL04-06987-00
	NPS 4 / DN 100	WAL04-06988-00
	NPS 5 / DN 125	WAL04-09991-00
	NPS 6 / DN 150	WAL04-06989-00
	NPS 8 / DN 200	WAL04-09996-00
	Normal	
	NPS 3 / DN 80	WAL04-03551-01
	NPS 4 / DN 100	WAL04-03552-00
	NPS 5 / DN 125	WAL04-09993-00
	NPS 6 / DN 150	WAL04-07113-00
	NPS 8 / DN 200	WAL04-09998-00
7*	Disk, Stainless steel	
	Full	
	Metal, Standard	
	NPS 3/8 / DN 10	WAL04-01790-02
	NPS 1/2 / DN 15	WAL04-01800-02
	NPS 3/4 / DN 20	WAL04-01813-02
	NPS 1 / DN 25	WAL04-01832-00
	NPS 1-1/4 / DN 32	WAL04-01850-02
	NPS 1-1/2 / DN 40	WAL04-01870-02
	NPS 2 / DN 50	WAL04-01888-02
	NPS 2-1/2 / DN 65	WAL04-01906-00
	NPS 3 / DN 80	WAL04-01918-00
	NPS 4 / DN 100	WAL04-01931-00
	NPS 5 / DN 125	WAL04-01938-00
	NPS 6 / DN 150	WAL04-01995-00
	NPS 8 / DN 200	WAL04-01691-00
	NPS 10 / DN 250	WAL04-01953-00
	NPS 12 / DN 300	WAL04-01957-00
	Metal, 45% or 50%	
	NPS 1/2 / DN 15	WAL04-09987-00
	NPS 3/4 / DN 20	WAL04-10268-00
	NPS 1 / DN 25	WAL04-07071-00
	NPS 1-1/4 / DN 32	WAL04-08700-00
	NPS 1-1/2 / DN 40	WAL04-04585-00
	NPS 2 / DN 50	WAL04-09231-00
	NPS 2-1/2 / DN 65	WAL04-09232-00
	NPS 3 / DN 80	WAL04-08724-00
	NPS 4 / DN 100	WAL04-10824-00
	NPS 5 / DN 125	WAL04-10790-00
	NPS 6 / DN 150	WAL04-10987-00

Key	Description	Part Number
7*	Disk, Stainless steel (continued)	
	Metal, 70% or 75%	
	NPS 1/2 / DN 15	WAL04-11368-00
	NPS 3/4 / DN 20	WAL04-11117-00
	NPS 1 / DN 25	WAL04-07401-01
	NPS 1-1/4 / DN 32	WAL04-10357-00
	NPS 1-1/2 / DN 40	WAL04-10898-00
	NPS 2 / DN 50	WAL04-02340-00
	NPS 2-1/2 / DN 65	WAL04-11118-00
	NPS 3 / DN 80	WAL04-08682-00
	NPS 4 / DN 100	WAL04-10583-00
	NPS 5 / DN 125	WAL04-11582-00
	NPS 6 / DN 150	WAL04-09601-00
	NPS 8 / DN 200	WAL04-11926-00
	NPS 10 / DN 250	WAL04-11432-00
	Soft Trim	
	NPS 3/8 and 1/2 / DN 10 and 15	WAL05-01714-00
	NPS 3/4 / DN 20	WAL05-01715-00
	NPS 1 / DN 25	WAL05-01716-00
	NPS 1-1/4 / DN 32	WAL05-01717-00
	NPS 1-1/2 / DN 40	WAL05-01718-00
	NPS 2 / DN 50	WAL05-01719-00
	NPS 2-1/2 / DN 65	WAL05-01721-00
	NPS 3 / DN 80	WAL05-01722-00
	NPS 4 / DN 100	WAL05-01724-00
	Stellite, Standard	
	NPS 1-1/2 / DN 40	WAL04-18782-00
	NPS 2-1/2 / DN 65	WAL04-01907-00
	NPS 3 / DN 80	WAL04-01919-00
	NPS 4 / DN 100	WAL04-01932-00
	NPS 6 / DN 150	WAL04-01996-00
	Normal	
	Metal, Standard	
	NPS 3/8 / DN 10	WAL04-01772-00
	NPS 1/2 / DN 15	WAL04-01790-02
	NPS 3/4 / DN 20	WAL04-01808-00
	NPS 1 / DN 25	WAL04-01823-02
	NPS 1-1/4 / DN 32	WAL04-01844-00
	NPS 1-1/2 / DN 40	WAL04-01862-02
	NPS 2 / DN 50	WAL04-01897-02
	NPS 2-1/2 / DN 65	WAL04-07072-00
	NPS 3 / DN 80	WAL04-07473-00
	NPS 4 / DN 100	WAL04-07121-00
	NPS 5 / DN 125	WAL04-08245-00
	NPS 6 / DN 150	WAL04-08247-00
	NPS 8 / DN 200	WAL04-02333-00
	NPS 10 / DN 250	WAL04-08265-00
	NPS 12 / DN 300	WAL04-01947-00
	Metal, 45% or 50%	
	NPS 2-1/2 / DN 65	WAL04-07818-00
	NPS 3 / DN 80	WAL04-06934-00
	NPS 4 / DN 100	WAL04-06972-01
	NPS 6 / DN 150	WAL04-02085-00
	NPS 8 / DN 200	WAL04-02092-00
	Metal, 70% or 75%	
	NPS 2-1/2 / DN 65	WAL04-07673-00
	NPS 3 / DN 80	WAL04-06619-00
	NPS 4 / DN 100	WAL04-07349-00
	NPS 5 / DN 125	WAL04-08618-00
	NPS 6 / DN 150	WAL04-09777-00

*Included in repair kit.

Cast Steel Valve (continued)

Key	Description	Part Number
7*	Disk, Stainless Steel (continued)	
	Normal (continued)	
	Soft Trim	
	NPS 1/2 / DN 15	WAL05-01714-00
	NPS 3/4 / DN 20	WAL05-01715-00
	NPS 1 and 1-1/4 / DN 25 and 32	WAL05-01716-00
	NPS 1-1/2 and 2 / DN 40 and 50	WAL05-01717-00
	NPS 2-1/2 / DN 65	WAL05-01718-00
	NPS 3 / DN 80	WAL05-01719-00
	Stellite, Standard	
	NPS 1 / DN 25	WAL04-01824-00
	NPS 1-1/2 / DN 40	WAL04-01863-02
	NPS 3 / DN 80	WAL04-01916-00
	NPS 6 / DN 150	WAL04-01945-00
	NPS 8 / DN 200	WAL04-01950-00
8*	Seat Ring, Stainless steel	
	Full	
	Metal, Standard	
	NPS 3/8 / DN 10	WAL04-04109-01
	NPS 1/2 / DN 15	WAL04-04066-01
	NPS 3/4 / DN 20	WAL04-04075-01
	NPS 1 / DN 25	WAL04-04084-01
	NPS 1-1/4 / DN 32	WAL04-04092-01
	NPS 1-1/2 / DN 40	WAL04-04496-01
	NPS 2 / DN 50	WAL04-11544-00
	NPS 2-1/2 / DN 65	WAL04-11539-00
	NPS 3 / DN 80	WAL04-11484-00
	NPS 4 / DN 100	WAL04-11565-00
	NPS 5 / DN 125	WAL04-11700-01
	NPS 6 / DN 150	WAL04-15142-00
	NPS 8 / DN 200	WAL04-15144-00
	NPS 10 / DN 250	WAL04-15146-00
	NPS 12 / DN 300	WAL04-15153-00
	Metal, 45% or 50%	
	NPS 1/2 / DN 15	WAL04-04066-01
	NPS 3/4 / DN 20	WAL04-04075-01
	NPS 1 / DN 25	WAL04-04084-01
	NPS 1-1/4 / DN 32	WAL04-04092-01
	NPS 1-1/2 / DN 40	WAL04-04496-01
	NPS 2 / DN 50	WAL04-11544-00
	NPS 2-1/2 / DN 65	WAL04-11539-00
	NPS 3 / DN 80	WAL04-11484-00
	NPS 4 / DN 100	WAL04-11565-00
	NPS 5 / DN 125	WAL04-11700-01
	NPS 6 / DN 150	WAL04-15142-00
	Metal, 70% or 75%	
	NPS 1/2 / DN 15	WAL04-04066-01
	NPS 3/4 / DN 20	WAL04-04075-01
	NPS 1 / DN 25	WAL04-04084-01
	NPS 1-1/4 / DN 32	WAL04-04092-01
	NPS 1-1/2 / DN 40	WAL04-04496-01
	NPS 2 / DN 50	WAL04-11544-00
	NPS 2-1/2 / DN 65	WAL04-11539-00
	NPS 3 / DN 80	WAL04-11484-00
	NPS 4 / DN 100	WAL04-11565-00
	NPS 5 / DN 125	WAL04-11700-01
	NPS 6 / DN 150	WAL04-15142-00
	NPS 8 / DN 200	WAL04-15144-00
	NPS 10 / DN 250	WAL04-15146-00

Key	Description	Part Number
8*	Seat Ring, Stainless steel (continued)	
	Full (continued)	
	Soft Trim	
	NPS 3/8 / DN 10	WAL04-04109-01
	NPS 1/2 / DN 15	WAL04-04066-01
	NPS 3/4 / DN 20	WAL04-04075-01
	NPS 1 / DN 25	WAL04-04084-01
	NPS 1-1/4 / DN 32	WAL04-04092-01
	NPS 1-1/2 / DN 40	WAL04-04496-01
	NPS 2 / DN 50	WAL04-11544-00
	NPS 2-1/2 / DN 65	WAL04-11539-00
	NPS 3 / DN 80	WAL04-11484-00
	NPS 4 / DN 100	WAL04-11565-00
	Stellite, Standard	
	NPS 1-1/2 / DN 40	WAL04-18783-00
	NPS 2-1/2 / DN 65	WAL04-11654-00
	NPS 3 / DN 80	WAL04-11660-00
	NPS 4 / DN 100	WAL04-11670-00
	NPS 6 / DN 150	WAL04-15154-00
	Normal	
	Metal, Standard	
	NPS 3/8 / DN 10	WAL04-08270-00
	NPS 1/2 / DN 15	WAL04-04109-01
	NPS 3/4 / DN 20	WAL04-04069-01
	NPS 1 / DN 25	WAL04-04081-01
	NPS 1-1/4 / DN 32	WAL04-04087-01
	NPS 1-1/2 / DN 40	WAL04-04095-00
	NPS 2 / DN 50	WAL04-11545-00
	NPS 2-1/2 / DN 65	WAL04-11541-00
	NPS 3 / DN 80	WAL04-11537-00
	NPS 4 / DN 100	WAL04-11567-00
	NPS 5 / DN 125	WAL04-11702-01
	NPS 6 / DN 150	WAL04-15141-00
	NPS 8 / DN 200	WAL04-15143-00
	NPS 10 / DN 250	WAL04-15145-00
	NPS 12 / DN 300	WAL04-18023-00
	Metal, 45% or 50%	
	NPS 2-1/2 / DN 65	WAL04-11541-00
	NPS 3 / DN 80	WAL04-11537-00
	NPS 4 / DN 100	WAL04-11567-00
	NPS 6 / DN 150	WAL04-15141-00
	NPS 8 / DN 200	WAL04-15143-00
	Metal, 70% or 75%	
	NPS 2-1/2 / DN 65	WAL04-11541-00
	NPS 3 / DN 80	WAL04-11537-00
	NPS 4 / DN 100	WAL04-11567-00
	NPS 5 / DN 125	WAL04-11702-01
	NPS 6 / DN 150	WAL04-15141-00
	Soft Trim	
	NPS 1/2 / DN 15	WAL04-04109-01
	NPS 3/4 / DN 20	WAL04-04069-01
	NPS 1 / DN 25	WAL04-04081-01
	NPS 1-1/4 / DN 32	WAL04-04087-01
	NPS 1-1/2 / DN 40	WAL04-04095-00
	NPS 2 / DN 50	WAL04-11545-00
	NPS 2-1/2 / DN 65	WAL04-11541-00
	NPS 3 / DN 80	WAL04-11537-00
	Stellite, Standard	
	NPS 1 / DN 25	WAL04-04082-01
	NPS 1-1/2 / DN 40	WAL04-04096-00
	NPS 3 / DN 80	WAL04-11662-00
	NPS 6 / DN 150	WAL04-15155-00
	NPS 8 / DN 200	WAL04-15157-00

*Included in repair kit.

Cast Steel Valve (continued)

Key	Description	Part Number
9	Pipe Plug, 1/4 in., Steel	WAL04-03772-00
10	Pipe Plug 1/8 in., Steel (2 required)	WAL04-03769-00
11*	Stem, Stainless Steel	
	Side Mount or Integral Mount	
	NPS 3/8 and 1/2 / DN 10 and 15	WAL04-05307-03
	NPS 3/4 / DN 20	WAL04-05235-03
	NPS 1 / DN 25	WAL04-05238-03
	NPS 1-1/4 / DN 32	WAL04-05249-03
	NPS 1-1/2 / DN 40	WAL04-05252-03
	NPS 2 / DN 50	WAL04-05263-03
	NPS 2-1/2 / DN 65	WAL04-05261-03
	NPS 3 / DN 80	WAL04-05280-03
	NPS 4 / DN 100	WAL04-05283-05
	NPS 5 / DN 125	WAL04-05286-01
	NPS 6 / DN 150	WAL04-05289-01
	NPS 8 / DN 200	WAL04-05293-01
	NPS 10 / DN 250	WAL04-05294-00
	NPS 12 / DN 300	WAL04-05297-00
	Side Mount Internally Balanced, 406°F / 208°C	
	or Side Mount Internally	
	Balanced, 550°F / 288°C	
	NPS 3/8 and 1/2 / DN 10 and 15	WAL04-05306-01
	NPS 3/4 / DN 20	WAL04-05233-01
	NPS 1 / DN 25	WAL04-05237-02
	NPS 1-1/4 / DN 32	WAL04-05248-01
	NPS 1-1/2 / DN 40	WAL04-05251-02
	NPS 2 / DN 50	WAL04-05262-01
	NPS 2-1/2 / DN 65	WAL04-05260-02
	NPS 3 / DN 80	WAL04-05279-01
	NPS 4 / DN 100	WAL04-05282-02
	NPS 5 / DN 125	WAL04-05285-01
	NPS 6 / DN 150	WAL04-05288-01
	NPS 8 / DN 200	WAL04-05292-01
12	Body	See Table 7
13*	Spring	
	Up to 600°F / 315°C	
	NPS 3/8 and 1/2 / DN 10 and 15	
	High Pressure	WAL05-09106-00
	Low Pressure	WAL05-05000-01
	NPS 3/4 / DN 20	
	High Pressure	WAL05-09107-00
	Low Pressure	WAL05-04987-01
	NPS 1 / DN 25	
	High Pressure	WAL05-09108-01
	Low Pressure	WAL05-04979-01
	NPS 1-1/4 and 1-1/2 / DN 32 and 40	
	High Pressure	WAL05-09110-00
	Low Pressure	WAL05-05010-01
	NPS 2 / DN 50	
	High Pressure	WAL05-09368-02
	Low Pressure	WAL05-04989-01
	NPS 2-1/2 / DN 65	
	High Pressure	WAL05-08257-02
	Low Pressure	WAL05-05021-01
	NPS 3 / DN 80	
	High Pressure	WAL05-09112-02
	Low Pressure	WAL05-05057-01

Key	Description	Part Number
13*	Spring (continued)	
	Up to 600°F / 315°C (continued)	
	NPS 4 / DN 100	
	High Pressure	WAL05-09114-02
	Low Pressure	WAL05-12267-00
	NPS 5 / DN 125	
	High Pressure	WAL05-09115-02
	Low Pressure	WAL05-12268-00
	NPS 6 / DN 150	
	High Pressure	WAL05-09116-01
	Low Pressure	WAL05-12269-00
	NPS 8 / DN 200	
	High Pressure	WAL05-09118-01
	Low Pressure	WAL05-12270-00
	NPS 10 / DN 250	
	High Pressure	WAL05-09119-01
	Low Pressure	WAL05-12271-00
	NPS 12 / DN 300	
	High Pressure	WAL05-09120-00
	Low Pressure	WAL05-12271-00
	Up to 750°F / 400°C, High Pressure	
	NPS 3/8 and 1/2 / DN 10 and 15	WAL05-11033-00
	NPS 3/4 / DN 20	WAL05-10520-00
	NPS 1 / DN 25	WAL05-10761-00
	NPS 1-1/4 / DN 32	WAL05-10434-00
	NPS 2 / DN 50	WAL05-10631-00
	NPS 2-1/2 / DN 65	WAL05-11034-00
	NPS 3 / DN 80	WAL05-09660-01
	NPS 4 / DN 100	
	High Pressure	WAL05-11533-00
	Low Pressure	WAL05-18791-00
	NPS 5 / DN 125	
	High Pressure	WAL05-11534-00
	Low Pressure	WAL05-18792-00
	NPS 6 / DN 150	WAL05-11535-00
	NPS 8 / DN 200	WAL05-11430-00
14*	Dowel Pin, Steel	
	NPS 3/8 and 1/2 / DN 10 and 15	WAL05-03243-00
	NPS 3/4 and 1/ DN 20 and 25	WAL05-03245-00
	NPS 1-1/4, 1-1/2 and 2 / DN 32, 40 and 50	WAL05-03248-00
	NPS 2-1/2 / DN 65	WAL05-03252-00
	NPS 3 and 4 / DN 80 and 100	WAL05-03254-00
	NPS 5 and 6 / DN 125 and 150	WAL05-03258-00
	NPS 8, 10 and 12 / DN 200, 250 and 300	WAL05-03261-00
15	Diaphragm Bolt, Steel	
	NPS 3/8 and 1/2 / DN 10 and 15	WAL05-05480-00
	NPS 3/4, 1, 1-1/4 and 1-1/2 /	
	DN 20, 25, 32 and 40	WAL05-05481-00
	NPS 2, 2-1/2 and 3 / DN 50, 65 and 80	WAL05-05486-00
	NPS 4 and 5 / DN 100 and 125	WAL05-05487-00
	NPS 6 and 8 / DN 150 and 200	WAL05-05483-00

*Included in repair kit

Cast Steel Valve (continued)

Key	Description	Part Number
16	Base, Cast iron	
	NPS 3/8 and 1/2 / DN 10 and 15	WAL04-00492-00
	NPS 3/4 / DN 20	WAL04-00484-00
	NPS 1 / DN 25	WAL04-00493-00
	NPS 1-1/4 / DN 32	WAL04-00485-00
	NPS 1-1/2 / DN 40	WAL04-00489-00
	NPS 2 / DN 50	WAL04-00486-00
	NPS 2-1/2 / DN 65	WAL04-00488-00
	NPS 3 / DN 80	WAL04-00487-00
	NPS 4 / DN 100	WAL04-00490-00
	NPS 5 / DN 125	WAL04-00495-00
	NPS 6 / DN 150	WAL04-00496-00
	NPS 8 / DN 200	WAL04-00491-00
	NPS 10 / DN 250	WAL04-02307-00
	NPS 12 / DN 300	WAL04-06528-00
17*	Pressure Plate, Cast iron	
	NPS 3/8 and 1/2 / DN 10 and 15	WAL04-03695-00
	NPS 3/4 / DN 20	WAL04-03579-00
	NPS 1 / DN 25	WAL04-03580-00
	NPS 1-1/4 / DN 32	WAL04-03582-00
	NPS 1-1/2 / DN 40	WAL04-03581-00
	NPS 2 / DN 50	WAL04-03584-01
	NPS 2-1/2 / DN 65	WAL04-03583-00
	NPS 3 / DN 80	WAL04-03585-01
	NPS 4 / DN 100	WAL04-03587-00
	NPS 5 / DN 125	WAL04-03588-01
	NPS 6 / DN 150	WAL04-03589-02
	NPS 8 / DN 200	WAL04-03591-00
	NPS 10 / DN 250	WAL04-03590-00
	NPS 12 / DN 300	WAL04-03592-00
18	Diaphragm Nut, Steel	
	NPS 3/8 and 1/2 / DN 10 and 15	WAL05-02848-00
	NPS 3/4, 1, 1-1/4 and 1-1/2 / DN 20, 25, 32 and 40	WAL05-02852-00
	NPS 2 / DN 50	WAL05-02857-00
	NPS 2-1/2, 3, 4 and 5 / DN 65, 80, 100 and 125	WAL05-02857-00
	NPS 6 and 8 / DN 150 and 200	WAL05-02861-00
	NPS 10 / DN 250	WAL05-02862-00
	NPS 12 / DN 300	WAL05-02864-00

Key	Description	Part Number
19	Hood, Cast iron	
	NPS 3/8 and 1/2 / DN 10 and 15	WAL04-02570-00
	NPS 3/4 / DN 20	WAL04-02574-00
	NPS 1 / DN 25	WAL04-02575-00
	NPS 1-1/4 / DN 32	WAL04-02578-00
	NPS 1-1/2 / DN 40	WAL04-02579-00
	NPS 2 / DN 50	WAL04-02582-00
	NPS 2-1/2 / DN 65	WAL04-02646-00
	NPS 3 / DN 80	WAL04-02586-00
	NPS 4 / DN 100	WAL04-02589-00
	NPS 5 / DN 125	WAL04-02592-00
	NPS 6 / DN 150	WAL04-02594-00
	NPS 8 / DN 200	WAL04-02596-00
	NPS 10 / DN 250	WAL04-02599-00
	NPS 12 / DN 300	WAL04-09961-00
20*	Diaphragm, Stainless steel	
	NPS 3/8 and 1/2 / DN 10 and 15	WAL04-01629-01
	NPS 3/4 / DN 20	WAL04-01662-00
	NPS 1 / DN 25	WAL04-01632-00
	NPS 1-1/4 / DN 32	WAL04-01664-00
	NPS 1-1/2 / DN 40	WAL04-01635-00
	NPS 2 / DN 50	WAL04-01638-00
	NPS 2-1/2 / DN 65	WAL04-01641-00
	NPS 3 / DN 80	WAL05-02038-00
	NPS 4 / DN 100	WAL05-01647-00
	NPS 5 / DN 125	WAL05-01649-00
	NPS 6 / DN 150	WAL05-01651-00
	NPS 8 / DN 200	WAL05-01653-00
	NPS 10 / DN 250	WAL04-02096-00
	NPS 12 / DN 300	WAL05-01656-00

*Included in repair kit

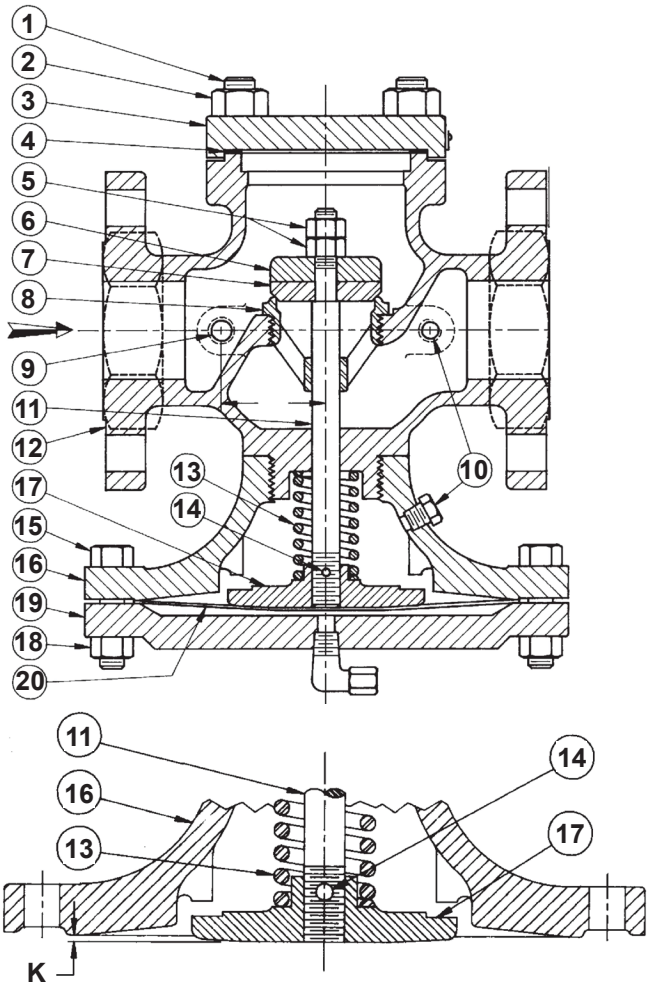


Figure 6. *Type E Main Valve Assembly Drawing*

Table 8. *Type E Main Valve K Values*

VALVE SIZE		TYPE E	
NPS	**DN**	**Hood (k)**	**Total**
3/8	10	1/32	3/32
1/2	15	3/64	7/64
3/4	20	3/64	1/8
1	25	1/16	5/32
1-1/4	32	5/64	3/16
1-1/2	40	3/32	7/32
2	50	7/64	1/4
2-1/2	65	1/8	9/32
3	80	9/64	3/8
4	100	3/16	13/32
5	125	7/32	1/2
6	150	9/32	19/32
8	200	11/32	3/4
10	250	7/16	31/32
12	300	9/16	1-1/4

Type E

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SD3001F

SPENCE™

Spence Type E2 Main Valve

WARNING

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

The Type E2 main valve 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 valve 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 Type E2 main valve.

Introduction

Scope of the Manual

This manual provides instructions for the installation, troubleshooting, maintenance, valve setting and parts ordering for Type E2 main valve regulator.

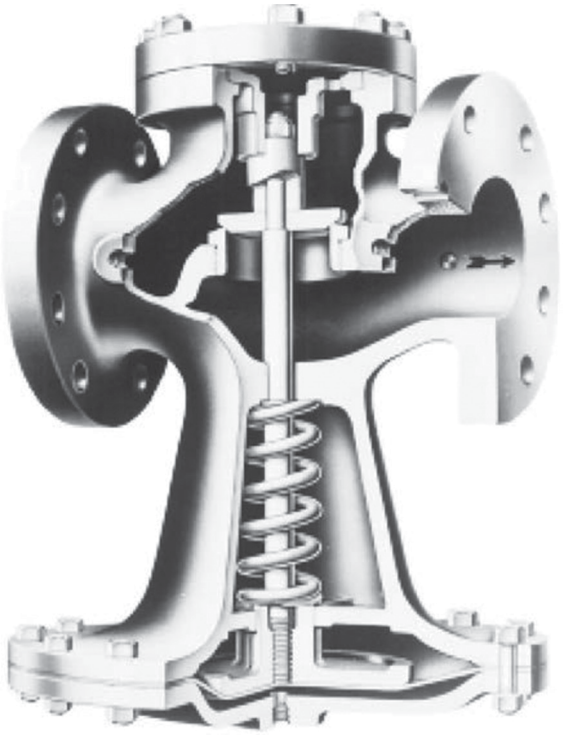

Figure 1. *Type E2 Main Valve*

Product Description

The Type E2 Main Valve is pilot-operated normally closed, single seat design featuring packless construction and protected main spring.

One or more pilot regulators are mounted to the Type E2 main valve to fit with the specifications defined by the pressure or temperature regulating system.

Specifications

This section lists the specifications for the Type E2 main valve. Factory specifications are stamped on the nameplate fastened on the regulator at the factory.

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

End Connection Styles
NPT, CL125

Pressure Rating(1)
15 psig / 1.03 bar

Temperature Rating(1)
250°F/ 121°C

Rated Flow Coefficient
See Table 1

Main Valve Material
Cast Iron

Approximate Weight
See Table 2

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

Table 1. *Type E2 Main Valve Rated Flow Coefficients*

SEAT FACTOR	REGULATOR SIZE, NPS / DN											
	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
Full	7.6	11.7	18.9	27.4	44	68	96	143	202	255	465	748
70 to 75%	- - - -	8.8	13.2	19.2	30.8	47.6	67.2	100	141	178	- - - -	- - - -
46%	- - - -	- - - -	- - - -	12.3	- - - -	30.6	- - - -	64.4	- - - -	115	- - - -	336

Table 2. *Type E2 Main Valve Approximate Weight*

VALVE SIZE		END CONNECTION STYLE			
		NPT		FLANGE	
NPS	DN	lbs	kg	lbs	kg
3/4	20	18	8.16	- - - -	- - - -
1	25	19	8.62	21	- - - -
1-1/4	32	30	13.6	33	- - - -
1-1/2	40	36	16.3	40	- - - -
2	50	50	22.7	57	- - - -
2-1/2	65	- - - -	- - - -	70	- - - -
3	80	- - - -	- - - -	98	- - - -
4	100	- - - -	- - - -	135	- - - -
5	125	- - - -	- - - -	185	- - - -
6	150	- - - -	- - - -	250	- - - -
8	200	- - - -	- - - -	415	- - - -
10	250	- - - -	- - - -	690	- - - -

Principle of Operation

The regulator is operated by initial steam or fluid pressure. It is normally closed, being held so by initial pressure on the disc and by an internal main spring, see Figure 3. When the pilot is opened (see pilot instructions), initial pressure flows through the pilot to the 8B tee. 4A bleed port restricts the flow and pressure builds under the diaphragm and opens the main valve.

Delivery pressure feeds back through the control pipe to the pilot diaphragm. As this pressure approaches a balance with the thrust of the adjusting spring, the pilot throttles the loading pressure. In turn, the main valve takes a position established by the loading pressure where just enough steam flows to maintain the set delivery pressure.

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.

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.

All pressure equipment should be installed in a non-seismic area; should not be exposed to fire; and should be protected from thunderbolt (lightning) strikes.

Planning

- Locate the valve in a straight run of horizontal pipe.
- Allow headroom above the valve for access through the blind flange.
- Provide clearance for stem withdrawal underneath.
- Prevent water hammer and erratic operation by installing traps to provide proper drainage before and after the valve and before secondary pressure relief valve or control valve.
- Avoid damaging effects of scale and dirt in the pipe lines by using a strainer as shown in Figure 2.
- Provide a 3-valve by-pass to facilitate inspection without interrupting service.
- To eliminate excessive noise and erratic regulation with steam and other compressible fluids, enlarge the delivery pipe size to effect a reasonable flow velocity at the reduced pressure. A tapered transition is recommended.
- If possible, avoid a sharp turn close to the regulator outlet and a bull-headed tee connection to the low pressure main.
- Install initial and delivery pressure gages to indicate performance.
- If the pressure rating of the delivery system or connected equipment is less than the initial steam pressure, provide a safety valve.

Main Valve

- Mount the main valve with diaphragm chamber down and arrow on body pointing in the direction of flow. Screwed end valves should be mounted in unions.

Pilot

For Side Mount Construction

1. Mount the pilot on either side of the main valve by means of 1/4 in. nipple and union provided.
2. Make this connection on the 1/4 in. pipe tap at the inlet of the main valve as shown in Figure 2.

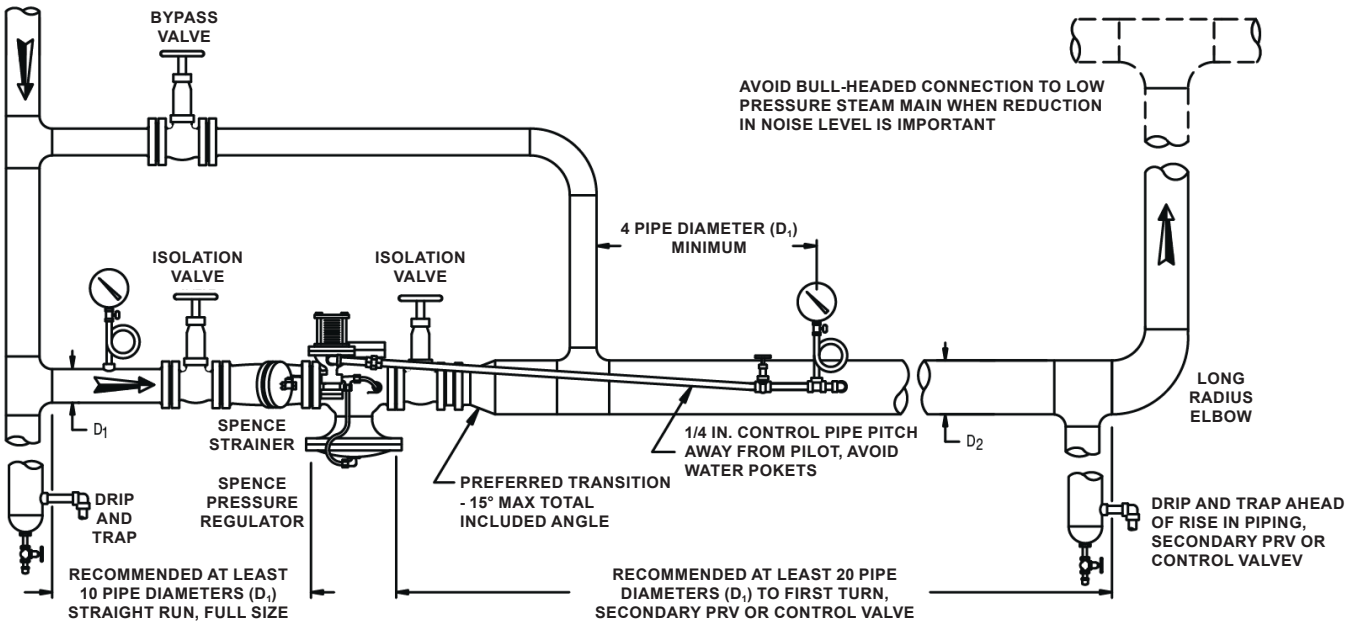

Figure 2. *Type E2 Main Valve Installation*

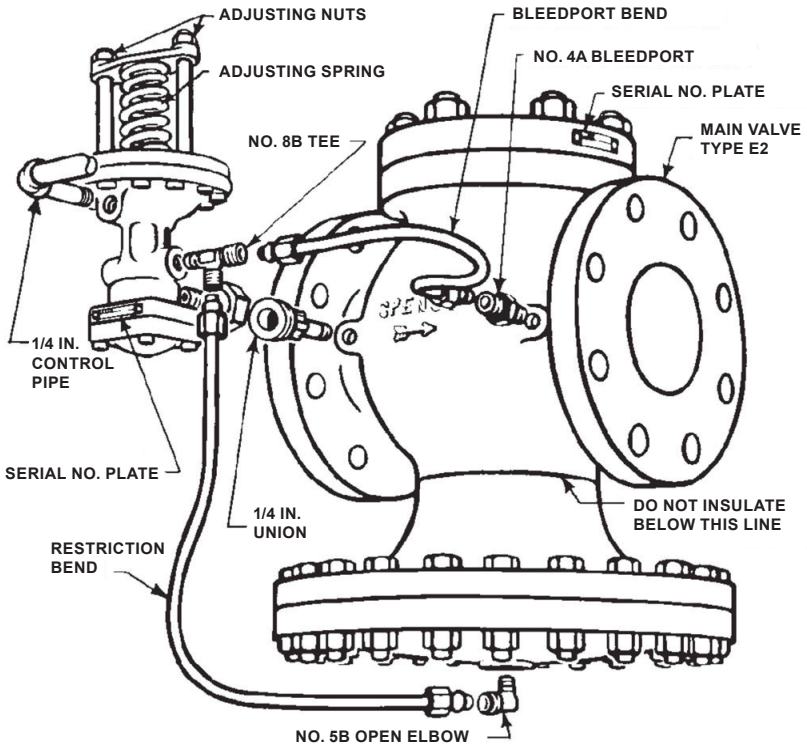

Figure 3. *Mounting Pilot on Type E2 Main Valve*

For Integral Mount Construction

1. Remove blind flange on pilot and mount on blind flange of main valve using provided bolt.
2. Screw 4A bleed port fitting into the 1/8 in. pipe tap at the outlet of the main valve body. Note bleed orifice in this fitting is vital to operation of regulator.
3. Screw 8B tee into 1/8 in. pipe tap in pilot. Select tap facing downstream.
4. Screw No. 5B elbow into 1/8 in. pipe tap on underside of main valve diaphragm chamber.
5. Connect tubing bends as illustrated in Figure 3.

Control Pipe (Not required with Type T14)

1. Use 1/4 in. pipe for this line which connect the pilot diaphragm chamber to the desired point of pressure control.
2. Take the control at a point of minimum turbulence. Avoid control immediately at the valve outlet or after a turn.
3. When the delivery pipe expands in size, select a spot at least 4 pipe diameters beyond the point of enlargement.
4. Pitch away from pilot to avoid erratic operation and excessive fouling.
5. Eliminate water pockets.
6. Locate delivery pressure gage in control pipe to show pressure actually reaching pilot diaphragm

Start-up and Setting

CAUTION

Never open a reducing valve without positive indication that the high side is clear of condensate.

1. On pressure reducing valves like Type E2, use by-pass to fill the delivery system and raise pressure to slightly below normal required.
2. Close pilot by releasing compression on adjusting spring. See Figure 3.
3. Open 1/4 in. control pipe valve.
4. Crack outlet stop valve.
5. Crack inlet stop valve.
6. Blow down strainer.
7. Open inlet stop valve and gradually compress adjusting spring until the valve opens and takes control at desired pressure.
8. Alternately choke down on the by-pass and open outlet stop valve until the regulator is on the line. See individual instructions for other pilots.

Valve Setting

Valve setting is gaged at K to establish correct stem length and diaphragm position. Dimension K is supplied with each replacement stem. See Table 5 for K values.

1. To install new stem (key 13), fasten disc (key 8) firmly on stem with stem nut.
2. Insert stem and disc assembly in valve and screw on pressure plate (key 16). Omit spring (key 14) for this operation.
3. Hold disc on seat and adjust position of pressure plate until valve setting K is reached.
4. Push pressure plate against stops in base (key 18).
5. Remove disc, drop out pressure plate and stem, drill and insert dowel pin (key 15) to lock the joint.
6. Grind off stem projection flush with face of pressure plate.

Troubleshooting

Failure to Open

If the main valve failed to open check the following possible causes to properly correct the problem.

- Adjusting spring on pilot may have been tampered with.
- Initial pressure may be down due to partially closed supply valve, clogged strainer or other obstruction.
- No. 4A bleed port fitting may have been omitted and an open coupling substituted.
- Control pipe may be plugged. Most likely points of obstruction are at shutoff valve and entrance to delivery main.
- Main diaphragm may be broken. Test with air or water before dismantling.

Failure to Close

If the main valve failed to close check the following possible causes to properly correct the problem.

- Adjusting spring on pilot may have been tampered with.
- Orifice in bleed port No. 4A may be plugged.
- By-pass valve may be leaking.
- On pressure regulators like Type E2, the main valve or pilot may be held open by foreign matter in seat.

  To determine which valve leaks, follow these steps. Close stop valve and 1/4 in. control pipe valve.

  1. Remove bleed port bend so pilot will exhaust to atmosphere.
  2. Crack inlet stop valve. Steam will issue from 8B tee.
  3. Release compression on adjusting spring to see if pilot closes tight.
  4. Open and close several times to wash seat. Steam blowing back from bleed port means main valve disc is held open by foreign matter. Steam may wash the obstruction from the seat if the valve is made to open wide. This can be accomplished, even at light loads, if the control point is beyond the outlet stop valve.
  5. Reassemble bleed port bend and place regulator in operation.
  6. Slowly open and close outlet stop valve.

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.

Inspection

Under normal conditions, complete dismantling is not recommended.

Check the following after operation. Then, schedule an inspection as required.

1. Inspect for dirt collected at 4A bleed port.
2. Inspect all joints for leakage. Keep bolts tight to avoid any leaks

Main Valve Maintenance

1. Connect a source of air or water pressure which can be adjusted by hand to the No. 5B elbow.
2. Apply 30 psi / 2.07 bar to jack valve open and prevent stem from turning while removing stem nuts.
3. Use penetrating oil on the threads.

Seat Ring Maintenance

Note

These joints should be made up with high temperature gasket compound.

1. Remove old compound from body and seat ring with a wire brush.
2. Apply new compound sparingly to both parts, threads and shoulders. Let stand until tacky before assembling.

Grinding In

CAUTION

Seats and discs should never require more than the lightest touch up with very fine (400 grit) grinding compound. Heavy grinding will produce galling, wider seating surface and a groove in the disc, all of which tend to cause leakage.

3. Reface a damaged surface before attempting to grind it in.
4. Grind sparingly.
5. Main stem (key 13, Figure 4) is slotted for rotation with a screwdriver, valve spring (key 14) is omitted from the assembly during grinding.
6. Slip the stem into its normal position.
7. Apply compound to the disc. Place it on the stem and guide plug, tighten with stem nut.
8. After grinding, disassemble and clean all parts.

Parts Ordering

When corresponding with your local Sales Office about Type E2 Main Valve, 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
	Repair Parts Kit	
	NPS 3/4 / DN 20	WAL08-07940-00
	NPS 1 / DN 25	WAL08-07941-00
	NPS 1-1/4 / DN 32	WAL08-07942-00
	NPS 1-1/2 / DN 40	WAL08-07943-00
	NPS 2 / DN 50	WAL08-07944-01
	NPS 2-1/2 / DN 65	WAL08-07945-01
	NPS 3 / DN 80	WAL08-07946-01
	NPS 4 / DN 100	WAL08-09587-01
	NPS 5 / DN 125	WAL08-10980-00
	NPS 6 / DN 150	WAL08-10995-00
	NPS 8 / DN 200	- - - - - - - - - -
	NPS 10 / DN 250	- - - - - - - - - -
	Type E2	
	NPS 3/4 to 3 / DN 20 to 80	See Table 3
	NPS 4 to 10 / DN 100 to 250	See Table 4

Table 3. *Type E2, NPS 3/4 to 3 / DN 20 to 80 Parts List*

ITEM NUMBER	PART NAME	MATERIAL	VALVE SIZE, NPS / DN						
			3/4 / 20	1 / 25	1-1/4 / 32	1-1/2 / 40	2 / 50	2-1/2 / 65	3 / 80
1	Blind Flange Stud	Steel	WAL05-05518-00	WAL04-10118-00	WAL05-05507-00	WAL04-05543-00	WAL04-10119-00	WAL04-10119-00	WAL04-05443-00
2	Blind Flange Nut	Steel	WAL05-02847-00	WAL05-02851-00	WAL05-02854-00	WAL05-02856-00	WAL05-02860-00	WAL04-02860-00	WAL05-02856-00
3	Blind Flange	Cast Iron	WAL04-02171-00	WAL04-02173-00	WAL04-02176-00	WAL04-02178-00	WAL04-02180-00	WAL04-02185-00	WAL04-02157-00
4	Gasket	Non-Asbestos	WAL05-02381-01	WAL05-02362-01	WAL05-02382-01	WAL05-02365-01	WAL05-02366-01	WAL05-02367-01	WAL05-02369-01
5	Stem Nut	Steel	WAL05-02969-00	WAL05-02970-00	WAL05-02970-00	WAL05-02971-00	WAL05-02971-00	WAL05-02972-00	WAL05-02973-00
6	Disk Guide Plate	Cast Iron	WAL04-03576-00	WAL04-03479-00	WAL04-03480-00	WAL04-03478-00	WAL04-03500-00	WAL04-03509-00	WAL04-03496-00
7	Guide Plug	Stainless Steel	----------	----------	----------	WAL04-03751-01	WAL04-03750-00	WAL04-03754-00	WAL04-03755-00
8	Integral Disk	Stainless Steel	WAL04-01813-02	WAL04-01832-02	WAL04-01850-02	WAL04-01870-02	WAL04-01888-02	WAL04-01906-01	WAL04-01918-00
9	Seat Ring	Stainless Steel	WAL04-04075-01	WAL04-04084-01	WAL04-04092-01	WAL04-04496-01	WAL04-11593-00	WAL04-11650-00	WAL04-11549-00
10	Pipe Plug 1/4"	Steel	WAL04-03772-00	WAL04-03772-00	WAL04-03772-00	WAL04-03772-00	WAL04-03772-00	WAL04-03772-00	WAL04-03772-00
11	NPT Body	Cast Iron	----------	----------	----------	----------	----------	----------	----------
	125 Body	Cast Iron	----------	----------	----------	----------	----------	----------	----------
12	Pipe Plug 1/8"	Steel	WAL04-03769-00	WAL04-03769-00	WAL04-03769-00	WAL04-03769-00	WAL04-03769-00	WAL04-03769-00	WAL04-03769-00
13	Stem	Stainless Steel	WAL04-05241-02	WAL04-05254-02	WAL04-05254-02	WAL04-05325-01	WAL04-05247-02	WAL04-05324-02	WAL04-05394-03
14	Main Spring	Steel	WAL05-05093-02	WAL05-05093-02	WAL05-05094-01	WAL05-05095-01	WAL05-05096-01	WAL05-05097-01	WAL05-05098-01
15	Groove Pin	Steel	WAL05-03247-00	WAL05-03247-00	WAL05-03247-00	WAL05-03251-00	WAL05-03251-00	WAL05-03253-00	WAL05-03254-00
16	Pressure Plate	Cast Iron	WAL04-03621-00	WAL04-03700-00	WAL04-03622-00	WAL04-03623-01	WAL04-03624-00	WAL04-03625-00	WAL04-03626-00
17	Diaphragm Bolt	Steel	WAL05-04770-00	WAL05-04770-00	WAL05-04773-00	WAL05-04773-00	WAL05-04773-00	WAL04-04773-00	WAL05-04774-00
18	Base	Cast Iron	----------	----------	----------	----------	----------	----------	----------
19	Diaphragm	Hycar	WAL05-01668-00	WAL05-01668-00	WAL05-01669-00	WAL05-01671-00	WAL05-01671-00	WAL05-01672-00	WAL05-01673-00
20	Hood	Cast Iron	WAL04-02571-00	WAL04-02571-00	WAL04-02605-00	WAL04-02606-00	WAL04-02607-00	WAL04-02608-00	WAL04-02648-00
21	Diaphragm Nut	Steel	WAL05-02872-00	WAL05-02872-00	WAL05-02874-00	WAL05-02874-00	WAL05-02874-00	WAL05-02874-00	WAL05-02874-00
22	Stem Washer	Stainless Steel	WAL04-06130-00	WAL04-06131-00	WAL04-10048-00	WAL04-06132-00	WAL04-12291-00	WAL04-06248-00	WAL05-06249-00
23	Retainer Ring	Stainless Steel	WAL05-09382-00	WAL05-09383-00	WAL05-09383-00	WAL05-09384-00	WAL05-09392-00	WAL05-09385-00	WAL05-09386-00
24	Top Flange	Cast Iron	WAL04-02246-00	WAL04-02248-00	WAL04-02250-00	WAL04-02252-00	WAL04-02233-00	WAL04-02259-00	WAL04-02261-00

Table 4. *Type E2, NPS 4 to 10 / DN 100 to 250 Parts List*

ITEM NUMBER	PART NAME	MATERIAL	VALVE SIZE, NPS / DN				
			4 / 100	5 / 125	6 / 150	8 / 200	10 / 250
1	Blind Flange Stud	Steel	WAL04-05443-00	WAL04-10119-00	WAL04-10120-00	WAL04-10120-00	WAL04-10120-00
2	Blind Flange Nut	Steel	WAL05-2856-00	WAL05-02860-00	WAL05-02860-00	WAL05-02860-00	WAL05-02860-00
3	Blind Flange	Cast Iron	WAL04-02157-00	WAL04-2158-00	WAL04-02162-00	WAL04-02165-00	WAL04-02167-00
4	Gasket	Non-Asbestos	WAL05-02369-01	WAL05-02371-01	WAL05-02397-01	WAL05-02374-01	WAL05-02375-01
5	Stem Nut	Steel	WAL05-02973-00	WAL05-02947-00	WAL04-02975-00	WAL04-02976-00	WAL04-02977-00
6	Disk Guide Plate	Cast Iron	WAL04-03496-00	WAL04-03504-00	WAL04-03473-00	WAL04-03474-00	WAL04-03497-00
7	Guide Plug	Stainless Steel	WAL04-03756-00	WAL04-03757-00	WAL04-03742-00	WAL04-03743-00	WAL04-03744-00
8	Integral Disk	Stainless Steel	WAL04-01922-00	WAL04-01931-00	WAL04-01940-00	WAL04-01994-00	WAL04-01951-00
9	Seat Ring	Stainless Steel	WAL04-11759-00	WAL04-11666-00	WAL04-15802-00	WAL07-43794-00	WAL04-15803-00
10	Pipe Plug 1/4"	Steel	WAL04-03772-00	WAL04-03772-00	WAL04-03772-00	WAL04-03772-00	WAL04-03772-00
11	125 Body	Cast Iron	----------	----------	----------	----------	----------
12	Pipe Plug 1/8"	Steel	WAL0403769-00	WAL04-03769-00	WAL04-03769-00	WAL04-03769-00	WAL04-03769-00
13	Stem	Stainless Steel	WAL04-05266-02	WAL04-05268-02	WAL04-05269-02	WAL04-05273-02	WAL04-05272-01
14	Main Spring	Steel	WAL05-05099-01	WAL05-05100-01	WAL05-05101-01	WAL05-05102-01	WAL05-05103-01
15	Groove Pin	Steel	WAL05-03256-00	WAL05-03257-00	WAL05-03259-00	WAL05-03260-00	WAL05-03262-00
16	Pressure Plate	Cast Iron	WAL04-03627-00	WAL04-03628-00	WAL04-03629-00	WAL04-03630-00	WAL04-03631-00
17	Diaphragm Bolt	Steel	WAL05-04774-00	WAL05-04775-00	WAL05-04780-00	WAL05-04780-00	WAL05-04782-00
18	Base	Cast Iron	----------	----------	----------	----------	----------
19	Diaphragm	Hycar	WAL05-01674-00	WAL05-01675-00	WAL05-01676-00	WAL05-01677-00	WAL04-01678-00
20	Hood	Cast Iron	WAL04-02609-00	WAL04-02618-00	WAL04-02610-00	WAL04-02611-00	WAL04-02612-00
21	Diaphragm Nut	Steel	WAL05-02874-00	WAL05-02874-00	WAL05-02877-00	WAL05-02877-00	WAL05-02877-00
22	Stem Washer	Stainless Steel	WAL04-06249-00	WAL04-06270-00	WAL04-06250-00	WAL04-06251-00	WAL04-06271-00
23	Retainer Ring	Stainless Steel	WAL05-09386-00	WAL05-09387-00	WAL05-09388-00	WAL05-09389-00	WAL05-09390-00
24	Top Flange	Cast Iron	WAL04-02261-00	WAL04-02263-00	WAL04-02268-00	WAL04-02266-00	----------

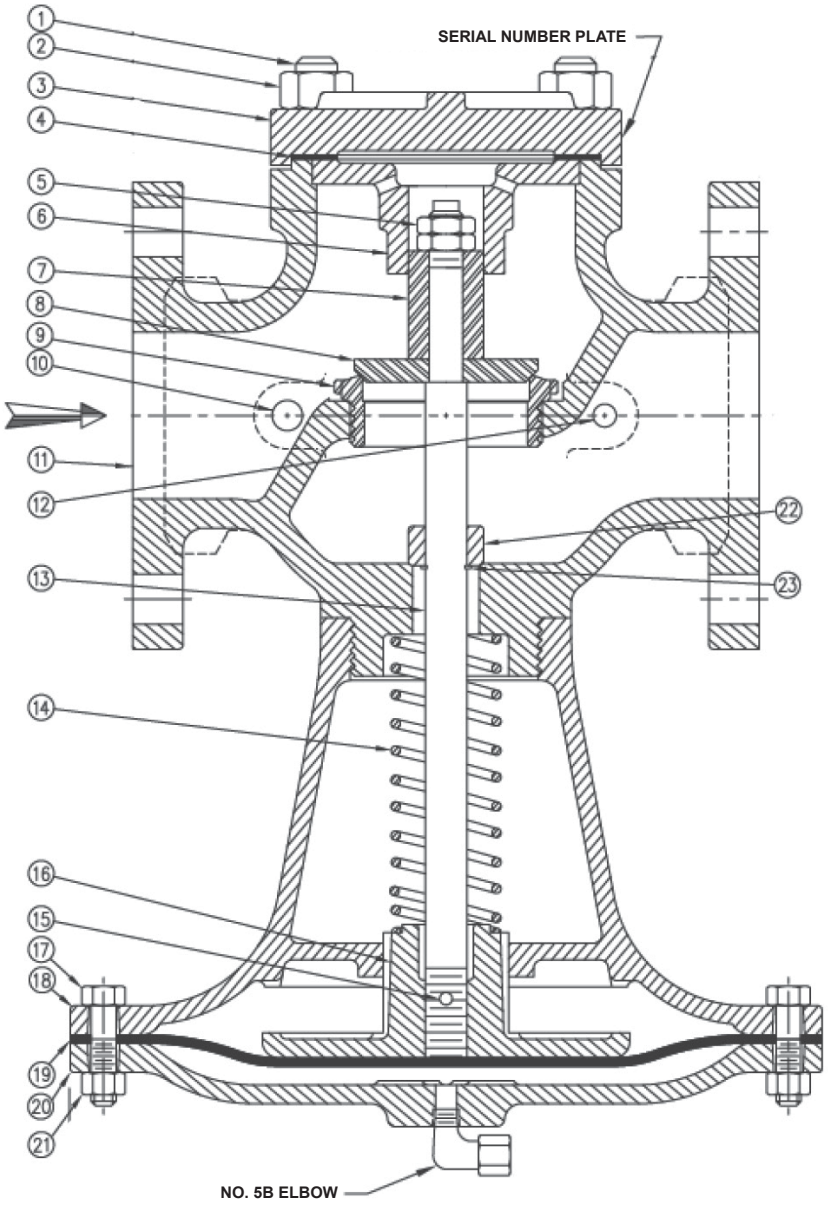

Figure 4. *Type E2 Assembly Drawing*

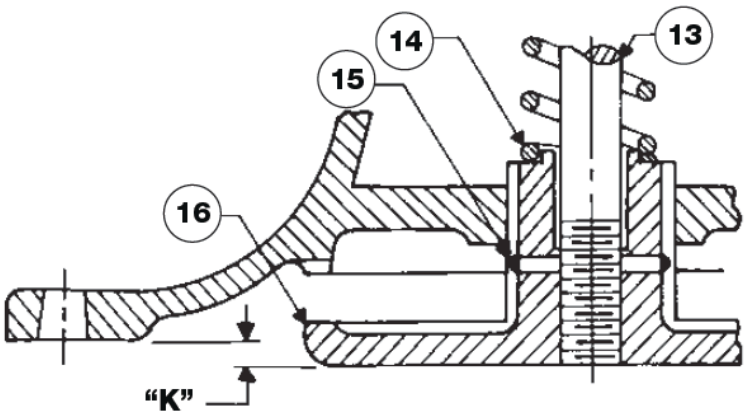

Figure 4. *Type E2 Assembly Drawing (continued)*

Table 5. *Type E2 Main Valve K Values*

VALVE SIZE		TYPE E2	
NPS	DN	Hood (K)	TOTAL
3/4	20	1/8	1/4
1	25	3/16	5/16
1-1/4	32	7/32	3/8
1-1/2	40	1/4	7/16
2	50	9/32	9/16
2-1/2	65	11/32	11/16
3	80	13/32	13/16
4	100	15/32	15/16
5	125	17/32	1-1/16
6	150	19/32	1-3/16
8	200	25/32	1-9/16
10	250	31/32	1-15/16

Type E2

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SD3002B

SPENCE™

Spence Type E5 Main Valve

⚠ WARNING

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

Type E5 main valve must be installed, operated and maintained in accordance with federal, state and local codes, rules and regulations and Emerson instructions.

If the valve 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 Type E5 main valve.

Figure 1. *Type E5 Main Valve*

Introduction

Scope of the Manual

This manual provides instructions for the installation, troubleshooting, maintenance, valve setting and parts ordering for Type E5 main valve regulator.

Product Description

The Spence Type E5 Main Valve is pilot-operated, single seated, normally closed design. The valve functions quickly and shuts tight on dead end service. The diaphragm is a balanced Hycar material designed for high lift but low differential pressure.

An external condensation chamber is included in the product. There are no springs in the steam flow path and no stuffing box.

Specifications

This section lists the specifications for the Type E5 main valve. Factory specifications are stamped on the nameplate fastened on the regulator at the factory.

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

End Connection Styles
NPT, CL125, CL150, CL250 and CL300

Pressure Rating(1)
See Table 1

MInimum Differential Pressure(1)
5 psi / 0.34 bar

Temperature Rating(1)
See Table 1

Rated Flow Coefficient
See Table 2

Material of Constructions
Body: Cast Iron or Cast Steel
Stem, Disk and Seat: Stainless steel
Gasket: Graphite
Diaphragm: Nitrile (NBR)
Spring: Steel

Approximate Weight
See Table 3

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

Table 1. *Type E5 Main Valve Pressure and Temperature Rating*

MAIN VALVE MATERIAL	END CONNECTION	PRESSURE RATING		TEMPERATURE RATING	
		psig	bar	°F	°C
Cast Iron	250 NPT	250	17.2	450	232
	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

Table 2. *Type E5 Main Valve Rated Flow Coefficients*

SEAT FACTOR	REGULATOR SIZE, NPS / DN												
	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	7.6	11.7	18.9	27.4	43	67	95	159	258	350	665	1018	1611
Normal	5.7	10.0	13.4	19.8	25	35	59	120	176	228	366	525	952

Table 3. *Type E5 Main Valve Approximate Weight*

VALVE SIZE		CAST IRON						CAST STEEL			
		NPT		CL125		CL250		CL150		CL300	
NPS	DN	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg
3/4	20	23	10	----	----	----	----	----	----	----	----
1	25	24	11	30	14	33	15	35	16	39	18
1-1/4	32	49	22	46	21	49	22	58	26	63	29
1-1/2	40	53	24	58	26	68	31	67	30	74	34
2	50	84	38	90	41	97	44	113	51	120	55
2-1/2	65	----	----	97	44	112	51	130	59	135	61
3	80	----	----	148	67	170	77	210	95	226	103
4	100	----	----	208	95	293	133	307	139	330	150
5	125	----	----	240	109	333	151	335	152	366	166
6	150	----	----	348	158	616	280	560	254	503	274
8	200	----	----	650	295	814	370	795	361	862	392
10	250	----	----	910	414	1130	513	1345	611	1420	645
12	300	----	----	1580	718	1920	872	1990	904	2160	982

Principle of Operation

Regulator

The regulator is operated by initial steam or fluid pressure. It is normally closed, being held so by initial pressure on the disk and by an internal main spring, see Figure 3. When the pilot is opened (see pilot instructions), initial pressure flows through the pilot to the 8B tee. 4A bleed port restricts the flow and pressure builds under the diaphragm and opens the main valve.

Delivery pressure feeds back through the control pipe to the pilot diaphragm. As this pressure approaches a balance with the thrust of the adjusting spring, the pilot throttles the loading pressure. In turn, the main valve takes a position established by the loading pressure where just enough steam flows to maintain the set delivery pressure.

Condensate Chamber

Main valves with large internal volumes or valves used in relatively high pressure or superheat, may require more water than can be condensed from radiation alone. Live steam will rapidly degrade the rubber diaphragm of a Type E5 and generally yield poor control in other main valves. To prevent this from happening, the condensation chamber and the base are primed with water before start-up. As the pilot opens, medium pressure steam flows to the condensation chamber condensing the vapor in the presence of the prime and larger radiational area. The condensate exits the chamber through a No. 5B open elbow directed to the No. 5A restriction elbow in the hood. This condensate collecting under the diaphragm creates a loading pressure which forces the valve open.

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.

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.

All pressure equipment should be installed in a non-seismic area; should not be exposed to fire; and should be protected from thunderbolt (lightning) strikes.

Planning

- Locate the valve in a straight run of horizontal pipe.
- Allow headroom above the valve for access through the blind flange.
- Provide clearance for stem withdrawal underneath.
- Prevent water hammer and erratic operation by installing traps to provide proper drainage before and after the valve and before secondary pressure relief valve or control valve.
- Avoid damaging effects of scale and dirt in the pipe lines by using a strainer as shown in Figure 2.
- Provide a three-valve by-pass to facilitate inspection without interrupting service.
- To eliminate excessive noise and erratic regulation with steam and other compressible fluids, enlarge the delivery pipe size to effect a reasonable flow velocity at the reduced pressure. A tapered transition is recommended.
- If possible, avoid a sharp turn close to the regulator outlet and a bull-headed tee connection to the low pressure main.
- Install initial and delivery pressure gages to indicate performance.
- If the pressure rating of the delivery system or connected equipment is less than the initial steam pressure, provide a safety valve.

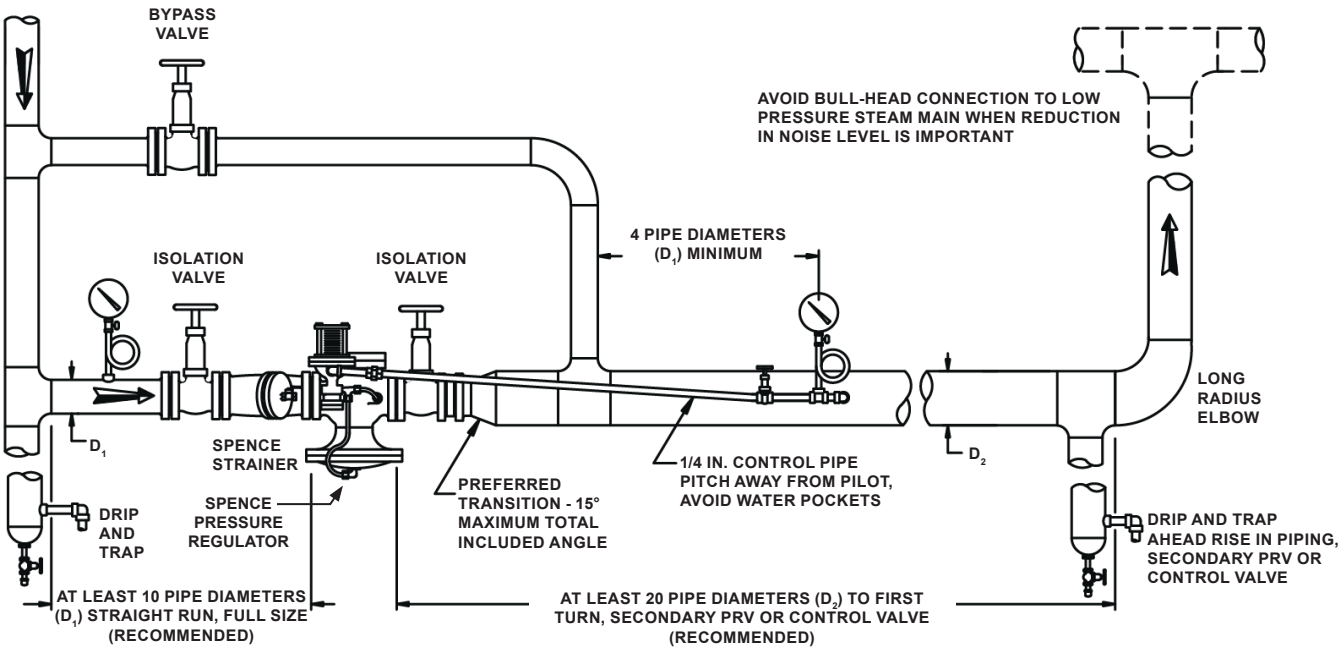

Figure 2. *Type E5 Main Valve Installation*

Main Valve

- Flush the piping system thoroughly to clear it of welding beads, scale, sand, etc.
- Mount the main valve with diaphragm chamber down and arrow on body pointing in the direction of flow. Screwed end valves should be mounted in unions.

Pilot

For Side Mount Construction

1. Mount the pilot on either side of the main valve by means of 1/4 in. nipple and union provided.
2. Make this connection on the 1/4 in. pipe tap at the inlet of the main valve as shown in Figure 2.

For Integral Mount Construction

1. Remove blind flange on pilot and mount on blind flange of main valve using provided bolt.
2. Screw 4A bleed port fitting into the 1/8 in. pipe tap at the outlet of the main valve body. Note bleed orifice in this fitting is vital to operation of regulator.
3. Screw 8B tee into 1/8 in. pipe tap in pilot. Select tap facing downstream.
4. Screw No. 5B elbow into 1/8 in. pipe tap on underside of main valve diaphragm chamber.
5. Connect tubing bends as illustrated in Figure 3.

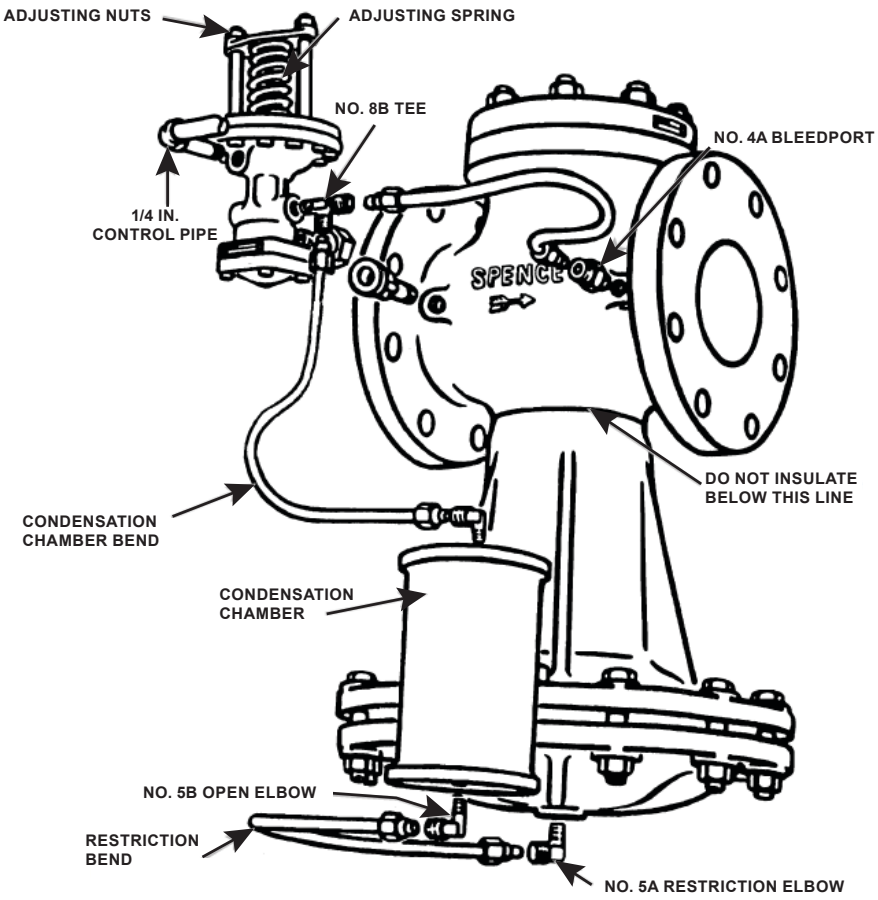

Figure 3. *Regulator Assembly for Type E5 Main Valve with Condensation Chamber*

Control Pipe (Not required with Types T14 and T52)

1. Use 1/4 in. pipe for the line that connects the pilot diaphragm chamber to the desired point of pressure control.
2. Take the control at a point of minimum turbulence. Avoid control immediately at the valve outlet or after a turn.
3. When the delivery pipe expands in size, select a spot at least 4 in. pipe diameters beyond the point of enlargement.
4. Pitch away from pilot to avoid erratic operation and excessive fouling.
5. Eliminate water pockets.
6. Locate delivery pressure gage in control pipe to show pressure actually reaching pilot diaphragm.

Start-up and Setting

CAUTION

Never open a reducing valve without positive indication that the high side is clear of condensate.

1. On pressure reducing valves like Type E5, use by-pass to fill the delivery system and raise pressure to slightly below normal required.
2. Close pilot by releasing compression on adjusting spring. See Figure 3.
3. Open 1/4 in. control pipe valve.
4. Crack outlet stop valve.
5. Crack inlet stop valve.
6. Blow down strainer.
7. Open inlet stop valve and gradually compress adjusting spring until the valve opens and takes control at desired pressure.
8. Alternately choke down on the by-pass and open outlet stop valve until the regulator is on the line. See individual instructions for other pilots.

Valve Setting

Valve setting is gaged at K to establish correct stem length and diaphragm position. Dimension K is supplied with each replacement stem. See Table 4 for K values.

1. To install new stem (key 13), fasten disk (key 8) firmly on stem with stem nut.
2. Insert stem and disk assembly in valve and screw on pressure plate (key 16). Omit spring (key 14) for this operation.
3. Hold disk on seat and adjust position of pressure plate until valve setting K is reached.
4. Push pressure plate against stops in base (key 18).
5. Remove disc, drop out pressure plate and stem, drill and insert dowel pin (key 15) to lock the joint.
6. Grind off stem projection flush with face of pressure plate.

Troubleshooting

Failure to Open

If the main valve failed to open check the following possible causes to properly correct the problem.

- Adjusting spring on pilot may have been tampered with.
- Initial pressure may be down due to partially closed supply valve, clogged strainer or other obstruction.
- No. 4A bleed port fitting may have been omitted and an open coupling substituted.
- Control pipe may be plugged. Most likely points of obstruction are at shutoff valve and entrance to delivery main.
- Main diaphragm may be broken. Test with air or water before dismantling.

Failure to Close

If the main valve failed to close check the following possible causes to properly correct the problem.

- Adjusting spring on pilot may have been tampered with.
- Orifice in bleed port No. 4A may be plugged.
- By-pass valve may be leaking.
- On pressure regulators like Type E5, the main valve or pilot may be held open by foreign matter in seat.

To determine which valve leaks, follow these steps. Close stop valve and 1/4 in. control pipe valve.

1. Remove bleed port bend so pilot will exhaust to atmosphere.
2. Crack inlet stop valve. Steam will issue from 8B tee.
3. Release compression on adjusting spring to see if pilot closes tight.
4. Open and close several times to wash seat. Steam blowing back from bleed port means main valve disk is held open by foreign matter. Steam may wash the obstruction from the seat if the valve is made to open wide. This can be accomplished, even at light loads, if the control point is beyond the outlet stop valve.
5. Reassemble bleed port bend and place regulator in operation.
6. Slowly open and close outlet stop valve.

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.

Inspection

Under normal conditions, complete dismantling is not recommended.

Check the following after operation. Then, schedule an inspection as required.

1. Inspect for dirt collected at 4A bleed port.
2. Inspect all joints for leakage. Keep bolts tight to avoid any leaks

Main Valve Maintenance (See Figure 5)

1. Connect a source of air or water pressure which can be adjusted by hand to the No. 5B elbow.
2. Apply 30 psi / 2.07 bar to jack valve open and prevent stem from turning while removing stem nuts.
3. Use penetrating oil on the threads.

Seat Ring Maintenance

Note

These joints should be made up with high temperature gasket compound.

1. Remove old compound from body and seat ring with a wire brush.
2. Apply new compound sparingly to both parts, threads and shoulders. Let stand until tacky before assembling.

Grinding In

CAUTION

Seats and discs should never require more than the lightest touch up with very fine (400 grit) grinding compound. Heavy grinding will produce galling, wider seating surface and a groove in the disc, all of which tend to cause leakage.

3. Reface a damaged surface before attempting to grind it in.
4. Grind sparingly.
5. Main stem (key 13, Figure 4) is slotted for rotation with a screwdriver, valve spring (key 14) is omitted from the assembly during grinding.
6. Slip the stem into its normal position.
7. Apply compound to the disc. Place it on the stem and guide plug, tighten with stem nut.
8. After grinding, disassemble and clean all parts.

Parts Ordering

When corresponding with your local Sales Office about Type E5 Main Valve, always reference the assembly number. When ordering replacement parts, specify the complete character part number from the following parts list.

Parts List

Type E5 (NPS 3/4 to 2 / DN 20 to 50)

Key	Description	Part Number
1	Stud (4 required)	
	Cast iron	
	NPS 3/4 / DN 20	WAL05-05518-00
	NPS 1 / DN 25	WAL04-10118-00
	NPS 1-1/4 / DN 32	WAL05-05507-00
	NPS 1-1/2 / DN 40	WAL04-05443-00
	NPS 2 / DN 50	WAL04-10119-00
	Steel	
	NPS 3/4 / DN 20	WAL05-05518-00
	NPS 1 / DN 25	WAL05-05506-00
	NPS 1-1/4 / DN 32	WAL05-05507-00
	NPS 1-1/2 / DN 40	WAL05-05509-00
	NPS 2 / DN 50	WAL05-05510-00

Type E5
(NPS 3/4 to 2 / DN 20 to 50) (continued)

Key	Description	Part Number
2	Hex Nut (4 required)	
	Cast iron	
	NPS 3/4 / DN 20	WAL05-02847-00
	NPS 1 / DN 25	WAL05-02851-00
	NPS 1-1/4 / DN 32	WAL05-02854-00
	NPS 1-1/2 / DN 40	WAL05-02856-00
	NPS 2 / DN 50	WAL05-02860-00
	Steel	
	NPS 3/4 / DN 20	WAL05-02848-00
	NPS 1 / DN 25	WAL05-02852-00
	NPS 1-1/4 / DN 32	WAL05-02855-00
	NPS 1-1/2 / DN 40	WAL05-02857-00
	NPS 2 / DN 50	WAL05-02861-00
3	Blind Flange	
	Cast iron	
	NPS 3/4 / DN 20	WAL04-02171-01
	NPS 1 / DN 25	WAL04-02173-00
	NPS 1-1/4 / DN 32	WAL04-02176-00
	NPS 1-1/2 / DN 40	WAL04-02178-00
	NPS 2 / DN 50	WAL04-02180-00
	Steel	
	NPS 3/4 / DN 20	WAL04-02190-00
	NPS 1 / DN 25	WAL04-02192-00
	NPS 1-1/4 / DN 32	WAL04-02194-00
	NPS 1-1/2 / DN 40	WAL04-02196-00
	NPS 2 / DN 50	WAL04-02198-00
4	Gasket, Graphite	
	NPS 3/4 / DN 20	WAL05-02381-01
	NPS 1 / DN 25	WAL05-02362-01
	NPS 1-1/4 / DN 32	WAL05-02382-01
	NPS 1-1/2 / DN 40	WAL05-02365-01
	NPS 2 / DN 50	WAL05-02366-01
5	Stem Nut, Steel (2 required)	
	NPS 3/4 / DN 20	WAL05-02969-00
	NPS 1 and 1-1/4 / DN 25 and 32	WAL05-02874-00
	NPS 1-1/2 and 2 / DN 40 and 50	WAL05-02971-00
6	Muffling Plate, For NPS 2 / DN 50 only	WAL04-03550-01
7	Disk	
	Full	
	Stainless steel	
	NPS 3/4 / DN 20	WAL04-01813-02
	NPS 1 / DN 25	WAL04-01832-02
	NPS 1-1/4 / DN 32	WAL04-01850-02
	NPS 2 / DN 50	WAL04-01888-02
	Stainless steel, 45%/50%	
	NPS 3/4 / DN 20	WAL04-11884-00
	NPS 1-1/2 / DN 40	WAL04-11424-00
	Stainless steel, 70%/75%	
	NPS 1-1/4 / DN 32	WAL04-11189-00
	NPS 1-1/2 / DN 40	WAL04-11916-00
	NPS 2 / DN 50	WAL04-11850-00
	Stellite, For NPS 2 / DN 50 only	WAL04-01889-02
	Soft	
	NPS 3/4 / DN 20	WAL05-01715-00
	NPS 1-1/2 / DN 40	WAL05-01718-00
	NPS 2 / DN 50	WAL05-01719-00
	Normal	
	Stainless steel	
	NPS 3/4 / DN 20	WAL04-01808-00
	NPS 1 / DN 25	WAL04-01823-02
	NPS 1-1/4 / DN 32	WAL04-01844-00
	NPS 1-1/2 / DN 40	WAL04-01862-02
	NPS 2 / DN 50	WAL04-01897-02
	Stellite, For NPS 2 / DN 50 only	WAL04-01898-00

Key	Description	Part Number
8	Seat Ring	
	Full	
	Stainless steel	
	NPS 3/4 / DN 20	WAL04-04075-01
	NPS 1 / DN 25	WAL04-04084-01
	NPS 1-1/4 / DN 32	WAL04-04092-01
	NPS 1-1/2 / DN 40	WAL04-04496-01
	NPS 2 / DN 50	WAL04-11544-00
	Stellite, For NPS 2 / DN 50 only	WAL04-11588-00
	Normal	
	Stainless steel	
	NPS 3/4 / DN 20	WAL04-04069-01
	NPS 1 / DN 25	WAL04-04081-01
	NPS 1-1/4 / DN 32	WAL04-04087-01
	NPS 1-1/2 / DN 40	WAL04-04095-00
	NPS 2 / DN 50	WAL04-11545-00
	Stellite, For NPS 2 / DN 50 only	WAL04-11589-00
9	Pipe Plug, 1/4 NPT	WAL04-03772-00
10	Pipe Plug, 1/8 NPT (2 required)	WAL04-03769-00
11	Stem	
	Side and Integral Mount	
	NPS 3/4 / DN 20	WAL04-05232-01
	NPS 1 / DN 25	WAL04-05242-01
	NPS 1-1/4 / DN 32	WAL04-05246-01
	NPS 1-1/2 / DN 40	WAL04-05383-01
	NPS 2 / DN 50	WAL04-05265-01
	Side Mount Balanced	
	NPS 3/4 / DN 20	
	Internally (406°F / 208°C), Full and Normal	WAL04-05643-00
	Dashpot	WAL04-05232-01
	NPS 1 / DN 25	
	Internally (406°F / 208°C), Full and Normal	WAL04-05644-00
	Externally (406°F / 208°C), Full	WAL04-11888-00
	Dashpot	WAL04-05242-01
	NPS 1-1/4 / DN 32	
	Internally (406°F / 208°C), Full and Normal	WAL04-05645-00
	Internally (550°F / 288°C), Full	WAL04-05645-00
	Externally (406°F / 208°C), Full	WAL04-05246-01
	Externally (550°F / 288°C), Full	WAL04-05246-01
	Dashpot	WAL04-05246-01
	NPS 1-1/2 / DN 40	
	Internally (406°F / 208°C), Full and Normal	WAL04-03132-00
	Externally (406°F / 208°C), Full	WAL04-12288-00
	Dashpot	WAL04-05383-01
	NPS 2 / DN 50	
	Internally (406°F / 208°C), Full	WAL04-05647-00
	Internally (406°F / 208°C), Normal	WAL04-13917-00
	Internally (550°F / 288°C), Full	WAL04-05647-00
	Externally (406°F / 208°C), Full	WAL04-05265-01
	Externally (550°F / 288°C), Full	WAL04-05265-01
	Dashpot	WAL04-05265-01
12	Body	
	Cast iron	
	NPT	
	NPS 3/4 / DN 20	WAL04-00639-00
	NPS 1 / DN 25	WAL04-00640-00
	NPS 1-1/4 / DN 32	WAL04-00643-00
	NPS 1-1/2 / DN 40	WAL04-00646-00
	NPS 2 / DN 50	WAL04-00649-00
	BSPT	
	NPS 3/4 / DN 20	WAL04-15262-00
	NPS 1 / DN 25	WAL04-15209-00
	NPS 1-1/4 / DN 32	WAL04-15263-00
	NPS 1-1/2 / DN 40	WAL04-15264-00
	NPS 2 / DN 50	WAL04-15265-00

Type E5
(NPS 3/4 to 2 / DN 20 to 50) (continued)

Key	Description	Part Number
12	Body (continued)	
	Cast iron (continued)	
	CL125 FF	
	NPS 1 / DN 25	WAL04-00641-00
	NPS 1-1/4 / DN 32	WAL04-00644-00
	NPS 1-1/2 / DN 40	WAL04-00647-00
	NPS 2 / DN 50	WAL04-00650-00
	CL250 RF	
	NPS 1 / DN 25	WAL04-00642-00
	NPS 1-1/4 / DN 32	WAL04-00645-00
	NPS 1-1/2 / DN 40	WAL04-00648-00
	NPS 2 / DN 50	WAL04-00651-00
	Steel	
	NPT	
	NPS 3/4 / DN 20	WAL04-00670-00
	NPS 1 / DN 25	WAL04-00672-00
	NPS 1-1/4 / DN 32	WAL04-00676-00
	NPS 1-1/2 / DN 40	WAL04-00687-00
	NPS 2 / DN 50	WAL04-00691-00
	SWE	
	NPS 3/4 / DN 20	WAL04-01211-00
	NPS 1 / DN 25	WAL04-01212-00
	NPS 1-1/4 / DN 32	WAL04-01213-00
	CL150 RF	
	NPS 1 / DN 25	WAL04-00673-00
	NPS 1-1/4 / DN 32	WAL04-00677-00
	NPS 1-1/2 / DN 40	WAL04-00688-00
	NPS 2 / DN 50	WAL04-00692-00
	CL300 RF	
	NPS 1 / DN 25	WAL04-00674-00
	NPS 1-1/4 / DN 32	WAL04-00678-00
	NPS 1-1/2 / DN 40	WAL04-00689-00
	NPS 2 / DN 50	WAL04-00693-00
13	Spring	
	NPS 3/4 and 1 / DN 20 and 25	WAL05-05072-01
	NPS 1-1/4 and 1-1/2 / DN 32 and 40	WAL05-05071-01
	NPS 2 / DN 50	WAL05-05073-01
14	Pin	
	NPS 3/4 and 1 / DN 20 and 25	WAL05-03245-00
	NPS 1-1/4, 1-1/2 and 2 / DN 32, 40 and 50	WAL05-03248-00
15	Cap Screw	
	1 required	
	NPS 3/4 and 1 / DN 20 and 25	WAL05-04775-00
	NPS 1-1/4, 1-1/2 and 2 / DN 32, 40 and 50	WAL05-04782-00
	11 required	
	NPS 3/4 and 1 / DN 20 and 25	WAL05-04774-00
	NPS 1-1/4, 1-1/2 and 2 / DN 32, 40 and 50	WAL05-04780-00
16	Base	
	Cast iron	
	NPS 3/4 and 1 / DN 20 and 25	WAL04-00546-00
	NPS 1-1/4 and 1-1/2 / DN 32 and 40	WAL04-00518-00
	NPS 2 / DN 50	WAL04-00521-00
	Steel	
	NPS 3/4 and 1 / DN 20 and 25	WAL04-01265-00
	NPS 1-1/4 and 1-1/2 / DN 32 and 40	WAL0A-17986-00
	NPS 2 / DN 50	WAL04-03058-00
17	Pressure Plate	
	NPS 3/4 / DN 20	WAL04-03697-00
	NPS 1 / DN 25	WAL04-03680-00
	NPS 1-1/4 / DN 32	WAL04-03698-00
	NPS 1-1/2 / DN 40	WAL04-03688-00
	NPS 2 / DN 50	WAL04-03673-00

Key	Description	Part Number
18	Hex Nut (12 required)	
	NPS 3/4 and 1 / DN 20 and 25	WAL05-02874-00
	NPS 1-1/4 and 1-1/2 / DN 32 and 40	WAL05-02877-00
19	Hood	
	Cast iron	
	NPS 3/4 and 1 / DN 20 and 25	WAL04-02630-00
	NPS 1-1/4 and 1-1/2 / DN 32 and 40	WAL04-02629-00
	NPS 2 / DN 50	WAL04-02638-00
	Steel	
	NPS 3/4 and 1 / DN 20 and 25	WAL04-02631-00
	NPS 1-1/4 and 1-1/2 / DN 32 and 40	WAL04-17996-00
	NPS 2 / DN 50	WAL04-02639-00
20	Diaphragm, Hycar	
	NPS 3/4 and 1 / DN 20 and 25	WAL05-01600-00
	NPS 1-1/4 and 1-1/2 / DN 32 and 40	WAL05-01601-00
	NPS 2 / DN 50	WAL05-01602-00
21	Disk Holder	
	NPS 3/4 / DN 20	WAL04-02515-00
	NPS 1-1/2 / DN 40	WAL04-02522-00
	NPS 2 / DN 50	WAL04-02525-00
22	Disk Washer	
	NPS 3/4 / DN 20	WAL04-06092-01
	NPS 1-1/2 / DN 40	WAL04-06099-01
	NPS 2 / DN 50	WAL04-06102-01
23	Internal Flange	
	Cast iron	
	NPS 3/4 / DN 20	WAL04-17583-00
	NPS 1 / DN 25	WAL04-17584-00
	NPS 1-1/4 / DN 32	WAL04-17585-00
	NPS 1-1/2 / DN 40	WAL04-17586-00
	NPS 2 / DN 50	WAL04-17587-00
	Steel	
	NPS 3/4 / DN 20	WAL0A-17999-00
	NPS 1 / DN 25	WAL0A-18000-00
	NPS 1-1/4 / DN 32	WAL0A-18001-00
	NPS 1-1/2 / DN 40	WAL0A-18002-00
	NPS 2 / DN 50	WAL0A-17997-00
24	Top Adapter	WAL04-17577-00
26	Piston, Side Mount Balanced	
	NPS 3/4 / DN 20	
	Internally (406°F / 208°C), Full	WAL04-03336-00
	Internally (406°F / 208°C), Normal	WAL04-11007-00
	Dashpot	WAL04-03372-00
	NPS 1 / DN 25	
	Internally (406°F / 208°C), Full	WAL04-03337-00
	Internally (406°F / 208°C), Normal	WAL04-10775-00
	Externally (406°F / 208°C), Full	WAL04-03337-00
	Externally (406°F / 208°C), Normal	WAL04-10775-00
	Dashpot	WAL04-03373-00
	NPS 1-1/4 / DN 32	
	Internally (406°F / 208°C), Full	WAL04-03338-00
	Internally (406°F / 208°C), Normal	WAL04-10778-00
	Internally (550°F / 288°C), Full	WAL04-03338-00
	Externally (406°F / 208°C), Full	WAL04-03338-00
	Externally (406°F / 208°C), Normal	WAL04-10778-00
	Externally (550°F / 288°C), Full	WAL04-03338-00
	Dashpot	WAL04-13931-00
	NPS 1-1/2 / DN 40	
	Internally (406°F / 208°C), Full	WAL04-03339-00
	Internally (406°F / 208°C), Normal	WAL04-10711-00
	Externally (406°F / 208°C), Full	WAL04-03339-00
	Externally (406°F / 208°C), Normal	WAL04-10711-00
	Dashpot	WAL04-03329-00
	NPS 2 / DN 50	
	Internally (406°F / 208°C), Full	WAL04-03340-00
	Internally (406°F / 208°C), Normal	WAL04-11306-00
	Internally (550°F / 288°C), Full	WAL04-03340-00
	Externally (406°F / 208°C), Full	WAL04-03340-00
	Externally (406°F / 208°C), Normal	WAL04-11306-00
	Externally (550°F / 288°C), Full	WAL04-03340-00
	Dashpot	WAL04-03331-00

Type E5 (NPS 3/4 to 2 / DN 20 to 50) (continued)

Key	Description	Part Number
27	Cylinder, Side Mount Balanced	
	NPS 3/4 / DN 20	
	Internally (406°F / 208°C), Full	WAL04-01569-01
	Internally (406°F / 208°C), Normal	WAL04-11006-00
	Dashpot	WAL04-01549-00
	NPS 1 / DN 25	
	Internally (406°F / 208°C), Full	WAL04-01570-01
	Internally (406°F / 208°C), Normal	WAL04-10774-00
	Externally (406°F / 208°C), Full	WAL04-01570-01
	Externally (406°F / 208°C), Normal	WAL04-10774-00
	Dashpot	WAL04-01550-00
	NPS 1-1/4 / DN 32	
	Internally (406°F / 208°C), Full	WAL04-01571-01
	Internally (406°F / 208°C), Normal	WAL04-10776-00
	Internally (550°F / 288°C), Full	WAL04-18240-00
	Externally (406°F / 208°C), Full	WAL04-01571-01
	Externally (406°F / 208°C), Normal	WAL04-10776-00
	Externally (550°F / 288°C), Full	WAL04-18240-00
	Dashpot	WAL04-01551-00
	NPS 1-1/2 / DN 40	
	Internally (406°F / 208°C), Full	WAL04-01572-01
	Internally (406°F / 208°C), Normal	WAL04-10710-00
	Externally (406°F / 208°C), Full	WAL04-01572-01
	Externally (406°F / 208°C), Normal	WAL04-10710-00
	Dashpot	WAL04-01552-00
	NPS 2 / DN 50	
	Internally (406°F / 208°C), Full	WAL04-01573-01
	Internally (406°F / 208°C), Normal	WAL04-11305-00
	Internally (550°F / 288°C), Full	WAL04-18242-00
	Externally (406°F / 208°C), Full	WAL04-01573-01
	Externally (406°F / 208°C), Normal	WAL04-11305-00
	Externally (550°F / 288°C), Full	WAL04-18242-00
	Dashpot	WAL04-01553-00
30	Piston O-ring, Side Mount Balanced	
	NPS 3/4 / DN 20	
	Internally (406°F / 208°C), Full	WAL05-04020-00
	Internally (406°F / 208°C), Normal	WAL05-04011-00
	Dashpot	WAL05-04491-00
	NPS 1 / DN 25	
	Internally (406°F / 208°C), Full	WAL05-04027-00
	Internally (406°F / 208°C), Normal	WAL05-07967-00
	Externally (406°F / 208°C), Full	WAL05-04027-00
	Externally (406°F / 208°C), Normal	WAL05-07967-00
	Dashpot	WAL05-04492-00
	NPS 1-1/4 / DN 32	
	Internally (406°F / 208°C), Full	WAL05-16514-00
	Internally (406°F / 208°C), Normal	WAL04-10776-00
	Internally (550°F / 288°C), Full	WAL05-16514-00
	Externally (406°F / 208°C), Full	WAL05-16514-00
	Externally (406°F / 208°C), Normal	WAL04-10776-00
	Externally (550°F / 288°C), Full	WAL05-16514-00
	Dashpot	WAL05-04493-00
	NPS 1-1/2 / DN 40	
	Internally (406°F / 208°C), Full	WAL05-04036-00
	Internally (406°F / 208°C), Normal	WAL05-04028-00
	Externally (406°F / 208°C), Full	WAL05-04036-00
	Externally (406°F / 208°C), Normal	WAL05-04028-00
	Dashpot	WAL05-04494-00
	NPS 2 / DN 50	
	Internally (406°F / 208°C), Full	WAL05-04041-00
	Internally (406°F / 208°C), Normal	WAL05-04030-00
	Internally (550°F / 288°C), Full	WAL05-16509-00
	Externally (406°F / 208°C), Full	WAL05-04041-00
	Externally (406°F / 208°C), Normal	WAL05-04030-00
	Externally (550°F / 288°C), Full	WAL05-16509-00
	Dashpot	WAL05-04501-00

Type E5 (NPS 3/4 to 2 / DN 20 to 50) (continued)

Key	Description	Part Number
33	Locknut	
	NPS 3/4 / DN 20	WAL05-03015-00
	NPS 1 and 1-1/4 / DN 25 and 32	WAL05-03016-00
	NPS 1-1/2 and 2 / DN 40 and 50	WAL05-03017-00
36	Gasket, Adapter, Cast iron	WAL05-02378-01
37	Gasket, Adapter, Steel	WAL05-11718-00
38	Hex Nut, Adapter (8 required)	
	Cast iron	WAL05-14888-00
	Steel	WAL05-02847-00
39	Stud, Adapter, Cast iron (4 required)	WAL05-05490-00
40	Stud, Adapter, Steel (4 required)	WAL05-05518-00
43	Retaining Ring	WAL05-17581-00

Type E5 (NPS 2-1/2 to 12 / DN 65 to 300)

Key	Description	Part Number
1	Stud	
	Cast iron	
	CL125 FF	
	NPS 2-1/2 / DN 65	WAL04-10119-00
	NPS 3 / DN 80	WAL04-05443-00
	NPS 4 / DN 100	WAL04-10119-00
	NPS 5, 6 and 8 / DN 125, 150 and 200	WAL04-10120-00
	NPS 12 / DN 300	WAL05-05450-00
	CL250 RF	
	NPS 2-1/2 / DN 65	WAL04-05448-00
	NPS 3 / DN 80	WAL04-10119-00
	NPS 4 and 5 / DN 100 and 125	WAL04-05448-00
	NPS 6 / DN 150	WAL04-05449-00
	NPS 8 / DN 200	WAL04-05455-00
	NPS 10 and 12 / DN 250 and 300	WAL05-05450-00
	Steel, CL150 and 300 RF	
	NPS 2-1/2 / DN 65	WAL05-18820-00
	NPS 3 and 4 / DN 80 and 100	WAL05-05509-00
	NPS 6 and 8 / DN 150 and 200	WAL05-05519-00
2	Hex Nut	
	Cast iron	
	CL125 FF	
	NPS 2-1/2 / DN 65	WAL05-02860-00
	NPS 3 / DN 80	WAL05-02856-00
	NPS 4, 5, 6 and 8 / DN 100, 125, 150 and 200	WAL05-02860-00
	NPS 12 / DN 300	WAL05-02864-00
	CL250 RF	
	NPS 2-1/2 / DN 65	WAL05-02862-00
	NPS 3 / DN 80	WAL05-02856-00
	NPS 4, 5, 6 and 8 / DN 100, 125, 150 and 200	WAL05-02862-00
	NPS 10 and 12 / DN 250 and 300	WAL05-02864-00
	Steel, CL150 and 300 RF	
	NPS 2-1/2 / DN 65	WAL05-02861-00
	NPS 3 / DN 80	WAL05-02856-00
	NPS 4 / DN 100	WAL05-02857-00
	NPS 6 and 8 / DN 150 and 200	WAL05-02861-00
3	Blind Flange	
	Cast iron	
	CL125 FF	
	NPS 2-1/2 / DN 65	WAL04-02185-00
	NPS 3 / DN 80	WAL04-02157-00
	NPS 4 / DN 100	WAL04-02158-00
	NPS 5 / DN 125	WAL04-02160-00
	NPS 6 / DN 150	WAL04-02165-00
	NPS 8 / DN 200	WAL04-02167-00
	NPS 12 / DN 300	WAL04-02168-00
	CL150 RF	
	NPS 2-1/2 / DN 65	WAL04-02183-00
	NPS 3 / DN 80	WAL04-02186-00

Type E5
(NPS 2-1/2 to 12 / DN 65 to 300) (continued)

Key	Description	Part Number
3	Blind Flange (continued)	
	Cast iron, CL150 RF (continued)	
	NPS 4 / DN 100	WAL04-02159-00
	NPS 5 / DN 125	WAL04-02161-00
	NPS 6 / DN 150	WAL04-02163-00
	NPS 8 / DN 200	WAL04-02166-00
	NPS 10 / DN 250	WAL04-02164-01
	NPS 12 / DN 300	WAL04-02168-00
	Steel, CL150 and 300 RF	
	NPS 2-1/2 / DN 65	WAL04-02184-00
	NPS 3 / DN 80	WAL04-02201-00
	NPS 4 / DN 100	WAL04-02204-00
	NPS 6 / DN 150	WAL04-02209-00
	NPS 8 / DN 200	WAL04-02211-00
4	Gasket, Graphite	
	NPS 2-1/2 / DN 65	WAL05-02367-01
	NPS 3 / DN 80	WAL05-02369-01
	NPS 4 / DN 100	WAL05-02371-01
	NPS 5 / DN 125	WAL05-02372-01
	NPS 6 / DN 150	WAL05-02374-01
	NPS 8 / DN 200	WAL05-02375-01
	NPS 10 / DN 250	WAL05-02376-01
	NPS 12 / DN 300	WAL04-02377-01
5	Stem Nut, Steel (2 required)	
	NPS 2-1/2 / DN 65	WAL05-02972-00
	NPS 3 / DN 80	WAL05-02973-00
	NPS 4 / DN 100	WAL05-02974-00
	NPS 5 / DN 125	WAL04-02975-00
	NPS 6 / DN 150	WAL04-02976-00
	NPS 8 and 10 / DN 200 and 250	WAL04-02977-00
	NPS 12 / DN 300	WAL04-02978-00
6	Muffling Plate	
	Side Mount, Full	
	NPS 2-1/2 / DN 65	WAL04-03515-00
	NPS 3 / DN 80	WAL04-03516-00
	NPS 4 / DN 100	WAL04-03518-00
	NPS 5 / DN 125	WAL04-03519-00
	NPS 6 / DN 150	WAL04-03520-00
	NPS 8 / DN 200	WAL04-03524-00
	NPS 10 / DN 250	WAL04-03538-00
	NPS 12 / DN 300	WAL04-03539-00
	Side Mount, Normal	
	NPS 2-1/2 / DN 65	WAL04-03515-00
	NPS 3 / DN 80	WAL04-03530-00
	NPS 4 / DN 100	WAL04-03532-00
	NPS 5 / DN 125	WAL04-03529-00
	NPS 6 / DN 150	WAL04-03522-00
	NPS 8 / DN 200	WAL04-03526-00
	NPS 10 / DN 250	WAL04-03545-00
	NPS 12 / DN 300	WAL04-03546-00
	Internally Balance, Full, For NPS 12 / DN 300 only	WAL04-14846-00
7	Disk	
	Full	
	Stainless steel	
	NPS 2-1/2 / DN 65	WAL04-01906-01
	NPS 3 / DN 80	WAL04-01918-00
	NPS 4 / DN 100	WAL04-01931-00
	NPS 5 / DN 125	WAL04-01938-00
	NPS 6 / DN 150	WAL04-01995-00
	NPS 8 / DN 200	WAL04-01691-00
	NPS 10 / DN 250	WAL04-01953-00
	NPS 12 / DN 300	WAL04-01957-00
	Stainless steel, 45%/50%, For NPS 12 / DN 300 only	WAL04-14839-00
	Stainless steel, 70%/75%	
	NPS 5 / DN 125	WAL04-11582-00
	NPS 8 / DN 200	WAL04-11926-00
	Soft	
	NPS 4 / DN 100	WAL05-01724-00
	NPS 5 / DN 125	WAL05-01726-00
	NPS 8 / DN 200	WAL05-01729-00
	Normal	
	Stainless steel	
	NPS 2-1/2 / DN 65	WAL04-07072-00
	NPS 3 / DN 80	WAL04-07473-00
	NPS 4 / DN 100	WAL04-07121-00
	NPS 5 / DN 125	WAL04-08245-00
	NPS 6 / DN 150	WAL04-08247-00
	NPS 8 / DN 200	WAL04-02333-00
	Soft, 70%/75%, For NPS 6 / DN 150 only	WAL04-09695-00
8	Seat Ring	
	Full	
	Stainless steel	
	NPS 2-1/2 / DN 65	WAL04-11539-00
	NPS 3 / DN 80	WAL04-11484-00
	NPS 4 / DN 100	WAL04-11565-00
	NPS 5 / DN 125	WAL04-11700-01
	NPS 6 / DN 150	WAL04-15142-00
	NPS 8 / DN 200	WAL04-15144-00
	NPS 10 / DN 250	WAL04-15146-00
	NPS 12 / DN 300	WAL04-15153-00
	Stainless steel, 45%/50%, For NPS 12 / DN 300 only	WAL04-14845-00
	Stainless steel, 70%/75%	
	NPS 5 / DN 125	WAL04-11700-01
	NPS 8 / DN 200	WAL04-15144-00
	Soft	
	NPS 4 / DN 100	WAL04-11565-00
	NPS 5 / DN 125	WAL04-11700-01
	NPS 8 / DN 200	WAL04-15144-00
	Normal	
	Stainless steel	
	NPS 2-1/2 / DN 65	WAL04-11541-00
	NPS 3 / DN 80	WAL04-11537-00
	NPS 4 / DN 100	WAL04-11567-00
	NPS 5 / DN 125	WAL04-11702-01
	NPS 6 / DN 150	WAL04-15141-00
	NPS 8 / DN 200	WAL04-15143-00
	Soft, 70%/75%, For NPS 6 / DN 150 only	WAL04-15141-00
9	Pipe Plug, 1/4 NPT (2 required)	WAL04-03772-00
10	Pipe Plug, 1/8 NPT	WAL04-03769-00
11	Stem	
	Side Mount Balanced	
	NPS 2-1/2 / DN 65	WAL04-05391-01
	NPS 3 / DN 80	WAL04-05382-01
	NPS 4 / DN 100	
	CL125 FF	WAL04-05281-00
	CL150, 250 and 300 RF	WAL04-05384-01
	NPS 5 / DN 125	
	CL125 FF	WAL04-05287-01
	CL250 RF	WAL04-05386-01
	NPS 6 / DN 150	
	CL125 FF	WAL04-05374-00
	CL150, 250 and 300 RF	WAL04-05385-01
	NPS 8 / DN 200	
	CL125 FF	WAL04-05290-00
	CL150, 250 and 300 RF	WAL04-05388-01
	NPS 10 / DN 250, CL250 RF	WAL04-05295-00
	NPS 12 / DN 300	
	CL250 RF	WAL04-05295-00
	CL300 RF	WAL04-05398-00
	Dashpot, CL250 RF, Full For NPS 5 / DN 125 only	WAL04-05386-01
	Internally Balanced (406°F / 208°C maximum)	
	NPS 8 / DN 200, CL125 FF	WAL04-07564-00
	NPS 12 / DN 300, CL300 RF	WAL04-14838-00

Type E5
(NPS 2-1/2 to 12 / DN 65 to 300) (continued)

Key	Description	Part Number
12	Body	
	Cast iron	
	CL125 FF	
	NPS 2-1/2 / DN 65	WAL04-00653-00
	NPS 3 / DN 80	WAL04-00655-00
	NPS 4 / DN 100	WAL04-00659-01
	NPS 5 / DN 125	WAL04-00661-01
	NPS 6 / DN 150	WAL04-00662-00
	NPS 8 / DN 200	WAL04-00665-00
	NPS 12 / DN 300	WAL04-06618-00
	CL250 RF	
	NPS 2-1/2 / DN 65	WAL04-00652-00
	NPS 3 / DN 80	WAL04-00654-00
	NPS 4 / DN 100	WAL04-00658-01
	NPS 5 / DN 125	WAL04-00660-01
	NPS 6 / DN 150	WAL04-00663-00
	NPS 8 / DN 200	WAL04-00664-00
	NPS 10 / DN 250	WAL04-00666-00
	NPS 12 / DN 300	WAL04-00667-00
	Steel	
	CL150 RF	
	NPS 2-1/2 / DN 65	WAL04-00695-00
	NPS 3 / DN 80	WAL04-00698-00
	NPS 4 / DN 100	WAL04-00704-00
	NPS 6 / DN 150	WAL04-00712-00
	NPS 8 / DN 200	WAL04-00715-00
	CL300 RF	
	NPS 2-1/2 / DN 65	WAL04-00696-00
	NPS 3 / DN 80	WAL04-00699-00
	NPS 4 / DN 100	WAL04-00705-00
	NPS 6 / DN 150	WAL04-00713-00
	NPS 8 / DN 200	WAL04-00716-00
13	Spring	
	NPS 2-1/2 / DN 65	WAL05-05073-01
	NPS 3 / DN 80	WAL05-05047-00
	NPS 4 and 5 / DN 100 and 125	WAL05-05062-00
	NPS 6 and 8 / DN 150 and 200	WAL05-05039-00
	NPS 10 / DN 250	WAL05-05040-01
	NPS 12 / DN 300	WAL05-05079-00
14	Pin	
	NPS 2-1/2 / DN 65	WAL05-03252-00
	NPS 3 and 4 / DN 80 and 100	WAL05-03254-00
	NPS 5 and 6 / DN 125 and 150	WAL05-03258-00
	NPS 8, 10 and 12 / DN 200, 250 and 300	WAL05-03261-00
15	Cap Screw	
	Cast iron	
	CL125 FF	
	1 required	
	NPS 2-1/2 / DN 65	WAL05-04782-00
	NPS 3, 4 and 5 / DN 80, 100 and 125	WAL05-04787-00
	NPS 6 / DN 150	WAL05-04789-00
	NPS 8 / DN 200	WAL05-04791-00
	NPS 12 / DN 300	WAL05-04799-00
	11 required	
	NPS 2-1/2 / DN 65	WAL05-04780-00
	NPS 3 / DN 80	WAL05-04785-00
	NPS 4 and 5 / DN 100 and 125	WAL05-04786-00
	15 required,	
	For NPS 6 and 8 / DN 150 and 200 only	WAL05-04787-00
	19 required, For NPS 12 / DN 300 only	WAL05-04798-00
	CL250 RF	
	1 required	
	NPS 2-1/2 / DN 65	WAL05-04782-00
	NPS 3 / DN 80	WAL05-04787-00
	NPS 4 and 5 / DN 100 and 125	WAL05-04788-00
	NPS 6 and 8 / DN 150 and 200	WAL05-04791-00
	NPS 10 and 12 / DN 250 and 300	WAL05-04799-00

Key	Description	Part Number
15	Cap Screw (continued)	
	Cast iron, CL250 RF (continued)	
	11 required	
	NPS 2-1/2 / DN 65	WAL05-04780-00
	NPS 3 / DN 80	WAL05-04785-00
	NPS 4 and 5 / DN 100 and 125	WAL05-04787-00
	19 required	
	NPS 6 and 8 / DN 150 and 200	WAL05-04788-00
	NPS 10 / DN 250	WAL05-04797-00
	NPS 12 / DN 300	WAL05-04798-00
	Steel	
	CL150 and 300 RF	
	1 required	
	NPS 2-1/2 / DN 65	WAL05-04782-00
	NPS 3 / DN 80	WAL05-04787-00
	NPS 6 / DN 150	WAL05-04791-00
	11 required	
	NPS 2-1/2 / DN 65	WAL05-04780-00
	NPS 3 / DN 80	WAL05-04785-00
	12 required, For NPS 4 / DN 100 only	WAL05-04787-00
	15 required,	
	For NPS 6 and 8 / DN 150 and 200 only	WAL05-04788-00
16	Base	
	Cast iron	
	CL125 FF	
	NPS 2-1/2 / DN 65	WAL04-00548-00
	NPS 3 / DN 80	WAL04-00520-00
	NPS 4 and 5 / DN 100 and 125	WAL04-00515-00
	NPS 6 and 8 / DN 150 and 200	WAL04-00519-01
	NPS 12 / DN 300	WAL04-17453-00
	CL250 RF	
	NPS 2-1/2 / DN 65	WAL04-00548-00
	NPS 3 / DN 80	WAL04-00520-00
	NPS 4 and 5 / DN 100 and 125	WAL04-00522-01
	NPS 6 and 8 / DN 150 and 200	WAL04-00523-01
	NPS 10 / DN 250	WAL04-09142-00
	NPS 12 / DN 300	WAL04-17453-00
	Steel, CL150 and 300 RF	
	NPS 2-1/2 / DN 65	WAL04-03059-00
	NPS 3 / DN 80	WAL0A-17960-00
	NPS 4 / DN 100	WAL0A-17961-00
	NPS 6 and 8 / DN 150 and 200	WAL04-01293-00
17	Pressure Plate	
	NPS 2-1/2 / DN 65	WAL04-03633-00
	NPS 3 / DN 80	WAL04-03681-00
	NPS 4 / DN 100	WAL04-03689-00
	NPS 5 / DN 125	WAL04-03683-00
	NPS 6 / DN 150	WAL04-03685-00
	NPS 8 / DN 200	WAL04-03682-00
	NPS 10 / DN 250	WAL04-03611-00
	NPS 12 / DN 300	WAL04-03690-00
18	Hex Nut	
	NPS 2-1/2 / DN 65	WAL05-02877-00
	NPS 3, 4, 5, 6 and 8 / DN 80, 100, 125, 150 and 200	WAL05-02881-00
	NPS 10 and 12 / DN 250 and 300	WAL05-02883-00
19	Hood	
	Cast iron	
	CL125 FF	
	NPS 2-1/2 / DN 65	WAL04-02638-00
	NPS 3 / DN 80	WAL04-02634-00
	NPS 4 and 5 / DN 100 and 125	WAL04-02626-00
	NPS 6 and 8 / DN 150 and 200	WAL04-18730-00
	NPS 12 / DN 300	WAL04-02637-00
	CL250 RF	
	NPS 2-1/2 / DN 65	WAL04-02638-00
	NPS 3 / DN 80	WAL04-02634-00
	NPS 4 and 5 / DN 100 and 125	WAL04-02633-00
	NPS 6 and 8 / DN 150 and 200	WAL04-02632-01
	NPS 10 / DN 250	WAL04-02628-00
	NPS 12 / DN 300	WAL04-02637-00

Type E5
(NPS 2-1/2 to 12 / DN 65 to 300) (continued)

Key	Description	Part Number
19	Hood (continued)	
	Steel, CL150 and 300 RF	
	NPS 2-1/2 / DN 65	WAL04-02639-00
	NPS 3 / DN 80	WAL04-17962-00
	NPS 4 / DN 100	WAL04-17963-00
	NPS 6 and 8 / DN 150 and 200	WAL04-06269-00
20	Diaphragm, Hycar	
	NPS 2-1/2 / DN 65	WAL05-01602-00
	NPS 3 / DN 80	WAL05-01603-00
	NPS 4 and 5 / DN 100 and 125	WAL05-01604-00
	NPS 6 / DN 150	WAL05-18213-00
	NPS 8 / DN 200	WAL05-01605-00
	NPS 10 / DN 250	WAL05-01606-00
	NPS 12 / DN 300	WAL05-01607-00
21	Disk Holder	
	NPS 4 / DN 100	WAL04-02548-01
	NPS 5 / DN 125	WAL04-02551-00
	NPS 8 / DN 200	WAL04-02537-01
22	Disk Washer	
	NPS 4 / DN 100	WAL04-06119-00
	NPS 5 / DN 125	WAL04-06122-00
	NPS 8 / DN 200	WAL04-06112-01
26	Piston	
	NPS 5 / DN 125	WAL04-03361-00
	NPS 8 / DN 200	WAL04-07253-00
	NPS 12 / DN 300	WAL0A-14848-00
27	Cylinder	
	NPS 5 / DN 125	WAL04-01558-00
	NPS 8 / DN 200	WAL04-07252-01
	NPS 12 / DN 300	WAL04-14875-00
29	Piston Ring, For NPS 5 / DN 125 only	WAL05-04507-00
30	Piston O-ring	
	NPS 8 / DN 200	WAL05-07468-00
	NPS 12 / DN 300	WAL05-14847-00
34	Body O-ring	
	NPS 4 and 5/ DN 100 and 125	WAL05-04528-00
	NPS 6 and 8 / DN 150 and 200	WAL05-04530-00
	NPS 10 and 12 / DN 250 and 300	WAL05-04531-00
35	Piston Spacer, For NPS 12 / DN 300 only	WAL04-14840-00
41	Reducing Bushing,	
	For NPS 10 and 12 / DN 250 and 300 only	WAL05-01109-00
42	Stem Bushing	
	NPS 10 / DN 250	WAL04-02307-00
	NPS 12 / DN 300	WAL04-06528-00
45	Quad Ring, For NPS 8 / DN 200 only	WAL05-07368-00
46	Cap Screw	
	NPS 4 and 5/ DN 100 and 125	WAL05-04808-00
	NPS 8 / DN 200	WAL05-04803-00

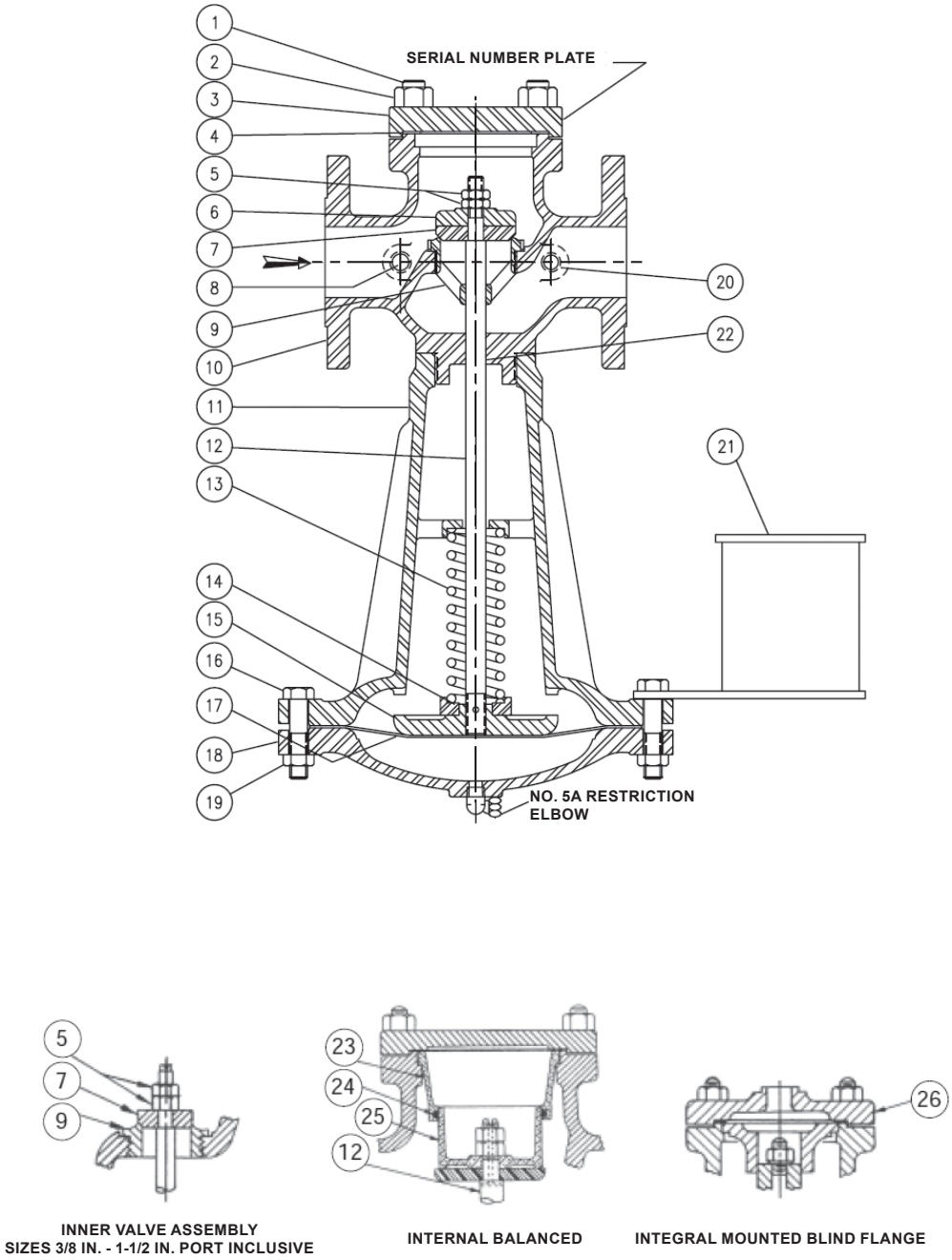

Figure 4. *Type E5 Assembly Drawing*

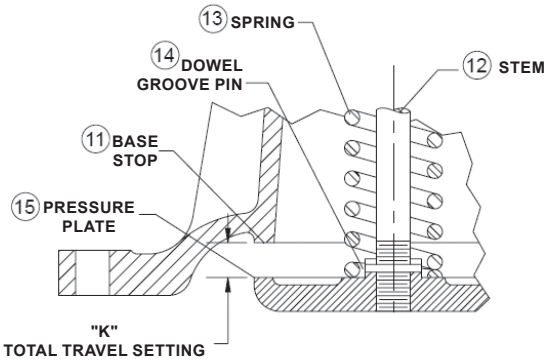

Figure 4. *Type E5 Assembly Drawing (continued)*

Table 4. *Type E5 Main Valve K Values*

VALVE SIZE		TYPE E5 TRAVEL SETTING (IN.)		
NPS	DN	Total Travel (K)	Groove Pin	Drill Size
3/4	20	1/4	1/8 x 11/16	1/8
1	25	5/16	1/8 x 11/16	1/8
1-1/4	32	3/8	5/32 x 13/16	5/32
1-1/2	40	7/16	5/32 x 13/16	5/32
2	50	9/16	5/32 x 15/16	5/32
2-1/2	65	11/16	3/16 x 15/16	3/16
3	80	13/16	3/16 X 1-3⁄8	3/16
4	100	1-1/16	1/4 X 1-3⁄4	1/4
5	125	1-5/16	5/16 X 1-3⁄4	5/16
6	150	1-9/16	5/16 X 2	5/16
8	200	2-1/16	3/8 X 2	3/8
10	250	2-9/16	3/8 X 2-1⁄2	3/8
12	300	3-1/16	1/2 X 2-3⁄4	1/2

Type E5

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SD3005A

SPENCE™

Spence D Series Pressure Reducing Pilot

⚠ WARNING

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

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

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

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

⚠ WARNING

CALIFORNIA PROPOSITION 65

This product can expose you to chemicals including lead and nickel which is known to the State of California to cause cancer, birth defects or other reproductive harm. For more information, go to www.P65Warnings.ca.gov.

Figure 1. *D Series*

Introduction

Scope of the Manual

This manual provides instructions for installation, maintenance and parts information for the D Series pressure reducing pilots.

Product Description

Spence Pressure Regulator is a combination of D Series pilot and a Type E main valve. This regulator reduces a steady or varying initial pressure to a constant, adjustable delivery pressure.

Specifications

The Specifications section gives some general specifications for the D Series pilot. The nameplates give detailed information for a specific pilot as built in the factory.

Available Configurations

Type D: For ±1 psi / 0.07 bar control of delivery pressures between 3 and 150 psi / 0.21 and 10.3 bar.

Type D2: For control of delivery pressures between 100 and 300 psi / 6.90 and 20.7 bar.

Type D5: For ±1/2 psi / 0.03 bar control of delivery pressures between 1 and 25 psi / 0.07 and 1.72 bar.

Type D120: Fast response controlling delivery pressures between 5 and 300 psi / 0.35 and 20.7 bar. Used on large Type E main valves.

Maximum Inlet Temperature(1)

Cast iron: 450°F / 232°C

Steel: 750°F / 400°C

Maximum Inlet Pressure(1)

Cast iron: 250 psig / 17.2 bar

Steel: 600 psig / 41.4 bar

Pressure Ranges(1)

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

Body: Cast iron, Steel

Stem, Disk, Seat and Diaphragm: Stainless steel

Gasket: Grafoil

Spring: Inconel®

Approximate Weights

Type D: 7 lbs / 3.2 kg

Type D2: 10 lbs / 4.5 kg

Type D5: 14 lbs / 6.4 kg

Type D120: 16 lbs / 7.3 kg

Optional Accessories

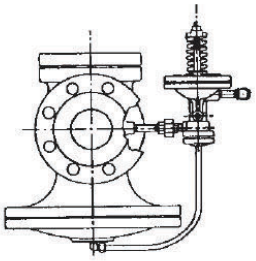
Spring Chamber
Adjusting Handwheel
Wall Bracket
Locking Device
Composition Disk
Integral Mount Body
Vacuum Spring Assembly

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

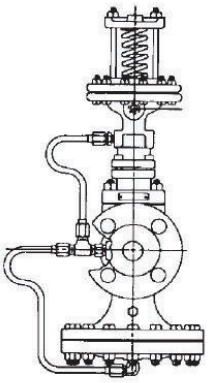
Table 1. *D Series Spring Pressure Ranges*

TYPE	PRESSURE RANGE, psig / bar	ADJUSTING SPRING		
		Wire Diameter, In. / mm	Part Number	Color
D	3 to 20 / 0.21 to 1.38(1)	3/16 / 4.76	WAL05-05007-00	Aluminum
	5 to 50 / 0.35 to 3.45(1)	1/4 / 6.35	WAL05-05003-00	Orange
	10 to 100 / 0.69 to 6.89	5/16 / 7.94	WAL05-05005-00	Green
	20 to 150 / 1.38 to 10.3	11/32 / 8.73	WAL05-05012-00	Black
D2	100 to 300 / 6.89 to 20.7	7/16 / 11.1	WAL05-04990-00	Aluminum
D5	1 to 10 / 0.07 to 0.69	3/16 / 4.76	WAL05-05007-00	Aluminum
	5 to 25 / 0.35 to 1.72	1/4 / 6.35	WAL05-05003-00	Orange
D120	5 to 25 / 0.35 to 1.72	7/32 / 5.56	WAL05-05016-00	Not Specified on Purchasing Specification, Item Details or Drawing.
	10 to 75 / 0.69 to 5.17	5/16 / 7.94	WAL05-05028-00	
	40 to 150 / 2.76 to 10.3	3/8 / 9.53	WAL05-05030-00	
	100 to 300 / 6.89 to 20.7	7/16 / 11.1	WAL05-04990-00	Aluminum

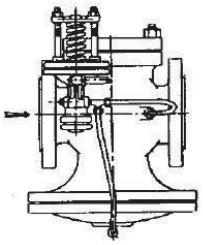
1. Vacuum Spring Assembly, minimum range is 30 in. Hg / 1.02 bar; maximum is reduced by 15 psig / 1.03 bar.



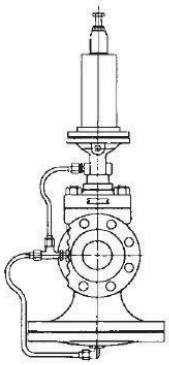
SIDE MOUNTED



INTEGRALLY MOUNTED



VALVE IS TAPPED SO THAT PILOT MAY BE MOUNTED ON EITHER SIDE.



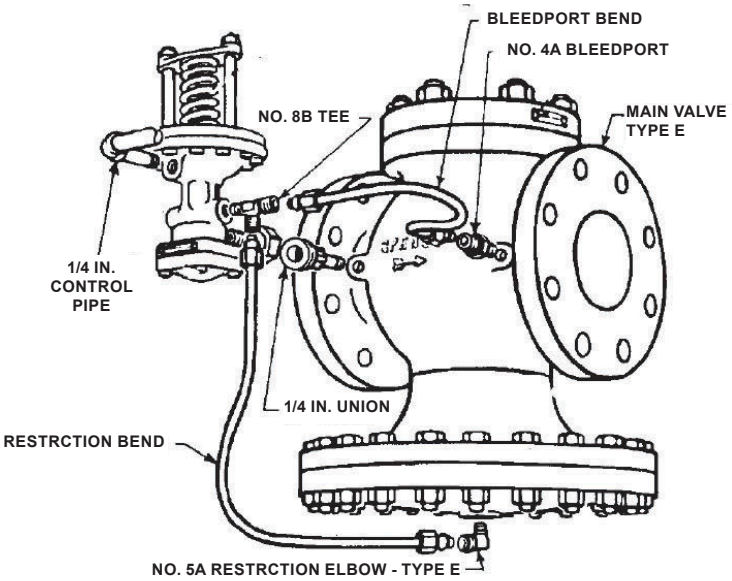


Figure 2. *Typical Type ED Installation*

Principle of Operation

The regulator is operated by initial steam or fluid pressure. It is normally closed, being held so by initial pressure on the disk and by an internal main spring.

When the pilot is opened, initial pressure flows through the pilot to the 8B tee. Bleedport 4A restricts the flow and pressure builds under the diaphragm and opens the main valve. The 5A restriction elbow steadies the operation of the regulator.

Delivery pressure feeds back through the control pipe to the pilot diaphragm. As this pressure approaches a balance with the air loading signal, the pilot throttles the loading pressure. In turn, the main valve takes a position established by the loading pressure where just enough steam flows to maintain the set delivery pressure.

Installation

⚠ WARNING

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

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

All pressure equipment should be installed in a non-seismic area; should not be exposed to fire; and should be protected from thunderbolt (lightning) strikes.

⚠ CAUTION

The piping system must be adequately designed and supported to prevent extraordinary loads to the pressure equipment.

Planning

1. Locate the regulator in a horizontal pipe.
2. Provide a trap ahead of the regulator to prevent water hammer and erratic operation.
3. Use strainer to protect the regulator and avoid damaging effects of scale and dirt in pipelines.
4. Provide a three valve bypass to facilitate inspection of the regulator without interrupting service.

Main Valve

1. Flush the main piping system thoroughly to clear it from welding beads, scale, sand, etc.
2. Mount main valve with diaphragm chamber down and arrow on body pointing in the direction of flow. Screwed end valve should be mounted in unions.

Pilot

1. Mount the pilot on either side of the main valve by means of a 1/4 in. / 6.35 mm nipple and union provided Make this connection to the 1/4 in. / 6.35 mm pipe tap on the inlet of the main valve.

Note

As a general rule of thumb, tighten 1.5 to 3 turns past hand tight all NPT connections and use thread sealant with a temperature range up to 450ºF / 232ºC.

2. Screw 4A bleedport fitting into 1/8 in. / 3.18 mm pipe tap on the outlet of the main valve body.

Note

Bleed orifice in this fitting is vital to operation of regulator.

3. Screw 8B tee into 1/8 in. / 3.18 mm pipe tap in pilot. Select tap facing downstream.
4. Screw 5A elbow containing restriction orifice into 1/8 in. / 3.18 mm pipe tap on underside of main valve diaphragm chamber. If initial pressure or pressure drop is less than 15 psi / 1.03 bar, a 5B open elbow without orifice is used.
5. Connect tubing bends as illustrated in Figure 2.

Maintenance

⚠ WARNING

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

pilot from system pressure and relieving all internal pressure from the pilot.

Pilots 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 pilot.

Due to normal wear or damage that may occur from external sources, this pilot 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.

Disassembly

1. Release adjusting spring (key 4) compression by loosening adjusting nuts (key 1). Remove nuts, yoke (key 2), adjusting spring and spring button (key 5).
2. Remove diaphragm nuts (key 15) and lift off cowl (key 6). Lift out diaphragm assembly (keys 7, 16 and 17).
3. Disassemble diaphragm assembly by removing diaphragm screw (key 7) from pressure plate (key 16).

Note

This step is not necessary if installing a new diaphragm assembly (included in repair kit).

4. Remove blind flange bolts (key 23) and take off blind flange (key 14). Remove screen (key 20) and gasket (key 13).
5. Hold the pusher plate (key 8) and remove stem nuts (key 22). Lift out stem assembly (keys 8 and 19) and valve spring (key 9). The disk (key 21) will drop off. If the disk is not easily removed from the stem, or the stem does not easily move in the bushing (key 10) is difficult to remove, inspect stem, seat ring (key 11) and disk carefully for notches, scratches or bending.
6. Remove the seat ring (key 11) from the pilot body (key 12) using a socket wrench. Do not remove the seat ring unless replacing the stem assembly (keys 8 and 19) and disk (key 21).

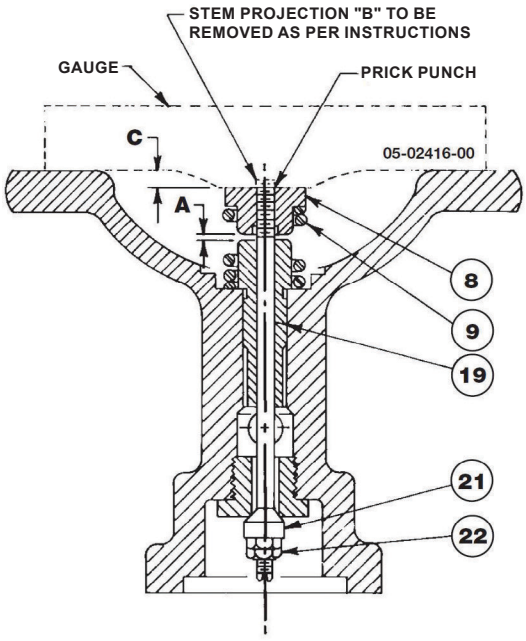


***Figure 3**. Travel Setting*

Inspection

1. Examine the seat ring (key 11) and disk (key 21) sealing surfaces for nicks or other signs of damage by pipeline debris. Slight imperfections may be removed by lapping the surfaces. Otherwise, replace the seat ring and disk.
2. Examine the stem (key 19) for a build-up of pipeline contaminants or erosion. Remove any build-up with a wire brush and polish with a very fine crocus cloth. Work carefully to avoid bending the stem.
3. Inspect the pilot body (key 12) and its ports for corrosion. Some rust is normal, but if corrosion debris is readily separated from the body, clean body with wire brush and remove debris.

Lapping Operations

Lap sparingly using 500 grit lapping compound and light pressure. Heavy grinding may cause galling, wide sealing surfaces and a groove disk, all of which tend to produce leakage.

Lapping may be done using a socket wrench to rotate the stem and disk assembly back and forth against the seat for 30 seconds or so. After the sealing surfaces are lapped in, disassemble and clean all parts.

Seat, Disk and Stem Replacement

1. Clean the body threads of old sealing compound using a wire brush.
2. Apply new sealing compound (High-pressure, high-temperature sealant) to the shoulder of the seat ring (key 11). Let stand until tacky before installing in pilot body (key 12).
3. Secure disk (key 21) to stem (key 19) with a stem nut (key 22). Apply lapping compound to the disk and insert this assembly into the pilot body (omit the valve spring C).
4. Use a socket and extender to lap in the disk (key 21) to seat joint. See Lapping Operations for more information.
5. Screw pusher plate (key 8) onto the stem. Holding the disk firmly against its seat, adjust the pusher plate so that dimension C = 11/64 in. / 4.37 mm. A gauge (part number 05-02416-00) is supplied with each repair kit. Be careful not to disturb the pusher plate adjustment, use a prick punch to notch the stem threads above the pusher plate so that the pusher plate will not rotate freely. Work carefully to avoid bending the stem. The valve travel is now set.
6. Remove the stem nut and lift the stem assembly (keys 19 and 8) out of the top of the pilot. Grind off the stem Projection B flush with the upper surface of the pusher plate. This can be done at the bench without removing the stem from the body as long as the grinder does not make contact with the mating surfaces of the pilot body.
7. Reinsert the stem into the pilot body. Install disk (key 21) and a stem nut (key 22).
8. Check that the valve travel A = 3/64 in. / 1.19 mm. This need not be exact. Stem (key 19) should move smoothly. Binding indicates a bent stem.
9. Remove the stem nut (key 22) and disk (key 21); withdraw stem (key 19). Install stem with valve spring (key 19), disk and both stem nuts.

Reassembly

1. If the seat ring (key 11), disk (key 21) and stem (key 19) were not replaced, reinstall the seat ring first, then slide the valve spring (key 9) over the bushing (key 10) and slide the stem back into place. If they were replaced, skip to step 3.
2. Install the seat ring (key 11) and stem nuts (key 22) one at a time while holding the pusher plate (key 8) with a socket.

Table 2. *Number of Diaphragm Disk*

ADJUSTING SPRING RANGE		DIAPHRAGM DISK
psig	bar	
0 to 8	0 to 0.55	1
3 to 20	0.21 to 1.38	2
5 to 50	0.35 to 3.45	2
10 to 100	0.69 to 6.89	2
20 to 150	1.38 to 10.3	3

3. Install the screen (key 20) and gasket (key 13). Using the blind flange bolts (key 23), reinstall blind flange (key 14).

Note

When replacing gaskets, be sure that any serrated sealing surfaces are cleaned of old gasket material.

4. Assemble the diaphragm assembly (keys 7, 16 and 17) by sandwiching the diaphragms (key 17) between the pressure plate (key 16) (flat side against diaphragm) and the diaphragm screw (key 7). The number of diaphragm disks depends on the adjusting spring range. See Table 2.
5. Apply sealing compound (High-pressure, high-temperature sealant) to the shoulder of the diaphragm screw. Apply sealing compound to the diaphragm flange of the pilot body for steel body pilots only.
6. Put the diaphragm assembly into place (pressure plate up). Center the assembly and install the cowl (key 6). Install four diaphragm bolts or studs (key 18) and diaphragm nuts (key 15) equally around the cowl to ensure the diaphragm assembly is centered. Install the rest of the diaphragm nuts, bolts and/or studs and tighten in an opposing pattern.
7. Install the spring button (key 5), adjusting spring (key 4), spring yoke (key 2) and adjusting nuts (key 1).

Parts Ordering

When ordering parts, it is essential that the pilot type, service and serial number be stated.

Select part by item number, but order by part number. Specify complete part number when ordering.

Parts List

Repair Parts Kit (See Table 3)

D Series and Options Parts List (See Tables 4 to 7)

Table 3. *Repair Parts Kit*

REPAIR KIT	MATERIAL	PART NUMBER
Repair Kit - Hard	Cast iron Pilot	WAL07-04164-00
Repair Kit - Hard	Steel Pilot	WAL08-10375-00
Repair Kit - Soft	Cast iron Pilot	WAL08-08556-00
Repair Kit - Soft	Steel Pilot	WAL08-10379-00

Table 4. *Types D and D5 Series Parts List*

KEY	PART NAME	MATERIAL	PART NUMBER	QUANTITY	REMARKS
1	Adjusting Nut	Steel	WAL05-02874-00	2	- - - -
2	Spring Yoke	Iron	WAL05-06183-00	1	- - - -
3	Standard	Steel	WAL04-05219-00	2	- - - -
4	Adjusting Spring	Steel	See Table 1	1	- - - -
5	Spring Button	Steel	WAL04-01040-00	1	- - - -
6	Cowl	Cast iron	WAL04-01508-00	1	Cast iron Body
	Cowl	Steel	WAL04-01592-00	1	Steel Body
7(1)	Diaphragm Screw	Steel	WAL04-04822-00	1	- - - -
8(1)	Pusher Plate	Steel	WAL04-03718-00	1	- - - -
9(1)	Valve Spring	Inconel®	WAL05-04985-00	1	- - - -
10	Bushing	Stainless steel	WAL04-01080-00	1	- - - -
11(1)	Seat Ring	Seco Metal	WAL04-04057-90	1	- - - -
12	Body, Bushing, Plug	Cast iron	WAL07-03514-00	1	- - - -
	Body, Bushing, Plug	Steel	WAL07-04267-02	1	- - - -
13*	Gasket	Blugard	WAL05-02378-01	1	Cast iron Body
	Gasket	Flexitalic	WAL05-11718-00	1	Steel Body
14	Blind Flange	Cast iron	WAL04-02151-00	1	- - - -
	Blind Flange	Steel	WAL04-11678-00	1	- - - -
15	Diaphragm Nut	Steel	WAL05-02871-00	12	Cast iron Body
	Diaphragm Nut	Steel	WAL05-02845-00	24	Steel Body
16(1)	Pressure Plate	Steel	WAL04-06979-00	1	- - - -
17(1)	Diaphragm	Stainless steel	WAL04-01623-00	3	- - - -
18	Diaphragm Bolt	Steel	WAL05-04764-00	12	Cast iron Body
	Diaphragm Stud	Steel	WAL05-05490-00	12	Steel Body
19(1)	Stem	Stainless steel	WAL04-05229-00	1	- - - -
20(1)	Screen	Stainless steel	WAL04-04700-00	1	Steam Service
	Screen	Stainless steel	WAL04-04701-00	1	Water Service
21(1)	Disk	Seco Metal	WAL04-01772-90	1	- - - -
22(1)	Stem Nut	Steel	WAL05-02888-00	2	Steam Service
	Stem Nut	Brass	WAL05-02886-00	2	Water Service
23	Blind Flange Bolt	Steel	WAL05-04803-00	4	Cast iron Body
	Blind Flange Bolt	Steel	WAL05-11719-00	4	Steel Body

1. This part is furnished in Repair Kit.

Inconel® is a mark owned by Special Metals Corporation.

Table 5. *D Series Options Parts List*

KEY	PART NAME	MATERIAL	PART NUMBER	QUANTITY	REMARKS
Locking Device					
35	Padlock	Brass	WAL05-03204-00	1	- - - -
36	Lock Bar	Steel	WAL04-00436-00	1	- - - -
37	Spring Yoke Assembly	Iron	WAL07-43507-00	1	- - - -
Wall Bracket					
15	Diaphragm Nut	Steel	WAL05-02871-00	1	Iron Body
	Diaphragm Nut	Steel	WAL05-02845-00	4	Steel Body
38	Wall Bracket	Cast iron	WAL04-01029-00	4	- - - -
39	Diaphragm Bolt	Steel	WAL05-04766-00	4	Iron Body
	Diaphragm Stud	Steel	WAL05-05462-00	8	Steel Body
Composition Disk					
25(1)	Disk Assembly	Brass	WAL07-53512-00	1	- - - -
26(1)	Stem	Stainless steel	WAL04-05381-00	1	- - - -
27(1)	Seat Ring	Stainless steel	WAL04-04060-00	1	- - - -
Enclosed Spring Chamber					
28	Adjusting Screw	Steel	WAL05-04860-00	1	- - - -
29	Locknut	Steel	WAL05-02942-00	1	- - - -
30	Spring Chamber	Iron	WAL04-01393-00	1	- - - -
	Spring Chamber	Bronze	WAL04-01395-00	1	- - - -
	Spring Chamber	Steel	WAL04-01394-00	1	- - - -
	Enclosed Spring Chamber Kit	Cast iron	WAL08-01868-00		- - - -
Adjusting Wheel					
31	Handwheel	Aluminum	WAL04-12985-01	1	- - - -
32	Adjusting Screw	Steel	WAL04-04752-02	1	- - - -
33	Locknut	Steel	WAL05-02942-00	1	- - - -
34	Yoke	Cast iron	WAL04-06170-00	1	Iron Body
	Yoke	Ductile iron	WAL04-06167-02	1	Steel Body
	Handwheel Kit	Cast iron	WAL08-01867-00		- - - -
Vacuum Spring Assembly					
40	Floating Plate	Iron	WAL04-03710-00	1	- - - -
41	Vacuum Spring	302 Stainless steel	WAL05-05055-00	1	- - - -
42	Valve Spring	Inconel®	WAL05-09353-00	1	- - - -

1. This part is furnished in Repair Kit.

Inconel® is a mark owned by Special Metals Corporation.

Table 6. *Type D120 Pilot (Figure 6)*

KEY	PART NAME	MATERIAL	PART NUMBER	REMARKS
1	Adjusting Screw	Steel	WAL04-04760-00	- - - -
2	Locknut	Steel	WAL05-02877-00	- - - -
3	Standard Nut	Steel	WAL05-02877-00	- - - -
4	Spring Yoke	Cast iron	WAL04-06177-00	- - - -
5	Guide Stud	Stainless steel	WAL04-05419-00	- - - -
6	Upper Spring Button	Steel	WAL04-01078-00	- - - -
7	Adjustment Spring, 5 to 25 psi / 0.35 to 1.72 bar	Steel	WAL05-05016-00	Use 2 Diaphragm
	Adjustment Spring, 10 to 75 psi / 0.69 to 5.17 bar	Steel	WAL05-05028-00	Use 2 Diaphragm
	Adjustment Spring, 40 to 150 psi / 2.76 to 10.3 bar	Alloy steel	WAL05-05030-00	Use 3 Diaphragm
8	Standard	Steel	WAL05-05200-00	- - - -
9	Lower Spring Button	Steel	WAL04-01041-00	- - - -
10	Diaphragm Nut	Steel	WAL05-02872-00	Note 1
	Diaphragm Nut	Steel	WAL05-02848-00	Note 2
11	Cowl	Cast iron	WAL04-01513-00	- - - -
	Cowl	Steel	WAL04-01514-00	- - - -
12	Diaphragm	Stainless steel	WAL04-01659-00	A, B See item 7
13	Diaphragm Bolt	Steel	WAL05-04770-00	Note 1
	Diaphragm Stud	Steel	WAL05-05480-00	Note 2
14	Bushing	Stainless steel	WAL04-01132-00	See item 16
15	Stem	Stainless steel	WAL04-05305-01	B
16	Body and Bushing	Cast iron	WAL08-09159-00	- - - -
	Body and Bushing	Steel	WAL08-09160-01	- - - -
17	Screen - Steam	Monel®	WAL04-04700-00	B
18	Pressure Plate	Cast iron	WAL04-03599-00	B
19	Diaphragm Screw	Steel	WAL04-04822-00	B
20	Pusher Plate	Steel	WAL04-03717-00	B
21	Valve Spring	Inconel®	WAL05-04985-00	A, B
22	Seat Ring	Stainless steel	WAL04-04062-00	B
23	Disk	Stainless steel	WAL04-07283-01	B
24	Stem Nut	Steel	WAL05-02891-00	B
25	Gasket	Asbestos	WAL05-02378-00	A, B Note 1
	Gasket	Flexitalic	WAL05-11718-00	A, B Note 2
26	Blind Flange	Cast iron	WAL04-02151-00	- - - -
	Blind Flange	Steel	WAL04-11678-00	- - - -
27	Blind Flange Bolt	Steel	WAL05-04803-00	Note 1
	Blind Flange Bolt	Steel	WAL05-11719-00	Note 2
28	Pipe Plug, 1/4 NPT	Steel	WAL04-03772-00	Not shown
Wall Bracket				
29	Wall Bracket	Iron	WAL04-01028-00	- - - -
30	Diaphragm Bolt	Steel	WAL05-04781-00	- - - -
10	Diaphragm Nut	Steel	WAL05-02872-00	- - - -

A - Recommended Spare Parts
B - Furnished in Repair Kit:
WAL08-09154-00 Note 1
WAL08-10356-00 Note 2
Note 1: Applies to Iron Body Pilots
Note 2: Applies to Steel Body Pilots

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Table 7. *Type D2 Pilot Parts List (Figure 7)*

KEY	PART NAME	MATERIAL	PART NUMBER	REMARKS
1	Adjusting Screw	Steel	WAL04-04760-00	- - - -
2	Adjusting Screw Locknut	Steel	WAL05-02953-00	- - - -
3	Guide Stud	Stainless steel	WAL04-05419-00	- - - -
4	Standard Nut	Steel	WAL05-02874-00	- - - -
5	Spring Yoke	Cast iron	WAL04-06179-00	- - - -
6	Upper Spring Button	Steel	WAL04-01078-00	- - - -
7	Standard	Steel	WAL04-05213-00	- - - -
8	Adjusting Spring	Aluminum steel	WAL05-04990-00	- - - -
9	Lower Spring Button	Steel	WAL04-01041-00	- - - -
10	Diaphragm Nut	Steel	WAL05-02871-00	Note 1
	Diaphragm Nut	Steel	WAL05-02845-00	Note 2
11	Pressure Plate	Steel	WAL04-03679-00	B
12	Body and Bushing	Iron	WAL07-03514-00	- - - -
	Body and Bushing	Bronze	WAL08-04265-00	- - - -
	Body and Bushing	Steel	WAL07-04267-02	Screwed
	Body and Bushing	Steel	WAL08-09518-02	Flanged Inlet
	Body and Bushing	Steel	WAL08-09517-02	Secoweld Screwed
	Body and Bushing	Steel	WAL08-07124-02	Secoweld Flanged Inlet
13	Diaphragm Bolt	Steel	WAL05-04764-00	Note 1
	Diaphragm Stud	Steel	WAL05-05490-00	Note 2
14	Diaphragm	Stainless steel	WAL04-01623-00	A, B (3 per set)
15	Valve Spring	Inconel®	WAL05-04985-00	A, B
16	Bushing	Stainless steel	WAL04-01080-00	See item 12
17	Gasket	Asbestos	WAL05-02378-00	A, B, Note 1
	Gasket	Flexitalic	WAL05-11718-00	A, B, Note 2
18	Blind Flange	Iron	WAL04-02151-00	- - - -
	Blind Flange	Bronze	WAL04-02153-00	- - - -
	Blind Flange	Steel	WAL04-11678-00	- - - -
19	Blind Flange Bolt	Steel	WAL05-04803-00	Note 1
	Blind Flange Bolt	Steel	WAL05-11719-00	Note 2
20	Cowl	Iron	WAL04-01505-00	- - - -
	Cowl	Steel	WAL04-01591-00	- - - -
21	Diaphragm Screw	Steel	WAL04-04822-00	B
22	Pusher Plate	Steel	WAL04-03718-00	B
23	Stem	Stainless steel	WAL04-05229-00	B
24	Seat Ring	Stainless steel	WAL04-04057-00	B
25	Disk	Stainless steel	WAL04-01772-00	B
26	Stem Nut	Steel	WAL05-02888-00	B
27	Screen - Water	Monel®	WAL04-04701-00	- - - -
	Screen - Steam	Monel®	WAL04-04700-00	B
28	Pipe Plug, 1/8 NPT	Steel	WAL04-03769-00	Not Shown
	Pipe Plug, 1/8 NPT	Brass	WAL04-03770-00	Not Shown

A - Recommended Spare Parts
B - These parts furnished in Repair Kit (Steam screen):
Stainless steel Disk: Cast iron and Bronze (WAL08-09157-00), Carbon steel (WAL08-10357-00)
Composite Disk: Cast iron and Bronze (WAL08-09158-00), Carbon steel (WAL08-10380-00)
Note 1: Applies to Iron and Bronze Body Pilots
Note 2: Applies to Steel Body Pilots
Use Pilot Setting instructions WAL09-98165-00

- continued -

Table 7. *Type D2 Pilot Parts List (Figure 7) (continued)*

KEY	PART NAME	MATERIAL	PART NUMBER	REMARKS
Enclosed Spring Chamber				
29	Spring Chamber	Steel	WAL07-40529-00	- - - -
Adjusting Handle				
30	Handle and Hub Assembly	Steel	WAL08-09774-00	- - - -
31	Adjusting Stud Spacer	Brass	WAL04-05600-00	- - - -
32	Thrust Bearing	Steel	WAL05-00552-00	- - - -
33	Guide Standard Locknut	Steel	WAL05-03016-00	- - - -
34	Cross Bar	Steel	WAL04-00434-00	- - - -
35	Guide Standard Spacer	Brass	WAL04-04936-00	- - - -
36	Support Standard Nut	Steel	WAL05-02942-00	- - - -
37	Adjusting Stud Assembly	- - - -	WAL07-40550-00	- - - -
38	Spring Yoke	Cast iron	WAL04-06173-00	- - - -
39	Support Standard	Steel	WAL04-05223-00	- - - -
40	Guide Standards	Steel	WAL04-05221-00	- - - -
Wall Bracket				
41	Wall Bracket	Cast iron	WAL04-01029-00	- - - -
42	Diaphragm Bolt	Steel	WAL05-04766-00	Note 1
10	Diaphragm Stud	Steel	WAL05-05462-00	Note 2
	Diaphragm Nut	Steel	WAL05-02871-00	Note 1
	Diaphragm Nut	Steel	WAL05-02845-00	Note 2
Flanged Inlet				
44	Gasket	Steel Asbestos	WAL05-02370-00	- - - -
45	Flange Assembly - Female	Steel	WAL07-43516-00	See item 12
46	Flange Assembly - Male	Steel	WAL07-40535-00	- - - -
13	Stud	Steel	WAL05-05490-00	- - - -
10	Nut	Steel	WAL05-02845-00	- - - -
Composition Disk				
47	Stem	Stainless steel	WAL04-05381-00	B
48	Seat Ring	Stainless steel	WAL04-04060-00	B
49	Composite Disk Assembly	Brass	WAL07-53512-00	B

A - Recommended Spare Parts
B - These parts furnished in Repair Kit (Steam screen):
Stainless steel Disk: Cast iron and Bronze (WAL08-09157-00), Carbon steel (WAL08-10357-00)
Composite Disk: Cast iron and Bronze (WAL08-09158-00), Carbon steel (WAL08-10380-00)
Note 1: Applies to Iron and Bronze Body Pilots
Note 2: Applies to Steel Body Pilots
Use Pilot Setting instructions WAL09-98165-00

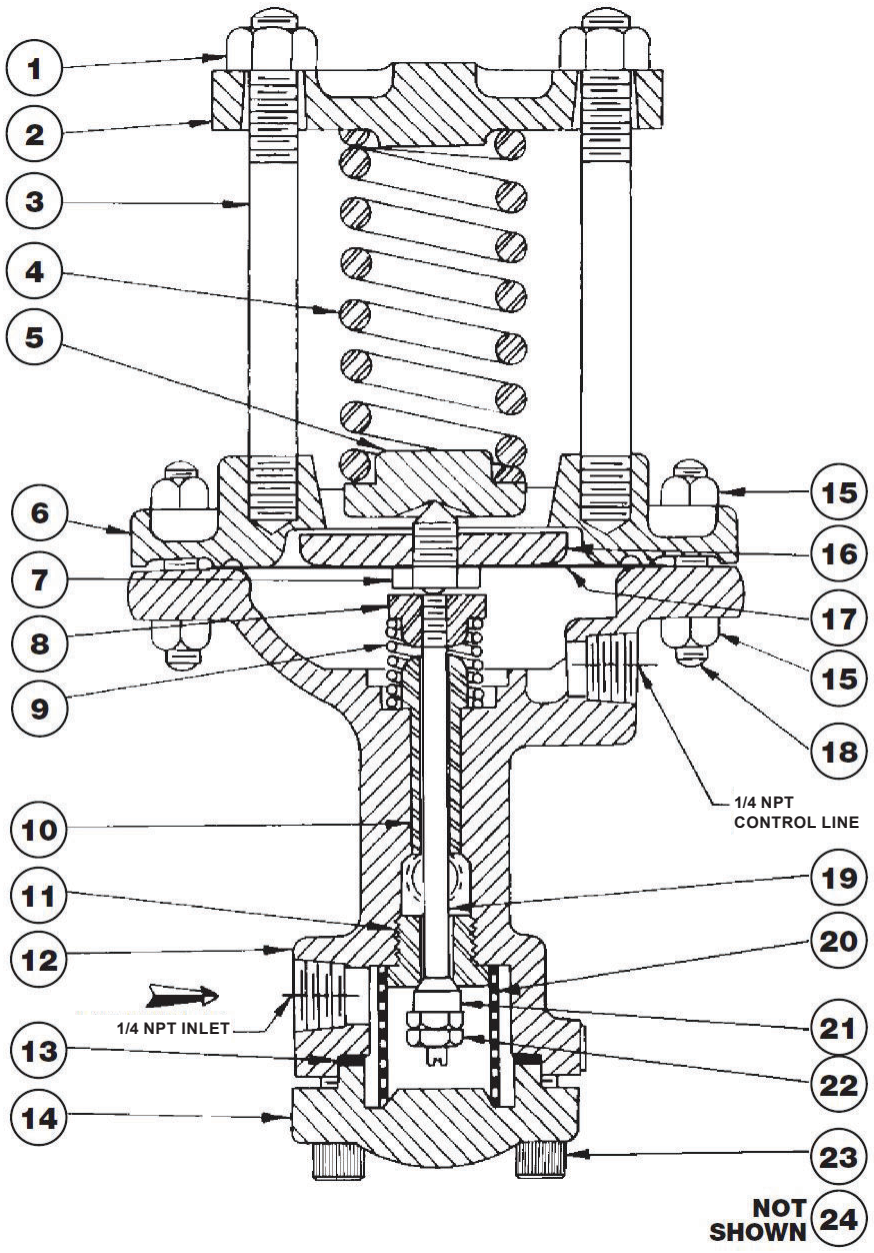


Figure 4. *Type D Pilot Assembly*

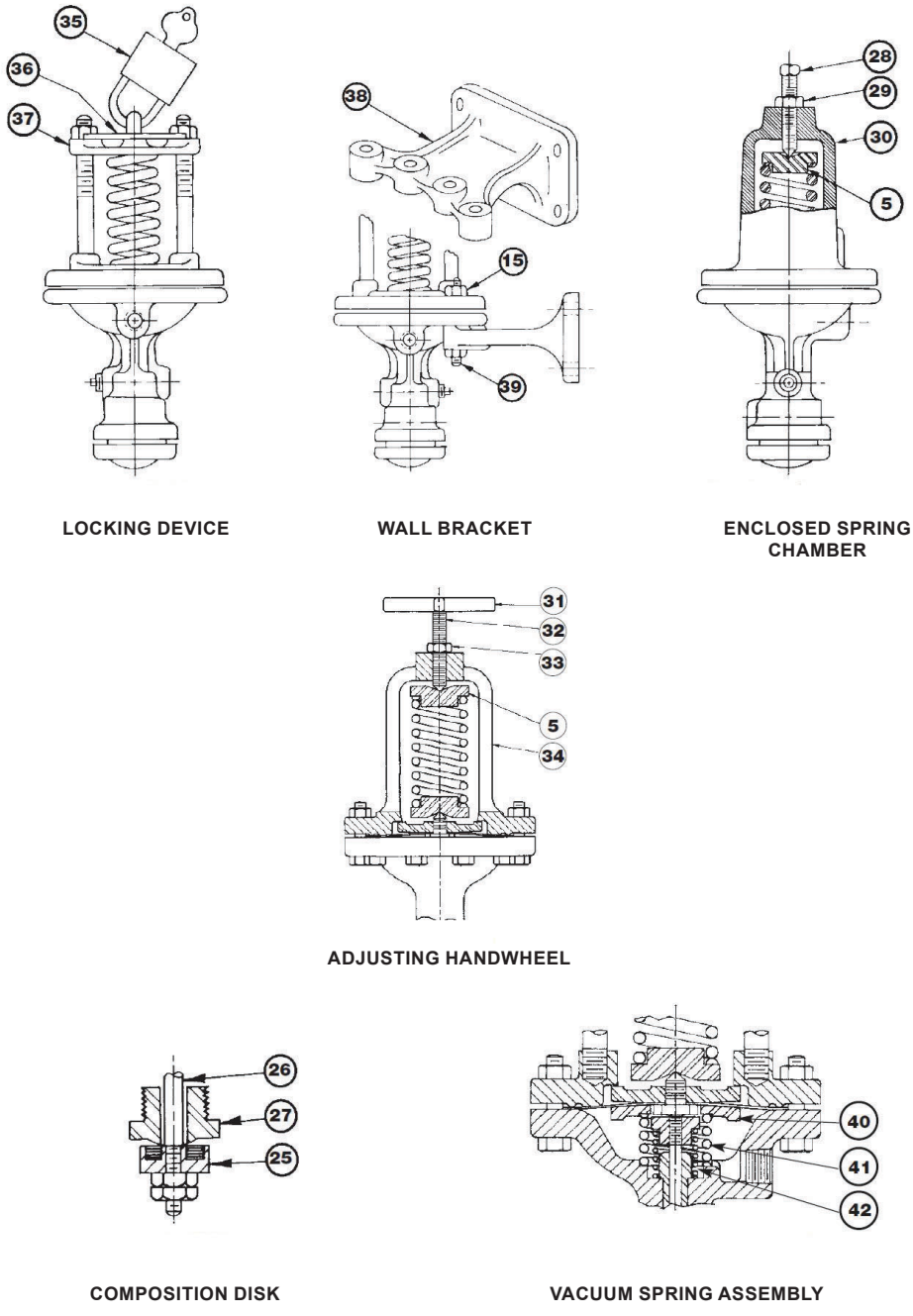


Figure 5. *D Series Options Assembly*

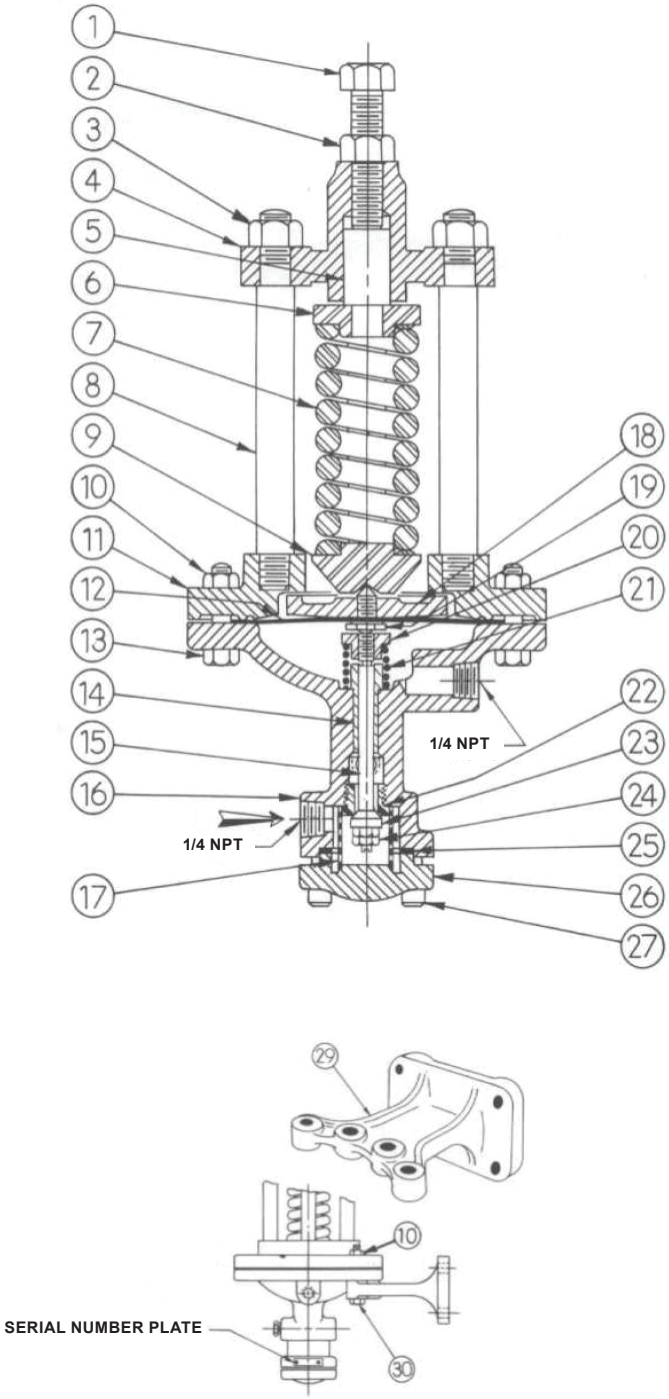
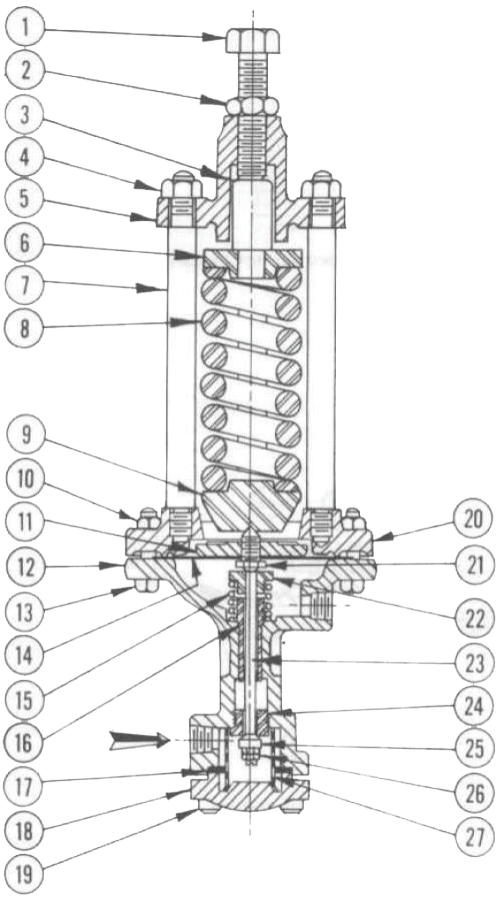
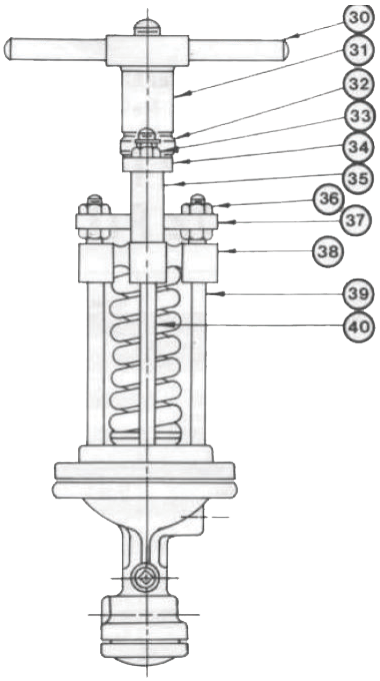
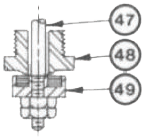


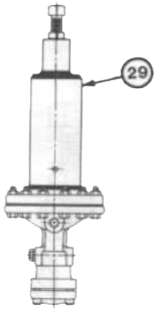
Figure 6. *Type D120 Pilot Assembly*



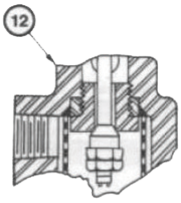


ADJUSTING HANDLE

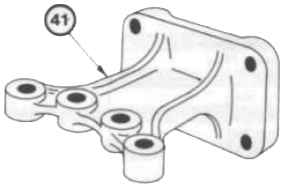


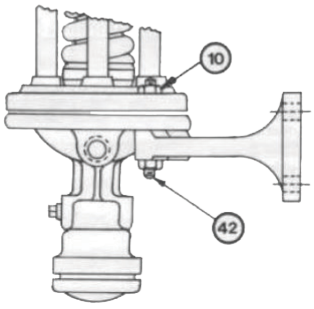


ENCLOSED SPRING CHAMBER

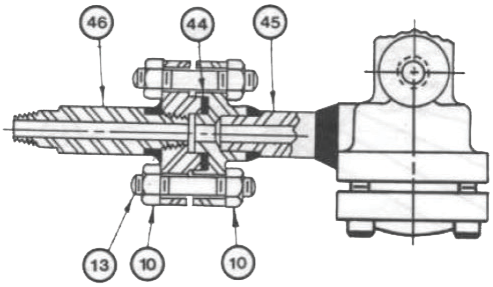


ALTERNATE:
SECOWELD CONSTRUCTIONS





WALL BRACKET



FLANGED INLET

Figure 7. *Type D2 Pilot Assembly*

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Dubai, United Arab Emirates
T +971 4 811 8100

SD4111C

SPENCE™

Spence A Series Air-Adjusted Pilot

⚠ WARNING

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

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

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

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

Introduction

Scope of the Manual

This manual provides instructions for installation, maintenance and parts information for the A Series air-adjusted pilot.

Product Description

The A Series air adjusted pilots, when combined with a Main Valve, will control a steady or varying inlet pressure to a constant delivery pressure. The pilots can control either pressure or temperature.

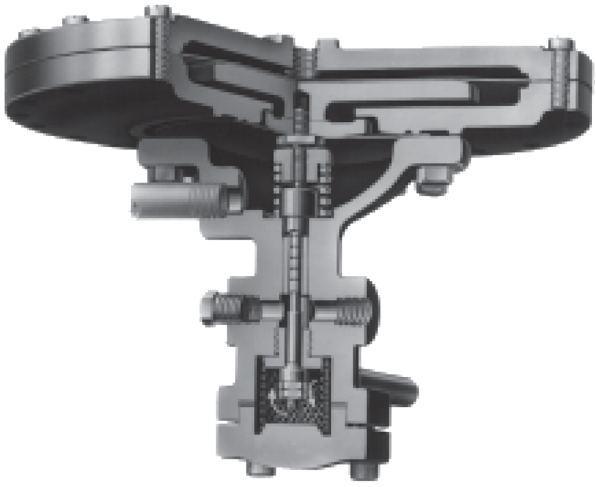

Figure 1. *A Series Air-Adjusted Pilot*

Pilot Types

- Type A for pressure control at low pressures. Delivery to loading pressure is 1 to 1 psi / 0.07 to 0.07 bar.
- Type A35 for pressure control at very low delivery pressures as in some heating system control. Delivery to loading pressure is 1/2 to 1 psi / 0.03 to 0.07 bar.
- Types A43 and A54 for pressure control at medium to high pressures. Delivery to loading pressure is 2-5/8 to 1 psi / 0.09 to 0.07 bar.
- Type A53 for pressure control at medium pressures. Delivery to loading pressure is 4 to 1 psi / 0.30 to 0.07 bar.
- Types A70 and A73 for pressure control at high delivery pressures when available loading air is at low pressure. Delivery to loading pressures are 15 and 6-2/3 (respectively) to 1 psi / 1.03 and 0.30 to 0.07 bar.
- Type A82 Vacuum for pressure control of very low pressure or systems varying between very low pressure and light vacuum. Delivery to loading pressure is 1 to 1 psi / 0.07 to 0.07 bar.

Specifications

The Specifications section gives some general specifications for the A Series pilot. The nameplates give detailed information for a specific pilot as built in the factory.

Available Configurations

Type A35: Very Low Pressure
Type A: Low Pressure
Type A53: Medium Pressure
Types A43 and A54: Medium to High Pressure
Types A70 and A73: High Pressure
Type A82: Vacuum Pressure Control
Type A83: Vacuum Temperature Control

Maximum Inlet Pressure(1)

Cast Iron: 250 psig / 17.2 bar
Cast Steel: 600 psig / 41.4 bar

Maximum Temperature(1)

Cast Iron: 450°F / 232°C
Cast Steel: 600°F / 316°C

Material of Construction

Body: Cast iron, Cast steel
Stem, Disk, Seat and Diaphragm: Stainless steel
Gasket: Graphite
Spring: Inconel®

Options

Integral Mount
Air Filter Gauges
Panel Board

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

- Type A83 Vacuum for temperature control. Delivery to loading pressure is 1 to 1 psi / 0.07 to 0.07 bar.
- Type A84 Vacuum for temperature control at lower delivery pressure features more gradual response. Delivery to loading pressure is 2-3/8 to 1 psi / 0.16 to 0.07 bar.
- Type A85 Vacuum for temperature, pressure and vacuum control. Delivery to loading pressure is 3-7/8 to 1 psi / 0.27 to 0.07 bar.
- Type A86 for pressure control at low pressures. Delivery to loading pressure is 1 to 1-13/16 psi / 0.07 to 0.12 bar.
- Type A87 Vacuum for temperature, pressure and vacuum control. Delivery to loading pressure is 8-2/3 to 1 psi / 0.60 to 0.07 bar.

Panel Board

Air adjustment panels are available in two models as illustrated in Figures 2 and 3.

- Type A includes an air adjusting valve incorporating it's own bleed and two gages: one for the supply air, the other to indicate the adjusting air. It is complete and ready to be mounted directly on a control board or box.
- Type B is the same as Model A with the exception that it has in addition, a gage indicating the delivery pressure. The air filter regulator bleeds only on a lowering of the pressure set point.

Principle of Operation

The regulator is operated by initial steam or fluid pressure. It is normally closed, being held so by initial pressure on the disk and by an internal main spring. When the pilot is opened, initial pressure flows through the pilot to the 8B tee. Bleedport 4A restricts the flow and pressure builds under the diaphragm and opens the main valve. The 5A restriction elbow steadies the operation of the regulator.

Delivery pressure feeds back through the control pipe to the pilot diaphragm. As this pressure approaches a balance with the air loading signal, the pilot throttles the loading pressure. In turn, the main valve takes a position established by the loading pressure where just enough steam flows to maintain the set delivery pressure. For temperature control, refer to SD for temperature pilot.

Installation

⚠ WARNING

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

Additionally, physical damage to the pilot may result in personal injury or property damage due to escaping

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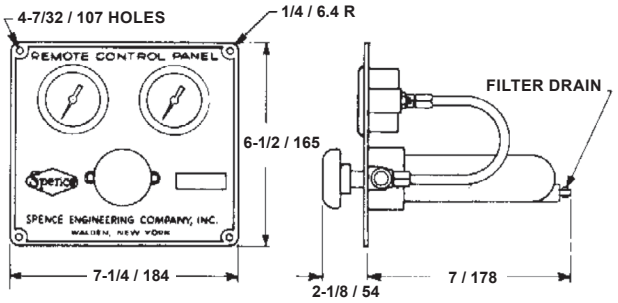

Figure 2. *Type A Panel (cut out 5-1/4 in. high by 6 in. wide)*

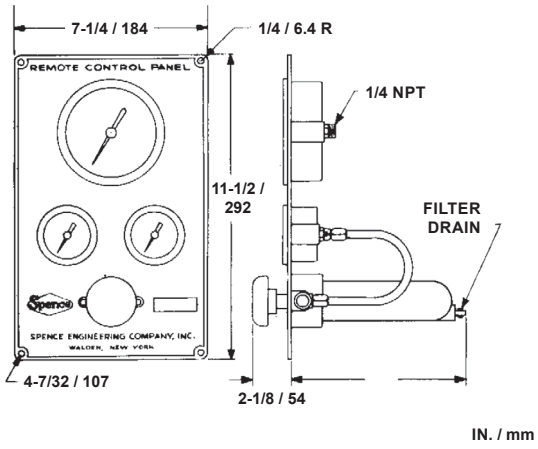

Figure 3. *Type B Panel (cut out 10-1/4 in. high by 6 in. wide)*

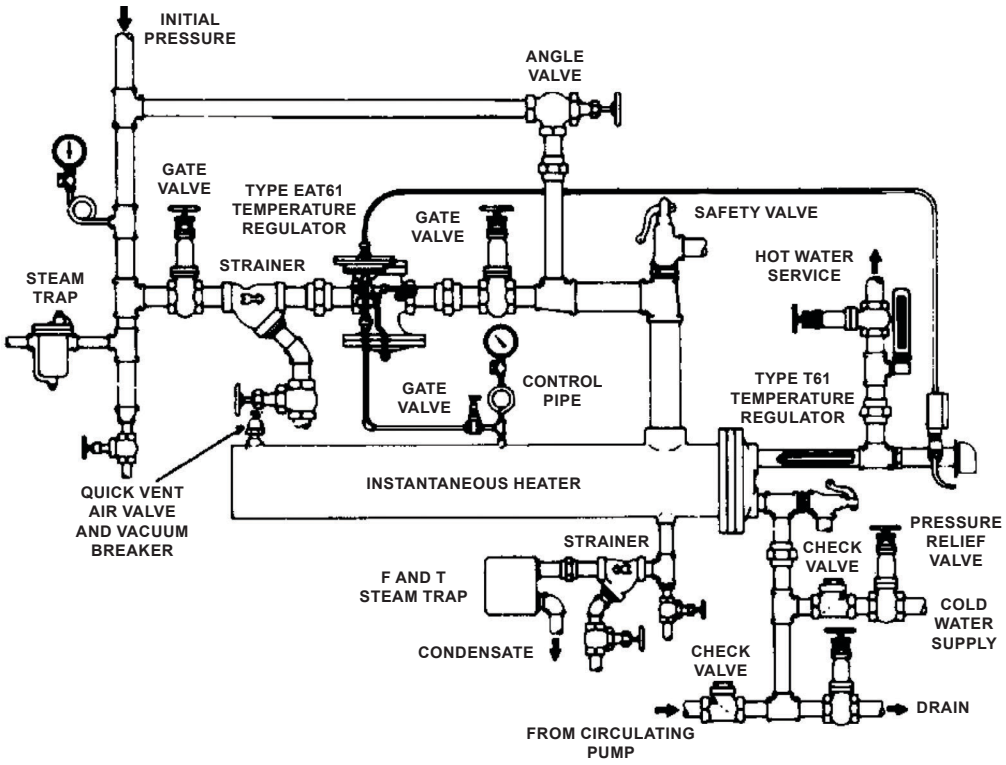

Figure 4. *A Series Recommended Installation*

of accumulated gas. To avoid such injury and damage, install the pilot in a safe location.

All pressure equipment should be installed in a non-seismic area; should not be exposed to fire; and should be protected from thunderbolt (lightning) strikes.

CAUTION

The piping system must be adequately designed and supported to prevent extraordinary loads to the pressure equipment.

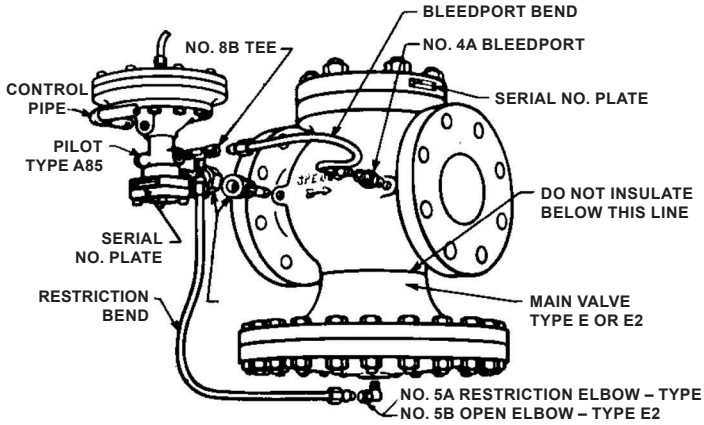

Figure 5. *Tubing Bends Connection*

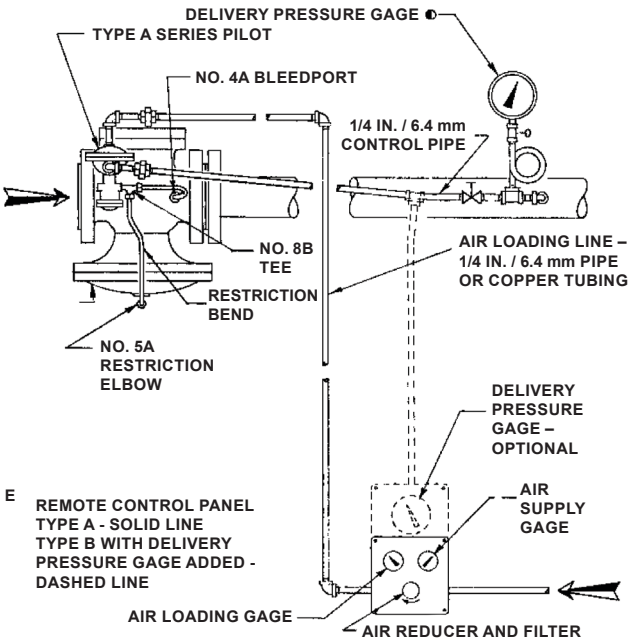

Figure 6. *Remote Control Panel*

Planning

1. Locate the regulator in a horizontal pipe.
2. Provide a trap ahead of the regulator to prevent water hammer and erratic operation.
3. Use strainer to protect the regulator and avoid damaging effects of scale and dirt in pipelines.
4. Provide a three valve bypass to facilitate inspection of the regulator without interrupting service.

Main Valve

1. Flush the main piping system thoroughly to clear it from welding beads, scale, sand, etc.
2. Mount main valve with diaphragm chamber down and arrow on body pointing in the direction of flow. Screwed end valve should be mounted in unions.

Pilot

1. Mount the pilot on either side of the main valve by means of a 1/4 in. / 6.35 mm nipple and union provided Make this connection to the 1/4 in. / 6.35 mm pipe tap on the inlet of the main valve.
2. Screw 4A bleedport fitting into 1/8 in. / 3.18 mm pipe tap on the outlet of the main valve body.

Note

Bleed orifice in this fitting is vital to operation of regulator.

3. Screw 8B tee into 1/8 in. / 3.18 mm pipe tap in pilot. Select tap facing downstream.
4. Screw 5A elbow containing restriction orifice into 1/8 in. / 3.18 mm pipe tap on underside of main valve diaphragm chamber. If initial pressure or pressure drop is less than 15 psi / 1.03 bar, a 5B open elbow without orifice is used.
5. Connect tubing bends as illustrated in Figure 5.

Control Pipe

1. Use 1/4 in. / 6.35 mm pipe for this line which connects the pilot diaphragm chamber to the desired point of pressure control.
2. On instantaneous heaters with steam in the shell, tap the control pipe into shell. See Figure 3. Otherwise, enter delivery steam pipe at point of entrance to heater.
3. Pitch the control pipe away from the pilot and avoid water pockets.
4. Locate delivery pressure gage in control pipe to show pressure actually reaching pilot diaphragm. Use a compound gage.

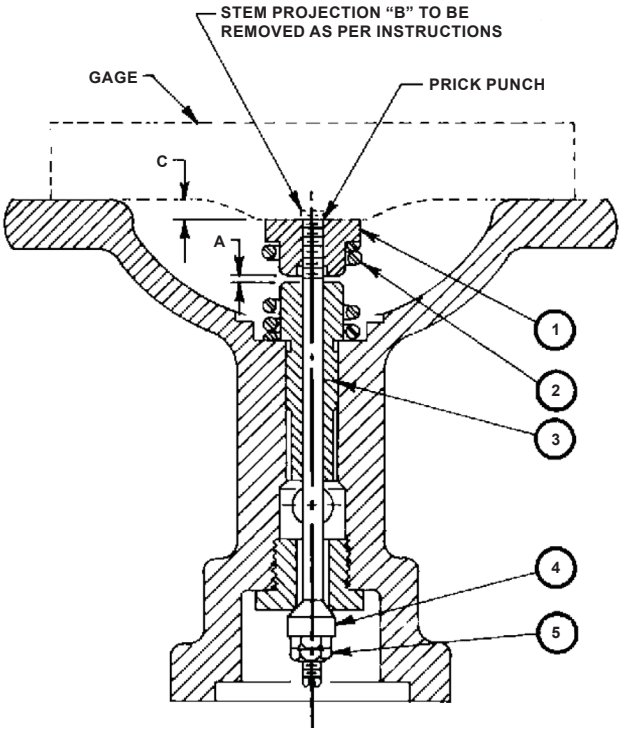

Figure 7. *Travel Setting - All A Series Pilots except Type A*

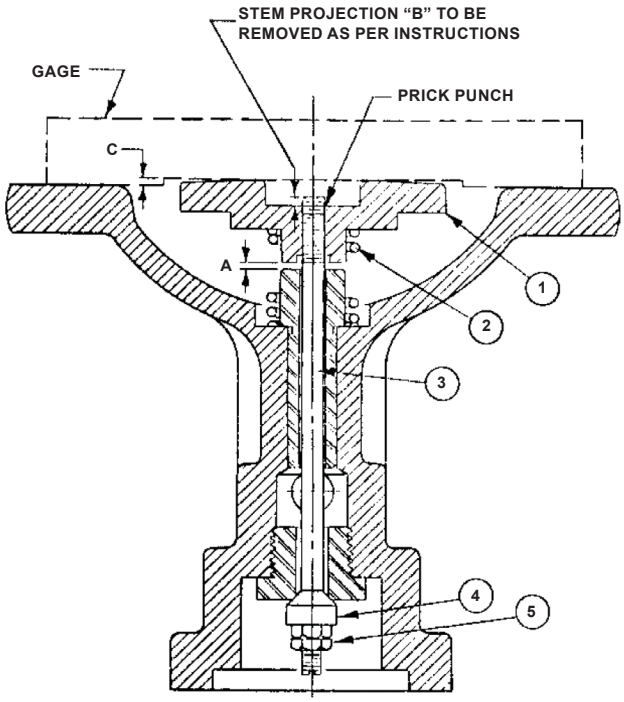

Figure 8. *Travel Setting - Type A Pilot only*

Insulation

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

Start-up and Setting

WARNING

The pilot may be handling hazardous fluids. Only qualified personnel, who are familiar with the installation, should be permitted to install, readjust, inspect or maintain the valve.

For pressure reduction, refer to Type E or E2 Instruction Manuals covering the main valve (VCIMD-14961 or VCIMD-14935). The instructions for the A Series Pilots are the same except that they are air loaded instead of spring loaded. For temperature control, refer to the Types T14 and T14D or Types T124 and T134 Instruction Manuals covering the temperature pilot (VCIMD-14973 or VCIMD-14980).

Maintenance

WARNING

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 pilot from system pressure and relieving all internal pressure from the pilot.

Pilots 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 pilot.

Due to normal wear or damage that may occur from external sources, this pilot 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.

Dismantling

1. Remove diaphragm nuts and lift off cowl. Lift out diaphragm assembly.
2. Disassemble diaphragm assembly by removing diaphragm screw from pressure plate.
3. Remove blind flange bolts and take off blind flange. Remove screen and gasket.
4. Hold the pusher plate and remove stem nuts. Lift out stem assembly and valve spring. Drop off the disk.
5. If the seat ring requires replacement, remove it from pilot body with a socket wrench.

Assembly

1. Reassemble the pilot in the reverse of the procedure described on Dismantling section.
2. When replacing diaphragms, apply sealing compound (high temperature high pressure sealant) sparingly to the shoulder of the diaphragm screw. For steel pilots only, apply sealing compound to the diaphragm flange of the pilot body.
3. When replacing gaskets, be sure that any serrated sealing surfaces are cleaned of old gasket material.

Inspection

1. Examine the seat and disk sealing surfaces for nicks or other signs of damage by pipeline debris. Slight imperfections may be removed by lapping the surfaces together. Otherwise, replace the seat and disk.
2. Examine the stem for a buildup of pipeline contaminants or erosion. Remove any buildup with a wire brush and polish with very fine crocus cloth. Work carefully to avoid bending the stem.

Lapping Operations

1. Lap sparingly using 500 grit lapping compound and light pressure. Heavy grinding may cause galling, wide sealing surfaces and a grooved disk. all of which tend to produce leakage.
2. After the sealing surfaces are lapped in, disassemble and clean all parts.

Seat, Disk and Stem Replacement

1. Clean the body threads of old sealing compound using a wire brush. Apply new sealing compound (high temperature high pressure sealant) to the shoulder of seat ring. Let stand until tacky before installing in pilot body.
2. Lap in stem to disk joint with lapping compound.
3. Secure disk (key 4) to stem (key 3) with a stem nut (key 5). Insert this assembly into pilot body (omit valve spring).
4. Apply lapping compound to the disk and lap in the seat to disk joint. The stem is slotted for rotation with a screwdriver.
5. Screw pusher plate (key 1) on stem (key 3). Holding disk against its seat, adjust the pusher plate so that dimension C = 11/64 in. / 4.4 mm (See Figure 7 or 8).
6. Remove stem nut, be careful not to disturb the pusher plate adjustment, and lift stem out the top of the pilot. Grind off stem Projection B flush with upper surface of the pusher plate.
7. Reinsert stem into pilot body. Install disk and stem nut. Check dimension C and, if correct, lock the adjustment by prick punching the thread at several points. Work carefully to avoid bending the stem.
8. Scrape away burs raised by prick punching. Upper surface of pusher plate must be smooth and flat.
9. Check that valve travel A = 3/64 in. / 1.2 mm. This need not be exact. Stem should move smoothly. Binding indicates a bent stem.

Parts Ordering

When ordering parts, it is essential that the pilot type, service and serial number be stated.

Select part by item number, but order by part number. Specify complete part number when ordering.

Parts List

Repair Parts Kit (See Table 1)

A Series Parts List (See Tables 2 to 4)

Table 1. *Repair Parts Kit*

PILOT TYPE	PART NUMBER	
	IRON	STEEL
A	WAL08-08115-00	WAL08-10372-00
A35	WAL08-08552-00	- - - - - - - - - - -
A82	WAL08-09107-00	- - - - - - - - - - -
A83	WAL08-09108-00	WAL08-10360-00
A43, A46	WAL08-08175-00	WAL08-10370-00
A53	WAL08-08117-00	WAL08-10369-00
A70	WAL08-09106-00	WAL08-10362-00
A73	WAL08-08178-00	WAL08-10368-00
A84	WAL08-08179-00	WAL08-10367-00
A85	WAL08-08180-00	WAL08-10366-00
A86	WAL08-08181-00	WAL08-10365-00
A87	WAL08-08182-00	WAL08-10364-00

Table 2. *Types A, A82 and A83 Parts List*

KEY	PART NAME	MATERIAL	PART NUMBER
1	Diaphragm Nut	Steel	WAL05-02871-00
2	Hood, A and A83 Hood, A and A83 Hood, A and A83 Hood, A82	Iron Bronze Steel Iron	WAL04-02563-00 WAL04-02565-00 WAL04-02564-00 WAL04-02600-00
3	Body and Bushing, A and A83 Body and Bushing, A and A83 Body and Bushing, A and A83 Body and Bushing, A82 Body and Bushing, A82	Iron Bronze Steel Iron Bronze	WAL07-03514-00 WAL08-04265-00 WAL07-04267-02 WAL08-04698-00 WAL08-04699-00
4	Diaphragm Bolt Diaphragm Nut	Steel Steel	WAL05-04764-00 WAL05-02871-00
5*	Valve Spring	Inconel	WAL05-04985-00
6	Bushing (see item 3)	Stainless steel	WAL04-01080-00
7*	Stem	Stainless steel	WAL04-05229-00
8*	Gasket, Iron and Bronze Bodies Gasket, Steel Bodies	Garlock Flexitalic	WAL05-16183-00 WAL05-11718-00
9	Blind Flange Blind Flange Blind Flange	Iron Bronze Steel	WAL04-02151-00 WAL04-02153-00 WAL04-11678-00
10	Blind Flange Bolt, Iron and Bronze Bodies Blind Flange Bolt, Steel Bodies	Steel Steel	WAL05-04803-00 WAL05-11719-00
11*	Diaphragm, A (2 required)	Stainless steel	WAL04-01626-00
12*	Pusher Plate, A, Iron and Bronze Bodies Pusher Plate, A, Steel Bodies	Iron Steel	WAL04-03728-00 WAL04-09520-00
13*	Seat Ring	Stainless steel	WAL04-04057-90
14*	Disk	Stainless steel	WAL04-01772-90
15*	Stem Nut	Steel	WAL05-02888-00
16	Screen, Water Screen, Heavy Oil *Screen, Steam	Stainless steel Stainless steel Stainless steel	WAL04-04701-00 WAL04-04702-00 WAL04-04700-00
17	Pipe Plug, 1/8 NPT (not shown) Pipe Plug, 1/8 NPT (not shown)	Steel Brass	WAL04-03769-00 WAL04-03770-00
18*	Diaphragm Screw Nut, A82 and A83	Steel	WAL04-02925-00
19*	Diaphragm Screw, A82 and A83	Steel	WAL04-04819-00
20*	Diaphragm, A82 (2 required) Diaphragm, A83 (2 required)	Stainless steel Stainless steel	WAL04-03927-00 WAL04-01623-00
21	Floating Plate, A82 Floating Plate, A83	Iron Iron	WAL04-03638-00 WAL04-03710-00
22*	Vacuum Spring, A82 and A83	Stainless steel	WAL05-05055-00
23*	Pusher Plate, A82 and A83	Steel	WAL04-08177-00

*These parts furnished in Repair Kit

Table 3. *Type A35 Parts List*

KEY	PART NAME	MATERIAL	PART NUMBER
1	Hood	Iron	WAL04-02623-00
2	Loading Pressure Plate	Iron	WAL04-03641-00
3	Diaphragm Nuts	Steel	WAL05-02871-00
4	Cowl	Iron	WAL04-01540-00
5	Body and Bushing Body and Bushing	Iron Bronze	WAL08-04698-00 WAL08-04699-00
6	Control Diaphragm Bolts Control Diaphragm Nuts	Steel Steel	WAL05-04764-00 WAL05-02871-00
7*	Diaphragm Screw	Steel	WAL04-04821-00
8*	Pusher Plate	Steel	WAL04-03718-00
9*	Valve Spring	Inconel	WAL05-04985-00
10	Bushing	Stainless steel	WAL04-01080-00
11*	Gasket	Graphite	WAL05-02378-00
12	Blind Flange Blind Flange	Iron Bronze	WAL04-02151-00 WAL04-02153-00
13	Blind Flange Bolts	Steel	WAL05-04803-00
14	Loading Diaphragm Bolts	Steel	WAL05-04832-00
15*	Loading Diaphragms (2 required)	Stainless steel	WAL04-01626-00
16*	Control Pressure Plate	Iron	WAL04-03684-01
17*	Control Diaphragm (2 required)	Stainless steel	WAL04-03927-00
18*	Stem	Stainless steel	WAL04-05229-00
19*	Seat Ring	Stainless steel	WAL04-04057-00
20*	Disk	Stainless steel	WAL04-01772-00
21*	Stem Nut	Steel	WAL05-02888-00
22	*Screen–Steam Screen–Heavy Oil Screen–Water	Stainless Steel Stainless Steel Stainless Steel	WAL04-04700-00 WAL04-04702-00 WAL04-04701-00
23	Pipe Plug 1/8 NPT (not shown) Pipe Plug 1/8 NPT (not shown)	Steel Brass	WAL04-03769-00 WAL04-03770-00

*These parts furnished in Repair Kit

Table 4. *Types A43, A46, A53, A70, A73, A84, A85, A86 and A87 Parts List*

KEY	PART NAME	MATERIAL	PART NUMBER
1	Loading and Control Diaphragm Bolt Control Diaphragm Bolts, A70	Steel Steel	WAL05-04809-00 WAL05-04837-00
2	Hood, A43, A84 Hood, A53, A85 Hood, A73, A87, A70 Hood, A46, A86	Iron Iron Iron Iron	WAL04-02622-00 WAL04-02621-00 WAL04-02620-00 WAL04-02624-00
3	Cowl, A43, A84, Iron and Bronze Bodies Cowl, A53, A85, Iron and Bronze Bodies Cowl, A73, A87, Iron and Bronze Bodies Cowl, A70, Iron and Bronze Bodies Cowl, A46, A86, Iron and Bronze Bodies Cowl, A43, A84, Steel Bodies Cowl, A53, A85, Steel Bodies Cowl, A73, A87, Steel Bodies Cowl,A46, A86, Steel Bodies Cowl, A70, Steel Bodies	Iron Iron Iron Iron Iron Duct. Iron Duct. Iron Duct. Iron Duct. Iron Duct. Iron	WAL04-01538-00 WAL04-01536-00 WAL04-01534-00 WAL04-01510-00 WAL04-01541-00 WAL04-01539-00 WAL04-01537-00 WAL04-01535-00 WAL04-04583-00 WAL04-01511-00
4*	Control Pressure Plate Control Pressure Plate, A70	Steel Steel	WAL04-03679-00 WAL04-08432-00
5*	Diaphragm Screw	Steel	WAL04-04821-00
6*	Pusher Plate	Steel	WAL04-03718-00
7*	Valve Spring Valve Spring, A70	Inconel Inconel	WAL05-04985-00 WAL05-05197-00
8	Bushing (see item 10)	Stainless steel	WAL04-01080-00
9*	Stem	Stainless steel	WAL04-05229-00
10	Body and Bushing Body and Bushing Body and Bushing Body and Bushing, A70 Body and Bushing, A70	Iron Bronze Steel Iron Steel	WAL07-03514-00 WAL08-04265-00 WAL07-04267-02 WAL08-04801-00 WAL08-04803-01
11*	Gasket, Iron and Bronze Bodies Gasket, Steel Bodies	Non-asbestos Flexitalic	WAL05-02378-00 WAL05-11718-00
12	Blind Flange Blind Flange Blind Flange	Iron Bronze Steel	WAL04-02151-00 WAL04-02153-00 WAL04-11678-00
13	Blind Flange Bolt, Iron and Bronze Bodies Blind Flange Bolt, Steel Bodies	Steel Steel	WAL05-04803-00 WAL05-11719-00
14*	Loading Diaphragm, A43, A46, A84, A86 (2 required) A53, A85 (2 required) A73, A87, A70 (2 required)	 Stainless steel Stainless steel Stainless steel	 WAL04-01629-01 WAL04-01632-00 WAL04-01635-00
15	Loading Pressure Plate, A43, A84 Loading Pressure Plate, A53, A85 Loading Pressure Plate, A70, A73, A87 Loading Pressure Plate, A46, A86	Iron Iron Iron Iron	WAL04-03641-00 WAL04-03640-00 WAL04-03639-00 WAL04-03642-00
16	Control Diaphragms (2 required) Control Diaphragms, A70 (4 required)	Stainless steel Stainless steel	WAL04-01623-00 WAL04-01620-00
17*	Seat Ring	Stainless steel	WAL04-04057-90
18*	Disk	Stainless steel	WAL04-01772-90
19*	Stem Nut	Steel	WAL05-02888-00
20	*Screen, Steam Screen, Heavy Oil Screen, Water	Monel Monel Monel	WAL04-04700-00 WAL04-04702-00 WAL04-04701-00
21	Pipe Plug, 1/8 NPT (not shown) Pipe Plug, 1/8 NPT (not shown)	Steel Brass	WAL04-03769-00 WAL04-03770-00
22*	Floating Plate, A84, A85, A86, A87	Steel	WAL04-03710-00
23*	Vacuum Spring, A84, A85 Vacuum Spring, A86 Vacuum Spring, A87	Stainless steel Stainless steel Stainless steel	WAL05-05055-00 WAL05-04970-00 WAL05-04968-00
24*	Pusher Plate, A84, A85, A86 Pusher Plate, A87	Steel Steel	WAL04-08177-00 WAL04-07070-00

*These parts furnished in Repair Kit

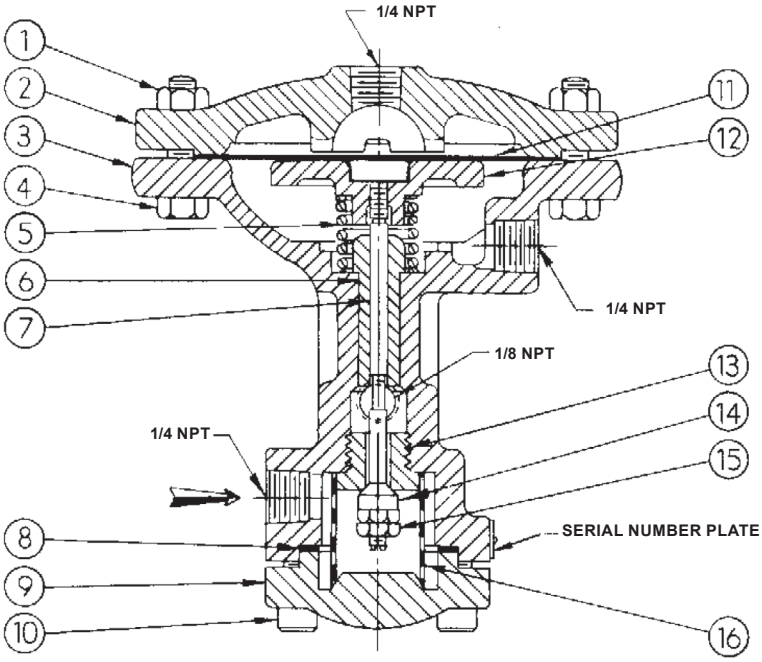

Figure 9. *Type A Pilot Assembly*

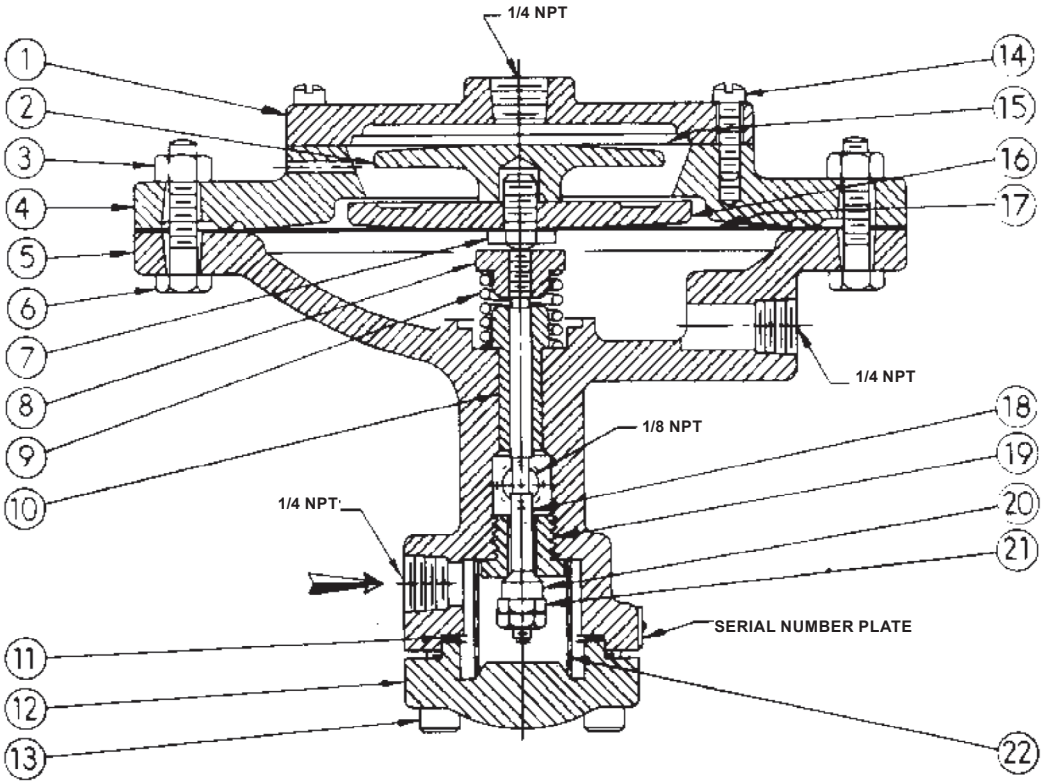

Figure 10. *Type A35 Pilot Assembly*

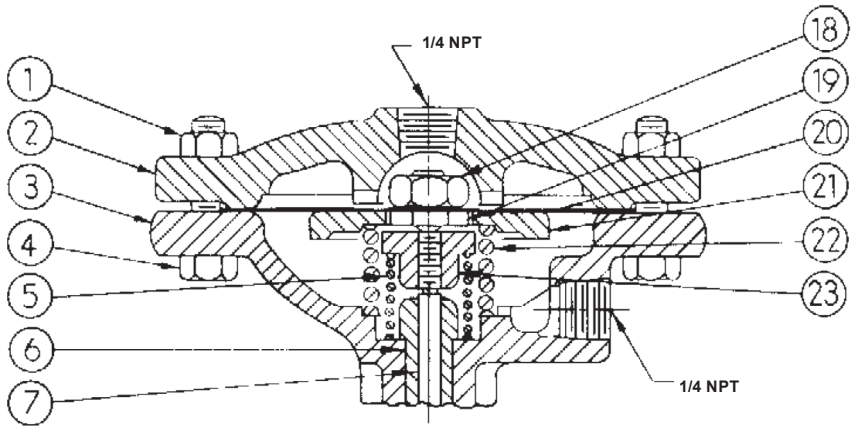

Figure 11. *Types A82 and A83 Pilots Assembly*

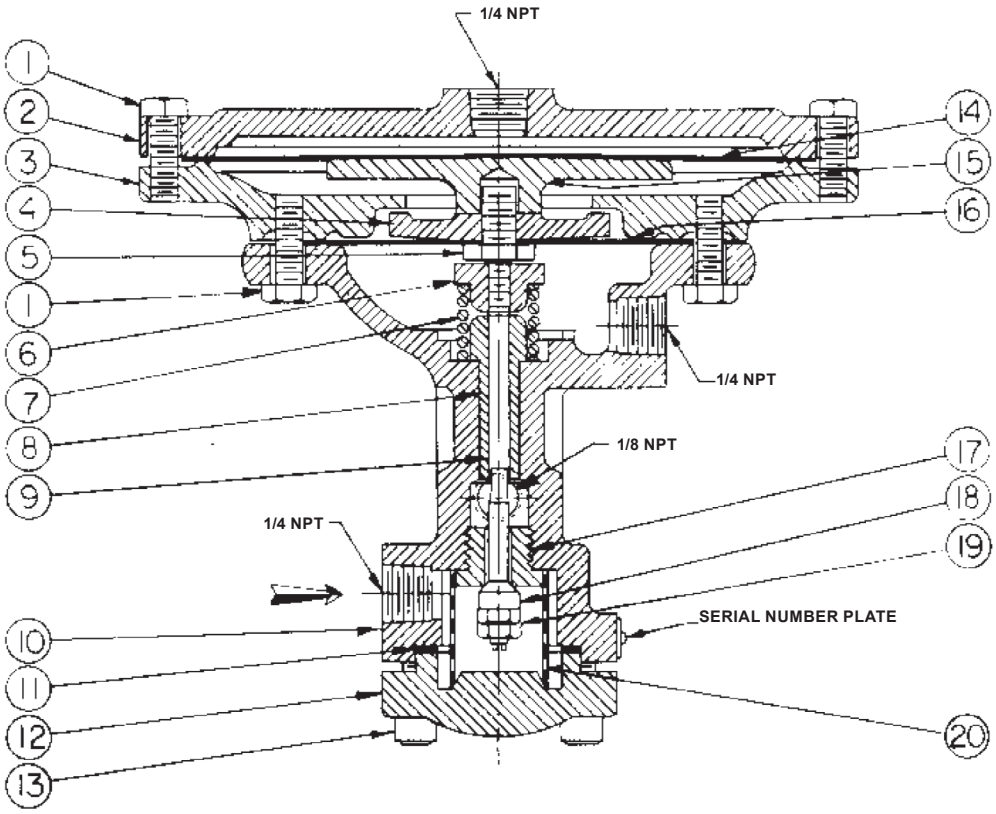

Figure 12. *Types A43, A46, A53, A70, A73, A84, A85, A86 and A87 Pilots Assembly*

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SPENCE™

N Series Differential Pressure Pilots

WARNING

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

The N Series Differential Pressure 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 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 N Series Differential Pressure Pilots.

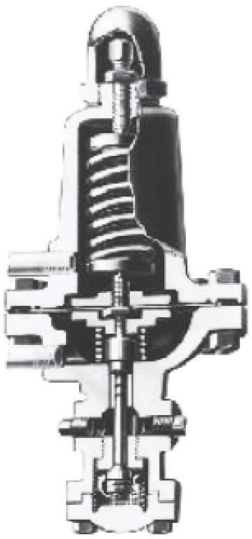
Introduction

Scope of the Manual

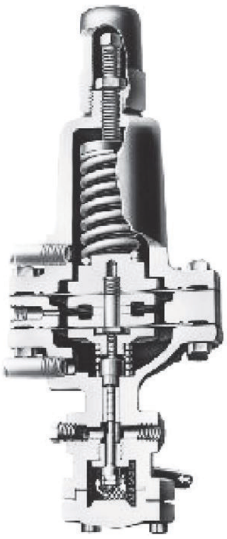
This manual provides instructions for the installation, troubleshooting, maintenance, valve setting and parts ordering for N Series Differential Pressure Pilots.

Product Description

The combination of a Spence Type N with a Spence Type E main valve produces a differential pressure regulator in a single pilot-operated valve. Type N is designed to control the pressure of the fluid discharged at a constant, adjustable differential above some separate source of pressure.



TYPE N PILOT



TYPE N33 PILOT

Figure 1. *Type N Differential Pressure Pilots*

Specifications

This section lists the specifications for the N Series Differential Pressure Pilot. Factory specifications are stamped on the nameplate fastened on the regulator at the factory.

Available Sizes
NPS 1/4 x 1/8 / DN 8 x 6

End Connection Styles
NPT

Maximum Operating Temperature(1)
Cast Iron: 450°F / 232°C
Cast Steel: 750°F / 399°C

Maximum Inlet Pressure(1)
Cast Iron: 250 psi / 17.2 bar
Cast Steel: 600 psi / 41.4 bar

Outlet Pressure Ranges
Types N, N20 and N33
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

Construction Materials
Types N and N20: Cast iron
Type N33: Cast iron and Cast steel

Option
Integral Mount

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

Typical applications are:

1. Steam atomizing oil burners–to maintain a constant excess of atomizing steam pressure over oil pressure.
2. Mechanical atomizing oil burners–where it is required to maintain a constant oil pressure drop across the burner tip.
3. Motor-driven centrifugal boiler feed pumps–to maintain a constant excess of feedwater pressure over boiler steam pressure.
4. Connection between high and low pressure boiler feed systems–to reduce the feedwater pressure and to maintain a constant excess pressure over the steam of the low pressure boilers.

Principle of Operation

The combination of the Spence Type N and the Spence Type E main regulator is operated by initial steam or fluid pressure. It is normally closed, being held so by initial pressure on the disk and by an internal main spring, see Figure 3. When the pilot is opened (see pilot instructions), initial pressure flows through the pilot to the 8B tee, see Figure 2. 4A bleed port restricts the flow and pressure builds under the diaphragm and opens the main valve. The 5A restriction elbow steadies the operation of the regulator.

Delivery pressure feeds back through the control pipe to the pilot diaphragm. As this pressure approaches a balance with the thrust of the adjusting spring, the pilot throttles the loading pressure. In turn, the main valve takes a position established by the loading pressure where just enough steam flows to maintain the set delivery pressure.

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.

CAUTION

Do not remove adjusting screw or entirely loosen locknut.

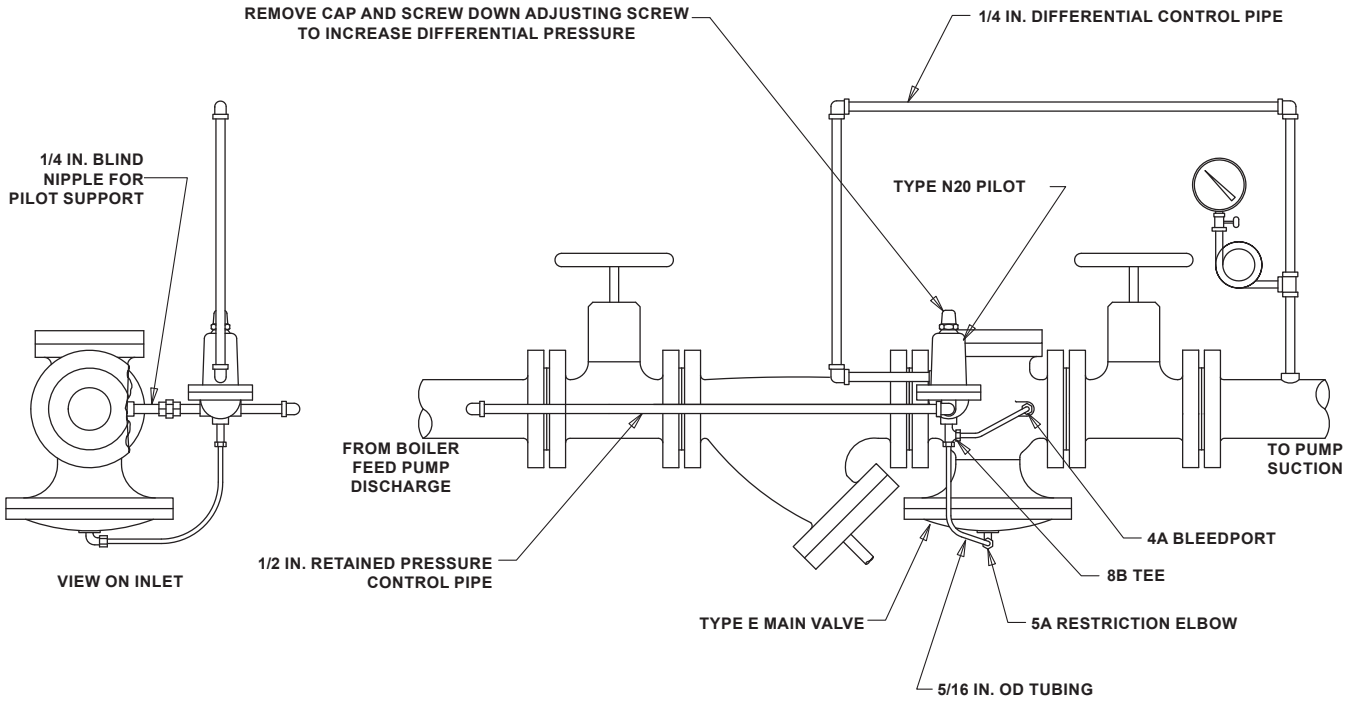


Figure 2. *Type E Main Valve and Type N20 Installation*

1. On boiler feed systems, locate the differential regulator as near the boiler as possible but leave a space of about 20 pipe diameters between it and the feedwater regulator.
2. Install the main valve in a straight run of horizontal pipe with diaphragm chamber down and arrow on the body pointing in the direction of flow.
3. Carefully clear the piping system of foreign matter at assembly. Provide a three-valve bypass to facilitate inspection of the valve without interrupting service. Avoid damaging effects of scale and dirt in pipelines by using a Spence strainer ahead of the regulator.
4. Mount the pilot on either side of the main valve, connecting it to the 1/4 in. / 6.35 mm pipe tap on the inlet end with the nipple and union provided.
5. Assemble the auxiliary fittings and tubing as shown on the connection drawing. Bleedport fitting and restriction elbow No. 5A (or Restriction Tee No. 7C) contain orifices which must not be obstructed.

Note

The delivery pressure control pipe should be as short as practical and must enter the delivery line at a point of minimum turbulence. Avoid a control point near a turn or an expanding fitting.

6. The differential control pipe should be run from the pilot spring chamber as directly as possible to the source of independently varying pressure. When connecting to boiler steam pressure, tie into the main steam header in preference to a branch line. If to a heavy fuel oil line, keep the control pipe short and in the warmest possible location.
7. Insulation may be applied to the upper portion (globe and flanges) of the main valve. Do not insulate the diaphragm chamber or any part of the pilot.

Pressure Adjustment

Turning the adjusting screw clockwise increases the differential pressure setting. Replace cap over adjusting screw after final adjustment is obtained.

Startup

1. Use the bypass valve to regulate the flow at desired differential pressure.
2. Remove cap from top of pilot spring chamber. Trapped air must be allowed to bleed out around threads of adjusting screw.
3. Open the valves in the delivery and differential control pipes.
4. Open the outlet stop valve wide. Open the inlet stop valve gradually and choke down on the bypass until the regulator is on the line.

Dismantling and Valve Grinding

1. To take main valve apart, begin by removing top flange.
2. Connect a source of air (water, steam) pressure which can be adjusted by hand to the underside of the diaphragm.
3. Apply 30 psi / 2.07 bar to jack the valve wide open. The friction of the pressure plate against stops in the base will prevent the stem from turning while removing the stem nuts.
4. A valve handling water or oil contains a dashpot. The dashpot piston is threaded on the stem and secured with one stem nut.
5. To dismantle the pilot, take it apart at the diaphragm joint. This exposes a pusher plate on the diaphragm end of the valve stem. Grasp it by hand while turning off the stem nuts at the other end.
6. To grind in either main valve or pilot Disk, use extremely fine (grit 400) compound with light pressure to avoid tearing the metal.
7. Clean all parts with kerosene or carbon tetrachloride before reassembling.

Troubleshooting

Failure to Open

1. Remove tubing bend at No. 4A Bleedport fitting which contains an orifice. This orifice may have been omitted or misplaced. It is 1/16 in. / 1.59 mm for water service, 3/32 in. / 2.38 mm for steam, gas or heavy oil.
2. Remove tubing bend at No. 5A Restriction fitting. This orifice may be clogged. If No. 7C Restriction Tee is used, turn this fitting out of the valve to examine its orifice.
3. Crack open inlet stop valve. Steam (water, oil, gas) should issue from open No. 8B Tee or No. 5B Elbow at pilot outlet provided there is compression on the control spring. If there is little or no flow, remove square bottom cap on pilot and clean the inlet screen.
4. Make sure there is adequate pressure at the main valve inlet.
5. Disconnect the delivery pressure control pipe and blow through it toward the delivery line. It may be plugged at the point of entry into the line. Be sure the differential control pipe is also clean and, if filled with heavy oil, warm enough to transmit pressure sensitivity.
6. Inspect main valve diaphragms.

Failure to Close

1. Remove tubing bend at No. 4A Bleedport fitting, as in item #1, under the Failure to Open section, and observe if orifice is clogged.
2. Break the union in the differential control pipe to remove pressure from pilot spring chamber.
3. Crack open the inlet stop valve and remove all compression on the control spring.
   a. If steam (water, oil, gas) issues from No. 8B Tee or No. 5B Elbow, the pilot has an obstruction between its seat and Disk.
   b. If the leakage is from the No. 4A Bleedport, the main valve is held open.
   c. To inspect either valve seat see Maintenance sub-paragraph on dismantling.

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.

Complete dismantling at regular intervals for inspection and repair is not recommended. Under normal conditions, if kept relatively free of dirt, a regulator will function for years with a minimum of maintenance attention. These service points are suggested.

After the first few days of operation, and thereafter twice a year:

1. Inspect for dirt collected at:
   a. No. 4A Bleedport orifice–screwed into outlet end of main valve.
   b. No. 5A Restriction orifice–screwed into underside of main valve.
   c. Inlet screen in pilot–remove square bottom cap to drop out.
2. Inspect all joints for leakage. Tighten all bolts. Never allow a leak to persist.

Parts Ordering

When corresponding with your local Sales Office about this equipment, always reference the equipment regulator size, service and serial number.

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

Parts List

Type E Main Valve

See Type E Instruction Manual VCIMD-14961-EN

Type N Pilot

Key	Description	Part Number
	Repair Parts Kit	
	Cast iron Pilot	WAL08-09109-00
	Steel Body Pilot	WAL08-10359-00
1	Top Cap	
	Steel	WAL04-01303-00
	Brass	WAL04-01304-00
2	Adjusting screw, Steel	WAL05-04860-00
3	Locknut, Steel	WAL05-07789-00
4*	Top Cap Gasket, Copper Graphite(1)	WAL05-02356-00
5	Spring Button, Steel	WAL04-01040-00
6	Adjusting Spring, Steel	
	3 to 20 psi / 0.21 to 1.38 bar (Aluminum)	WAL05-05007-00
	5 to 50 psi / 0.35 to 3.45 bar (Orange)	WAL05-05003-00
	10 to 100 psi / 0.69 to 6.90 bar (Green)	WAL05-05005-00
	20 to 150 psi / 1.38 to 10.3 bar (Black)	WAL05-05012-00
7	Spring Chamber	
	Iron(2)	WAL04-01420-00
	Steel	WAL04-01422-00
8	Diaphragm Nut, Steel	
	For Iron Body Pilots	WAL05-02871-00
	For Steel Body Pilot	WAL05-02845-00
8	Nut, Steel	WAL05-02845-00
9	Pressure Plate, Steel(1)	WAL04-03679-00
10	Diaphragm Bolt, Steel	
	For Iron Body Pilots	WAL05-04764-00
	For Steel Body Pilot	WAL05-05490-00
10	Stud, Steel	WAL05-05490-00
11*	Valve Spring, Inconel®(1)	WAL05-04985-00
12	Bushing, Stainless steel	WAL04-01080-00
13	Body and Bushing	
	Iron	WAL07-03514-00
	Steel, Screwed	WAL07-04267-02
	Steel, Flanged Inlet	WAL07-41105-02
	Steel, Secoweld Flanged Inlet	WAL07-41379-02
14	1/8 NPT Pipe Plug	
	Steel	WAL04-03769-00
	Brass	WAL04-03770-00
15	Seat Ring, Stainless steel(1)	WAL04-04057-00
16	Screen, Monel®	
	Water	WAL04-04701-00
	Heavy Oil	WAL04-04702-00
	Steam(1)	WAL04-04700-00
17	Gasket	
	Non-asbestos, For Iron Body Pilots(1)	WAL05-02378-00
	Flexitalic, For Steel Body Pilot (1)	WAL05-11718-00
18	Blind Flange	
	Iron	WAL04-02151-00
	Steel	WAL04-11678-00

- continued -

Inconel® and Monel® are marks owned by Special Metals Corporation.
* Recommended Spar Part Kit
1. Included in Repair Kits
2. For Cast iron Spring Chamber with Steel Body Pilot use WAL5-04764-0 and WAL5-02871-0 Diaphragm Bolting

Type N Pilot (continued)

Key	Description	Part Number
19	Blind Flange Bolt, Steel	
	For Iron Body Pilots	WAL05-04803-00
	For Steel Body Pilot	WAL05-11719-00
20*	Diaphragm, Stainless steel (2 required)(1)	WAL04-01623-00
21	Pusher Plate	
	Iron, For Iron Body Pilots(1)	WAL04-03728-00
	Steel, For Steel Body Pilot(1)	WAL04-09520-00
22	Diaphragm Screw, Steel(1)	WAL04-04822-00
23	Stem, Stainless steel(1)	WAL04-05229-00
24	Disk, Stainless steel(1)	WAL04-01772-00
25	Stem Nut, Steel(1)	WAL05-02888-00
26	Stem, Stainless steel	WAL04-05381-00
27	Seat Ring, Stainless steel	WAL04-04060-00
28	Composition Disk Assembly, Brass	WAL07-53512-00
29	Gasket, Steel Non-asbestos	WAL05-02370-00
30	Flange Assembly - Female, Steel	WAL07-43516-00
31	Flange Assembly - Male, Steel	WAL07-04535-00

Type N33 Pilot

Key	Description	Part Number
	Repair Parts Kit	
	Iron Body Pilots	WAL07-08302-00
	Steel Body Pilot	WAL08-10363-00
1	Cap	
	Steel	WAL04-01303-00
	Brass	WAL04-01304-00
2	Adjusting screw, Steel	WAL05-04860-00
3	Seal Nut, Steel	WAL05-07789-00
4*	Cap Gasket, Copper Non-asbestos(1)	WAL05-02356-00
5	Spring Button, Steel	WAL04-01040-00
6	Spring Chamber	
	Cast iron	WAL04-01420-00
	Steel	WAL04-01422-00
7	Adjusting Spring, Steel	
	3 to 20 psi / 0.21 to 1.38 bar (Aluminum)	WAL05-05007-00
	5 to 50 psi / 0.35 to 3.45 bar (Orange)	WAL05-05003-00
	10 to 100 psi / 0.69 to 6.90 bar (Green)	WAL05-05005-00
	20 to 150 psi / 1.38 to 10.3 bar (Black)	WAL05-05012-00
8	Spring Button, Steel	WAL04-01037-00
9	Diaphragm Screw, Steel(1)	WAL04-04818-00
10	Diaphragm Nut, Steel	WAL05-02871-00
11	Diaphragm Spacer, Steel	WAL04-04940-00
12	Body Spacer	
	Cast iron	WAL04-04937-00
	Steel	WAL04-04938-00
13*	Diaphragm, Stainless steel	
	(4 required, 2 per set)(1)	WAL04-01623-00
14	Body and Bushing	
	Cast iron	WAL07-03514-00
	Steel	WAL07-04267-02
15	Cap Screw, Steel	WAL05-04767-00
16	Bushing, Stainless steel	WAL04-01080-00
17	Stem, Stainless steel(1)	WAL04-05229-00
18	1/8 NPT Pipe Plug	
	Steel	WAL04-03769-00
	Brass	WAL04-03770-00

Type N33 Pilot (continued)

Key	Description	Part Number
19	Seat Ring, Stainless steel(1)	WAL04-04057-00
20	Screen Steam, Monel®(1)	WAL04-04700-00
21*	Gasket	
	Non-asbestos, For Iron Body Pilot(1)	WAL05-02378-00
	Flexitalic, For Steel Body Pilot(1)	WAL05-11718-00
22	Cap Screw, Steel	
	For Iron Body Pilot	WAL05-04803-00
	For Steel Body Pilot	WAL05-11719-00
23	Pusher Plate, Steel(1)	WAL04-03718-00
24	Spring, Inconel®(1)	WAL05-04985-00
25	Disk, Stainless steel(1)	WAL04-01772-00
26	Stem Nut, Steel(1)	WAL05-02888-00
27	Blind Flange	
	Cast iron	WAL04-02151-00
	Cast Steel	WAL04-11678-00

Type N20 Pilot

Key	Description	Part Number
1	Top Cap, Ledloy	WAL04-01303-00
2	Adjusting screw, Steel	WAL05-04860-00
3	Seal Nut, Steel	WAL05-07789-00
4*	Gasket, Copper Non-asbestos	WAL05-02356-00
5	Spring Button, Powder Iron (2 required)	WAL05-01040-00
6	Spring Chamber, Cast iron	WAL04-01420-00
7	Adjusting Spring, Steel	
	3 to 20 psi / 0.21 to 1.38 bar (Aluminum)	WAL05-05007-00
	5 to 50 psi / 0.35 to 3.45 bar (Orange)	WAL05-05003-00
	10 to 100 psi / 0.69 to 6.90 bar (Green)	WAL05-05005-00
	20 to 150 psi / 1.38 to 10.3 bar (Black)	WAL05-05012-00
8	Pressure Plate, Powder Iron	WAL05-03679-00
9	Diaphragm Nut, Steel (12 required)	WAL05-02871-00
10	Diaphragm, 301 Stainless steel	
	3 to 100 psi / 0.21 to 6.90 bar (2 required)	WAL04-01623-00
	20 to 150 psi / 1.38 to 10.3 bar (3 required)	WAL04-01623-00
11	Diaphragm Screw, 303 Stainless steel	WAL04-04823-00
12	Diaphragm Bolts, Steel	WAL05-04764-00
13*	Seat Ring	WAL04-04381-00
14	Backing Plate, Brass	WAL04-03575-00
15	Disc Adjusting Screw, 303 Stainless steel	WAL04-04761-00
16	Integral Disc	WAL04-01712-00
17	Body, Cast iron	WAL04-00737-00

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* Recommended Spar Part Kit
1. Included in Repair Kits

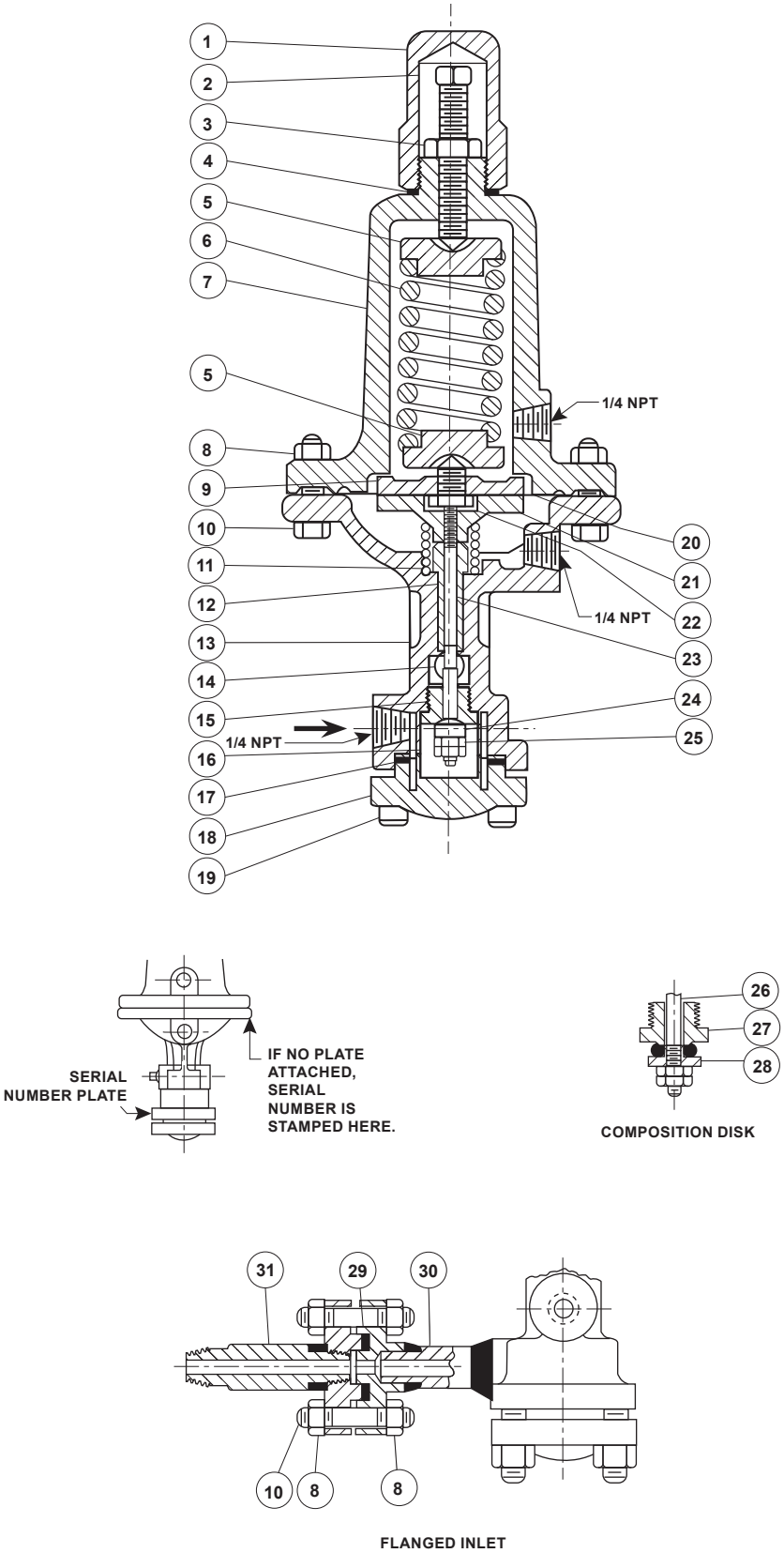

Figure 3. *Type N Pilot Assembly*

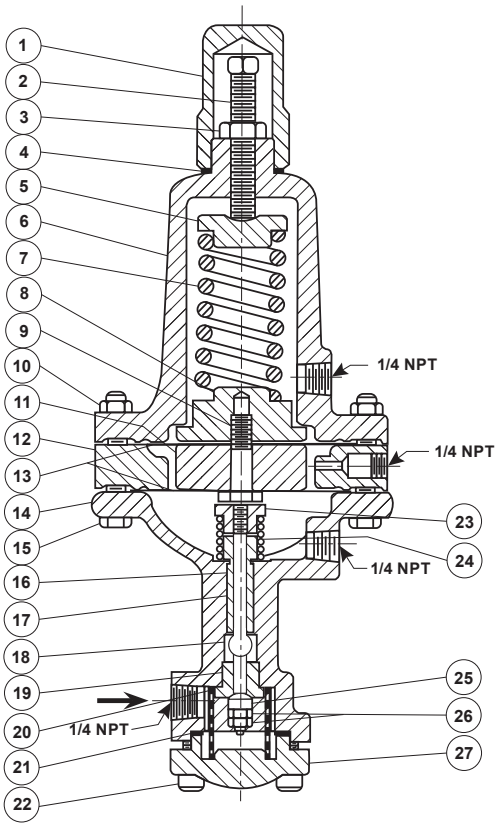

Figure 4. *Type N33 Pilot Assembly*

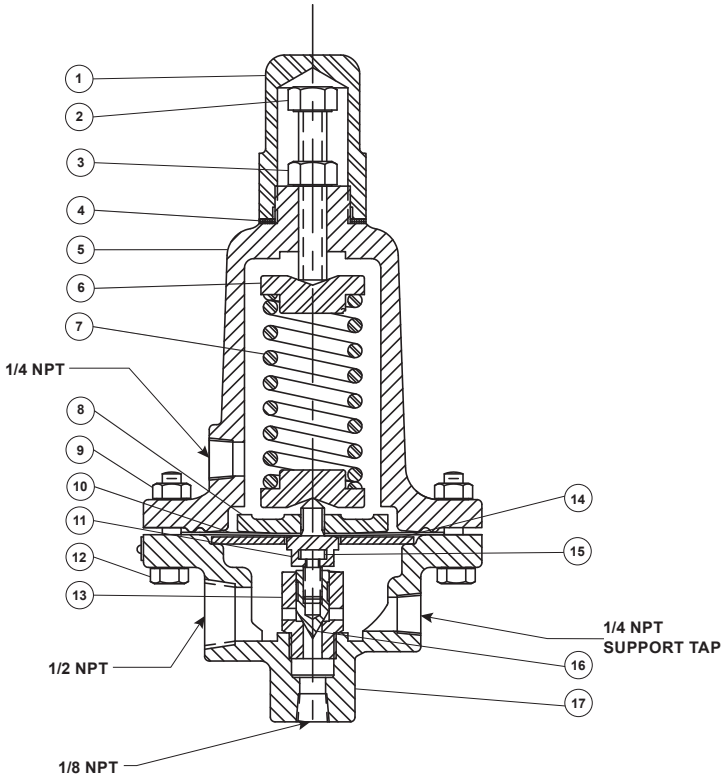

Figure 5. *Type N20 Pilot Assembly*

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SIOI13
SPP33D
SPP75

SPENCE™

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.

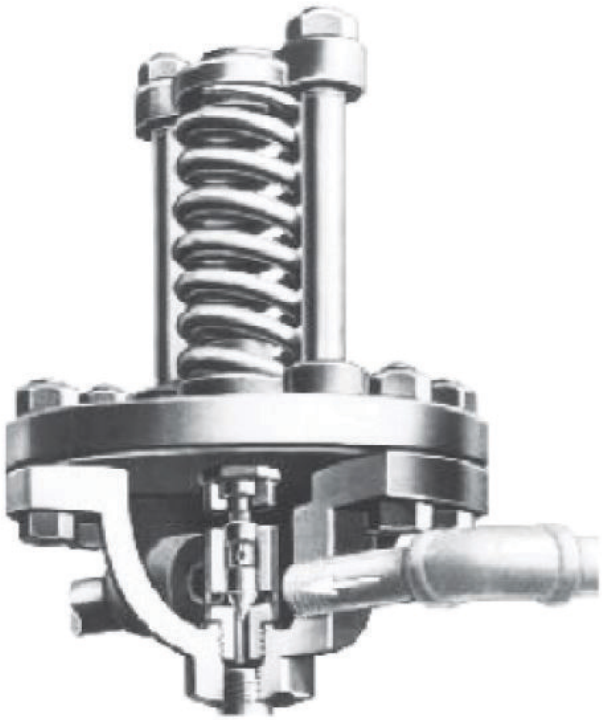

Figure 1. *Q Series Pilot*

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.

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.

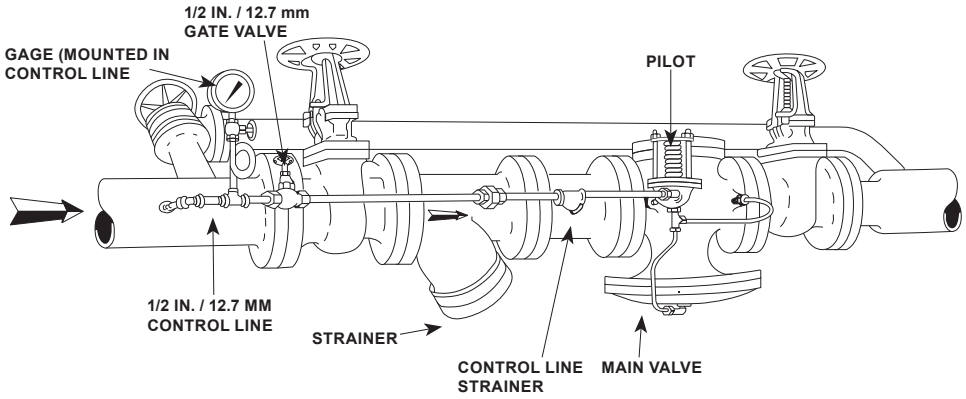

Figure 2. *Installation of Back Pressure Regulator with Three-Valve Bypass and Strainers*

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.

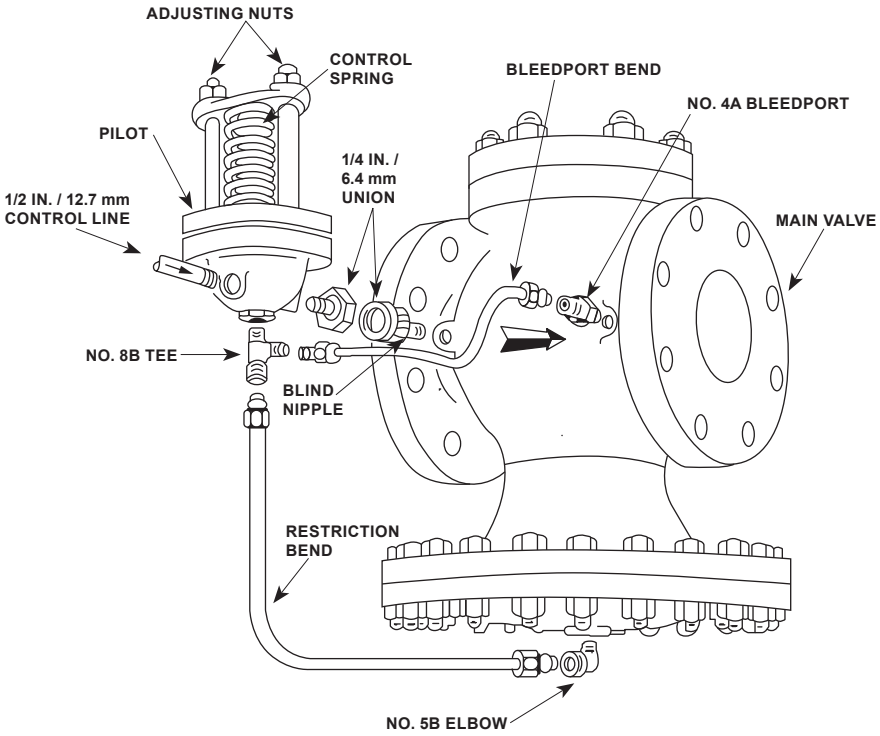

Figure 3. *Pilot and Fittings Installation*

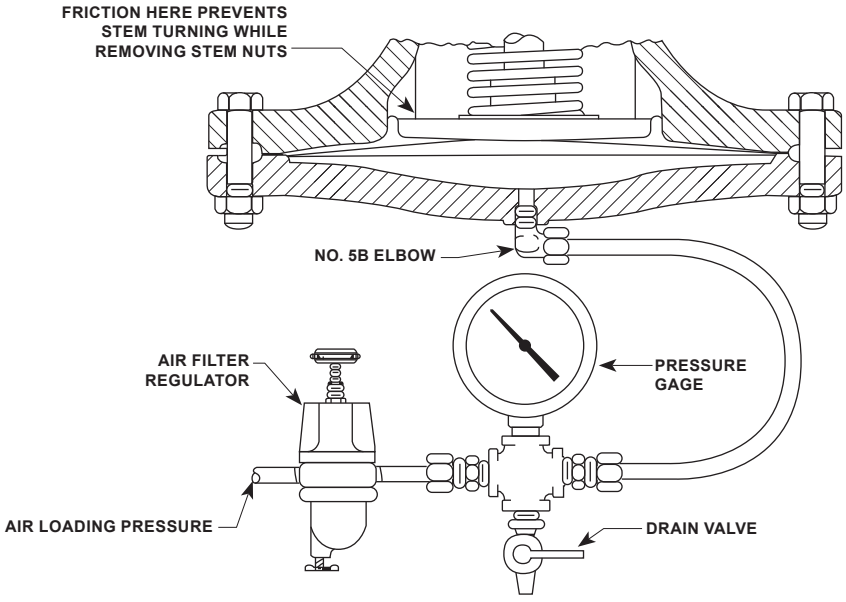

Figure 4. *Air Loading Arrangement for Removing Stem Nuts*

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	WAL05-05007-00
	5 to 50 psi / 0.35 to 3.45 bar	WAL05-05003-00
	10 to 100 psi / 0.69 to 6.90 bar	WAL05-05005-00
	20 to 150 psi / 1.38 to 10.3 bar	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	WAL04-00737-00
	Bronze	WAL04-00739-00
	Steel	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)	WAL04-06166-00
	Ductile iron(3)	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	WAL04-01393-00
	Bronze	WAL04-01395-00
	Steel	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.

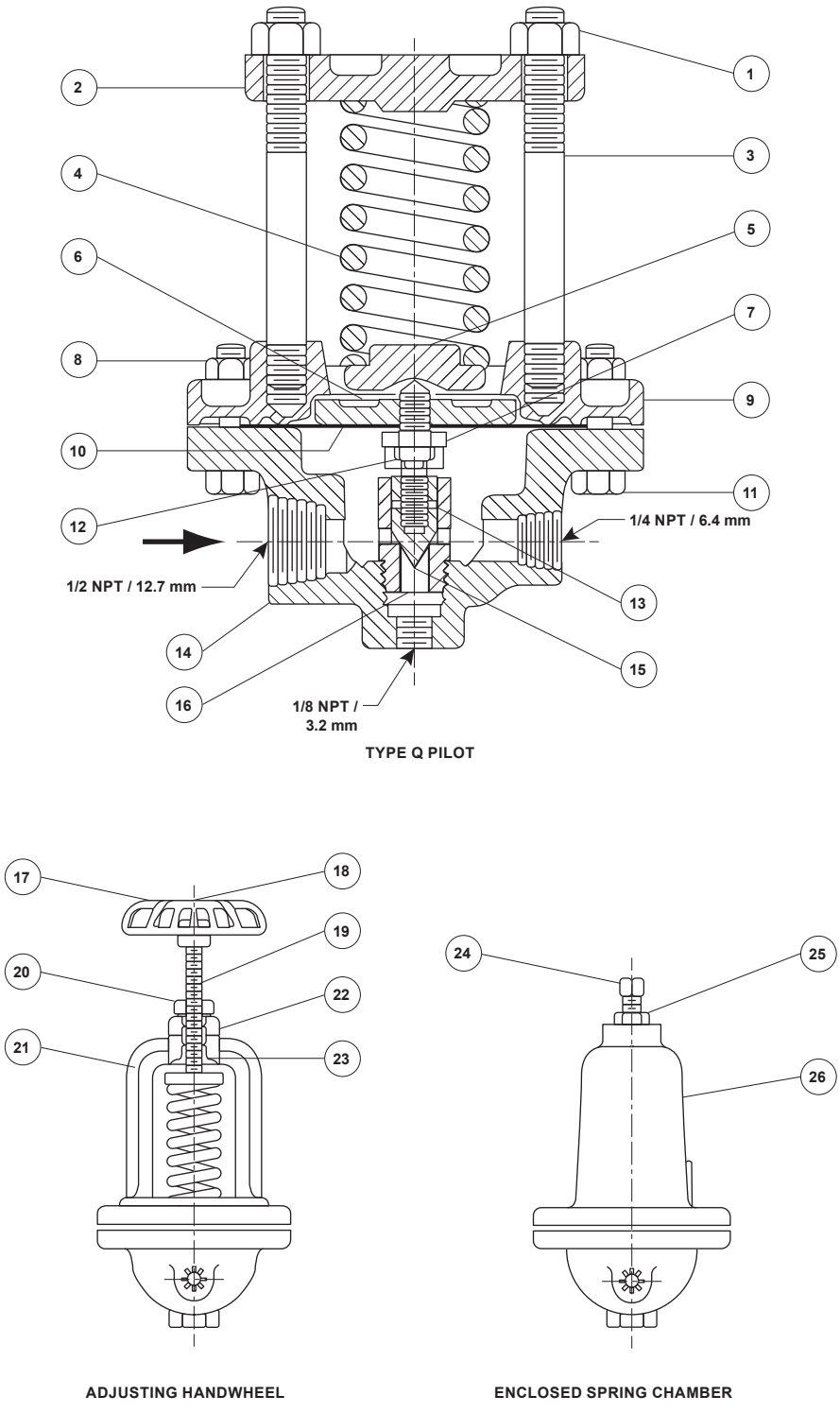

Figure 5. *Type Q Pilot Assembly*

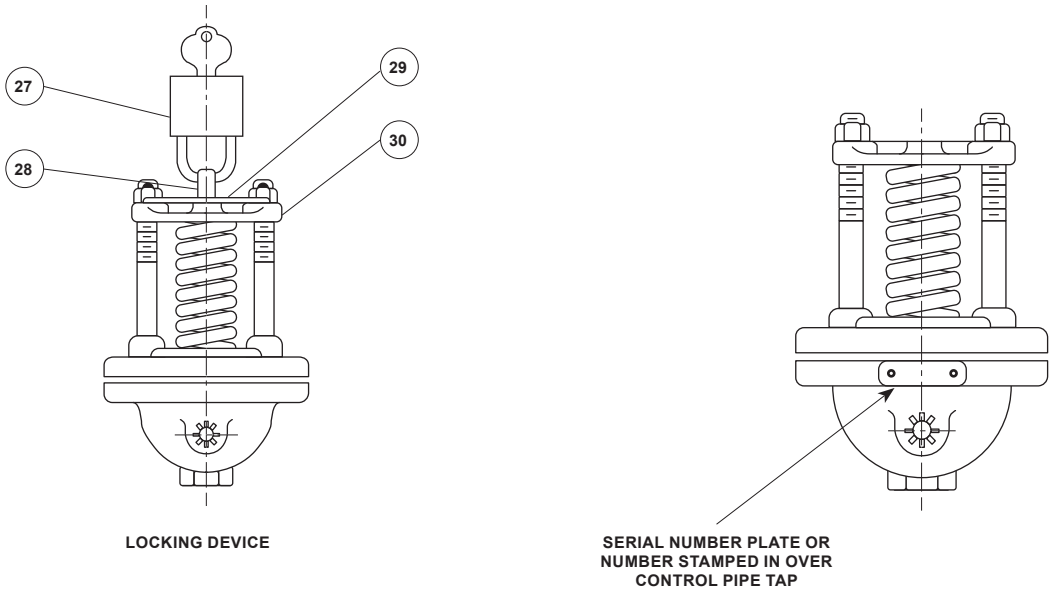

Figure 5. *Type Q Pilot Assembly (continued)*

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SPENCE™

Spence P125 Trip Stop Pilot

⚠ WARNING

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

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

Installation, operation and maintenance procedures performed by unqualified personnel may result in improper adjustment and unsafe operation. Either condition may result in equipment damage or personal injury. Only a qualified person shall install or service the Type P125.

Introduction

Scope of the Manual

This manual provides instructions for installation, operation, maintenance and parts information for the Type P125 trip stop pilot.

***Figure 1**. Type P125 Trip Stop Pilot*

Product Description

The Type P125 trip stop pilot is used in conjunction with a Spence main valve. This combination is known as a trip stop valve.

Type P125 is a manually resettable trip pilot that, once “tripped”, results in the closing of a Spence main valve; therefore preventing further overpressure of the downstream system. The trip pilot is set at a pressure slightly greater than the desired delivery pressure. This setting procedure is completed at the factory before the pilot is shipped.

Specifications

The Specifications section gives some general specifications for the Type P125 trip stop pilot. The nameplates give detailed information for a specific pilot as built in the factory.

Maximum Inlet Temperature[1]
Cast Iron: 450°F / 232°C
Cast Steel: 750°F / 400°C

Maximum Inlet Pressure[1]
Cast Iron: 250 psig / 17.2 bar
Cast Steel: 600 psig / 41.4 bar

Pressure Ranges[1]
5 to 25 psig / 0.35 to 1.72 bar
10 to 50 psig / 0.69 to 3.45 bar
40 to 150 psig / 2.76 to 10.3 bar
150 to 175 psig / 10.3 to 12.1 bar

Construction Materials
Body: Cast Iron, Steel
Stem, Disk and Seat: Stainless steel
Gasket: Stainless steel

Approximate Weights
Cast Iron: 26 lbs / 12 kg
Cast Steel: 28 lbs / 13 kg

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

Principle of Operation

During normal operation, the Type P125 trip stop pilot is mechanically held open (latched). Steam supply pressure is piped to the diaphragm of the trip stop main valve (Spence Types E, E2 or E5), holding it in the open position. Reduced pressure is then controlled by the pressure reducing valve. If the reduced pressure increases to the set pressure of the Type P125 trip stop pilot, two things happen. The weighted lever is unlatched, shutting off the steam supply to the trip stop main valve diaphragm chamber and the actuating steam in the diaphragm chamber of the trip stop main valve is vented downstream. Venting of the actuating steam allows the spring in the trip stop main valve to shut the valve. The Type P125 Pilot must be manually reset after being tripped. The reduced steam pressure must be less than the Type P125 set pressure for the Type P125 to remain reset.

Installation (Figures 2 and 3)

WARNING

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

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

All pressure equipment should be installed in a non-seismic area; should not be exposed to fire; and should be protected from thunderbolt (lightning) strikes.

CAUTION

The piping system must be adequately designed and supported to prevent extraordinary loads to the pressure equipment.

Planning

1. Locate the trip stop valve in a straight run of horizontal pipe, downstream of the reducing valve. Allow headroom above the trip stop main valve for access through the blind flange.
2. Provide clearance for stem withdrawal below. Allow headroom above the trip stop pilot for installation of 1/4 in. / 6.35 mm control pipe.

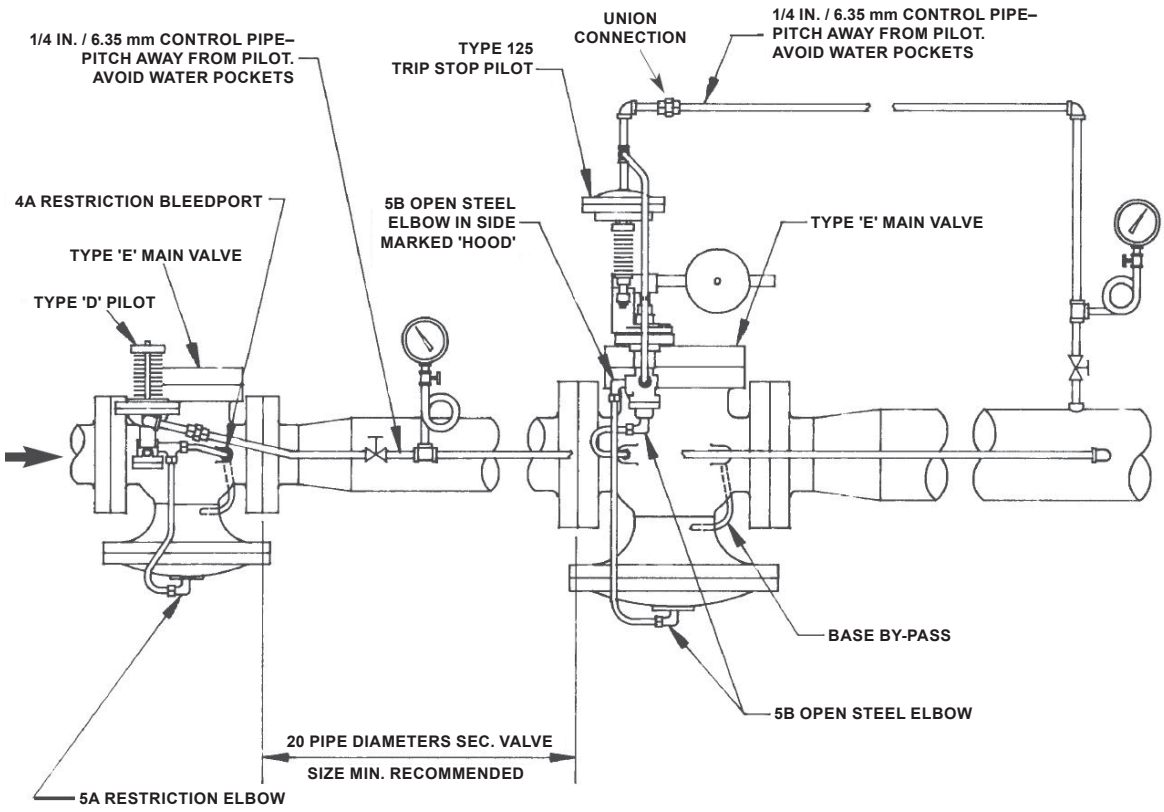

***Figure 2**. Type P125 Typical Installation*

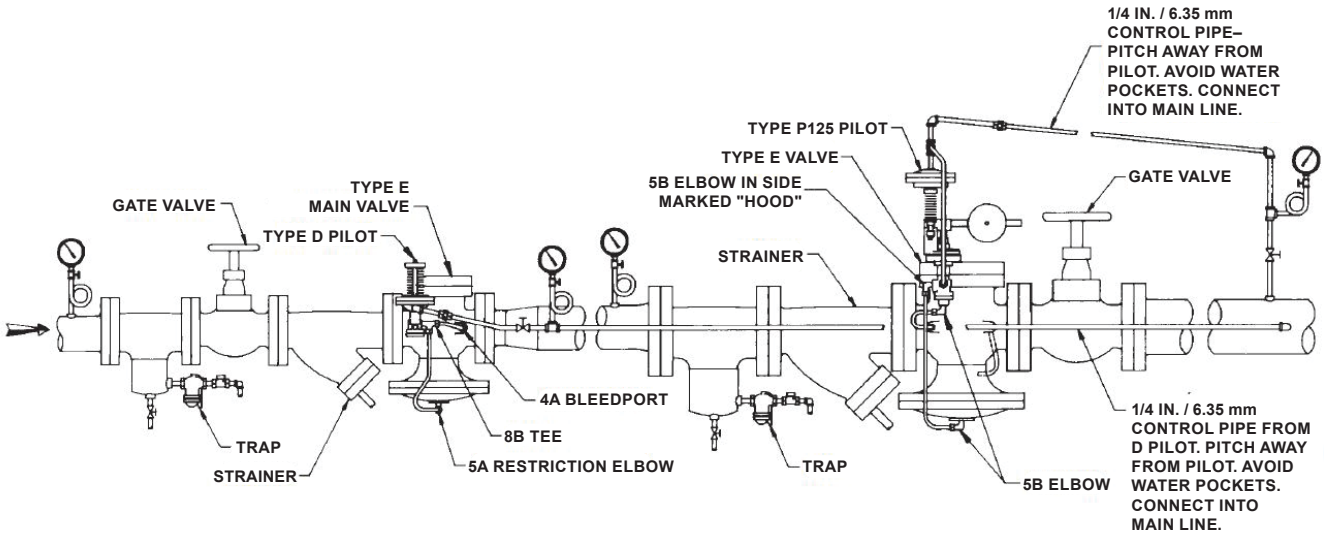

***Figure 3**. Type P125 Piping Installation*

Gauges and Trapping

WARNING

Steam is a potentially dangerous fluid and should be treated with caution.

CAUTION

Any steam line being filled and pressurized will form condensate. This condensate can be carried by high velocity steam, causing water hammer and possible failure of system components. The steam system must be adequately trapped to remove the condensate as it forms.

Install initial and reduced pressure gauges to indicate performance.

Trip Stop Main Valve

1. Flush the piping system thoroughly to clear it of dirt and debris.
2. Mount the trip stop main valve with the diaphragm chamber down and the arrow on the body pointing in the direction of flow.
3. Screwed end valves should be mounted between unions.

Type P125 Pilot

CAUTION

Type P125 is a bracket mounted pilot. Never mount the Type P125 by the pipe nipple. Cracking of the nipple and/or pilot body can occur causing steam to blow out.

1. Mount the bracket on the long stud extending above the trip stop main valve top flange. Bracket should be perpendicular to pipe run. Tubing is supplied pre-bent when the Type P125 pilot and the trip stop main valve are ordered together. No further bending is needed.
2. Connect the 1/4 NPT / 6.35 mm pipe tee installed on top of the trip stop pilot to the reduced pressure control point using 1/4 in. / 6.35 mm pipe. This is the Type P125 sensing line.
3. Pitch sensing line to avoid water pockets. Connect it to a dedicated connection on the top of the steam pipe.
4. Connect the vent line from the tee installed on top of the pilot to the pilot body. 5B open elbow is used at the body and 4B open straight coupling is used at the tee.
5. Connect the steam supply line from the upstream connection on the trip stop valve to the inlet connection on the bottom flange of the Type P125 trip stop pilot. This line must have the needle valve installed with flow direction arrow away from the main valve. A 4B open straight coupling is used at the trip stop main valve and a 5B open elbow is used at the pilot.
6. Connect the pilot outlet to the trip stop main valve hood.

For Type E main valves without condensation chamber only (Figure 4):

a. Screw 5B open elbow into tapped hole in bottom of diaphragm chamber. Connect this fitting with provided tubing to the 5B open elbow stamped “HOOD” in the Type P125 Pilot.

b. Install base bypass by screwing 5B open elbow into tapped hole in upper diaphragm chamber and 5B open elbow into tapped hole on outlet side of trip stop main valve.

For Type E2, E5, NPS 10 / DN 250 E or NPS 12 / DN 300 Type E main valves only (Figure 5)

a. Install the condensation chamber using the long bolt provided.

b. Install 5B open elbows in bottoms of condensation chamber and diaphragm chamber. Connect these fittings together with tubing provided.

c. Fill condensation chamber with water.

d. Install 5B open elbow in top of condensation chamber and connect to the 5B elbow stamped “HOOD” in the Type P125 trip stop pilot with tubing provided.

e. Install base bypass by screwing 5B open elbow into tapped hole in upper diaphragm chamber and 5B open elbow into tapped hole on outlet side of trip stop main valve.

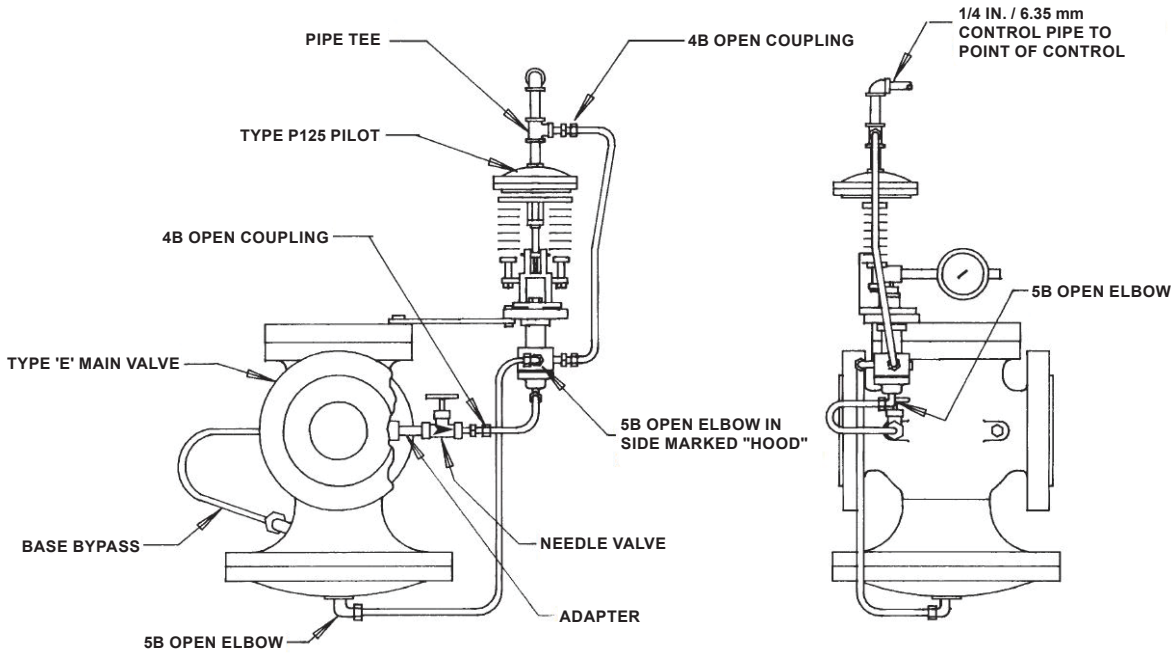

***Figure 4**. Type E Main Valve Without Condensation Chamber*

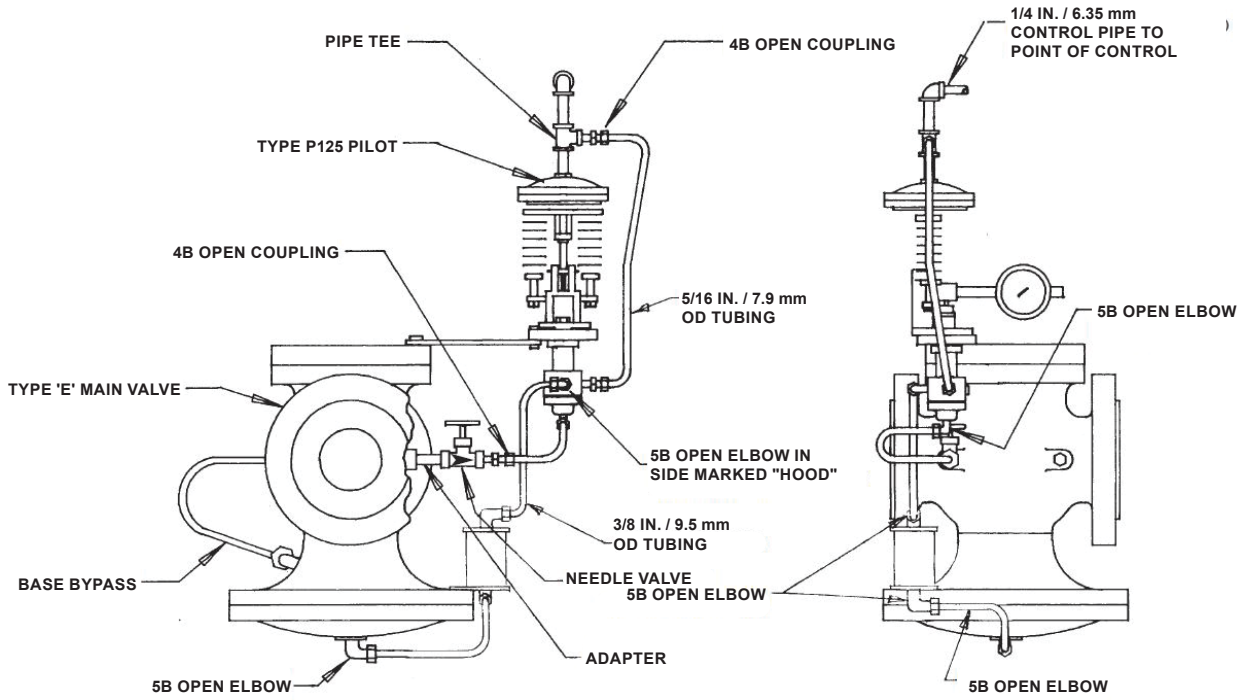

***Figure 5**. Types E, E5 or E Main Valves*

Insulation

Insulation may only be applied to the globe and flanges of the trip stop main valve.

Adjusting Pilot Trip Point

The Type P125 trip stop pilot is factory set to trip at the specified pressure. Field adjustment of the trip set pressure should not be necessary and is not recommended. If the Type P125 trip stop pilot fails to trip at the desired pressure, refer to Troubleshooting section or consult your Local Sales Office.

Start-up (Figure 3)

WARNING

The pilot may be handling hazardous fluids. Only qualified personnel, who are familiar with the installation, should be permitted to install, readjust, inspect or maintain the pilot.

CAUTION

For a non-pressurized system, there must be no load.

The Trip Stop Station

1. Close all stop valves and the needle valve.
2. Remove any compression on the Type D Pilot spring and latch the Type P125 Pilot in the open position.
3. Crack open the stop valve and blow down the strainer upstream of the pressure reducing main valve.
4. Open the 1/4 in. / 6.35 mm stop valve on the Type D Pilot sensing line. If the system is pressurized downstream, allow time for the pressure to feed back to the Type D Pilot and normalize between the pressure reducing main valve and the trip stop main valve.
5. Open blowdown on the strainer between the pressure reducing main valve and the trip stop main valve. If the system is pressurized downstream, note flow through the blowdown.
6. Apply compression to Type D Pilot spring only until pressure reducing valve opens (audible flow) or an increase in flow is noticed through the strainer blowdown. Allow time to blowdown strainer.
7. Open 1/4 in. / 6.35 mm stop valve on Type P125 Pilot sensing line.
8. Open needle valve on Type P125 Pilot.
9. Crack open stop valve downstream of trip stop main valve.

For a Non-Pressurized System

With no load on the system, incrementally compress the Type D Pilot spring until desired downstream pressure is obtained. Alternately and incrementally open the upstream and downstream stop valves. The system is now ready for a load.

For a Pressurized System

Alternately and incrementally open the upstream and downstream stop valves. Make final adjustments on Type D Pilot spring to obtain desired set pressure.

Restarting Type P125 After Pilot has Tripped

After having determined and corrected the cause of the overpressure, if any setting has been changed, repeat Start-up procedure. Otherwise:

1. Close Type P125 needle valve.
2. Close shut off valve downstream of the trip stop main valve.
3. Re-latch the Type P125.
4. Open Type P125 needle valve.
5. Incrementally open downstream shutoff valve.

Maintenance

WARNING

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

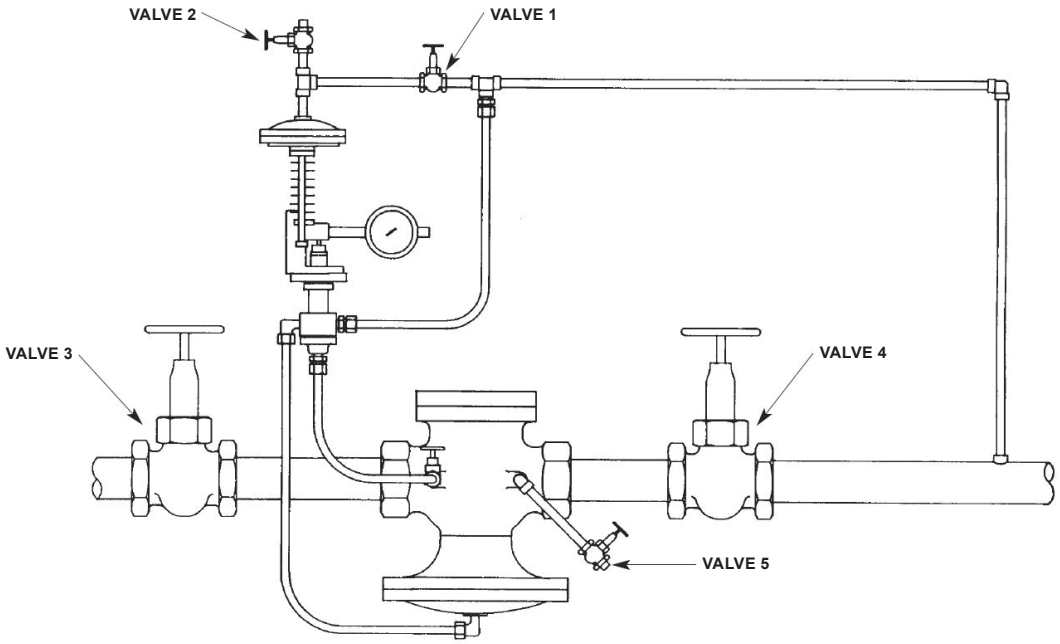

Figure 6. *Type P125 Testing Procedure Installation*

disassembly without first isolating the pilot from system pressure and relieving all internal pressure from the pilot.

Pilots 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 pilot.

Due to normal wear or damage that may occur from external sources, this pilot 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.

Under normal conditions, complete dismantling of trip stop valves is not recommended. If it must be dismantled, contact your Local Sales Office.

- Periodically inspect Type P125 pilot for trip arc clearance in the lever area.
- Inspect the latch pin, lever pin and associated guides for accumulated dirt or corrosion.
- Lubricate guide/pin surfaces with a light grade machine oil.

Troubleshooting

WARNING

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

Pilots 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 pilot.

Failure To Open

Check for positive inlet pressure. Check to see if Pressure Reducing Valve is open by opening blow down valve upstream of the trip stop main valve.

- If Type P125 Pilot is not in lever latched position, close needle valve, latch lever and repeat Start-up procedure.
- If the Type P125 Needle Valve is closed, check the needle valve and repeat Start-up procedure.
- Loosen 5B open elbow at outlet of Type P125. If steam comes out, you have assured that steam is going through the pilot.

Failure To Trip

- Check the set pressure to see that it is not higher than desired. If so, consult your Local Sales Office.
- Ensure that the weight is not missing from the lever and replace if necessary.
- Make sure there are no foreign objects restricting the lever's movement and remove any obstructions.
- Check the lever pin for corrosion and remove, clean and lubricate if necessary.
- Correct the cause of the corrosion.

Pilot Trips And Main Valve Doesn't Shut

Check Type P125 Pilot sensing line shut off valve. Open it if it is closed. Carefully remove bend and 5B elbow from lower diaphragm chamber of trip stop main valve.

- If the trip stop main valve closes, check to see if the vent line is plugged or incorrectly installed.
- If the trip stop main valve does not close, it is wedged open. In this case, check for foreign object between seat and disc of trip stop main valve.
- All joints must be inspected periodically for leakage. Keep bolts and fittings tight.
- Never allow a leak to persist.

Testing Procedure

The purpose of the testing procedure is to confirm that:

- The control pipe is obstruction free.
- The pilot de-latches.
- The pilot closes and shuts off.
- The trip stop main valve closes and shuts off.

The required installation is shown in Figure 6. The tests are conducted with the system pressurized and in running mode. Observe precautions necessary for safety and personal protection.

To Check Control Pipe for Obstructions:

1. Crack valve 2. Steam should blow through. If there is no steam flow, close valve 2 and clear the obstructed control pipe.
2. Close valve 1. Steam flow through valve 2 should cease.
3. Close valve 2 and open valve 1.

To Check trip stop pilot and main valves:

1. Isolate main valve from downstream pressure by closing valve 4. Valve 3 is open.
2. Isolate pilot from downstream pressure by closing valve 1.
3. Vent pilot by opening valve 2.
4. Pressurize pilot diaphragm by connecting an air pressure source to valve 2.
5. Trip pilot valve by gradually increasing the air pressure to the pilot diaphragm. Valve should trip when air pressure reaches set pressure. Do not over pressurize.
6. Vent main valve body by cracking valve 5.
7. Observe valve 5 discharge. No steam flow should be seen. Wispy flash steam from the base cavity may be present. Blowing steam indicates main valve is not closed or downstream pressure, if present, may be leaking through shutoff valve 4.
8. Close valve 5.
9. Close valve 2.
10. Open valve 1.
11. Open needle valve and re-latch lever on Type P125 Pilot.
12. Repeat start-up procedure for a pressurized system.

Parts Ordering

When ordering parts, it is essential that the pilot type, service and serial number be stated.

Select part by item number, but order by part number. Specify complete part number when ordering.

Parts List

Key	Description	Part Number
1	Cottor Pin, Steel (4 required)	WAL05-03265-00
2	Hex Nut, Steel (16 required)	WAL05-02872-00
3	Mounting Bracket, Steel	- - - - - - - - - -
4	Cap Screw, Steel (14 required)	WAL05-04771-00
5	1/4 NPT / 6.35 mm Pipe Plug, Steel	WAL04-03769-00
6	Spring, OTS (2 required)	
	5 to 25 psi / 0.35 to 1.72 bar	WAL05-05032-00
	10 to 50 psi / 0.69 to 3.45 bar	WAL00-15081-00
	40 to 150 psi / 2.76 to 10.3 bar	WAL05-05028-00
	150 to 175 psi / 10.3 to 12.1 bar	WAL05-05030-00
7	Spring Button, Ledloy (2 required)	WAL04-01053-00
8	Hex Nut, Steel (2 required)	WAL05-02877-00
9	Standard, Ledfin (2 required)	WAL04-05201-00
10	Hex Nut, Steel (2 required)	WAL05-02874-00
11	Hood, Cast iron	WAL04-02640-00
12	Cowl, Cast iron	WAL04-01513-00
13	Guide Pin, Ledloy	WAL04-03240-00
14	Hex Nut, Steel (2 required)	WAL05-03014-00
15	Trip Latch Stud Assembly, Steel	WAL07-42861-00
16	Trip Latch Assembly, Steel	WAL07-40549-00
17	Base Bracket, Cast iron	WAL04-01001-00
18	Stem Button, Brass	WAL04-01064-00

Key	Description	Part Number
19	Adjusting Stem, Ledloy	WAL04-05402-00
20	Stop Nut, Brass	WAL04-02980-00
21	Cap Screw, Steel (2 required)	WAL05-04772-00
22	Bonnet, Cast iron	WAL04-13944-00
23	Stem Bushing, Cast iron	WAL04-11094-00
24	Disk and Seat assembly, 203 Lead	WAL02-08586-02
25	Gasket	WAL05-11718-00
26	Bottom Flange, Carbon steel	WAL04-14759-00
27	Diaphragm, 301 Stainless steel	WAL04-01629-01
28	Pressure Plate, Cast iron	WAL04-03676-00
29	Spring Yoke, Cast iron	WAL04-06178-00
30	Pivot Pin, 416 Stainless steel (2 required)	WAL04-03215-00
31	Trip Level, 17-4 PH	WAL04-13945-00
32	Weight, Cast iron	WAL04-06135-00
33	Thumb Screw, Steel	WAL05-04880-00
34	Set Screw, Steel	WAL05-04874-00
35	Bellows Nut, Brass	WAL04-02911-00
36	Bellows, Brass	WAL05-17579-00
37	Cap Screw, Steel (8 required)	WAL05-04803-00
38	Body, Cast iron	WAL04-11095-01
39	1/4 NPT / 6.35 mm Pipe Plug, Steel	WAL04-03772-00
40	Seat Ring, 420 FH Stainless steel	WAL04-11099-00

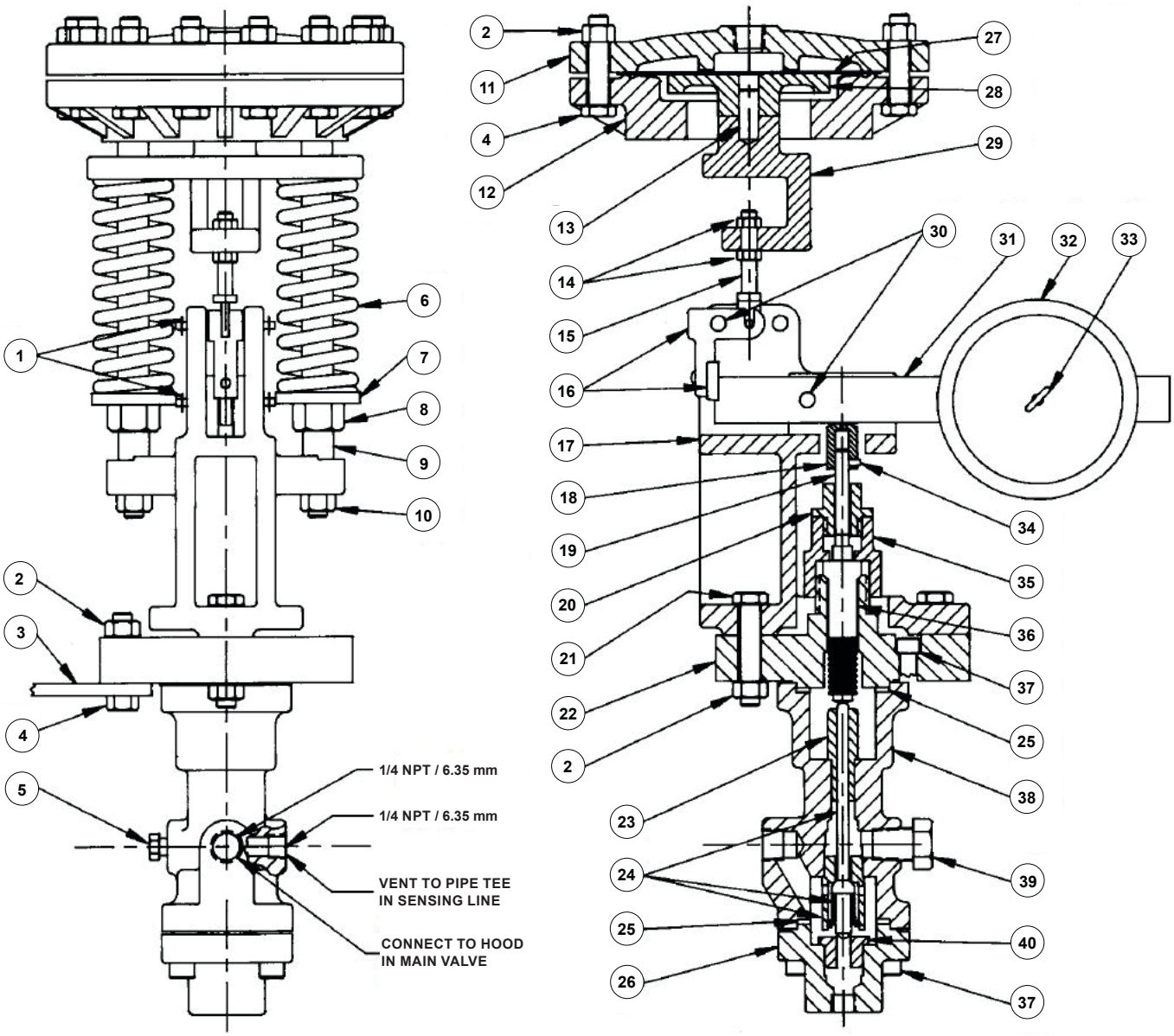

Figure 7. *Type P125 Assembly, Cast Iron*

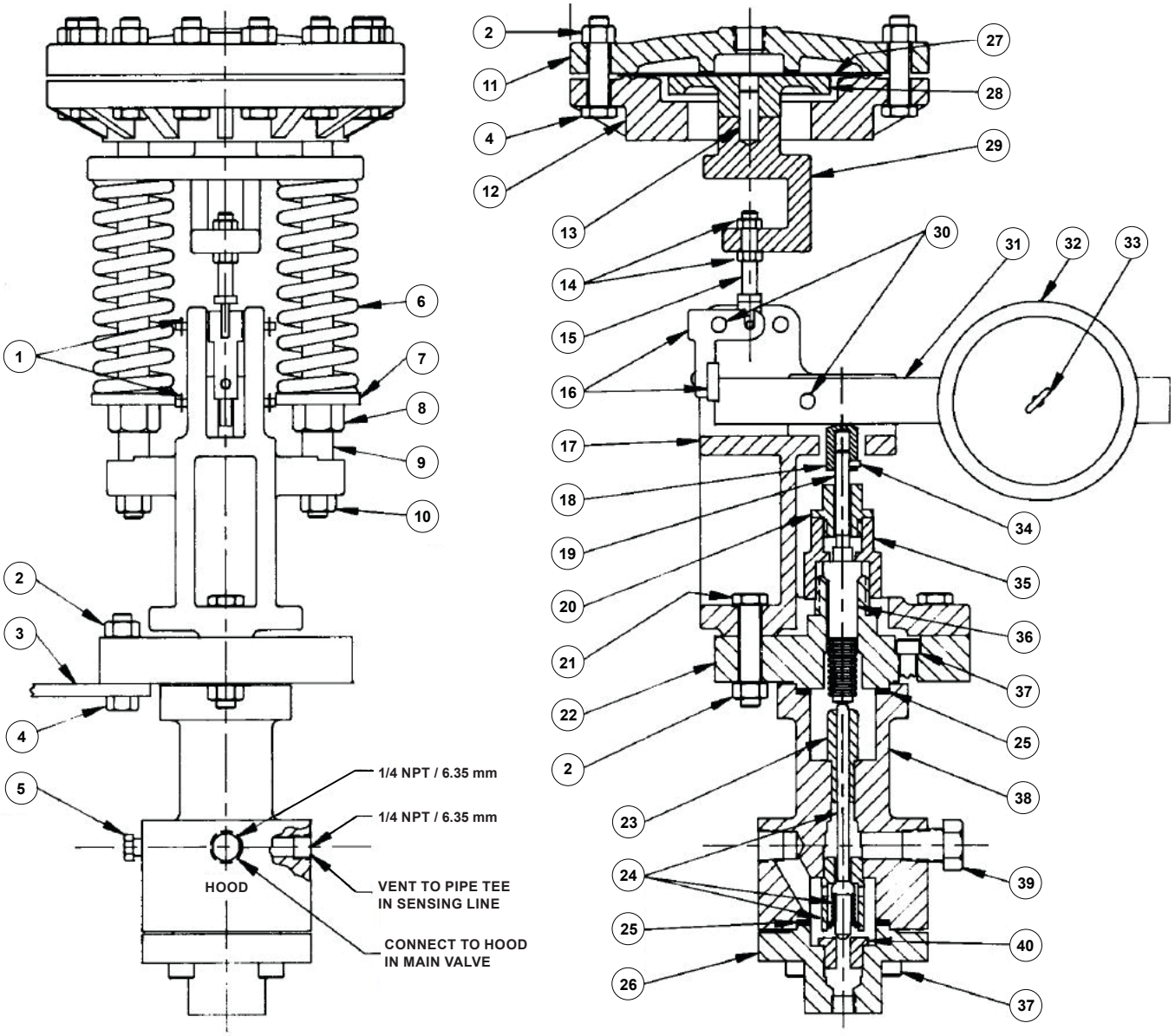

Figure 8. *Type P125 Assembly, Cast Steel*

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SPENCE™

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.

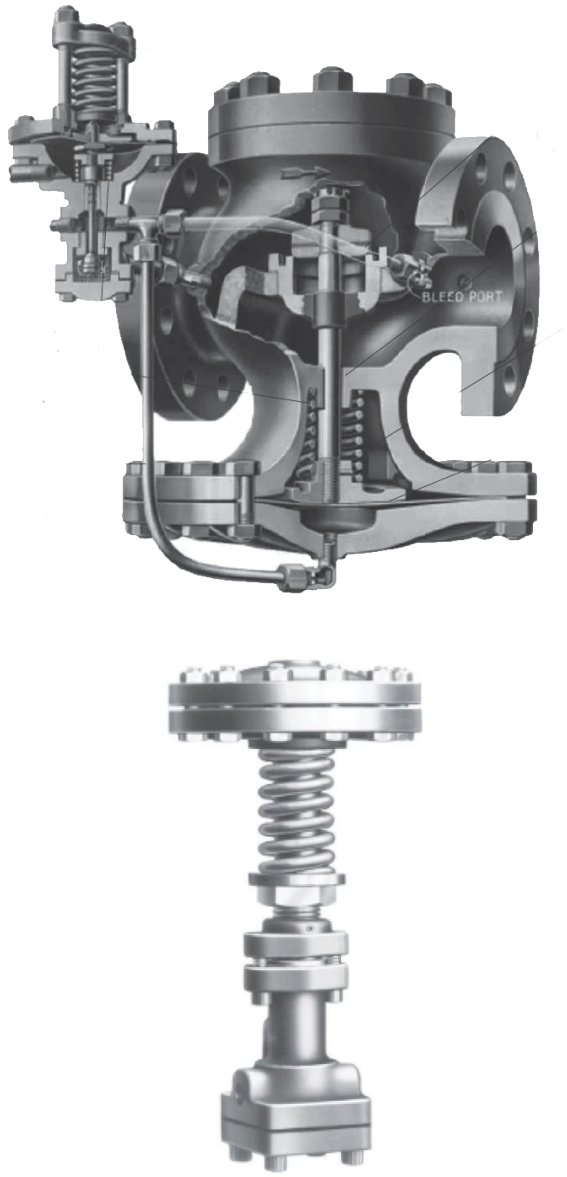

***Figure 1**. Type E Main Valve with Type D Pilot and Type SP/P Pressure Safety Pilot*

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.

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, 34, 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(1)
See Table 1

Temperature Rating(1)
See Table 1

Rated Flow Coefficient
See Table 2

Construction Materials
Cast Iron and Cast Steel

Type D Pilot

Maximum Inlet Temperature(1)
Cast Iron: 450°F / 232°C
Steel: 750°F / 400°C

Maximum Inlet Pressure(1)
Cast Iron: 250 psig / 17.2 bar
Steel: 600 psig / 41.4 bar

Pressure Ranges(1)
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(1)
Bronze: 500°F / 260°C
Steel: 750°F / 400°C

Maximum Inlet Pressure(1)
Bronze: 300 psig / 20.7 bar
Steel: 600 psig / 41.4 bar

Pressure Ranges(1)

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(1)*

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

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

⚠ 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.

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.

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

WARNING

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.

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.

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).

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
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[1][2], 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[2], Steel	WAL04-03726-00
23	Valve Spring[2], Inconel®	WAL05-04982-00
24	Valve Stem[2], Stainless steel	WAL04-05379-00
25	Seat Ring[2], Stainless steel	WAL04-04380-00
26	Disk[2], Stainless steel	WAL04-01780-00
27	Pipe Plug, 1/8 NPT	
	Brass	WAL04-03770-00
	Steel	WAL04-03769-00
28	Stem Nuts[2], Steel	WAL05-02888-00
29	Gasket[2], Asbestos	WAL05-02378-00

Inconel® is a mark owned by Special Metals Corporation.
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

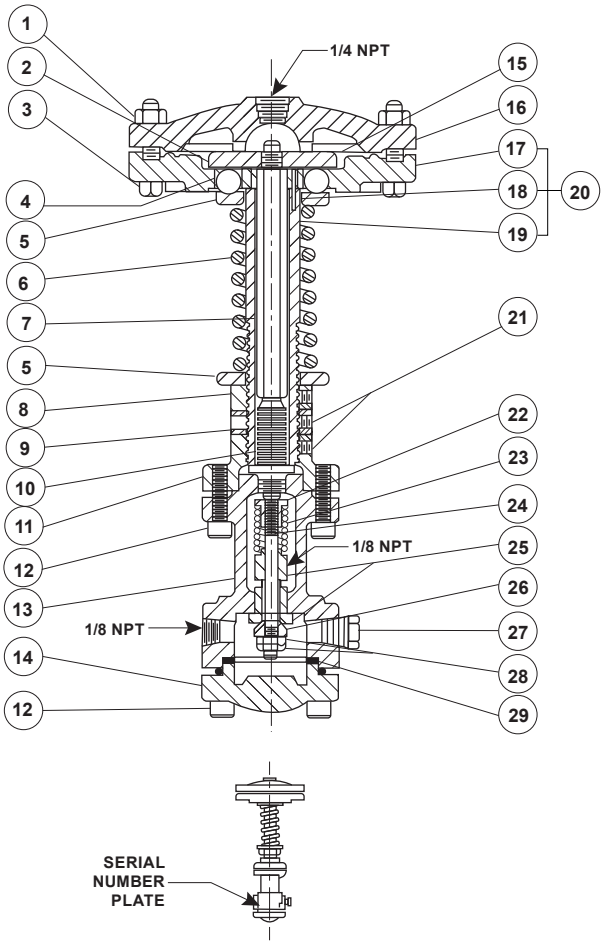

Figure 2. *Pressure Safety Pilot Assembly*

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SPENCE™

M Series Solenoid Pilot

⚠ WARNING

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

The Solenoid Pilot must be installed, operated and maintained in accordance with federal, state and local codes, rules and regulations and Emerson instructions.

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 Solenoid Pilot.

Figure 1. *M Series Solenoid Pilot*

Introduction

Scope of the Manual

This manual provides instructions for the operation, installation, troubleshooting, maintenance, and parts ordering for M Series Solenoid Pilot.

Product Description

The M Series are epoxy encapsulated solenoids. The green solenoid with lead wires and 1/2 in. / 12.7 mm conduit connection.

See Temperature Limitations section for solenoid identification and nameplate/retainer for service. When M Series is installed just as a solenoid and not attached to a Spence valve, the core has a 0.250-28UNF- 2B tapped hole, 0.38 minimum full thread.

General purpose solenoids (green) are available in open-frame construction. This construction may be supplied with 1/4 in. / 6.35 mm spade, screw or DIN terminals (See Figure 2).

Optional Features for Type 1 - General Purpose Construction Only

Junction Box - This junction box construction meets Enclosure Types 2, 3, 3S 4, and 4X. Only solenoids with 1/4 in. / 6.35 mm spade or screw terminals may have a junction box. The junction box provides a 1/2 in. / 12.7 mm conduit connection, grounding and spade or screw terminal connections within the junction box (See Figure 3).

DIN Plug Connector Kit No. K236034 - Use this kit only for solenoids with DIN terminals. The DIN plug connector kit provides a two pole with grounding contact DIN Type 43650 construction. (See Figure 4).

Specifications

This section lists the specifications for the M Series. Factory specifications are stamped on the nameplate fastened on the unit at the factory.

Available Configuration
See Table 1

End Connection Style
CL125 and CL250

Maximum Pressure(1)
See Table 2

Maximum Temperature(1)
See Table 2

Materials of Construction
Body: Brass
Head: Aluminum and polypropylene
Internal Core Assembly: Ferrous and brass
Bonnet Gasket: Ethylene propylene (EPDM)

Applications
Remote Electronic Shutoff of Regulators

Approximate Weight
CL125: 3 lbs / 1.4 kg
CL250: 6 lbs / 2.7 kg

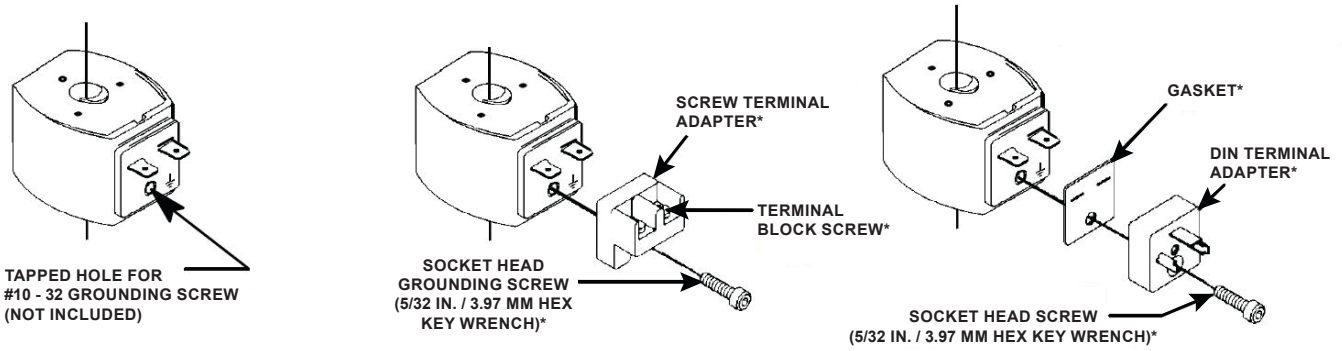
1. The pressure/temperature limits in this Instruction Manual and any applicable standard or code limitation should not be exceeded.

Table 1. *M Series Available Configurations*

TYPE	NUMBER OF PORTS	OPERATION	APPLICATION
M24	3-way	Normally open	for cold fluids in straight solenoid valve
M25	3-way	Normally closed	for cold fluids in straight solenoid valve
M26	2-way	Normally open	for cold fluids in multiple pilot arrangements
M27	2-way	Normally closed	for cold fluids in multiple pilot arrangements
M32(1)	2-way	Normally open	for steam or other hot fluid services in multiple pilot arrangements
M33(1)	2-way	Normally closed	for steam or other hot fluid services in multiple pilot arrangements
M34(1)	3-way	Normally open	for steam or other hot fluid services in straight solenoid valve
M35(1)	3-way	Normally closed	for steam or other hot fluid services in straight solenoid valve
1. Add LP suffix for low pressure and HP suffix for high pressure.			

Table 2. *M Series Pressure and Temperature Ratings*

TYPE	MAXIMUM PRESSURE		MAXIMUM TEMPERATURE	
	psig	bar	°F	°C
M24, M25	250	17.2	200	93.3
M26, M27	125	8.6	180	82.2
M32LP, M33, M34LP, M35LP	125	8.6	363	178
M32HP, M33HP, M34HP	250	17.2	406	208



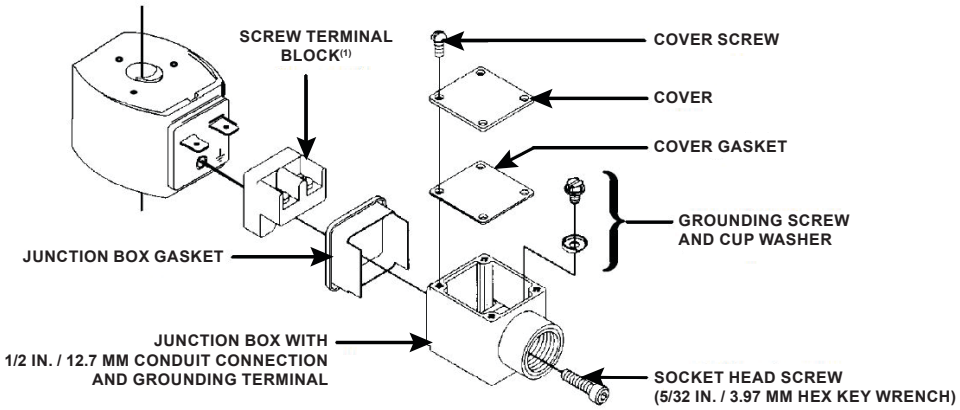
OPEN-FRAME SOLENOID WITH 1/4 IN. SPADE TERMINALS

OPEN-FRAME SOLENOID WITH SCREW TERMINALS, SOCKET HEAD SCREW IS USED FOR GROUNDING

OPEN-FRAME SOLENOID WITH DIN TERMINALS

*** INDICATES PARTS SUPPLIED IN TERMINATION MODULE KIT NO. K256104**

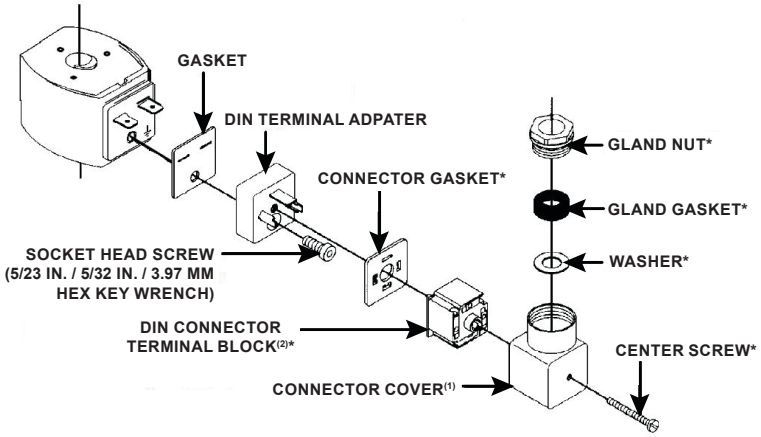
Figure 2. *Open-frame Solenoids*



JUNCTION BOX SOLENOID WITH 1/4 IN. / 6.35 MM SPADE TERMINALS OR SCREW TERMINALS

1. Junction box with screw terminals shown. With screw terminal block removed, remaining parts compromise the juction box for spade terminal construction.

Figure 3. *Junction Box (Optional Feature)*



OPEN - FRAME SOLENOID WITH DIN TERMINAL PLUG CONNECTOR

*** INCLUDED IN DIN PLUG CONNNECTOR KIT NO. K236034**

1. Connector cover may be rotated in 90° increments from position shown for alternate position of cable entry.
2. Refer to markings on din connector for proper electircal connections.

Figure 4. *DIN Plug Connector Kit No. K236034 (Optional Feature)*

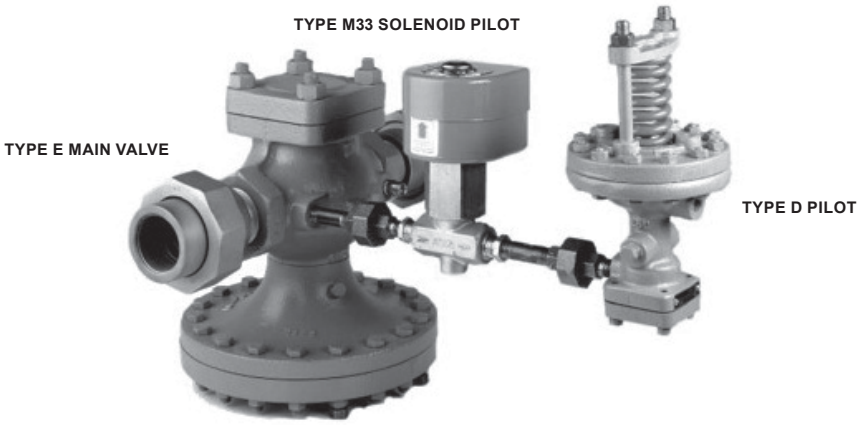


Figure 5. *M Series Installation*

Principle of Operation

Direct Acting Solenoid Pilot - When the solenoid is energized, the core is drawn into the solenoid base sub-assembly.

Note

When the solenoid is de-energized, the initial return force for the core, whether developed by spring, pressure or weight, must exert a minimum force to overcome residual magnetism created by the solenoid. Minimum return force 1 lb / 12 oz.

Reverse Acting Solenoid Pilot - When the solenoid is energized, the disk holder assembly seats against the orifice.

Note

Initial return force for the disk or disk holder assembly, whether developed by spring, pressure, or weight, must exert a minimum force to overcome residual magnetism created by the solenoid. Minimum return force is 1 lb / 12 oz. When the solenoid is de-energized, the disk holder assembly returns.

Installation

⚠ WARNING

Electrical hazard from the accessibility of live parts. To prevent the possibility of death, serious injury or property damage, install the open - frame solenoid in an enclosure.

To prevent fire or explosion, do not install solenoid and/or valve where ignition temperature of hazardous atmosphere is less than 356°F / 180°C.

Note

Block enclosure solenoids have an internal non-resetable thermal fuse to limit solenoid temperature in the event that extraordinary conditions occur which could cause excessive temperatures. These conditions include high input voltage, a jammed core, excessive ambient temperature or a shorted solenoid, etc. This unique feature is standard on solenoids with black explosion proof/dust-ignition proof enclosures (Types 7 and 9).

Product Verification

Check nameplate for correct catalog number, service and wattage. Check front of solenoid for voltage and frequency.

Strainer or Filter Requirement

Note

To protect the solenoid valve or operator, install a strainer or filter, suitable for the service involved in the inlet side as close to the valve or operator as possible. Clean periodically depending on service conditions.

Table 3. *Temperature Limitations for M Series Solenoids for Use on Valves Rated at 16.1 or 20.1 Watts*

WATT RATING	CATALOG NUMBER COIL PREFIX	CLASS OF INSULATION	MAXIMUM AMBIENT TEMPERATURE
16.1	None, KF, KP, SD, SF and SP	F	52°C / 125°F
20.1	FB, KF, KP, SD, SF and SP	F	40°C / 104°F
16.1	None, KB, KH, SS, ST and SU	H	60°C / 140°F 52°C / 125°F (for steam service)
20.1	B, KH, SS, ST, SU and SV	H	60°C / 140°F Not for steam service
Note: For steam service, refer to Wiring section, Junction Box for temperature rating of supply wires.			

Temperature Limitations

For maximum valve ambient temperatures, refer to chart. The temperature limitations listed, only indicate maximum application temperatures for field wiring rated at 194°F / 90°C. Check catalog number prefix and watt rating on nameplate to determine maximum ambient temperature. See valve installation and maintenance instructions for maximum fluid temperature.

Positioning

This solenoid is designed to perform properly when mounted in any position. However, for optimum life and performance, the solenoid should be mounted vertically and upright to reduce the possibility of foreign matter accumulating in the solenoid base sub-assembly area.

Wiring

⚠ WARNING

To reduce the risk of electrocution, fire, or property damage, wiring must comply with local codes and the National Electrical Code.

The solenoid must be grounded with grounding wire (if included) or rigid metallic conduit - do not rely on pipe as ground.

All solenoids supplied with lead wires are provided with a grounding wire which is green or green with yellow stripes and a 1/2 in. / 12.7 mm conduit connection.

To facilitate wiring, the solenoid may be rotated 360°. For explosion proof solenoid version, the conduit lead wires are factory sealed for use in hazardous locations.

Note

Cryogenic Applications - Solenoid lead wire insulation should not be subjected to cryogenic temperatures. Adequate lead wire protection and routing must be provided.

Additional Wiring Instructions For Optional Features

Open-Frame solenoid with 1/4 in. spade terminals: For solenoids supplied with screw terminal connections, use #12 to 18.

AWG stranded copper wire rated at 194°F / 90°C or greater. Torque terminal block screws to 10 ± 2 in-lbs / 1.1 ± 0.2 N•m. A tapped hole is provided in the solenoid for grounding, use a #10 to 32 machine screw. Torque grounding screw to 15 to 20 in-lbs / 1.7-2.3 N•m. On solenoids with screw terminals, the socket head screw holding the terminal block to the solenoid is the grounding screw. Torque the screw to 15 to 20 in-lbs / 1.7-2.3 N•m with a 5/32 in. / 3.97 mm hex key wrench.

Junction Box

The junction box is used with spade or screw terminal solenoids only and is provided with a grounding screw and a 1/2 in. / 12.7 mm conduit connection. Connect #12 to 18 AWG standard copper wire only to the screw terminals. Within the junction box use field wire that is rated 194°F / 90°C or greater for connections. For steam service use 221°F / 105°C rated wire up to 50 psi / 3.45 bar or use 257°F / 125°C rated wire above 50 psi / 3.45 bar. After electrical hookup, replace cover gasket, cover, and screws. Tighten screws evenly in a criss-cross manner.

Table 4. *M Series Torque Values*

PART NAME	TORQUE VALUE	
	In-lbs	N•m
Solenoid base sub-assembly and adapter	175 ± 25	19.8 ± 2.8
Terminal block screws	10 ± 2	1.1 ± 0.2
Socket head screw	15 to 20	1.7 to 2.3
Center screw	5 ± 1	0.6 ± 0.1

DIN Plug Connector Kit No. K236034

1. The open-frame solenoid is provided with DIN terminals to accommodate the plug connector kit.
2. Remove center screw from plug connector. Using a small screwdriver, pry terminal block from connector cover.
3. Use #12 to 18 AWG stranded copper wire rated at 194°F / 90°C or greater for connections. Strip wire leads back approximately 1/4 in. / 6.35 mm for installation in socket terminals. The use of wire-end sleeves is also recommended for these socket terminals. Maximum length of wire-end sleeves to be approximately 1/4 in. / 6.35 mm Tinning of the ends of the lead wires is not recommended.
4. Thread wire through gland nut, gland gasket, washer and connector cover.

Note

Connector housing may be rotated in 90° increments from position shown for alternate positioning of cable entry.

5. Check DIN connector terminal block for electrical markings. Then make electrical hookup to terminal block according to markings on it. Snap terminal block into connector cover and install center screw.
6. Position connector gasket on solenoid and install plug connector. Torque center screw to 5 ± 1 in-lbs / 0.6 ± 1.1 N•m.

Installation of Solenoid

Solenoids may be assembled as a complete unit. Tightening is accomplished by means of a hex flange at the base of the solenoid.

Solenoid Temperature

Standard solenoids are designed for continuous duty service. When the solenoid is energized for a long period, the solenoid becomes hot and can be touched by hand only for an instant. This is the safe operating temperature.

Maintenance

⚠ WARNING

To prevent the possibility of death, serious injury or property damage, turn off electrical power, de-pressurize solenoid operator and/or valve, and vent fluid to a safe area before servicing.

Verify solenoid is grounded with grounding wire or rigid metallic conduit - do not rely on pipe as ground

Cleaning

All solenoid operators and valves should be cleaned periodically. The time between cleaning will vary depending on medium and service conditions. In general, if the voltage to the solenoid is correct, sluggish valve operation, excessive noise or leakage will indicate that cleaning is required. Clean strainer or filter when cleaning the valve.

Preventive Maintenance

- Keep the medium flowing through the solenoid operator or valve as free from dirt and foreign material as possible.
- Periodic exercise of the valve should be considered if ambient or fluid conditions are such that corrosion, elastomer degradation, fluid contamination build up, or other conditions that could impede solenoid valve shifting, are possible. The actual frequency of exercise necessary will depend on specific operating conditions. A successful operating history is the best indication of a proper interval between exercise cycles.
- Depending on the medium and service conditions, periodic inspection of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. Replace any worn or damaged parts.

Solenoid Replacement (Refer to Figure 6)

1. Disconnect conduit, coil leads and grounding wire.

Note

Any optional parts attached to the old solenoid must be reinstalled on the new solenoid. For removal or assembly of optional parts, see Figures 2, 3 or 4.

2. Snap off red cap from the top of the solenoid base sub-assembly.
3. Push down on solenoid. Then using a suitable screwdriver,insert blade between solenoid and nameplate/retainer. Pry up slightly and push to remove.
4. Remove solenoid spacer and solenoid from solenoid base sub-assembly.
5. Reassemble in reverse order of disassembly.

Troubleshooting

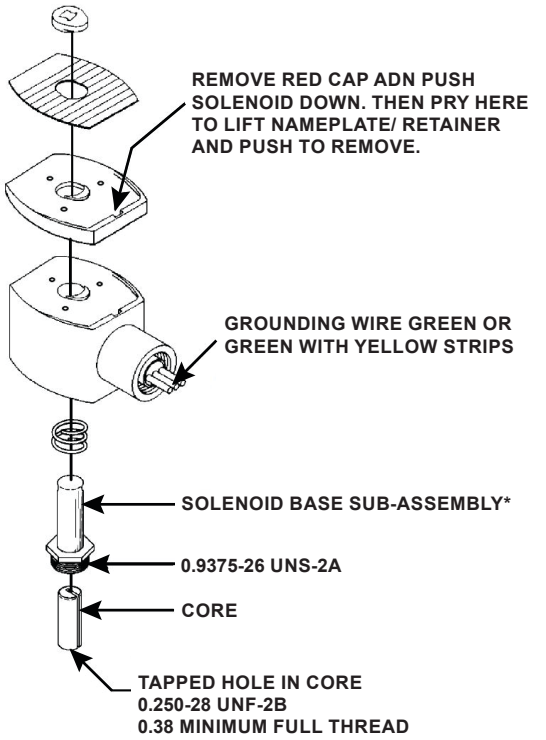
- Faulty Control Circuit - Check the electrical system by energizing the solenoid. A metallic click signifies that the solenoid is operating. Absence of the click indicates loss of power supply. Check for loose or blown fuses, open-circuited or grounded solenoid, broken lead wires or splice connections.
- Burned-Out Solenoid - Check for open-circuited solenoid. Replace if necessary. Check supply voltage; it must be the same as specified on nameplate/retainer and marked on the solenoid. Check ambient temperature and check that the core is not jammed.
- Low Voltage - Check voltage across the terminals. Voltage must be at least 85% of the rated voltage.

Disassembly and Reassembly

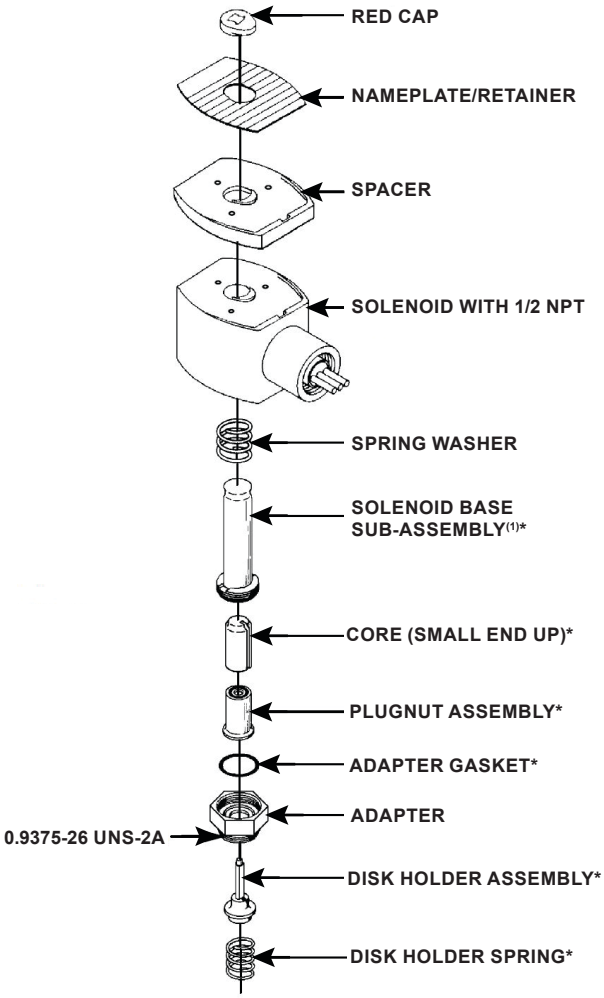
1. Remove solenoid, see Solenoid Replacement.
2. Remove spring washer from solenoid base sub-assembly.
3. Unscrew solenoid base sub-assembly from valve body. For reverse-acting solenoids, a special wrench adapter for the solenoid base sub-assembly is supplied in the ASCO Rebuild Kit. For wrench adapter only, order Wrench Kit No. K218950.
4. Remove internal solenoid parts for cleaning or replacement. Use exploded views for identification and placement of parts.
5. If the solenoid is part of a valve, refer to basic valve installation and maintenance instructions for further disassembly.
6. Reassemble in reverse order of disassembly. Use exploded views for identification and placement of parts.
7. Torque solenoid base sub-assembly and adapter to 175 ± 25 in-lbs / 19.8 ± 2.8 N•m.

Parts Ordering

When corresponding with your local Sales Office about this equipment, always reference the service and serial number. Also specify voltage and frequency.



SERIES 8017G DIRECT-ACTING SOLENOID



SERIES 8014G REVERSE-ACTING SOLENOID

*** INDICATES THAT THESE PARTS ARE INCLUDED IN ASCO REBUILD KIT**

1. Special wrench adapter supplied in ASCO Rebuild Kit. For wrench kit only, order no. K218950.

Figure 6. *M Series Assembly*

SpenceValve.com

Emerson

Americas
McKinney, Texas 75070 USA
T +1 800 558 5853
+1 972 548 3574

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Bologna 40013, Italy
T +39 051 419 0611

Asia Pacific
Singapore 128461, Singapore
T +65 6777 8211

Middle East and Africa
Dubai, United Arab Emirates
T +971 4 811 8100

SPENCE™

Spence Type VH210 Electronic Actuator Pilot

⚠ WARNING

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

Type VH210 Electronic Actuator Pilot must be installed, operated and maintained in accordance with federal, state and local codes, rules and regulations and Emerson 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 Type VH210 Electronic Actuator Pilot.

Introduction

Scope of the Manual

This manual provides instructions for the installation, initial startup and setting, troubleshooting, maintenance, and parts ordering for Type VH210 Electronic Actuator Pilot.

Figure 1. *Type VH210*

Product Description

The Type VH210 electronic actuator pilot maintains a system variable and modulate the valve travel in response to that system variable as requirements dictate. A continuous signal (4 to 20mA, 0 to 10 VDC) is transmitted by the system controller to the actuator which positions the valve stem. In the event of power loss, the electronic actuator pilot returns to a closed position.

The Type VH210 is used with an E or C Series main valve. The typical configuration as shown in Figure 2 is the Type EVH210 electronic modulating, pilot-operated regulator.

Specifications

This section lists the specifications for the Type VH210. Factory specifications are stamped on the nameplate fastened on the pilot at the factory.

Maximum Inlet Pressure[1]
250 psig / 17.2 bar

Electronic Data
4 to 20 mA or 0 to 10 VDC Input Signals
24 VAC 50 to 60 Hz Power Supply
17VA/12W Power Consumption
UL Listed (UL873)

Applications
Building Control Systems
SCADA
PLC
Upgrading Type E Main Installations for Automated Control

Construction Materials
Body: Cast Iron and Steel
Stem, Disc and Seat: Stainless steel
Gasket: Graphite

Approximate Weight
12.5 lbs / 5.7 kg

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

Principle of Operation

The complete regulator consists of an E Series main valve, equipped with a Type VH210 pilot. The end user supplies a process controller, which transmits a continuous proportional electronic signal (4 to 20 mA or 0 to 10 VDC) to the actuator.

The main valve is normally closed, held by an internal spring and initial pressure acting on its disc. Type VH210 pilot is controlled by the continuous proportional electronic signal received by the actuator from the process controller.

When the process controller signals the Type VH210 pilot to open, process fluid flows through the pilot to the main valve via the bends and fittings, actuating the main valve by causing pressure to build under the main valve diaphragm. Depending on the signal received by the process controller, the Type VH210 pilot may be closed, partially open or fully open.

Once the main valve opens, the downstream fluid variable is affected, measured and fed back to the pilot via a variable transmitter and the process controller.

Installation

WARNING

Personal injury or system damage may result if this pilot 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 pilot may result in personal injury or property damage due to escaping of accumulated gas. To avoid such injury and damage, install the pilot 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.

Planning

1. Locate the valve in a straight run of horizontal pipe. See Figure 3.
2. Allow headroom above the main valve for access through the blind flange. Provide clearance below the main valve for stem withdrawal.

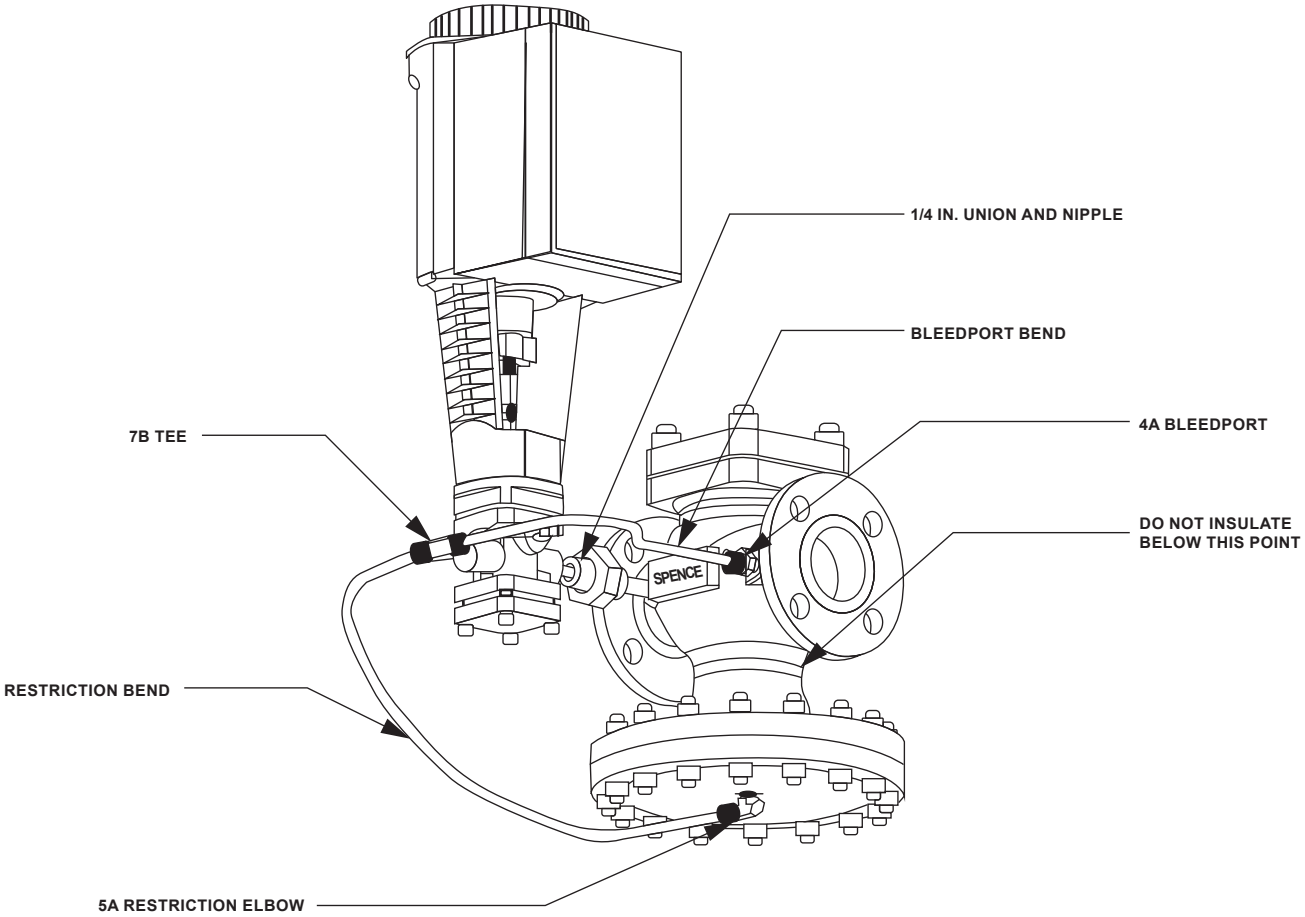


Figure 2. *Type EVH210 Electronic Modulating, Pilot Operated Regulator*

3. Proper regulator installations have drip leg steam trap stations before and after the main valve(s).
4. Avoid damaging effects of scale and dirt in pipelines by using a strainer as shown in Figure 3.
5. Provide a three-valve-bypass to facilitate inspection without interrupting service.
6. Maximize efficiency with the Insulcap and reduce heat loss through the regulator.
7. To eliminate excessive noise and erratic regulation with steam and other compressible fluids, enlarge the delivery pipe size to effect a reasonable flow velocity at the reduced pressure. A concentric transition is recommended. If possible, avoid a sharp turn close to the regulator outlet and a bullheaded tee connection to a low pressure main.
8. Install inlet (upstream) and delivery (downstream) pressure gauges to indicate performance. If the pressure rating of the delivery system or connected equipment is less than the upstream (inlet) steam pressure, provide a safety relief valve.
9. If it is anticipated that the ambient temperature at the Type VH210 pilot will be outside the 5 to 130°F / -15 to 54°C limitations, remote mounting of the Type VH210 pilot is necessary.

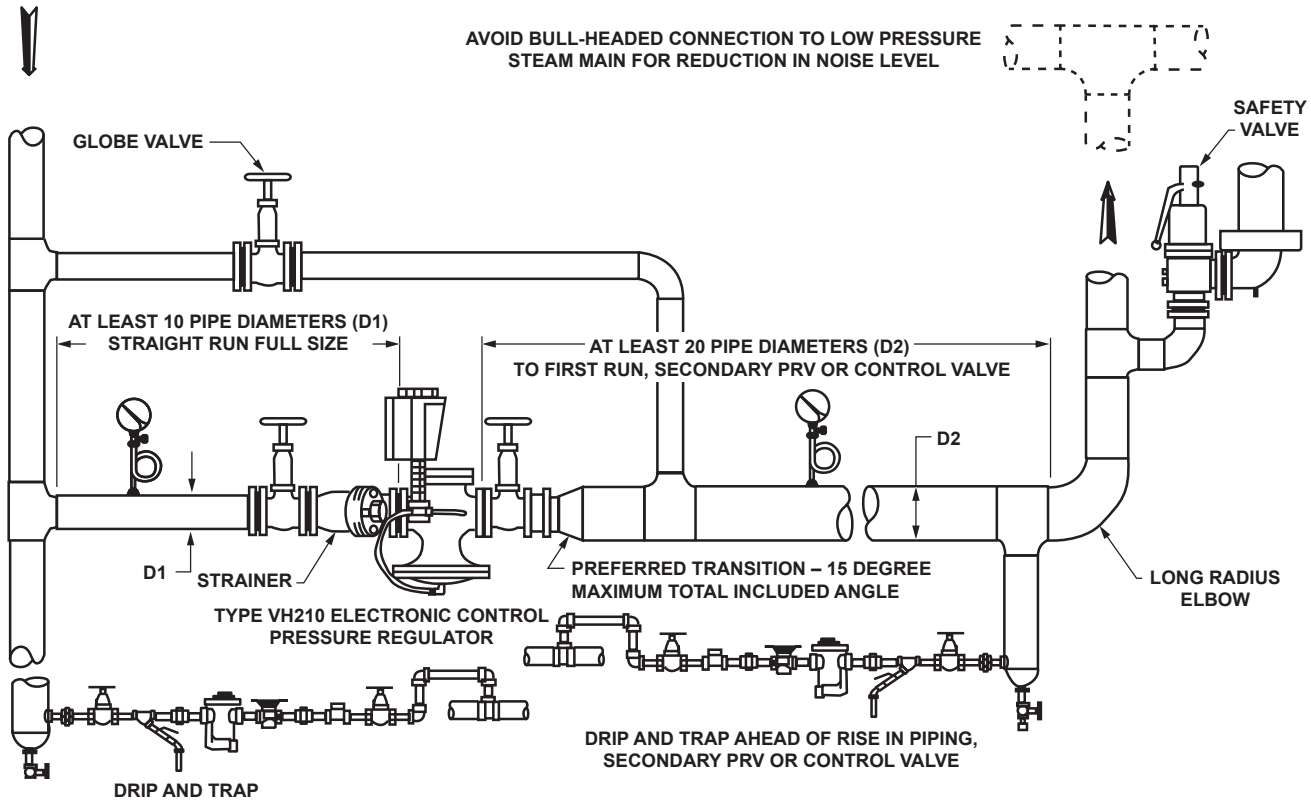


Figure 3. *Recommended Installation of Type EVH210 Regulator with Strainer*

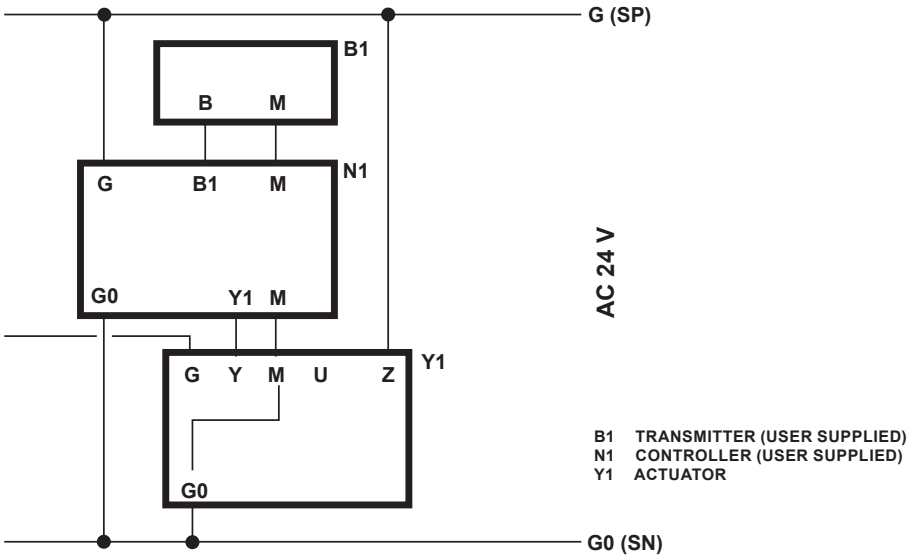
10. If hydrostatic testing of the installation is necessary, proceed as follows:
    a. Manually open the Type VH210 pilot by turning the knob on top of the actuator in a clockwise direction until the red “MAN” tab is displayed, then continuing to turn clockwise until the valve reaches its travel stop.
    b. Before filling the system, open the inlet and outlet stop valves.
    c. Slowly fill the system from the inlet (upstream) side of the regulator.
    d. Bleed off trapped air.
    e. Slowly develop hydrostatic test pressure up to 1.5 times the maximum working pressure. If a higher test pressure is necessary, contact the factory.
    f. Hydrostatic type test pressure may cause normally acceptable leakage at the diaphragm joint.

Main Valve Installation

1. Flush the piping system thoroughly to clear it of welding beads, sand, scale, etc.
2. Mount the main valve with diaphragm chamber down and arrow on the body oriented in the direction of flow.
3. Main valves with threaded connections should be mounted between unions.
4. Insulation may be applied to the upper portion (globe and flanges) of the main valve.

Note

Do not insulate the diaphragm chamber, condensation chamber (if used) or any part of the pilot. See Figure 2.



CONNECTING TERMINALS
24 VAC

G	**SYSTEM POTENTIAL (SP)**
G0	**SYSTEM NEUTRAL (SN)**
Y	**CONTROL INPUT: 0 TO 10 VDC OR 2 TO 20 mA (DIP SWITCH SELECTABLE)**
Z	**OVERRIDE CONTROL (SEE TECHNICAL INSTRUCTIONS 155-717)**
M	**MEASURING NEUTRAL**
U	**OUTPUT FOR 0 TO 10 VDC OR 4 TO 20 mA MEASURING VOLTAGE. IT WILL MATCH THE INPUT SIGNAL TYPE**

NOTE: THE POSITION OUTPUT SIGNAL U WILL SWITCH FROM 0 TO 10 VDC TO 4 TO 20 mA WHEN A 4 TO 20 mA INPUT SIGNAL IS SELECTED AND USED ON THE TERMINAL

Figure 4. *Type VH210 Wiring Diagram*

Pilot Installation

1. Mount Type VH210 pilot with the arrow on the body pointing in the direction of flow, on either side of the main valve, by means of the 1/4 in. nipple and union provided. Make this connection to the 1/4 in. pipe tap at the inlet of the main valve as shown in Figure 2. Remote mounting of Type VH210 pilot is recommended when the ambient temperature at the pilot exceeds 130°F / 54°C. Take caution to protect the electrical portion of Type VH210 pilot from any dripping condensate.
2. Screw the 4A bleedport fitting into the 1/8-in pipe tap at the outlet of the main valve body.

Note

The restriction orifice in this fitting is vital to the operation of the valve.

3. Screw the 7B tee into the 1/4 in. pipe tap in Type VH210 pilot using the branch connection of the tee.
4. Screw the 5A restriction elbow containing a restriction orifice into the 1/8-in pipe tap on the underside of the main valve diaphragm chamber. If the initial pressure or pressure drop is less than 15 psi / 1.03 bar, a 5B open elbow (no restriction orifice) is used.
5. Connect the tubing bends as illustrated in Figure 2.
6. Connect the power and signal wiring to the actuator per wiring diagram shown in Figure 4.
7. There are (4) Dip Switches located under the wiring terminal. They should all be in the “Down” position for 0 to 10 VDC input. For 4 to 20 mA input, Dip Switch 3 should be in the “Up” position.

Initial Start-Up and Setting

WARNING

Steam is potentially dangerous and should be treated with respect. Any steam line which is being filled and pressurized will form condensate.

The steam system must be adequately trapped to remove the condensate as it forms. NEVER open a reducing valve without positive indication that the high pressure side is clear of condensate.

1. Using the bypass, slowly fill the delivery system and raise the pressure to slightly below that which is required.
2. Crack open the inlet stop valve. Blow down the strainer.
3. Open the inlet stop valve. Crack open the outlet stop valve and allow the user supplied process controller to activate the pilot and take control of the system.
4. Alternatively choke down the bypass and open the outlet stop valve until the regulator is online.

Troubleshooting

WARNING

Steam is potentially dangerous and should be treated with respect. All installation, troubleshooting and maintenance should be performed by qualified personnel who are familiar with steam systems.

1. Failure to open or sagging delivery pressure
   a. Inlet pressure may be down due to partially closed supply valve, clogged strainer or other obstruction.
   b. Orifice in 5A restriction elbow (see Figure 2) may be plugged.
   c. 4A bleedport may have been omitted and an open coupling substituted
   d. Type VH210 pilot may be inoperative
      i. Check power supply and signal to pilot.
      ii. Check power and signal to process controller (customer supplied)
2. Failure to close or overriding delivery pressure
   a. Orifice in 4A bleedport may be plugged
   b. Bypass valve may be leaking
   c. Main valve or pilot may be held open by foreign matter in seat
      i. Close stop valves
      ii. Remove bend from 4A bleedport
      iii. Crack inlet stop valve. Steam will issue from the open bend. Using the manual override knob, fully open and close the pilot several times to wash the seat. Completely close the pilot. If steam still issues from the bend, the pilot is not closing correctly.
      iv. Steam blowing back from the 4A bleedport means the main valve seat is held open by foreign matter.
      v. Steam may wash the obstruction from the seat if the valve is made to open and close fully a few times. If the user supplied variable transmitter is installed downstream of the outlet stop valve, slowly opening and closing the outlet stop valve will accomplish this.
      vi. If leakage continues from either the main valve or the pilot, dismantling and maintenance of one or the other may be required. See Maintenance section.
   d. Pilot may need recalibration, see Maintenance Step 3.
   e. Type VH210 pilot may be inoperative
      i. Check power supply and signal to pilot
      ii. Check power and signal to process controller (customer supplied)
3. Erratic operation may be caused by:
   a. Partial clogging of 4A bleedport
   b. Sticking or binding of the pilot valve stem (5), Figure 2. Look for deposits or bits of scale on the stem (5) or guide (8).
   c. Loose or dirty electrical connections
4. Power / Signal failure - In the event of a power or signal failure, Type VH210 returns to a closed position, which, in turn,will cause the main valve to lose pressure underneath its diaphragm and close.

Maintenance

WARNING

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

Steam is potentially dangerous and should be treated with respect. Any steam line which is being filled and pressurized will form condensate.

The steam system must be adequately trapped to remove the condensate as it forms. NEVER open a reducing valve without positive indication that the high pressure side is clear of condensate.

1. Under normal conditions, complete dismantling at regular intervals is not recommended. A valve kept relatively free of dirt will function for years with minimum attention.
2. After an initial period of operation and twice a year thereafter:
   a. Inspect for dirt collected at 4A bleedport and 5A restriction elbow (see Figure 2)
   b. Inspect all joints for leakage. Keep bolts tight and never allow a leak to persist.
3. After an initial period of operation and on regular maintenance schedule(set by the customer), it may be necessary to recalibrate the pilot.
   a. Remove the front cover of the actuator
   b. Stick a flat head screwdriver in the “CALIB” slot to begin the calibration process.
   c. When the calibration process finishes there is a solid green light.
   d. To verify send either a 10vDC or 20mA signal to the actuator and measure the travel. The goal is to achieve 0.125 to 0.140-in travel.

Parts Ordering

When corresponding with your local Sales Office about this equipment, always reference the service and serial number.

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

Parts List

Key	Description	Part Number
1	Electric Actuator, Aluminum	WAL05-17580-00
2	Adapter, Stainless steel	WAL04-17407-00
3	Hex Nuts, Stainless steel	WAL05-17342-00
4	Packing Kit, Stainless steel/TFE	WAL204a104-01
5	Stem, Stainless steel	WAL04-18341-00
6	Bonnet, Steel	WAL04-18340-00
7	Guide, Stainless steel	WALSu260
8	Cap Screw, 8 required, Steel	WAL05-11719-00
9	Gasket, 2 required, Graphite	WAL05-02378-01
10	Plug, 2 required, Steel	WAL05-03778-00
11	Seat Ring, Stainless steel	WAL04-04057-00
12	Body, Cast Iron	WAL04-00741-00
13	Disc, 440 CH	WAL04-18493-00
14	Cap, Cast Iron	WAL04-02151-00
15	Nut, 2 required, Steel	WAL05-02888-00
16	Strainer, Stainless steel	WAL04-04700-00
17	Red Bush 1/4 X 1/8 NPT, Brass (not shown)	WAL05-01104-00
18	7B Tee 5/16 X 1/8 NPT, Brass (not shown)	WAL05-05909-00
19	Union M/F 1/4, 4 required, Iron (not shown)	WAL05-06064-00
20	Nameplate (not shown)	WAL05-03819-00
21	Sticker (not shown)	WAL05-13288-00
22	Nipple, Steel (not shown)	WAL05-02804-00

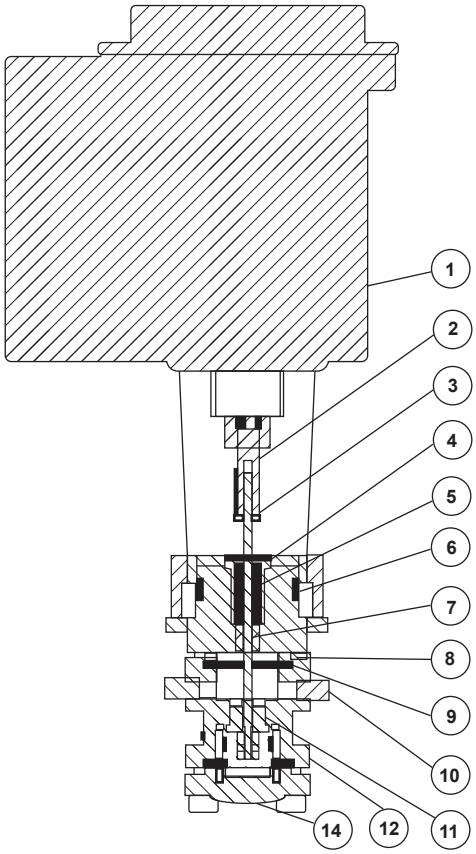


Figure 5. *Type VH210 Assembly Drawing*

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SPENCE™

Spence Types T124 and T134 Temperature and Pressure Pilots

⚠ WARNING

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

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

Installation, operation and maintenance procedures performed by unqualified personnel may result in improper adjustment and unsafe operation. Either condition may result in equipment damage or personal injury. Only a qualified person shall install or service the Types T124 and T134.

Introduction

Scope of the Manual

This manual provides instructions for installation, maintenance and parts information for the Types T124 and T134 temperature pilot.

***Figure 1**. Types T124 and T134 Temperature Pilot*

Product Description

The steam pressure reducing valve and temperature regulator in a single pilot-operated valve is a combination of Type T124 or T134 Pilot and a Type E or C Main Valve. Steam pressure is modulated in proportion to temperature and load variations. Pressure control provides fast, accurate adjustment of heat transfer rate to demand requirements.

This pilot is primarily intended for use on instantaneous heaters. By combining both temperature and pressure control in one pilot, unusually close regulation of temperature is achieved through the anticipation of fast load changes. An additional benefit of this pilot is that pressure reduction and temperature control can be provided with a single regulator. For pressures not to exceed 20 psi / 1.38 bar, Type T134 should be used. For pressures between 20 and 125 psi / 1.38 and 8.62 bar, Type T124 should be used.

Specifications

The Specifications section gives some general specifications for the Types T124 and T134 temperature pilots. The nameplates give detailed information for a specific pilot as built in the factory.

Available Configurations

Type T124: Operating pressures between 20 to 125 psi / 1.38 to 8.62 bar
Type T134: Operating pressures up to 20 psi / 1.38 bar

Maximum Inlet Temperature(1)

Cast Iron: 450°F / 232°C
Cast Steel (Type T134 only): 750°F / 400°C

Temperature Control Ranges(1)

20 to 120°F / -7 to 49°C
50 to 150°F / 10 to 66°C
70 to 170°F / 21 to 77°C
120 to 220°F / 49 to 104°C
150 to 300°F / 66 to 149°C
170 to 270°F / 77 to 132°C
250 to 350°F / 121 to 177°C
290 to 390°F / 143 to 199°C
300 to 400°F / 149 to 204°C
330 to 430°F / 166 to 221°C
400 to 500°F / 204 to 260°C

Maximum Inlet Pressure(1)

Cast Iron: 250 psi / 17.2 bar
Cast Steel (Type T134 only): 600 psi / 41.4 bar

Construction Materials

Body: Cast Iron, Steel
Stem, Disk, Seat and Diaphragm: Stainless steel
Gasket: Graphite
Spring: Steel

Approximate Weights

Type T124: 16 lbs / 7.3 kg
Type T134: 18 lbs / 8.2 kg

Options

Bronze or Stainless steel Thermostat
Tubing from 5 to 50 ft / 1.52 to 15.2 m
Thermostat Well
Dial Thermometer
Adjustment Indicator
Integral Mount Body

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

Principle of Operation

The regulator is operated by its initial steam pressure. The main valve is normally closed, being held so by initial pressure on the disk and by an internal main spring. The pilot is opened by compressing the pressure limit spring.

When steam is turned on, it flows to the pilot through the connecting nipple and union (see Figure 2). At No. 8B tee on the pilot outlet, the flow divides. One branch is connected to bleedport No. 4A and the other to restriction elbow No. 5A and the underside of the main valve diaphragm. Bleedport No. 4A restricts the flow, builds pressure under the diaphragm and opens the main valve. Restriction No. 5A steadies the operation of the regulator.

Steam flowing to the heater creates a rising delivery pressure which is feed back through the control pipe to the underside of the pilot diaphragm. As the pressure on this diaphragm approaches a balance with the thrust of the pressure limit spring, the pilot throttles. This, in turn, allows the main valve to assume a position where just enough steam flows to maintain the set maximum delivery pressure.

As the temperature of the heated medium rises, vapor pressure is generated in the thermostat bulb and transmitted to the pilot temperature diaphragm. When the vapor pressure becomes sufficient to over-balance the combined thrust of the temperature adjusting and pressure limit springs, the regulator throttles to maintain the set temperature.

Installation

WARNING

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

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

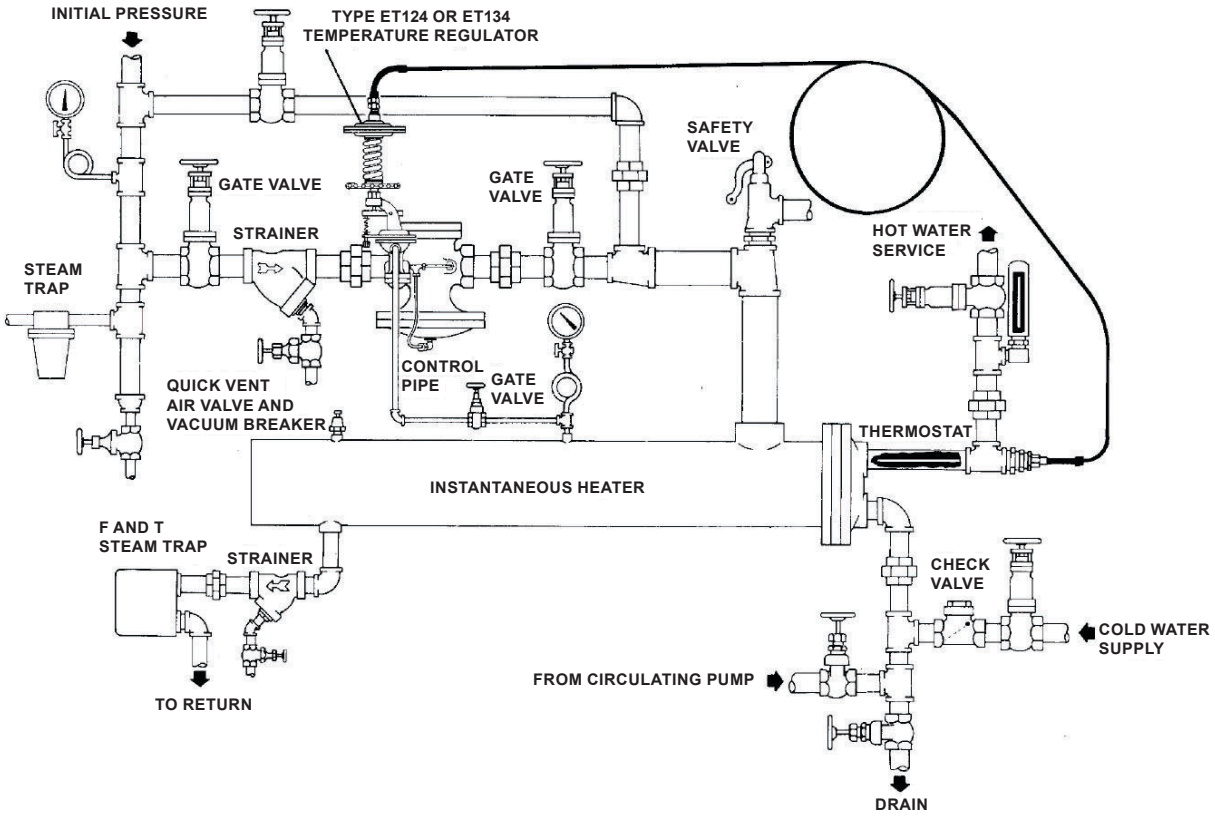


***Figure 2**. Typical Heater Installation*

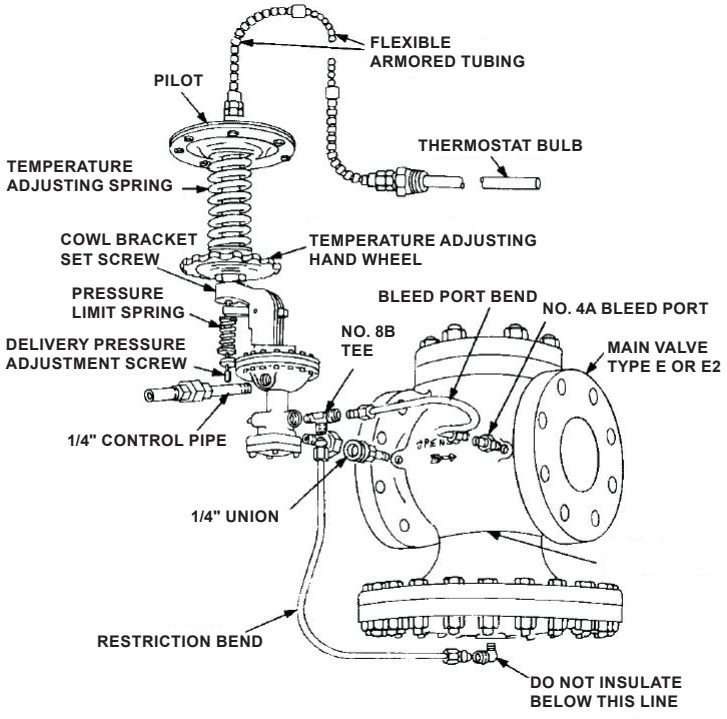


***Figure 3**. Type T124 Tubing Bends Connection*

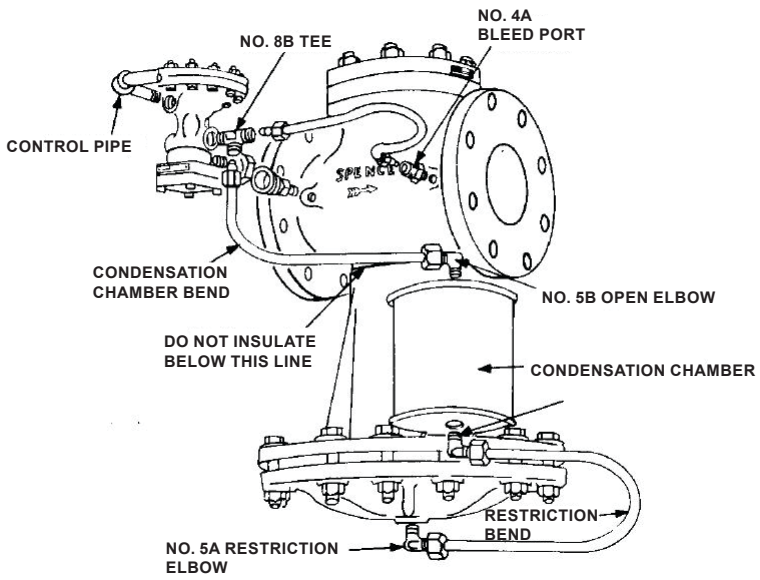


***Figure 4**. Type T124 with Valve Condensation Chamber Tubing Bends Connection*

All pressure equipment should be installed in a non-seismic area; should not be exposed to fire; and should be protected from thunderbolt (lightning) strikes.

Hot water and similar liquid systems require a relief valve to prevent dangerous overpressure due to expansion. Instantaneous heaters, when operated on intermittent demand (as in domestic water heating), require the following conditions for best temperature regulation.

- **Constant forced recirculation of fluid through the heater.**
- **Omission of thermostat well to reduce temperature lag.**

Note

Use of a thermostat compatible with the heated medium is preferred over the use of a standard thermostat installed in a well which is compatible with the heated medium. When the use of a well is unavoidable, an appropriate heat transfer medium should be installed between the well and the thermostat.

CAUTION

The piping system must be adequately designed and supported to prevent extraordinary loads to the pressure equipment.

Planning

1. Locate the regulator in a horizontal pipe. Provide a trap ahead of the regulator to prevent water hammer and erratic operation.
2. Use a strainer to avoid damaging effects of scale and dirt in pipelines to protect the regulator.
3. Provide a three valve bypass to facilitate inspection of the regulator without interrupting service.
4. Position the thermostat horizontally. When vertical or slanting, the tip end of the bulb must point downward.
5. Locate the thermostat as close to the heater outlet as practical. Expose the entire length of the bulb to the active flow leaving the heater.
6. If the pressure rating of the heater or connected equipment is less than the initial steam pressure, provide a safety valve.

Main Valve

1. Flush the piping system thoroughly to clear it of welding beads, scale, sand, etc.
2. Mount the main valve with diaphragm chamber down and arrow on body pointing in the direction of flow.
3. Mount screwed end valves in unions.

Pilot

1. Mount the pilot on either side of the main valve by means of 1/4 in. / 6.35 mm nipple and union provided.
2. Connect the 1/4 in. / 6.35 mm pipe tap at the inlet side of the main valve as shown in Figure 3.
3. Screw No. 4A bleedport fitting into the 1/8 in. / 3.18 mm pipe tap at the outlet side of the main valve body. Note that the bleed orifice in this fitting is vital to operation of regulator.
4. Screw No. 8B tee into 1/8 in. / 3.18 mm pipe tap in pilot. Select tap facing downstream.
5. Screw No. 5A elbow containing restriction orifice into 1/8 in. / 3.18 mm pipe tap on the underside of main valve diaphragm chamber. If the initial pressure or pressure drop is less than 15 psi / 1.03 bar, use No. 5B open elbow without orifice.
6. Connect tubing bends as illustrated in Figure 3. Valves with condensation chamber are fitted up according to Figure 4.

Control Pipe

1. Use 1/4 in. / 6.35 mm pipe for this line which connects the pilot pressure diaphragm chamber (Figure 3) to the desired point of pressure control.

Note

On instantaneous heaters with steam in shell, tap the control pipe into the shell. Otherwise, enter the delivery steam pipe at point of entrance to heater.

2. Pitch the control pipe away from the pilot and avoid water pockets.

Insulation (If Required)

Insulation may be applied to the upper portion (globe and flanges) of the main valve. Do not insulate the diaphragm chamber or any part of pilot. See Figure 2.

Start-up and Setting

WARNING

The pilot may be handling hazardous fluids. Only qualified personnel, who are familiar with the installation, should be permitted to install, readjust, inspect or maintain the pilot.

CAUTION

Insulation, may be applied to the pilot body only. Do not insulate the bonnet.

Best temperature control will result when the delivery pressure setting is the lowest steam pressure capable of sustaining the desired temperature at maximum load. Perform the following adjustments under full load conditions or as near to such as possible.

1. Close bypass, open 1/4 in. / 6.35 mm control pipe valve turn up the temperature adjusting wheel (Figure 2) until 1/2 in. / 12.7 mm of thread is exposed.
2. Back off pressure adjusting screw to remove all compression from pressure limit spring.
3. Crack open the outlet stop valve.
4. Crack open the inlet stop valve, blow down strainer and then slowly open the inlet valve wide.
5. Slowly turn up the pressure adjustment.
6. When steam begins to flow, gradually open the outlet stop valve.
7. Continue delivery pressure adjustment until heater output temperature is 5°F / -15°C above required. If the temperature adjustment made at the beginning of this procedure limits this operation, set the adjusting wheel a little higher. Lower the temperature adjusting wheel until the desired operating temperature is reached.
8. If the adjustment is made at partial load, the temperature will sag under heavier loads. When maximum load occurs, increase the pressure setting just enough to restore the temperature to normal.

Maintenance

WARNING

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 pilot from system pressure and relieving all internal pressure from the pilot.

Pilots 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 pilot.

Due to normal wear or damage that may occur from external sources, this pilot 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.

CAUTION

Do not, under any circumstances, loosen the bolts on the diaphragm chamber of the Type T124 or T134 Temperature Pilot or attempt to dismantle the thermostat element. The system is filled with volatile fluid which, if lost, will render the pilot inoperative.

Dismantling

1. Remove diaphragm nuts (key 4) and lift off top works and diaphragms.
2. Remove the blind flange bolts (key 7) and take off the blind flange (key 26). Remove the screen (key 46) and gasket (key 45).
3. Hold the pusher plate (key 41) with a socket wrench and remove stem nuts (key 25). The disk (key 24) will drop off.
4. Lift out the stem (key 22) and valve spring (key 43).

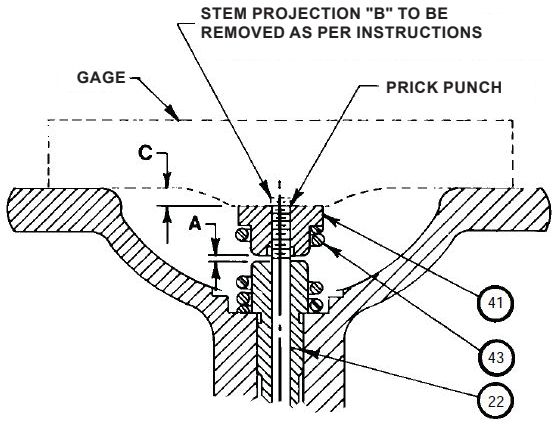


***Figure 5**. Travel Setting*

Assembly

1. Reassemble the pilot in the reverse of the Dismantling procedure.
2. Ensure that diaphragm screw (key 37) and cowl bracket (key 19) are centered on diaphragm flange of the pilot body (key 44). Misalignment can cause erratic performance.
3. When replacing diaphragms, apply sealing compound (High pressure, high-temperature sealant) sparingly to the shoulder of the diaphragm screw (key 37). For steel pilot only, apply sealing compound to the diaphragm flange of the pilot body.

Seat, Disk and Stem Replacement

1. Examine the seat and disk sealing surfaces for nicks or other signs of damage by pipeline debris. Replace the sealing surfaces if damaged.
2. When seat or disk is replaced, ensure that the sealing surfaces are lapped. After the sealing surfaces are lapped in, disassemble and clean all parts.

Note

Lap sparingly using 500 grit lapping compound and light pressure. Heavy grinding may cause galling, wide sealing surfaces and a grooved disk, all of which tend to produce leakage.

3. Remove the seat ring (key 15) from the body with a socket wrench.
4. Clean the body threads of old sealing compound using a wire brush.
5. Apply new sealing compound (high-pressure, high-temperature sealant) sparingly to the threads and shoulder of the new seat ring. Let stand until tacky before assembling into the pilot body.
6. Lap in joint between new stem (key 22) and disk (key 24).
7. Apply lapping compound to the disk, place it on the stem and secure with a stem nut (key 25). Slip the stem into it's normal position and lap the disk to seat joint.
8. Screw on the pusher plate (key 41), omitting the valve spring. Hold the disk on the seat and adjust the pusher plate until dimension (C=11/64 in. / 4.37 mm) is obtained. See Figure 5).
9. Remove stem nut, being careful not to disturb the pusher plate adjustment and lift stem out the top of the pilot. Grind off stem projection B flush with upper surface of pusher plate.
10. Reinsert stem in the pilot with disk and a stem nut attached. Check dimension c and, if correct, lock the position by prick punching the thread at several points. Work carefully to avoid bending the stem.
11. Scrape away burrs raised by prick punching. Upper surface must be smooth and flat.
12. Check that valve travel is A=3/64 in. / 1.19 mm. This need not be exact. Stem should move smoothly. Binding indicates a bent stem.
13. Remove stem nut and disk and withdraw stem. Install stem with valve spring, disk and both stem nuts in place.

Thermostat Replacement

To replace thermostat, proceed as follows:

1. Cool the thermostat bulbs of original and replacement elements below the low end of their temperature range (See range tag on flexible tubing). Maintain bulbs at this temperature during replacement process.
2. Back off temperature adjusting wheel (key 14) to within a turn or two of the barrel nut (key 1). Back off pressure adjusting screw (key 20) to remove all compression from spring. This will allow temperature diaphragm plate (key 7) to remain seated in correct alignment on balls (key 10) after disengagement of thermostat assembly. Unless pilot is upright, balls will fall out of position.
3. Remove diaphragm nuts (key 8) and detach thermostat assembly from pilot. Similarly, detach shipping plate from replacement thermostat. When removing diaphragm nuts, be sure cowl assembly (key 29) does not turn in threaded joint at barrel nut (key 1). If movement is observed, reset position as per instructions for temperature stem position adjustment.
4. Install replacement thermostat on pilot and install shipping plate on original thermostat. Tighten bolts evenly.

Temperature Adjustment

The temperature stem adjustment is factory set and locked by a barrel nut (key 1). If the setting is accidentally disturbed, readjust as follows:

1. Remove thermostat assembly per instructions in Thermostat Replacement section.
2. Clamp a flat bar to the cowl (key 29) so that the pressure plate (key 7) is flush with the cowl's pinch ring.
3. Loosen cowl bracket set screw (key 30) and turn cowl assembly (key 29) up about one turn. Remove putty from barrel nut set screw (key 1), loosen set screw and back off barrel nut about one turn.
4. Crack inlet stop valve or apply shop air to the pilot inlet. Turn up pressure adjusting screw (key 20) until flow issues from pilot outlet tee. Rotate the cowl assembly (key 29) down until flow stops.
5. Lock this adjustment with the cowl bracket's set screw (key 30). Turn down the barrel nut (key 1) to jam against cowl bracket and lock with it's set screw (key 5).
6. Reinstall the thermostat assembly.

Troubleshooting

WARNING

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

Pilots 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 pilot.

Failure to Open or Sagging Delivery Pressure

1. Adjusting spring on pilot may have been tampered with.
2. Initial pressure may be down due to partially closed supply valve, clogged strainer or other obstruction.
3. Bleedport may have been omitted and an open coupling substituted.
4. Orifice in No. 5A restriction elbow may be plugged.
5. Control pipe may be plugged. Most likely points of obstruction are at shutoff valve and entrance to delivery main.
6. Make sure heater is properly trapped and free of condensate.
7. Pilot or main valve diaphragm may be broken. Check for leakage around stem between lever and diaphragm on pilot. Check the main valve with air pressure in diaphragm chamber before dismantling.
8. Leak in the thermostat bulb may allow heated fluid pressure if sufficiently high to back up into the thermal system to hold pilot closed.

Failure To Close – Overheating

1. Adjusting spring on pilot may have been tampered with.
2. By-pass may be leaking.
3. Thermostat located too far from instantaneous heater outlet.
4. Thermostat may be kinked or broken or have lost its fill. Alternately warm and cool thermostat 10°F / -12°C above and below its set point. If thermostat is operative, the pin between the lever and pressure diaphragm will become loose and snug as the temperature stem on opposite end of the lever moves up and down.
5. Orifice in bleedport may be plugged.
6. A lift of condensate to a hot well may require more pressure in heater than the heated medium. Arrange drainage of the heater by gravity or install a pump to lift condensate.
7. Main valve or pilot may be held open by foreign matter. To determine which valve leaks:
   a. Close inlet stop valves and 1/4 in. / 6.35 mm control valve.
   b. Remove bleedport bend so pilot will exhaust to atmosphere.
   c. Remove all compression from pressure adjusting spring.

If steam issues from the end of the bleedport bend on the pilot, there is an obstruction between it's seat and disk. Steam blowing back from the bleedport on the downstream side of the valve indicates that the main valve disk is held open by foreign matter. Leakage of either valve requires dismantling. See Dismantling section for instructions.

Erratic Temperature Control

1. Thermostat installed too far from heater outlet.
2. Improper trapping or erratic discharge of trap.
3. Lift of condensate to hot well may require more pressure than that called for by the medium flowing through the heater. Arrange to drain condensate by gravity or lift it with a pump.
4. Sticky check valve in return line.
5. Poor circulation through heater. Constant circulation should be employed.
6. Valve too large for the heater or heater too large for the load.
7. Valve installed too far from heater.

Parts Ordering

When ordering parts, it is essential that the pilot type, service and serial number be stated.

Select part by item number, but order by part number. Specify complete part number when ordering.

Parts List

Key	Description	Part Number
1	Barrel Nut, Aluminum	WAL04-02908-00
2	Set Screw Pivot Pin, Steel	WAL05-04875-00
3	Cotter Pin, Steel	WAL05-03265-00
4	Diaphragm Nut, Steel	
	Type T124	WAL05-02890-00
	Type T134	WAL05-02871-00
5	Diaphragm Bolt, Steel	
	Type T124	WAL05-04879-00
	Type T134	WAL05-04764-00
6	Pipe Plug, Ledloy	WAL04-03769-00
7	Temperature Plate, Ledloy	WAL04-03602-01
8	Temperature Diaphragm Nut, Steel	WAL05-02992-00
9	Temperature Diaphragm Bolt, Steel	WAL05-05634-00
10	Temperature Plate Ball, Steel	WAL05-00553-00
11	Temperature Spring Button, Ledloy	WAL04-01052-00
12	Temperature Spring, Oil Temperature Steel	WAL05-05122-00
13	Thrust Bearing, Steel	WAL05-00550-00
14	Handwheel, Cast Iron	WAL04-02502-00
15	Set Screw Barrel, Steel	WAL05-04874-00
16	Spring Button, Upper, Ledloy	WAL04-01039-01
17	Pressure Spring, Oil Temperature Steel	
	Type T124	WAL05-05076-00
	Type T134	WAL05-04980-00
18	Spring Button, Lower, Ledloy	WAL04-01079-00
19	Cowl Bracket	
	Type T124, Cast Iron	WAL04-01014-00
	Type T134	
	Cast Iron	WAL04-01016-00
	Ductile Iron	WAL04-01017-00
20	Adjusting Screw, 416 Stainless steel	WAL04-04756-01
21	Stem Bushing, 203 PB	WAL04-01080-00
22	Stem, 303 Stainless steel	
	Standard	WAL04-05229-00
	Composition Disk	WAL04-05381-00
23	Seat Ring	
	Standard, 420 FH Stainless steel	WAL04-04057-90
	Composition Disk, 303 Stainless steel	WAL04-04060-00
24	Disk	
	Standard, 440 CH	WAL04-01772-90
	Composition Disk, Brass Hycar	WAL07-53512-00
25	Stem Nut	
	Steel	WAL05-02888-00
	Brass	WAL05-02886-00
26	Blind Flange	
	Cast Iron	WAL04-02151-00
	Cast Steel	WAL04-11678-00
27	Blind Flange Bolt	
	Steel and Iron	WAL05-04803-00
	Steel and Steel	WAL05-11720-00
28	Temperature Plate Center, Ledloy	WAL04-03715-00
29	Cowl, Steel	WAL04-01525-00
30	Cowl Pin, Steel	WAL05-03243-00
31	Barrel, Aluminum	WAL04-01247-00
32	Temperature Stem, Aluminum	WAL04-05653-00
33	Pivot Pin, 416 Stainless steel	WAL04-03273-00
34	Set Screw Pressure Stem, Steel	WAL05-04850-00
35	Lever, Steel	
	Type T124	WAL04-02758-00
	Type T134	WAL04-02760-00
36	Pressure Stem, 416 Stainless steel	WAL04-05426-00
37*	Diaphragm Screw, Ledloy	
	Type T124	WAL04-02926-00
	Type T134	WAL04-04822-00
38*	Pressure Plate, Ledloy (Type T134 only)	WAL04-03679-00
39*	Diaphragm, 301 Stainless steel	WAL04-01623-00
40*	Floating Plate, Iron (Type T134 only)	WAL04-03710-00
41*	Pusher Plate, Ledloy	WAL04-03718-00
42*	Vacuum Spring,	
	302 Stainless steel (Type T134 only)	WAL05-05055-00
43*	Valve Spring, Inconel	
	Type T124	WAL05-09353-00
	Type T134	WAL05-04985-00
44	Body, Cast Iron	
	Type T124, Cast Iron	WAL04-00950-00
	Type T134	
	Cast Iron	WAL04-00630-00
	Cast Steel	WAL04-10439-01
45*	Gasket	
	Graphite	WAL05-02378-01
	Flexitalic	WAL05-11718-00
46*	Screen, 301 Stainless steel	
	Steam Service	WAL04-04700-00
	Water Service	WAL04-04701-00
47*	Diaphragm Nut, Ledloy	WAL04-02925-00
48	Adjusting Indicator Plate, Aluminum	WAL05-03512-00
49	Adjusting Indicator Pointer, Aluminum	WAL05-03513-00

*These parts furnished in Repair Kit.

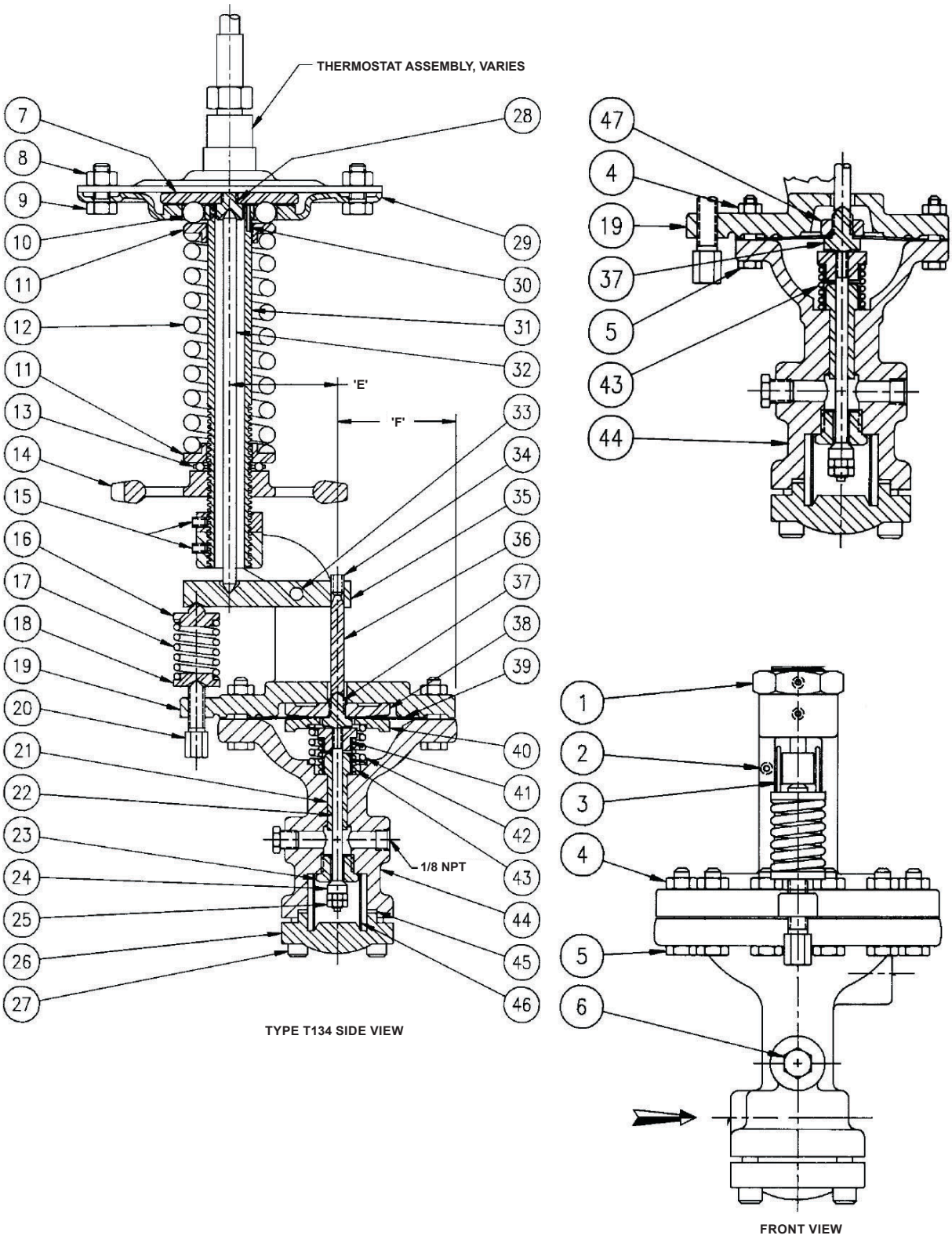
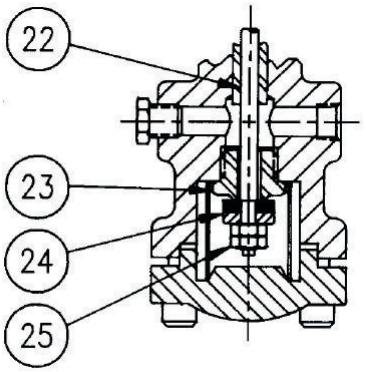
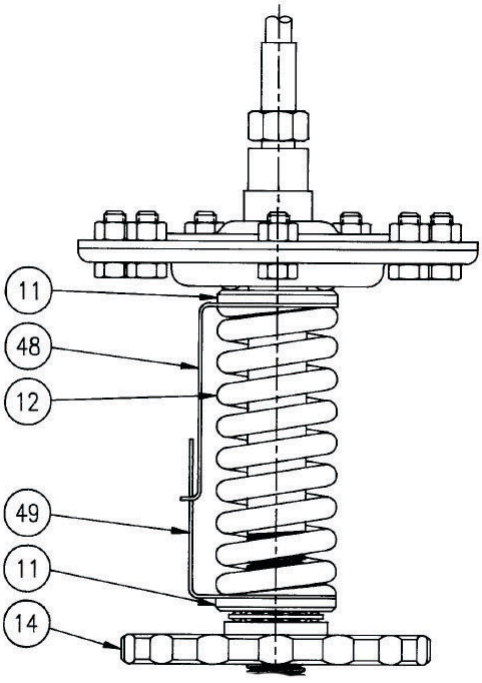


***Figure 6**. Type T124 Assembly*



COMPOSITION DISK



ADJUSTMENT INDICATOR

***Figure 7**. Type T124 Options Assembly*

SpenceValve.com

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T +971 4 811 8100

SD4512B

SPENCE™

Spence Type T14 Temperature Pilot

⚠ WARNING

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

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

Installation, operation and maintenance procedures performed by unqualified personnel may result in improper adjustment and unsafe operation. Either condition may result in equipment damage or personal injury. Only a qualified person shall install or service the Type T14.

Introduction

Scope of the Manual

This manual provides instructions for installation, maintenance and parts information for the Type T14 temperature pilots.

Figure 1. *Type T14 Temperature Pilot*

Product Description

The Spence Type T14 is a temperature pilot regulator. When combined with the Spence Type E or Type C Main Valve, it produces a temperature regulator, ET14, or a combined pressure and temperature regulator in a single pilot operated valve, ET14D.

Type T14 pilot is recommended for use with storage heaters, jacketed kettles and vats.

Specifications

The Specifications section gives some general specifications for the Type T14 temperature pilot. The nameplates give detailed information for a specific pilot as built in the factory.

Available Configurations
Type T14: Temperature Pilot

Maximum Inlet Temperature(1)
Cast Iron: 450°F / 232°C
Cast Steel: 750°F / 400°C

Maximum Inlet Pressure(1)
Cast Iron: 250 psig / 17.2 bar
Cast Steel: 600 psig / 41.4 bar

Temperature Ranges(1)
20 to 120°F / -7 to 49°C
50 to 150°F / 10 to 66°C
70 to 170°F / 21 to 77°C
120 to 220°F / 49 to 104°C
150 to 300°F / 66 to 149°C
170 to 270°F / 77 to 132°C
250 to 350°F / 121 to 177°C
290 to 390°F / 143 to 199°C
300 to 400°F / 149 to 204°C
330 to 430°F / 166 to 221°C
400 to 500°F / 204 to 260°C

Construction Materials
Body: Cast Iron, Steel
Disk and Seat: Stainless steel
Diaphragm: Bronze
Gasket: Graphite
Spring: Steel

Approximate Weights
Type T14: 13 lbs / 6 kg

Optional Accessories
Bronze or Stainless steel Thermostat
Tubing from 5 to 50 ft / 1.52 to 15.2 m
Thermostat Well
Dial Thermometer
Adjustment Indicator
Integral Mount Body

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

Principle of Operation

The regulator is operated by its initial steam pressure. The main valve is normally closed, being held so by initial pressure on the disk and by an internal main spring. The pilot opens when the temperature at the thermostat bulb is lower than the setting of the temperature adjusting spring.

Steam flows to the pilot through the connecting nipple and union (see Figure 2). At the No. 8B tee on the pilot outlet, the flow divides. One branch is connected to bleedport No. 4A and the other to restriction elbow No. 5A and the underside of the main valve diaphragm. Bleedport No. 4A restricts the flow, builds pressure under the diaphragm and opens the main valve. Restriction No. 5A steadies the operation of the regulator.

As the temperature of the heated medium rises, vapor pressure is generated in the thermostat bulb and transmitted to the pilot temperature diaphragm. When the vapor pressure becomes sufficient to over-balance the combined thrust of the temperature adjusting and pressure limit springs, the regulator throttles to maintain the set temperature.

When a Type D Pressure Pilot is added (Type ET14D), the operation remains the same except the delivery pressure is limited to the setting of this pilot. On decreasing load, the temperature pilot reassumes the control and throttles the delivery pressure as required to maintain the desired temperature. For additional information on the Type D Pressure Reducing Pilot, please refer to VCIMD-14966.

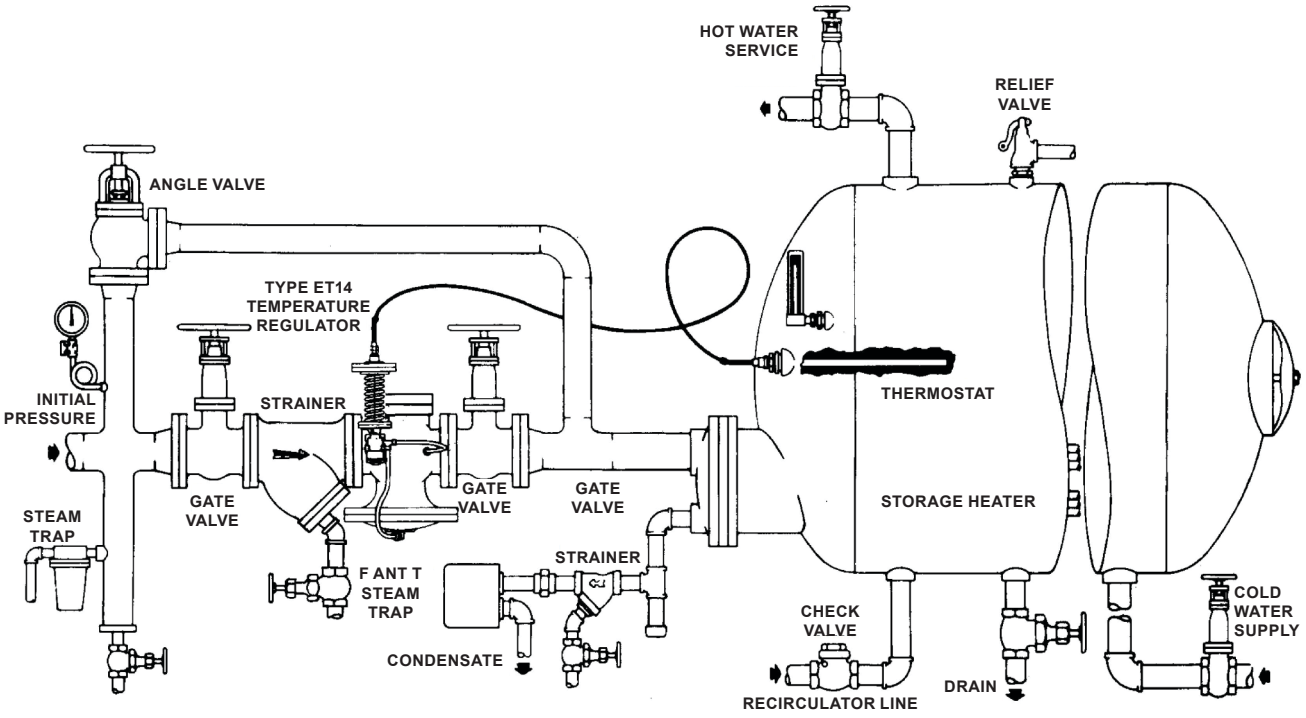

Figure 2. *Typical Installation*

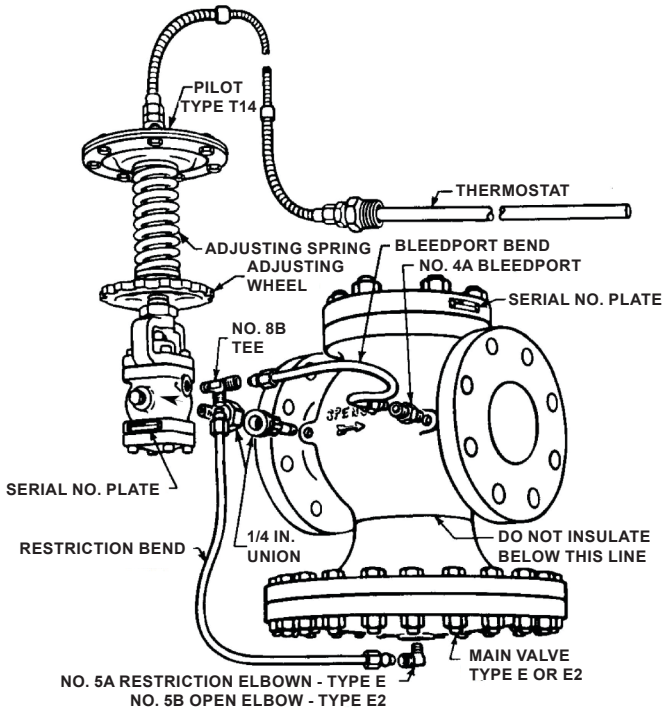

Figure 3. *Type T14 Tubing Bends Connection*

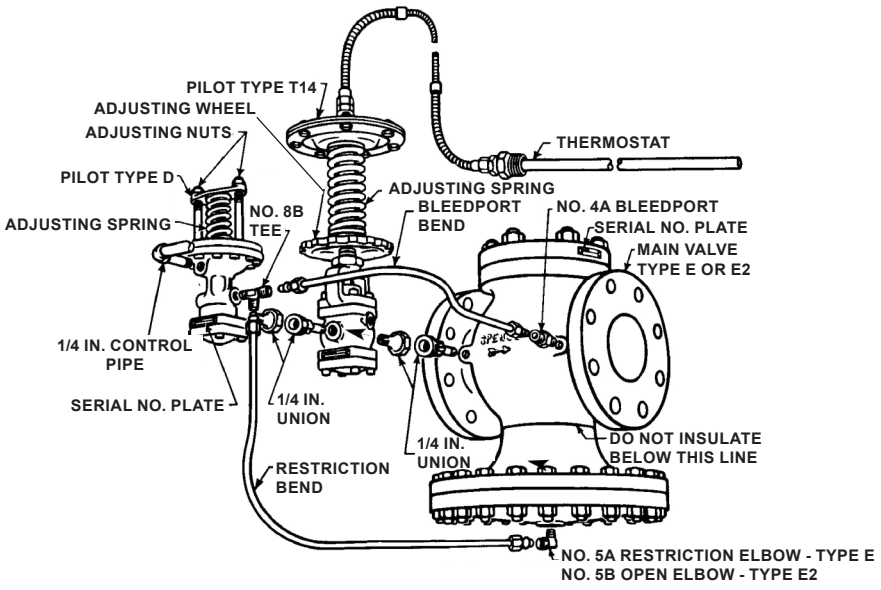

Figure 4. *Type ET14D Tubing Bends Connection*

Installation

WARNING

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

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

All pressure equipment should be installed in a non-seismic area; should not be exposed to fire; and should be protected from thunderbolt (lightning) strikes.

Hot water and similar liquid systems require a relief valve to prevent dangerous overpressure due to expansion. Instantaneous heaters, when operated on intermittent demand (as in domestic water heating), require the following conditions for best temperature regulation.

- **Constant forced recirculation of fluid through the heater.**
- **Omission of thermostat well to reduce temperature lag.**

Note

Use of a thermostat compatible with the heated medium is preferred over the use of a standard thermostat installed in a well which is compatible with the heated medium. When the use of a well is unavoidable, an appropriate heat transfer medium should be installed between the well and the thermostat.

CAUTION

The piping system must be adequately designed and supported to prevent extraordinary loads to the pressure equipment.

Planning

1. Locate the regulator in a horizontal pipe. Provide a trap ahead of the regulator to prevent water hammer and erratic operation.
2. Use a strainer to avoid damaging effects of scale and dirt in pipelines to protect the regulator.
3. Provide a three valve bypass to facilitate inspection of the regulator without interrupting service.
4. Position the thermostat horizontally. When vertical or slanting, the tip end of the bulb must point downward.
5. Locate the thermostat as close to the heater outlet as practical. Expose the entire length of the bulb to the active flow leaving the heater.
6. If the pressure rating of the heater or connected equipment is less than the initial steam pressure, provide a safety valve.

Main Valve

1. Flush the piping system thoroughly to clear it of welding beads, scale, sand, etc.
2. Mount the main valve with diaphragm chamber down and arrow on body pointing in the direction of flow.
3. Mount screwed end valves in unions.

Pilot

1. Mount the pilot on either side of the main valve by means of 1/4 in. / 6.35 mm nipple and union provided.
2. Connect the 1/4 in. / 6.35 mm pipe tap at the inlet side of the main valve as shown in Figure 3.
3. Screw No. 4A bleedport fitting into the 1/8 in. / 3.18 mm pipe tap at the outlet side of the main valve body. Note that the bleed orifice in this fitting is vital to operation of regulator.
4. Screw No. 8B tee into 1/8 in. / 3.18 mm pipe tap in pilot. Select tap facing downstream.
5. Screw No. 5A elbow containing restriction orifice into 1/8 in. / 3.18 mm pipe tap on the underside of main valve diaphragm chamber. If the initial pressure or pressure drop is less than 15 psi / 1.03 bar, use No. 5B open elbow without orifice.
6. Connect tubing bends as illustrated in Figure 3. Valves with condensation chamber are fitted up according to Figure 4.

Control Pipe (Required for Type T14 and Type D Pilot Combination Only)

1. Use 1/4 in. / 6.35 mm pipe for this line which connects the pilot pressure diaphragm chamber (Figure 3) to the desired point of pressure control.
2. On instantaneous heaters with steam in shell, tap the control pipe into the shell. Otherwise, enter the delivery steam pipe at point of entrance to heater.
3. Pitch the control pipe away from the pilot and avoid water pockets.

Insulation

Insulation may be applied to the upper portion (globe and flanges) of the main valve. Do not insulate the diaphragm chamber or any part of pilot. See Figure 2.

Start-up and Setting

WARNING

The pilot may be handling hazardous fluids. Only qualified personnel, who are familiar with the installation, should be permitted to install, readjust, inspect or maintain the pilot.

CAUTION

Insulation, may be applied to the pilot body only. Do not insulate the bonnet.

For Type ET14

1. Close bypass and open outlet stop valve.
2. Blow down strainer.
3. Gradually open inlet stop valve.
4. Turn temperature adjusting wheel (Figure 2) to obtain desired control temperature.

Type ET14D

1. Close bypass, open 1/4 in. / 6.35 mm control pipe valve. Turn up the temperature adjusting wheel (Figure 2) until 1/2 in. / 12.7 mm of thread is exposed.
2. Back off pressure adjusting screw to remove all compression from Type D Pilot adjusting spring.
3. Crack open the outlet stop valve.
4. Crack open the inlet stop valve, blow down strainer and then slowly open the inlet valve wide.
5. Gradually compress Type D Pilot adjusting spring until the valve opens and takes control at set pressure.
6. Open outlet stop valve slowly and adjust temperature by turning adjusting wheel until desired operating temperature is reached.

Maintenance

WARNING

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 pilot from system pressure and relieving all internal pressure from the pilot.

Pilots 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 pilot.

Due to normal wear or damage that may occur from external sources, this pilot 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.

CAUTION

Do not, under any circumstances, loosen the bolts on the diaphragm chamber of the Type T14 Temperature Pilot or attempt to dismantle the thermostat element. The system is filled with volatile fluid which, if lost, will render the pilot inoperative.

Inspection

Under normal conditions, complete dismantling at regular intervals is not recommended. A valve kept relatively free of dirt will function for years with minimum attention.

After the first few days of operation and twice per year:

- Inspect for dirt collected at bleedport 4A and restriction elbow 5A.
- Inspect all joints for leakage. Keep bolts tight. Never allow a leak to persist.

Thermostat Replacement

To replace thermostat, proceed as follows:

1. Cool the thermostat bulbs of original and replacement elements below the low end of their temperature range (See range tag on flexible tubing). Maintain bulbs at this temperature during replacement process.

2. Back off temperature adjusting wheel (key 10) to within a turn or two of the barrel nut (key 22). This will allow temperature diaphragm plate (key 4) to remain seated in correct alignment on balls (key 5) and will release all compression on bellows stem assembly (key 12). Unless pilot is upright, balls will fall out of position.
3. Remove diaphragm nuts (key 2) and detach thermostat assembly (key 11) from pilot. Similarly, detach shipping plate from replacement thermostat. When removing diaphragm nuts, be sure cowl assembly (key 28) does not turn in bonnet (key 24). If movement is observed, reset position as per instructions for temperature stem position adjustment.
4. Install replacement thermostat on pilot and install shipping plate on original thermostat. Tighten bolts evenly.

Bellows Seal Replacement

If steam blows out around temperature stem (key 8) at bonnet (key 24), the bellows seal is defective and must be replaced. Proceed as follows:

1. Remove set screw (key 23) and bonnet bolts (key 18).
2. Remove cowl assembly (key 28) and bonnet (key 24) from body (key 25).
3. Fit 5/8 in. / 15.9 mm deep socket wrench on nut at the end of bellows assembly (key 12) and remove it from bonnet (key 24).
4. Install new bellows following instructions for replacing seat rings.
5. Ensure bellows stem fits into coupling on temperature stem (key 8) and tighten set screw (key 23).

Dismantling

1. Remove bonnet bolts (key 18) and lift off cowl assembly (key 28).
2. Remove disk (key 14) and clean seat (key 15).
3. Remove blind flange bolts (key 18) and clean screen (key 16).

Assembly

Reassemble the pilot in the reverse of the procedure described in Dismantling section.

Seat and Disk Replacement

1. Examine the seat and disk sealing surfaces for nicks or other signs of damage by pipeline debris. Replace the sealing surfaces if damaged.
2. Remove the seat ring (key 15) from the body with a socket wrench.
3. Clean the body threads of old sealing compound using a wire brush.
4. Apply new sealing compound (high-pressure, high-temperature sealant) sparingly to the threads and shoulder of the new seat ring. Let stand until tacky before assembling into the pilot body.
5. When seat or disk is replaced, ensure that the sealing surfaces are lapped. After the sealing surfaces are lapped in, disassemble and clean all parts.

Note

Lap sparingly using 500 grit lapping compound and light pressure. Heavy grinding may cause galling, wide sealing surfaces and a grooved disk, all of which tend to produce leakage.

Type T14 Pilot Setting

The temperature stem adjustment is factory set and locked by a barrel nut (key 2). If the setting is accidentally disturbed, readjust as follows:

1. Leave pilot connected to main valve. Remove thermostat assembly (key 1).
2. Clamp a steel flat bar to the cowl (key 19) so that the pressure plate (key 4) is flush with the diaphragm seat on cowl.
3. Disconnect bleedport bend (tubing between tee at pilot outlet and bleedport fitting in outlet end of main valve).
4. Crack inlet stop valve until steam issues from tee fitting on pilot outlet.

1. If pilot is blocked by temperature stem (key 8), loosen bonnet set screw (key 11) and stem set screw (key 23).
2. Rotate cowl assembly (key 28) upward to raise barrel (key 21) until steam flows.
3. If barrel nut (key 22) prevents cowl assembly from turning down far enough or is above bonnet (key 24) when steam stops flowing, remove sealing wax and loosen set screw (key 11).
4. Lock the setting by tightening set screw (key 11) in bonnet (key 24). Turn down barrel nut (key 22) fast against bonnet and tighten its set screw (key 11) and the stem set screw (key 23).
5. Reassemble thermostat (key 1).

Troubleshooting

WARNING

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

Pilots 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 pilot.

Failure to Open or Sagging Delivery Pressure

1. Adjusting spring on pilot may have been tampered with.
2. Initial pressure may be down due to partially closed supply valve, clogged strainer or other obstruction.
3. Bleedport may have been omitted and an open coupling substituted.
4. Orifice in No. 5A restriction elbow may be plugged.
5. Control pipe may be plugged. Most likely points of obstruction are at shutoff valve and entrance to delivery main.
6. Make sure heater is properly trapped and free of condensate.
7. Main valve diaphragm may be broken. Check the main valve with air pressure in diaphragm chamber before dismantling.
8. Leak in the thermostat bulb may allow heated fluid pressure if sufficiently high to back up into the thermal system to hold pilot closed.

Failure To Close – Overheating

1. Adjusting spring on pilot may have been tampered with.
2. By-pass may be leaking.
3. Thermostat located too far from instantaneous heater outlet.
4. Thermostat may be kinked or broken or have lost its fill.
5. Alternately warm and cool thermostat 10°F / 12°C above and below its set point. If thermostat is operative, the pin between the lever and pressure diaphragm will become loose and snug as the temperature stem on opposite end of the lever moves up and down.
6. Orifice in bleedport may be plugged.
7. A lift of condensate to a hot well may require more pressure in heater than the heated medium. Arrange drainage of the heater by gravity or install a pump to lift condensate.

1. Main valve or pilot may be held open by foreign matter. To determine which valve leaks:
   a. Close stop valves and 1/4 in. / 6.35 mm control pipe valve if Type D Pilot is used.
   b. Remove bleedport bend so pilot will exhaust to atmosphere.
   c. Turn down temperature adjusting wheel and bypass some steam to the heater to overheat the thermostat and close the temperature pilot.

   For Type T14:

   - Crack open inlet stop valve. If steam issues from 8B tee on pilot, there is an obstruction under it's seat or the thermostat is defective.

   For Types T14 and D Pilot Combination:

   - Compress adjusting spring on Type D pilot. If steam issues from 8B tee, temperature pilot has an obstruction under it's seat or the thermostat is defective.
   - If temperature pilot is tight, turn up adjusting wheel until steam flows. Release compression on Type D Pilot adjusting spring to see if pilot closes tight. Open and close several times to wash seat.
   - Steam blowing back from bleedport means main valve disk is held open by foreign matter.
   - Steam may wash the obstruction from the seat if the valve is made to open wide. This can be accomplished if the temperature pilot is set well above temperature of liquid in tank heater and if the control pipe of the Type D Pilot is installed beyond the outlet stop valve. Reassemble bleedport bend and place regulator in operation. Then, slowly open and close outlet stop valve.

   d. Leakage of either valve requires dismantling to correct.

Erratic Temperature Control

1. Thermostat installed too far from heater outlet.
2. Improper trapping or erratic discharge of trap.
3. Lift of condensate to hot well may require more pressure than that called for by the medium flowing through the heater.
4. Arrange to drain condensate by gravity or lift it with a pump.
5. Sticky check valve in return line.
6. Poor circulation through heater. Constant circulation should be employed.
7. Valve too large for the heater or heater too large for the load.
8. Valve installed too far from heater.

Parts Ordering

When ordering parts, it is essential that the pilot type, service and serial number be stated.

Select part by item number, but order by part number. Specify complete part number when ordering.

Parts List

Key	Description	Part Number
	Repair Parts Kit	
	Cast Iron/Bronze	WAL07-06606-00
	Steel	WAL08-09110-01
1	Thermostat Assembly	- - - - - - - - -
2	Diaphragm Nut, Steel	WAL05-02992-00
3	Diaphragm Bolt, Steel	WAL05-05634-00
4	Pressure Plate, Iron	WAL04-03602-01
5	Pressure Plate Balls, Alloy Steel	WAL05-00553-00
6	Temperature Spring Button, Steel	WAL04-01052-00
7	Temperature Adjusting Spring, Steel	WAL05-05122-00
8	Temperature Stem, Aluminum	WAL04-05654-00
9	Bearing, Steel	WAL05-00550-00
10	Handwheel, Iron	WAL04-02502-00
11	Bonnet Set Screw, Steel	WAL05-04874-00
12*	Bellows Stem Assembly	
	Bronze	WAL07-60302-00
	Steel	WAL07-60536-00
13*	Gasket	
	Non-Asbestos	WAL05-02378-00
	Flexitalic	WAL05-11718-00
14*	Disk, Stainless steel	WAL04-01776-00
15*	Seat Ring, Stainless steel	WAL04-04057-90
16*	Screen Steam, Monel	WAL04-04700-00
17	Blind Flange	
	Iron	WAL04-02151-00
	Bronze	WAL04-02153-00
	Steel	WAL04-11678-00
18	Blind Flange and Bonnet Bolt	
	Steel	WAL05-04803-00
	Steel	WAL05-11719-00
19	Cowl, Steel	WAL04-01525-00
20	Groove Pin, Stainless steel	WAL05-03243-00
21	Barrel, Aluminum	WAL04-01247-00
22	Barrel Nut, Steel	WAL04-02908-00
23	Stem Set Screw, Steel	WAL05-04872-00
24	Bonnet	
	Iron	WAL04-00976-00
	Bronze	WAL04-00978-00
	Steel	WAL04-10021-01
25	Body	
	Iron	WAL04-00741-00
	Bronze	WAL04-00761-00
	Steel (for Flexitalic)	WAL04-10912-01
26	1/4 NPT Pipe Plug	
	Steel	WAL04-03772-00
	Brass	WAL04-03771-00
27	1/8 NPT Pipe Plug	
	Steel	WAL04-03769-00
	Brass	WAL04-03770-00
28	Cowl Assembly, Steel/Aluminum	WAL07-00334-00

*These parts furnished in Repair Kit

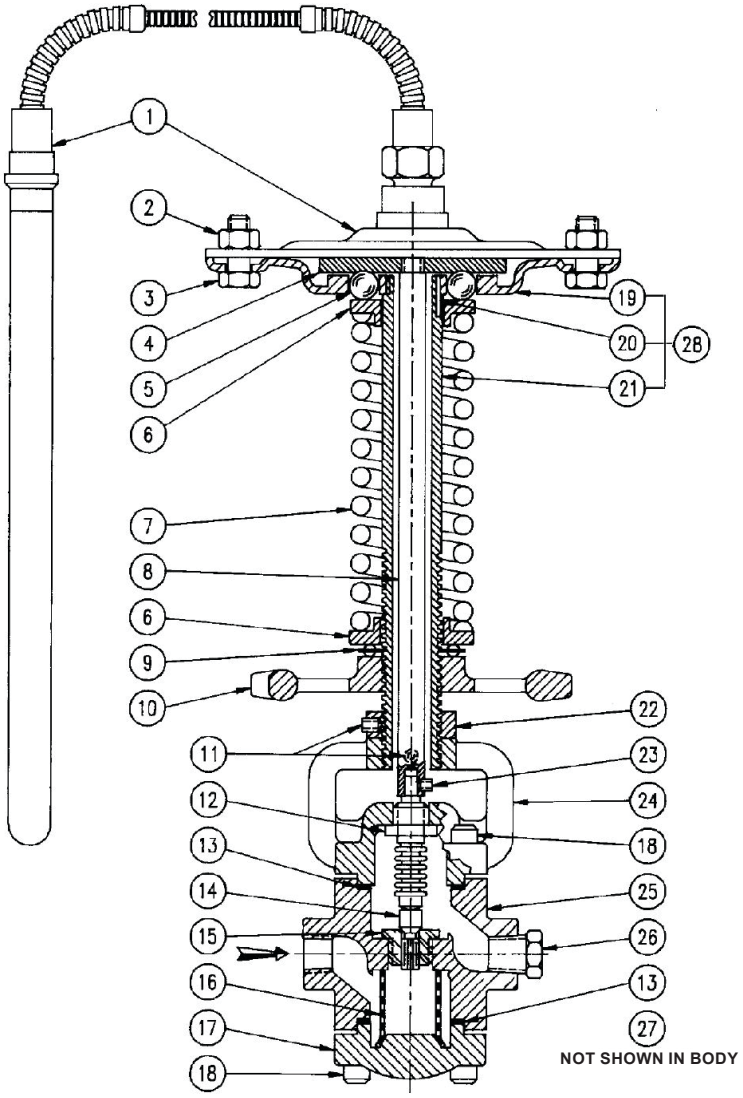

Figure 5. *Type T14 Assembly*

Type T14

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SD4511A

SPENCE™

Spence T61 Series Pneumatic Temperature Controller

⚠ WARNING

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

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

Installation, operation and maintenance procedures performed by unqualified personnel may result in improper adjustment and unsafe operation. Either condition may result in equipment damage or personal injury. Only a qualified person shall install or service the T61 Series Pneumatic Temperature Controllers.

Introduction

Scope of the Manual

This manual provides instructions for installation, maintenance and parts information for the T61 Series pneumatic temperature controllers.

Figure 1. *T61 Series Pneumatic Temperature Controller*

Product Description

The T61 Series Temperature Controller is ideal for wide ranging, fast changing loads on instantaneous heaters and other difficult process applications. The cascade principle, normally used only on instrument type regulators, is the basis for this design.

T61 Series, used with a properly selected A Series Pilot or Control Valve, continuously adjusts a pressure regulator to the required heater pressure. This action, coupled with the fast response of a bimetallic thermostat, gives exceptional results. Added convenience and economy results from the wide (200°F / 93°C) adjustable range and the low air consumption (0.35 cfm / 0.59 m^3/h). These controllers have adjustable proportional band as well as over temperature protection.

Type T61: For applications where air control signal decreases as process temperature increases.

Specifications

The Specifications section gives some general specifications for the T61 Series pneumatic temperature controller. The nameplates give detailed information for a specific controller as built in the factory.

Available Configurations[1]
Type T61: Reverse Acting

Maximum Air Supply
32 psi / 2.21 bar

Maximum Signal Pressure
2 psi / 0.14 bar below supply

Maximum Inlet Pressure[2]
250 psi / 17.2 bar

Maximum Inlet Temperature[2]
400°F / 204°C

Temperature Ranges[2]
Type T61: 50 to 250°F / 10 to 121°C

Mounting
1/2 NPT

Air Connections
1/8 NPT

Air Consumption
Normal: 0.35 SCFM / 0.59 m^3/hr
Maximum: 0.70 SCFM / 1.19 m^3/hr

Proportional Band Adjustable
1/4 to 2 psi per 1°F / 0.02 to 0.14 bar per 17.2°C

Construction Materials
Body: Bronze
Seal: Viton®
Spool: Brass
Seat: Stainless steel
Spring: Stainless steel

Approximate Weight
2-3/4 lbs / 0.68 kg

1. Reverse Acting is when air control signal decreases as process temperature increases. Direct Acting is when air control signal increases as process temperature increases.
2. The pressure/temperature limits in this Instruction Manual or any applicable standard limitation should not be exceeded.

Principle of Operation

When Used with Regulator

The regulator is operated by its initial steam pressure. It is normally closed, being held so by initial pressure on the disc and by an internal main spring. The pressure pilot is actuated by means of an air signal applied to its diaphragm. This signal is received from the temperature pilot as a result of the temperature bulb sensing a drop in temperature from the control setting.

When steam is turned on, it flows through the pressure pilot (Figure 3) to No. 8B tee. Bleedport No. 4A restricts the flow, builds pressure under the diaphragm and opens the main valve. Restriction No. 5A steadies the operation of the regulator.

Steam flowing to the heater develops a rising delivery pressure which feeds back through the control pipe to the pressure pilot diaphragm. As this pressure approached a balance with the air pressure signal supplied by the temperature pilot, the pressure pilot throttles. This, in turn, allows the main valve to assume a position to maintain the set temperature.

As the temperature at the outlet of the heater increases, it causes the T61 Series controller to reduce the loading pressure and this, in turn, will cause the pressure regulator to modulate the steam flow to the heater.

When Used with Pneumatic Control Valve

The T61 Series controller sends a proportional air signal from 0 psi / 0 bar to a maximum of 30 psi / 2.07 bar (not greater than 2 psi / 0.14 bar less than the supplied pressure) within a 10 degree span. The pilot will increase signal as the temperature falls, which will either open or close the control valve, depending upon actuator configuration.

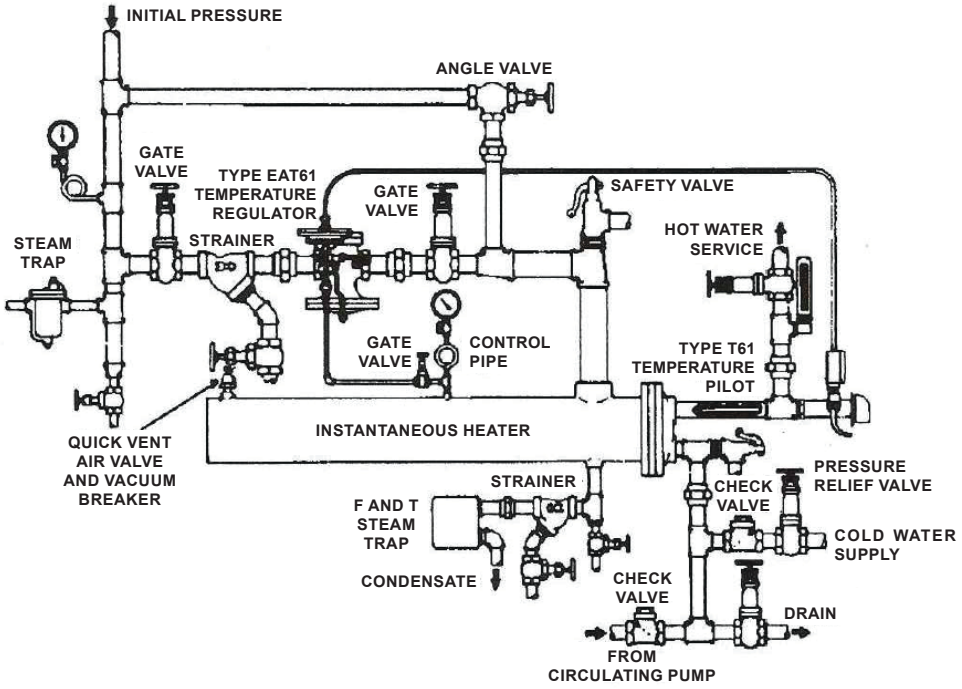

Figure 2. *T61 Series Typical Installation*

Installation

⚠ WARNING

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

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

All pressure equipment should be installed in a non-seismic area; should not be exposed to fire; and should be protected from thunderbolt (lightning) strikes.

⚠ CAUTION

The piping system must be adequately designed and supported to prevent extraordinary loads to the pressure equipment.

Ensure to blow out all lines before making final connections.

Planning

1. Locate the regulator in a horizontal pipe. Provide a trap ahead of the regulator to prevent water hammer and erratic operation.
2. Use a strainer to avoid damaging effects of scale and dirt in pipelines to protect the regulator.
3. Provide a three valve bypass to facilitate inspection of the regulator without interrupting service.

Main Valve

1. Flush the piping system thoroughly to clear it of welding beads, scale, sand, etc.
2. Mount the main valve with diaphragm chamber down and arrow on body pointing in the direction of flow.
3. Mount screwed end valves in unions.

Pilot

1. Mount the pilot with the bulb projecting entirely into the liquid or air being controlled.

   Note

   If the body is not in a horizontal position with air gauges on top, loosen the set screw (key 5) on bottom of body nearest the bulb and rotate the body to horizontal position.

2. Retighten the set screw.
3. Connect a reliable source of clean compressed air (not to exceed 32 psi / 2.21 bar) to the inlet of the pilot.
4. Set the supply air at 2 psi / 0.14 bar above the maximum desired air signal. If air is available at a higher pressure, install a pressure reducing valve.
5. Connect pilot outlet to 1/4 in. / 6.35 mm tap on top of pressure pilot.

Start-up and Setting

⚠ WARNING

The controller may be handling hazardous fluids. Only qualified personnel, who are familiar with the installation, should be permitted to install, readjust, inspect or maintain the controller.

⚠ CAUTION

Insulation, may be applied to the pilot body only. Do not insulate the bonnet.

1. Shut off supply air.
2. Set temperature adjusting knob at the lowest temperature setting.
3. Turn on supply air. The supply air should be set at 2 psi / 0.14 bar above the maximum desired air signal.

   Note

   If air is available at a higher pressure, install a pressure reducing valve. No more than 1 to 2 lbs / 0.45 to 0.91 kg should show on the control air gauge (supplied with the T61 Series controller).

4. Gradually turn up temperature adjusting knob until rising loading air pressure causes regulator to open. Continue raising temperature setting in this fashion until desired control temperature is reached.
5. The T61 Series controller is factory set so that 5 degrees variation above and below the controlled temperature will cause the loading air pressure to vary approximately 8 lbs / 3.63 kg. The factory setting produces satisfactory control.
6. If closer control is desired, the sensitivity of the T61 Series controller can be increased by turning the sensitivity screw (key 7) clockwise. This will cause the control temperatures to move to a position below the set point. This effect must then be corrected by readjusting the temperature adjusting knob (key 4).
7. Adjust slowly, turning the sensitivity screw no more than 1/8 turn and allow two to three minutes after each adjustment for the system to settle out. Practical range of adjustment of the sensitivity screw is 1/2 turn from the factory setting.
8. After final setting is reached, release the set screw in the temperature adjusting knob and reposition it so that the indicator is aligned with the temperature being controlled. Retighten set screw.
9. If the hunt develops (a steady swinging temperature) when the sensitivity is increased, the temperature pilot is being called on to function at a setting finer than the installation will permit. At this point, factors such as thermostat location, reexamine trapping and valve size.
10. If the regulator swings immediately on startup and does not settle out and decreasing the sensitivity by turning the sensitivity screw (key 7) counterclockwise cannot be tolerated, restudy the installation as a whole.

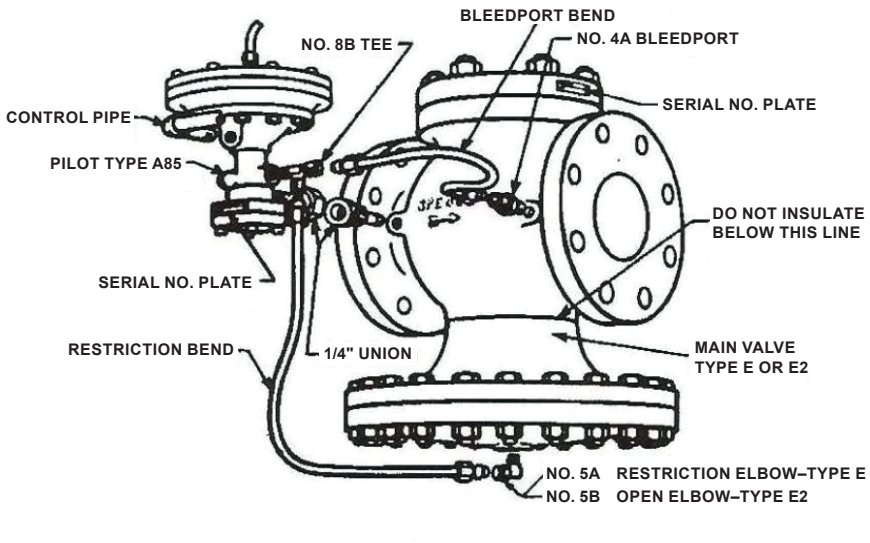

Figure 3. *T61 Series Tubing Bends Connection*

Maintenance

WARNING

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 controller from system pressure and relieving all internal pressure from the controller.

Controllers 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 controller.

Due to normal wear or damage that may occur from external sources, this controller 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.

CAUTION

Do not, under any circumstances, loosen the bolts on the diaphragm chamber of the T61 Series Temperature Controller or attempt to dismantle the thermostat element. The system is filled with volatile fluid which, if lost, will render the pilot inoperative.

Under normal conditions, complete dismantling at regular intervals is not recommended. A valve kept relatively free of dirt will function for years with minimum attention.

- Inspect for dirt collected at bleedport 4A and restriction elbow 5A.
- Inspect all joints for leakage. Keep bolts tight. Never allow a leak to persist.

Troubleshooting

WARNING

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

Controllers 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 controller.

Failure To Open

1. Check supply gauge to be sure it shows 2 psi / 0.14 bar higher than the required signal pressure.
2. Turn adjusting knob to top of temperature range. Pressure should go to within 2 or 3 lbs / 0.91 or 1.36 kg of supply pressure. If not, check for dirt in sensitivity screw and ball seating surface.

Failure to Close of Overriding Delivery Pressure

1. Adjusting knob may have been tampered with.
2. If air pressure will not bleed down when adjusting knob is turned to bottom of range, it is likely that vent is plugged. Sensitivity screw (key 7) improperly adjusted (open too wide).

Erratic Control

1. Fast over and under rides are the result of fast load changes, usually accentuated by the thermostat being located at a point where it cannot immediately sense a change in conditions.

Installation Faults

1. Poor circulation through heater. Constant circulation should be employed.
2. Traps on the return may be discharging erratically or may be improperly installed.
3. Sticky check valve.
4. High lift to condensate hot well. Gravity drainage from heater should be arranged or return pumped installed.

Dismantling

1. Remove sensitivity screw (key 7) and clean.
2. Unlock knob set screw. Loosen and move adjusting knob (key 4) out to clear stop on dial plate and lock to shaft.
3. Unscrew spool (key 3) from body by rotating adjusting knob counterclockwise.
4. Carefully examine O-rings (key 6) for nicks and other defects.
5. Examine spool (key 3) and ball (key 2) for defects.
6. Clean spool and ball with air pressure.
7. Reassemble.

Testing and Calibrating

Reverse Acting

For reverse acting pilots, control pressure decreases with increasing temperature.

1. Plug the pilot control air port and apply supply pressure 2 psi / 0.14 bar above the control range to the supply air port.
2. Open the sensitivity screw (key 7) one turn while establishing a steady system temperature.
3. Turn the spool (key 3) clockwise to the point where the invar rod, ball and seat are in contact. The control gauge should show pressure near the top of the control range.
4. Turn the spool counter-clockwise until the control pressure is at the middle of the range.
5. Continue to turn the spool counter-clockwise until the low end of the range is reached.
6. Adjust the sensitivity screw as required so this occurs within a 5° change on the dial. The control pressure should vary from the minimum to the maximum (15 or 30 psi / 1.03 or 2.07 bar) with a 10° change of the dial setting. When used with an A-pilot the minimum is 3 psi / 0.21 bar, when used with a control valve the minimum is the lower end of the bench range.

Parts Ordering

When ordering parts, it is essential that the pilot type, service and serial number be stated.

Select part by item number, but order by part number. Specify complete part number when ordering.

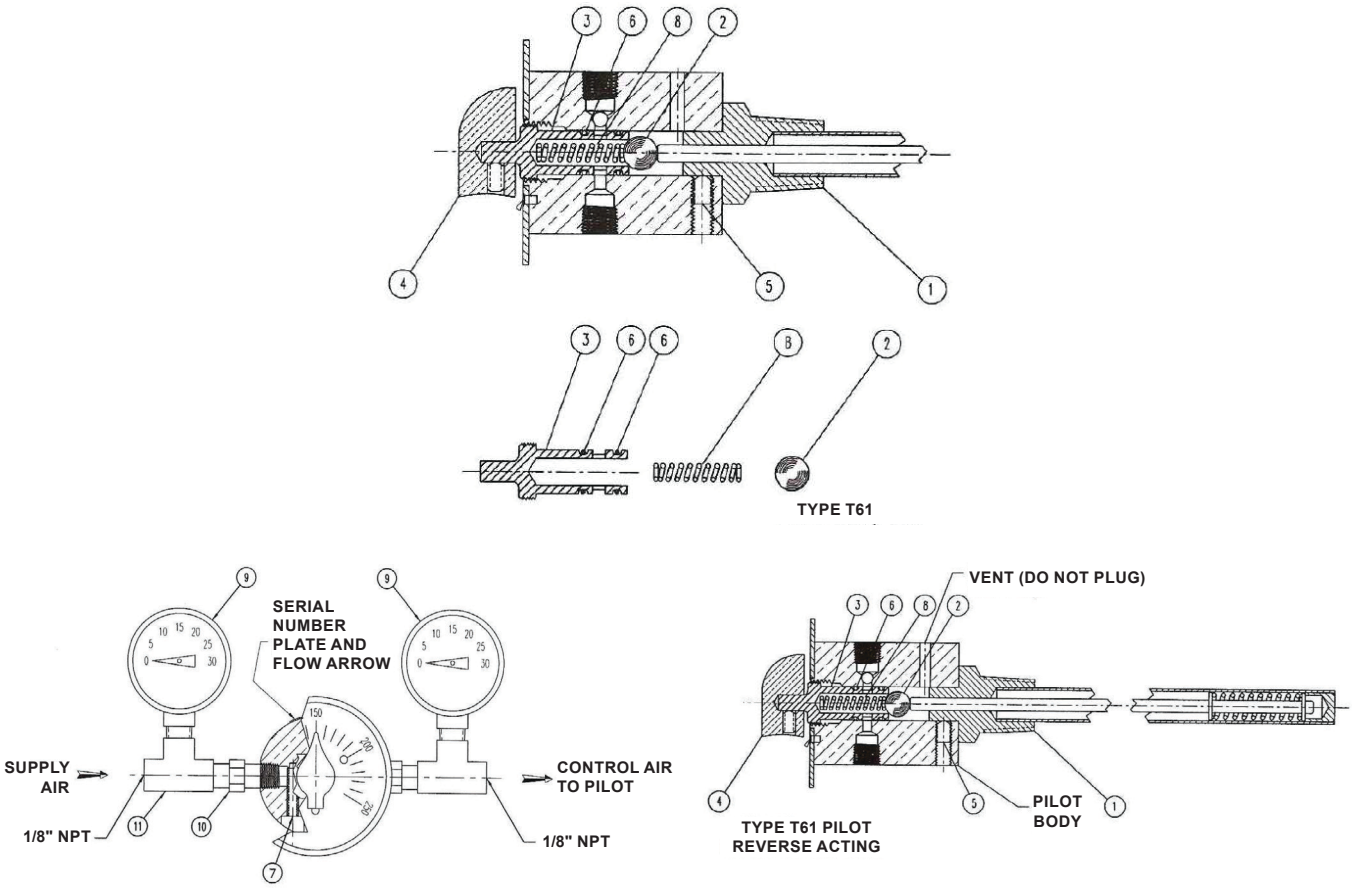

Figure 4. *T61 Series Assembly*

Parts List

Key	Description	Part Number
	Repair Parts Kit	
	Type T61, Reverse Acting	WAL08-11507-00
1	Bulb Assembly	
	Bronze	WAL07-40190-03
	Stainless steel	WAL07-40191-03
2*	Ball, Stainless steel	WAL05-07709-00
3*	Spool Reverse Acting Types T61, Brass	WAL04-07741-00
4	Adjusting Knob, Plastic	WAL05-07927-00
5	Body Set Screw, Steel	WAL05-11134-00
6*	Spool Sealing Rings, Viton®	WAL05-04004-00
7*	Sensitivity Screw, Steel	WAL05-07930-00
8*	Valve Spring, Stainless steel	WAL05-05175-00
9	Pressure Gauge	WAL05-17460-00
10	1/8 Nipple, Brass	WAL05-17459-00
11	1/8 Tee, Brass	WAL05-17458-00

*These parts furnished in Repair Kit

Viton® is a mark owned by E.I. du Pont de Nemours and Co.

SpenceValve.com

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SD4522D

SPENCE™

2000 Series Temperature Regulator

WARNING

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

The 2000 Series Temperature Regulator 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 valve 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 2000 Series Temperature Regulator.

WARNING

CALIFORNIA PROPOSITION 65

This product can expose you to chemicals including lead, nickel and cobalt, which is known to the State of California to cause cancer, birth defects or other reproductive harm. For more information, go to www.P65Warnings.ca.gov.

Figure 1. *2000 Series Temperature Regulator*

Introduction

Scope of the Manual

This instruction manual covers operation, installation, maintenance and troubleshooting for 2000 Series Temperature Regulator.

Product Description

The 2000 Series is a self-operated temperature regulator available with single or double seat in direct or reverse acting. It is also available with two seat areas for three-way mixing. This regulator provides economical temperature control of a storage heater and open topped tank heater.

Specifications

The Specifications section gives some general specifications for the 2000 Series Temperature Regulator. The nameplates give detailed information for a specific pilot as built in the factory.

Available Configurations

Type 2010: Single seat, direct-acting
Type 2020: Single seat, reverse-acting
Type 2030: Double seat, direct-acting
Type 2040: Double seat, reverse-acting
Type 2050: Three-way mixing

Body Sizes

See Table 1

End Connection Style

NPT Union

Maximum Inlet Temperature(1)

415°F / 213°C

Maximum Inlet Pressure(1)

250 psig / 17.2 bar

Pressure Ratings(1)

See Table 1

Bulb Ranges(1)

See Table 5

Bulb Materials

Copper Bronze
Stainless steel

Fills

Iso-Butane
Ethylene-Glycol
N-Butane
Reclaimed R-123
N-Propyl-Alcohol
Toluene

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

***Table 1**. 2000 Series Flow and Pressure Ratings*

SIZE, NPS / DN	ORIFICE	MAXIMUM UPSTREAM PRESSURE, PSIG / BAR		MAXIMUM DIFFERENCE BETWEEN INLET PRESSURE, PSIG / BAR
		Single Seat, Types 2010 and 2020	Double Seat, Types 2030 and 2040	Three-way, Type 2050
1/2 / 15	C	250 / 17.2	N/A	N/A
1/2 / 15	D			
1/2 / 15	E			
1/2 / 15	A			
1/2 / 15	B	200 / 13.8		
1/2 / 15	T	140 / 9.7	250 / 17.2	140 / 9.7
3/4 / 20	T	90 / 6.2		90 / 6.2
1 / 254	T	65 / 4.5		65 / 4.5
1-1/4 / 32	T	40 / 2.8		40 / 2.8
1-1/2 / 40	T	30 / 2.1		30 / 2.1
2 / 50	T	20 / 1.4		20 / 1.4

Principle of Operation

The 2000 Series Temperature Regulator controls the flow of the media passing through its valve by responding to temperature changes at the temperature bulb. The valve is made up of two assemblies: the valve body and the thermal system assemblies. The thermal system of the 2000 Series temperature regulator consists of a temperature probe (bulb), pressure chamber (bellows) and a length of tubing (capillary) which connects the two. A liquid is sealed inside the thermal system. For each temperature range, a specific liquid is used.

On temperature increase, the vapor pressure of the liquid in the bulb increases, forcing liquid into the capillary and bellows and increases the pressure exerted on the bellows. On temperature decrease, the vapor pressure of the liquid in the bulb decreases withdrawing liquid from the bellows which reduces the pressure exerted on the bellows.

A balance is established between the force exerted by the bellows and the counteracting range spring force. On bellows pressure increase, the bellows volume expands, the compression of the range spring increases and the stem moves downward.

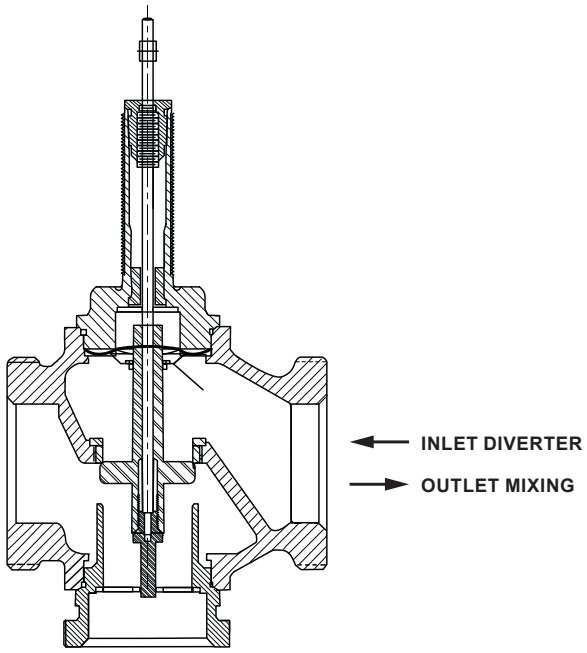

Figure 2. *2000 Series Temperature Regulator Operation*

On bellows pressure decrease, the bellows volume compresses, the range spring expands and the stem moves upward.

For a direct acting valve, an increase in bulb temperature closes the valve (heating). For a reverse acting valve, an increase in bulb temperature opens the valve (cooling).

Type 2050 Three-way Valve (Figure 3)

The Type 2050 three-way valve meets most mixing or diverting application requirements. When used for mixing, the forces developed by the two inlet flows oppose each other and create a balanced environment. On temperature increase, the bellow shall force the disk (plug) to close the bottom inlet of the valve (hot fluid), at the same time the other side inlet of the valve (cold fluid) shall be opened until the temperature is balanced again.

When used for diverting, the forces developed by the two outlet flows oppose each other and create a balanced environment. On temperature increase, the bellow shall force the disk to close the bottom outlet of the valve and open the side outlet of the valve until temperature is balanced again.

For diverting service, simply rotate the valve installation. The diverter inlet is the outlet mixing.

Installation

⚠ WARNING

Failure of the thermal system or foreign material lodged between the valve's closure members can lead to an over-temperature and/or an over-pressure condition which may cause injury and/or property damage.

Never install a 2000 Series Temperature Regulator in a system, which does not have a properly installed, code approved temperature and pressure safety valve or other approved safety device. These devices must be suitable for the equipment and processes involved and in conformance to applicable codes.

⚠ CAUTION

The piping system must be adequately designed and supported to prevent extraordinary loads to the pressure equipment.

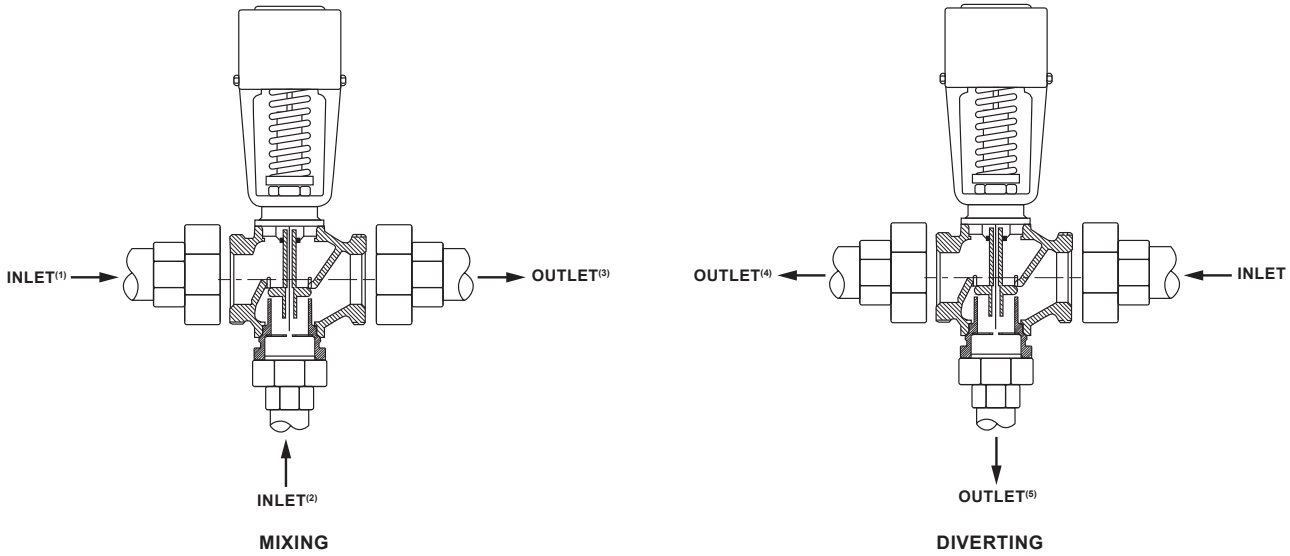

Figure 3. *Type 2050 Three-way Valve*

Valve Body (Figure 4)

1. Place the 2000 Series Temperature Regulator in the direction of the arrow cast on the valve body so that the heating or cooling media will flow through it.
2. Place strainer and steam trap ahead of the valve to protect the valve from the damaging effects of dirt, scale, foreign material and condensate.
3. Place a manual shut off valve before and after the valve.
4. Place a bypass line with a manual shut off valve around the valve for manual operation if the valve is out of service. Additional recommended installation diagrams can be found in the Spence Designer's Guide.
5. To avoid stresses on the valve or unions, cut the connecting pipes to the exact length required and should be in correct alignment.
6. To connect the valve, remove the union ends from the valve body and attach them to the nipples on each side of the valve.
7. When tightening the unions to the valve always use two wrenches. "Never use the valve frame for leverage." The valve should be installed in the vertical position with the thermal assembly on top.

Bulb

The location of the bulb should be chosen carefully so that the temperature of the media around the bulb or well will be representative of the entire body of fluid being heated or cooled.

Note

When large volumes of oil are being heated it may be necessary to place the bulb near the heating coils to avoid dangerous hot spots which would result if the bulb was remote for the heating coils.

Plain bulbs (standard for 2000 Series), without a union bushing, are used in open tanks, ovens, drying, rooms, kilns, etc. Install the bulb vertically, pointing downward and held securely by suitable straps and clamps. If the application requires that the bulb be held in a horizontal position, the free end of the bulb must not be higher than the fixed end.

1. Cold fluid inlet opens with increase in temperature rise.
2. Hot fluid inlet closes with increase in temperature rise.
3. Mixed fluid
4. Opens with increase in temperature rise.
5. Closes with increase in temperature rise.

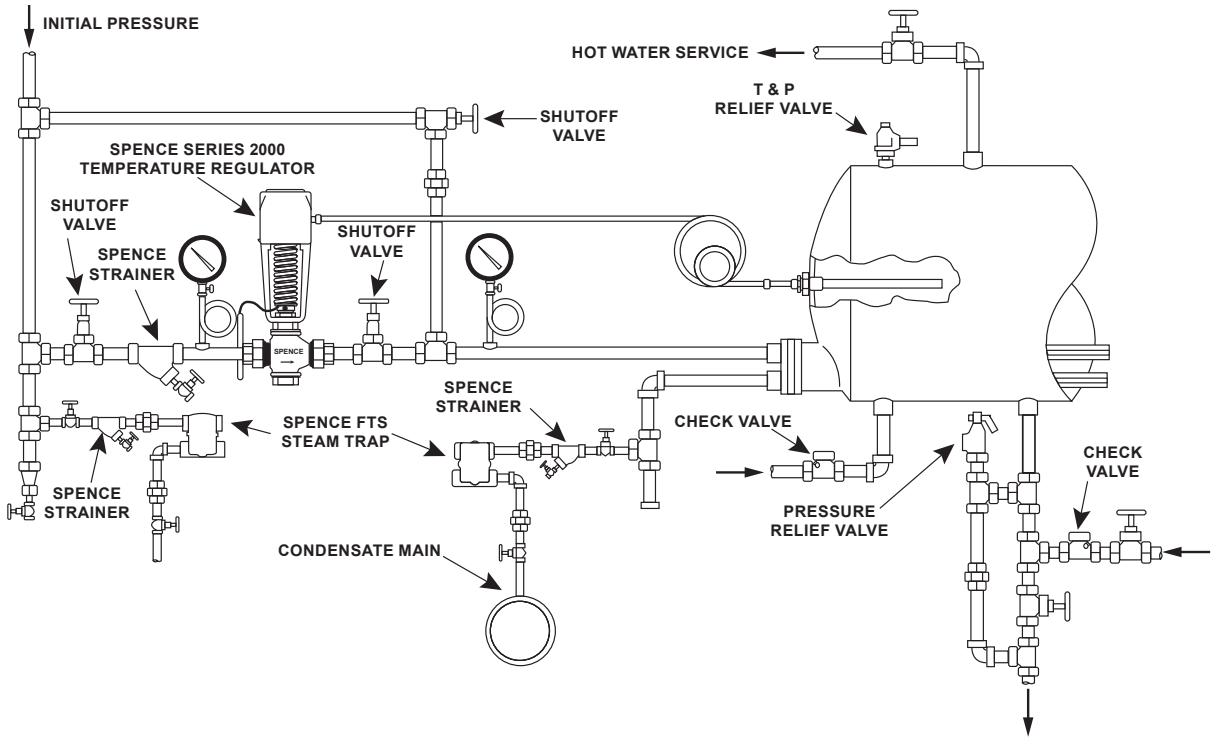

Figure 4. *2000 Series Temperature Regulator Installation*

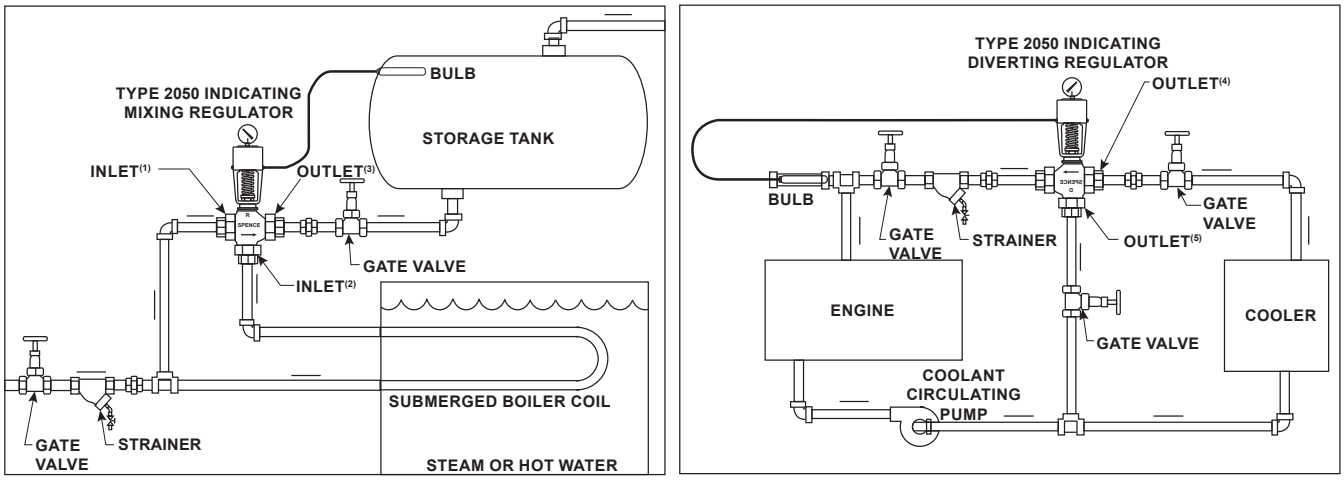

Figure 5. *2050 Series Temperature Regulator Installation*

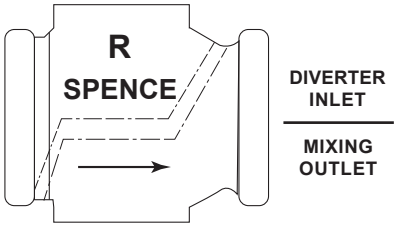

Figure 6. *Body Marking Identification*

1. Cold fluid inlet opens with increase in temperature rise.
2. Hot fluid inlet closes with increase in temperature rise.
3. Mixed fluid
4. Opens with increase in temperature rise.
5. Closes with increase in temperature rise.

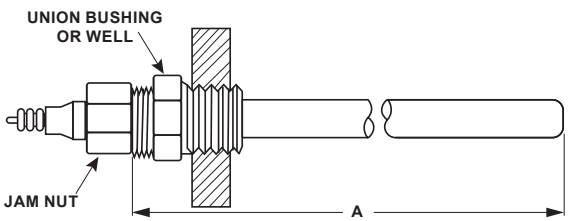

Figure 7. *Bulb*

Union Bushings (Figure 7)

When a union bushing is required for the bulb, the union bushing is ordered and shipped separate from the valve. The union bushing consists of three parts: the bushing, sleeve and jam nut.

1. Attach the bushing tightly to the equipment.
2. Slide the jam nut and sleeve on the bulb and locate them at a distance. This distance should be maintained during installation and use. This distance will allow for the entire effective length of the bulb to be totally immersed in the media.
3. Insert the bulb into the bushing making sure that the insertion depth is correct and tighten the jam nut to secure the bushing to the bulb.

Wells (Figure 7)

When a well is required for the bulb, the well is ordered and shipped separate from the valve. The well consists of three parts: the cylinder, sleeve and jam nut (a separate union bushing is not required).

1. Attach the cylinder tightly to the equipment.
2. Slide the jam nut and sleeve on the bulb and locate them at a certain distance. The bulb should be coated with a heat conducting media such as a mixture of graphite and glycerin or high temperature grease. This improves the speed of response of the regulator.
3. Insert the bulb into the well making sure that the insertion depth is correct.
4. After the bulb is inserted, tighten the jam nut to secure the bulb to the well.

Table 2*. Location of Jam Nut on Bulb*

BULB	DIAMETER, In. / mm	A, In. / mm
Small	5/6 / 21.2	11-7/8 / 302
Large	1 / 25.4	13-7/8 / 352
Extra long	1 / 25.4	17-3/8 / 441

Replacement Thermal Systems

The vapor pressure in some systems is too high at ordinary ambient temperatures to permit removal of the shipping block without damage to the bellows. To reduce the vapor pressure within safe limits, the complete system (bulb, line and bellows) must be cooled. See Table 3.

1. Allow the system to cool for a period of at least 15 minutes before removing the shipping block.
2. Assemble the bellows to the regulator frame as quickly as possible after removal from the cooler so that it will have no chance to warm up. The bulb should remain in the cold bath while the bellows is being assembled.
3. After the bellows is assembled to the frame, the bulb and bellows may warm up without damaging the bellows.

Startup

1. After the installation, be certain that all shutoff valves are closed and the valve is pre-adjusted according to Table 4.
2. Crack open the inlet shutoff valve.
3. Blow down the strainer upstream of the valve. Let blow for several minutes, particularly on new installations.
4. Gradually open the downstream shutoff valve.
5. Gradually open the inlet shutoff valve carefully watching the temperature and adjust the valve to achieve the desired set point.

***Table 3**. Replacement Thermal Systems*

FOR SYSTEMS WITH RANGES STARTING AT		COOL SYSTEM TO	SUGGESTED COOLING MEANS
90 to 110°F	32 to 43°C	50°F / 10°C or lower	Tap water mixed with ice as needed
65 to 85°F	18 to 29°C	32°F / 0°C or lower	Crushed ice mixed with water
45 to 60°F	7 to 16°C	10°F / -12°C or lower	Crushed ice mixed with plenty of salt
-15 to 40°F	-26 to 4°C	-35°F / -37°C or lower	Alcohol and “dry ice”

***Table 4**. Approximate Temperature Equivalents for Various Scale Settings*

REGULATOR SETTING	RANGE, °F					
	45 to 115	45 to 145	65 to 140	65 to 170	240 to 310	240 to 340
0						
1	45	50	65	70	236	240
2	58	70	80	91	250	267
3	72	87	92	108	265	281
4	81	102	103	125	275	296
5	92	114	114	137	285	308
6	101	124	124	147	295	318
7	108	135	131	158	303	329
8	115	143	138	167	310	337
9	122	152	145	177	317	347
10	129	158	157	183	322	353
REGULATOR SETTING	**RANGE, °C**					
	7.2 to 46	**7.2 to 63**	**18 to 60**	**18 to 77**	**116 to 154**	**116 to 171**
0						
1	7	10	18	21	113	116
2	14	21	27	33	121	131
3	22	31	33	42	129	138
4	27	39	39	52	135	147
5	33	46	46	58	141	153
6	38	51	51	64	146	159
7	42	57	55	70	151	165
8	46	62	59	75	154	169
9	50	67	63	81	158	175
10	54	70	69	84	161	178

▭ - Control points at these settings are slightly below the low end of the regulator range.

***Table 5**. 2000 Series Bulb Ranges*

BULB RANGES				MAXIMUM OVER TEMPERATURE	
Short		Long			
°F	°C	°F	°C	°F	°C
45 to 115	10 to 45	45 to 145	10 to 60	450	230
65 to 140	20 to 60	65 to 170	20 to 75	450	230
120 to 200	50 to 90	120 to 230	50/ to 110	300	150
240 to 310	115 to 155	240 to 340	115 to 170	350	175
280 to 375	138 to 191	280 to 415	138 to 213	450	230

Table 6. *Troubleshooting*

PROBLEM	VALVE TYPE	POSSIBLE CAUSES
Valve does not close	Single Seat, Direct Acting	• Leakage through valve— note allowable leakage rate • Sediment trapped under seat— strainer required • Upstream pressure too high— check catalog for recommended maximum pressure • Location of bulb in process— change location of bulb (bulb located in “cold spot”) poor process agitation • Dead system— leak in temperature system • Reverse acting used where direct acting is required
	Double Seat, Direct Acting	See above (except c)
Valve does not open	Single Seat, Direct Acting	• Incorrect range setting— adjust range spring screw • Direct acting used where reverse acting is required • Location of bulb in process— change location of bulb • Range °C instead of °F
Erratic Action (Snap action or wide temperature control band)	Single Seat	• Valve installed with flow reversed
Poor Temperature Control	All	• Location of bulb in process— change location of bulb • Oversized valve— 1. Proper size valve will enhance temperature control 2. Oversize valve give high temperature overshoot • Valve installed with flow reversed (single seat only) • Bellows and line hotter than bulb (requires dual fill - ranges A - D)

Adjustment

Unless otherwise specified, the regulator is shipped from the factory with the adjustment nut at its lowest position and must therefore be raised to the desired control setting. When the temperature for which the regulator has been set is reached, it will be maintained automatically. After the installation is completed, preset the regulator according to Table 3.

The operating range of the regulator is indicated on the nameplate. The setting scale is stamped on the side of the frame and is graduated 0 to 10 representing the limits of the operating range. This is an arbitrary scale, since it must necessarily vary for different temperature ranges. Table 4 gives the approximate temperature equivalent for all scale settings in each temperature range. The values are not absolute and will vary from one regulator to another because of manufacturing tolerances.

1. On initial starting, the controlled temperatures may overshoot slightly, then drop back. Allow sufficient time for the process to stabilize.
2. Check the controlled temperature and make fine adjustments. The arm extending out from the adjusting nut indicates the temperature setting.
3. To change the temperature setting, turn the adjusting nut up if a higher temperature is desired and down if a lower temperature is desired. The adjusting pin needed for this purpose is chained to the end of the indicating arm.

On regulators equipped with a temperature indicator, change the orientation of the indicator by loosening the bracket retaining screws and rotate the indicator a maximum of 180°F in either direction.

Note

All Series 2000 Regulators are provided with a safety spring which will prevent the bellows from expanding (even though the valve has reached the end of its travel) and draining the bulb of its fill. This prevents a buildup in vapor pressure which would damage the bellows.

There is, however, a limiting temperature applicable to each thermostat fill used. It is the temperature above which the chemistry of the fill will decompose. This limiting temperature is, therefore, the maximum allowable temperature on 2000 Series Regulators supplied with bulbs as indicated in Table 5.

Maintenance

The adjusting nut of each regulator is permanently lubricated before leaving the factory, and the valve stem is equipped with a spring loaded Teflon packing gland assembly so that no maintenance should be required for the life of the regulator.

The valve stem is set and locked at the factory in a permanent position to give the valve its proper travel. No adjustment should be made on the valve stem after the regulator leaves the factory.

The Spence Strainer protects the valve disc and seat of the regulator from the destructive effects of scale, etc. The strainer should be blown out at regular intervals by removing the plug. For quick blowouts, a hand valve may be installed on the strainer in place of the plug.

Parts Ordering

Each regulator is assigned a serial number, which can be found on the nameplate. Refer to the number when contacting your local Sales Office for technical information or when ordering parts.

When ordering replacement parts, reference the key number of each needed part as found in the following parts list. Separate kit containing all recommended spare parts is available.

Parts List

2000 Series (Figure 8)

Key	Description
1	Complete Valve
2	Union Ends
3	Body Assembly
4	Stem Guide
5	Washer, Wave Spring
6	Bonnet
7	“V” Packing Assembly
8	Nuts
9	Frame
10	Mounting Screws
11	Lock Washer
12	Frame Locking Nut
13	Adjusting Nut
14	Indicator Assembly
15	Adjusting Spring
16	Safety Spring Assembly
17	Guide
18	E-Ring
19	Thermal System Assembly

Table 7. *2000 Series Replacement Kit Part Numbers*

REPLACEMENT KIT	MATERIAL	PART NUMBER
"V" Packing Kit	Bronze or Polytetrafluoroethylene (PTFE)	WAL2819
Safety Spring Kit	Bronze or Steel	WAL2815
Frame Kit	Steel	WAL2814
Indicator Kit	Steel or Stainless steel	WAL2811
Adjusting Spring - Gold (Short Range)	Steel	WAL2812
Adjusting Spring - Silver (Long Range)	Steel	WAL2813
Thermal System Indicating - 2.4 m / 8 ft.	Bronze	GQ[1]
Thermal System Indicating - 2.4 m / 8 ft.	Stainless steel	GT[1]
Thermal System Indicating - 4.6 m / 15 ft.	Bronze	GR[1]
Thermal System Indicating - 4.6 m / 15 ft.	Stainless steel	GV[1]
Thermal System Non-Indicating - 2.4 m / 8 ft.	Bronze	NQ[1]
Thermal System Non-Indicating - 2.4 m / 8 ft.	Stainless steel	NT[1]
Thermal System Non-Indicating - 4.6 m / 15 ft.	Bronze	NR[1]
Thermal System Non-Indicating - 4.6 m / 15 ft.	Stainless steel	NV[1]
1. Refer to Type Number Code on 2000 Series Bulletin to add appropriate letter for temperature range.		

Table 8. *2000 Series Replacement Kit Part Numbers*

REPLACEMENT KIT	MATERIAL	VALVE SIZE										
		1/2 A	1/2 B	1/2 C	1/2 D	1/2 E	1/2 T	3/4 T	1 T	1-1/4 T	1-1/2 T	2 T
Union End Kit - Single Seat	Cast iron	WAL2822	WAL2822	WAL2822	WAL2822	WAL2822	WAL2822	WAL2823	WAL2826	WAL2827	WAL2828	WAL2829
Union End Kit - Double Seat	Cast iron	- - - -	- - - -	- - - -	- - - -	- - - -	WAL2824	WAL2825	WAL2826	WAL2827	WAL2828	WAL2829
Union End Kit - 3-Way	Cast iron	- - - -	- - - -	- - - -	- - - -	- - - -	WAL2830	WAL2831	WAL2832	WAL2833	WAL2834	WAL2835
Body Assembly Kit - 2010	Bronze	2010AC	2010BC	2010CC	2010DC	2010EC	2010TC	2010TD	2010TE	2010TF	2010TG	2010TH
Body Assembly Kit - 2020	Bronze	2020AC	2020BC	2020CC	2020DC	2020EC	2020TC	2020TD	2020TE	2020TF	2020TG	2020TH
Body Assembly Kit - 2030	Bronze	- - - -	- - - -	- - - -	- - - -	- - - -	2030TC	2030TD	2030TE	2030TF	2030TG	2030TH
Body Assembly Kit - 2040	Bronze	- - - -	- - - -	- - - -	- - - -	- - - -	2040TC	2040TD	2040TE	2040TE	2040TG	2040TH
Body Assembly Kit - 2050	Bronze	- - - -	- - - -	- - - -	- - - -	- - - -	2050TC	2050TD	2050TE	2050TF	2050TG	2050TH
Stem Guide Kit	Steel / Monel®	WAL2820	WAL2820	WAL2820	WAL2820	WAL2820	WAL2820	WAL2820	WAL2820	WAL2821	WAL2821	WAL2821
Bonnet Assembly Kit - Single Seat	Bronze	WAL2818	WAL2818	WAL2818	WAL2818	WAL2818	WAL2818	WAL2818	WAL2816	WAL2817	WAL2817	WAL2817
Bonnet Assembly Kit - Double Seat	Bronze	- - - -	- - - -	- - - -	- - - -	- - - -	WAL2816	WAL2816	WAL2816	WAL2817	WAL2817	WAL2817
Bonnet Assembly Kit - 3-Way	Bronze	- - - -	- - - -	- - - -	- - - -	- - - -	WAL2816	WAL2816	WAL2816	WAL2817	WAL2817	WAL2817

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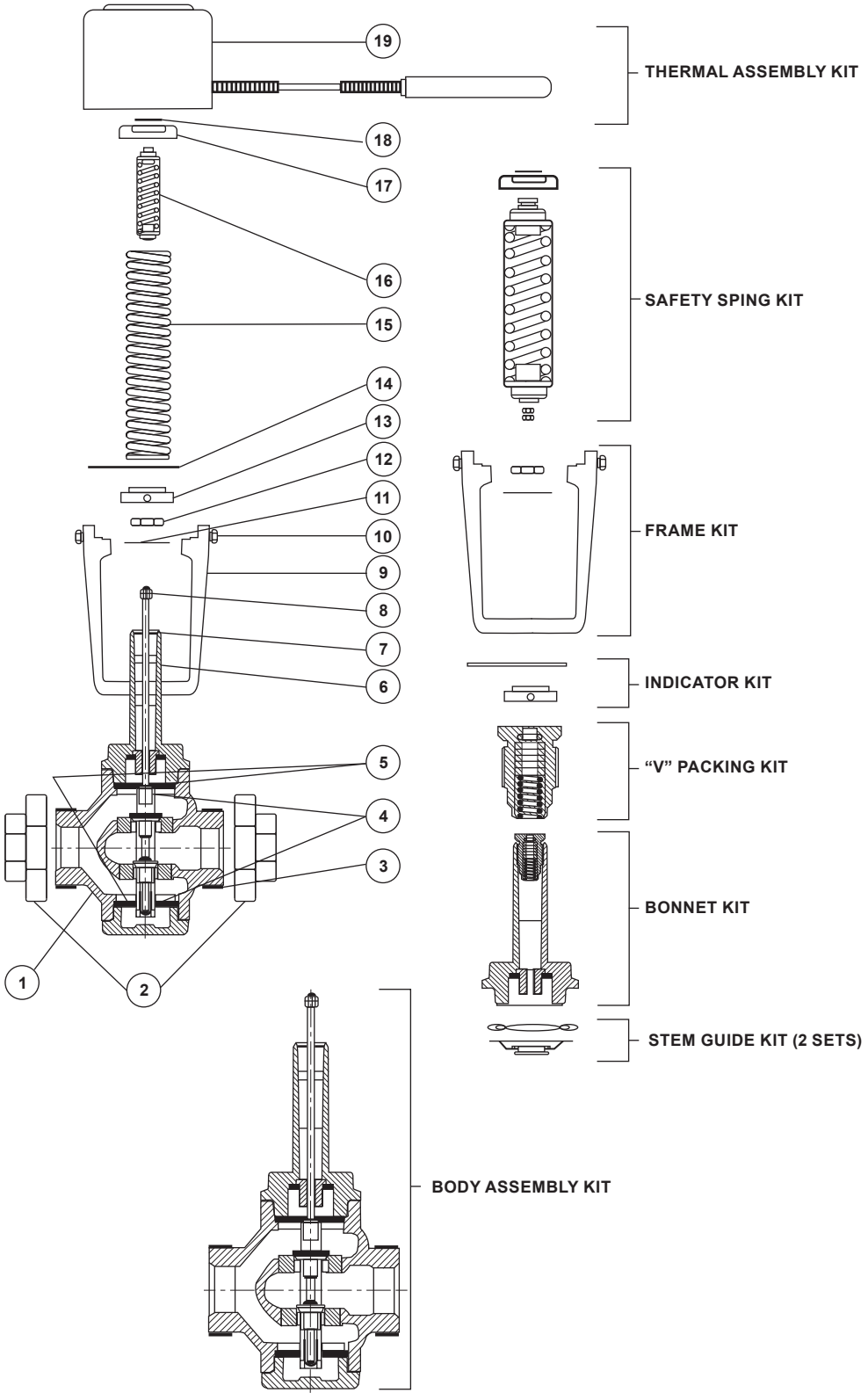

Figure 8. *2000 Series Temperature Regulator Assembly*

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SD1520C

SPENCE™

Spence Type D50A Pressure Regulator

⚠ WARNING

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

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

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

Installation, operation and maintenance procedures performed by unqualified personnel may result in improper adjustment and unsafe operation. Either condition may result in equipment damage or personal injury. Only a qualified person shall install or service the Type D50A pressure regulator.

⚠ WARNING

CALIFORNIA PROPOSITION 65

This product can expose you to chemicals including lead, nickel and cobalt, which is known to the State of California to cause cancer, birth defects or other reproductive harm. For more information, go to www.P65Warnings.ca.gov.

Figure 1. *Type D50A Pressure Regulator*

Introduction

Scope of the Manual

This manual provides instructions for the installation, maintenance and parts ordering for Type D50A pressure regulator.

Product Description

The Type D50A pressure reducing regulator automatically reduces a high inlet pressure to a lower delivery pressure and maintains the lower pressure within reasonably close limits regardless of the pressure fluctuations on the inlet side of the regulator.

Specifications

The specifications section on this page provide the ratings and other specifications for the Type D50A.

Body Sizes and End Connection
1/4, 3/8, 1/2, 3/4, 1, 1 1/4, 1 1/2 and 2 NPTF

Maximum Inlet Pressure(1)
Air or water: 200 psi / 13.8 bar
Steam: 150 psi / 10.3 bar

Maximum Outlet Pressure(1)
Air or water: 150 psi / 10.3 bar
Steam: 125 psi / 8.62 bar

Maximum Operating Temperature(1)
Air or water: 180°F / 82°C
Steam: 400°F / 204°C

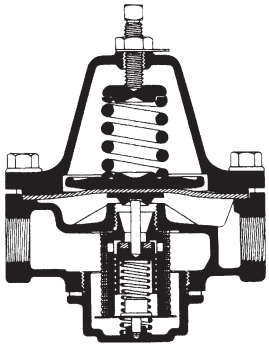
Outlet Pressure Range(1)
See Table 1

Materials of Construction
Body: Iron
Spring: Steel
Bottom Plug: Brass
Seat Disk
Air or Water: Nitrile (NBR)
Steam: Polytetrafluoroethylene (PTFE)
Diaphragm
Air or Water: Nitrile (NBR)
Steam: Bronze

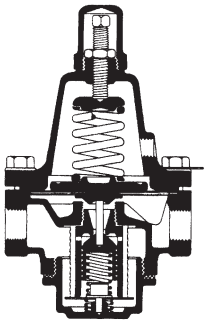
1. The pressure/temperature limits in this Instruction Manual and any applicable standard or code limitation should not be exceeded.

Table 1. *Outlet Pressure Range*

BODY SIZE, NPT	SPRING RANGE			
	Air or Water		Steam	
	psi	bar	psi	bar
1/4	2 to 25	0.14 to 1.72	2 to 25	0.14 to 1.72
	20 to 60	1.38 to 4.14	20 to 60	1.38 to 4.14
	30 to 100	2.07 to 6.90	30 to 100	2.07 to 6.90
	50 to 150	3.45 to 10.3	50 to 125	3.45 to 8.62
3/8	2 to 30	0.14 to 2.07	2 to 30	0.14 to 2.07
	20 to 70	1.38 to 4.83	20 to 70	1.38 to 4.83
	40 to 110	2.76 to 7.58	40 to 110	2.76 to 7.58
	90 to 150	6.21 to 10.3	90 to 125	6.21 to 8.62
1/2	2 to 30	0.14 to 2.07	2 to 30	0.14 to 2.07
	10 to 50	0.69 to 3.45	10 to 50	0.69 to 3.45
	30 to 125	2.07 to 8.62	30 to 125	2.07 to 8.62
	50 to 150	3.45 to 10.3	50 to 125	3.45 to 8.62
3/4	2 to 20	0.14 to 1.38	2 to 20	0.14 to 1.38
	10 to 35	0.69 to 2.41	10 to 35	0.69 to 2.41
	30 to 75	2.07 to 5.17	30 to 75	2.07 to 5.17
	50 to 110	3.45 to 7.58	50 to 110	3.45 to 7.58
	105 to 150	7.24 to 10.3	105 to 125	7.24 to 8.62
1	2 to 20	0.14 to 1.38	2 to 20	0.14 to 1.38
	10 to 45	0.69 to 3.10	10 to 45	0.69 to 3.10
	20 to 60	1.38 to 4.14	20 to 60	1.38 to 4.14
	55 to 100	3.79 to 6.90	55 to 100	3.79 to 6.90
	90 to 150	6.21 to 10.3	90 to 125	6.21 to 8.62
1-1/4 and 1-1/2	2 to 15	0.14 to 1.03	2 to 15	0.14 to 1.03
	10 to 30	0.69 to 2.07	10 to 30	0.69 to 2.07
	20 to 50	1.38 to 3.45	20 to 50	1.38 to 3.45
	45 to 100	3.10 to 6.90	45 to 100	3.10 to 6.90
	90 to 150	6.21 to 10.3	90 to 125	6.21 to 8.62
2	2 to 20	0.14 to 1.38	2 to 20	0.14 to 1.38
	10 to 60	1.69 to 4.14	10 to 60	1.69 to 4.14
	20 to 100	1.38 to 6.90	20 to 100	1.38 to 6.90
	90 to 150	6.21 to 10.3	90 to 125	6.21 to 8.62

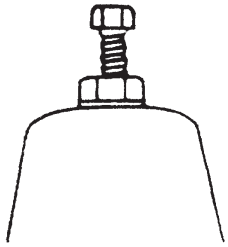


AIR OR WATER SERVICE

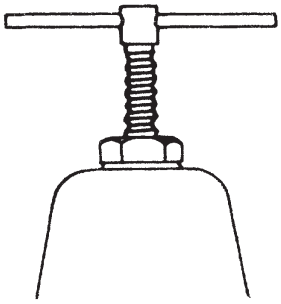


STEAM SERVICE

Figure 2. *Type D50A Schematic*



STANDARD
ADJUSTING SCREW



T-HANDLE

Figure 3. *Type D50A Adjusting Screw Options*

Air and Water Service

Type D50A regulators are available in 1/4 to 2 NPT sizes with iron bodies and feature a variety of optional internal trim (diaphragm, piston and cylinder) that enable them to be used in a wide range of applications.

Each regulator is equipped with a pressure spring selected to provide the desired outlet or reduced delivery pressure setting. Depending on the adjusting spring installed, delivery pressures may be adjusted from a minimum of 2 psi / 0.14 bar to a maximum of 150 psi / 10.3 bar. The range of adjustment or satisfactory working range of the individual springs that may be fitted to each regulator size is listed in the spring range table. See Table 2.

The regulator is designed for systems with a maximum operating temperature of 180°F / 82°C. In addition to the standard specifications indicated in Table 1, any combination of body material, piston cylinder and diaphragm is available to special order.

The Type D50A air and water regulators are suitable for a variety of applications including paint spray equipment, dishwashers, air tanks and equipment, food, chemical and industrial process gases and many other applications.

Steam Service

These regulators are designed for steam operating temperatures up to 400°F / 204°C and are available in 1/4 to 2 NPT sizes with iron bodies. Iron body regulators have a PTFE seat and are for systems with initial pressures up to 150 psi / 10.3 bar.

Regulators will normally be equipped as indicated in the table but other combinations of body material, piston-cylinder and diaphragm are available to special order.

The Type D50A Steam Pressure Reducing and Regulating Regulator is ideally suited for installation in pressing irons, steam cookers, degreasers, sterilizers, vulcanizers and hundreds of other applications. Type D50A Steam Regulators can also be furnished with a differential pressure control feature which may be desirable in steam/oil atomizing service.

Table 2. *Type D50A Torque Values*

VALVE SIZE, NPT	TORQUE	
	BOTTOM PLUG	ASSEMBLY BOLT
1/4	80 to 90 ft-lbs / 108 to 122 N•m	70 to 100 in-lbs / 7.9 to 11.3 N•m
3/8		
1/2		150 to 200 in-lbs / 16.9 to 22.6 N•m
3/4		
1		225 to 275 in-lbs / 25.4 to 31.1 N•m
1-1/4		325 to 375 in-lbs / 36.7 to 42.4 N•m
1-1/2		
2	27 to 31 ft-lbs / 36.6 to 42.0 N•m	

Optional Differential Pressure Control

The Type D50A Steam Regulator can be factory modified to serve as a constant differential pressure control regulator by incorporating a 1/4 NPT side tap in the spring housing.

In a typical steam-oil atomizing installation, fluid loading pressure is introduced above the diaphragm of the regulator and steam is delivered through the regulator at a regulated pressure higher than the loading pressure, with the difference in pressure being determined by the diaphragm spring setting. The outlet steam pressure is maintained automatically to provide a constant, fixed pressure differential between the steam pressure and the oil pressure. Variations in the loading pressure are reflected in a pound-for-pound change in the discharge pressure.

Regulators equipped with the optional differential pressure control are fitted with a pressure-tight closing cap and gasket over the pressure adjusting screw and a gasket above the diaphragm to ensure a good seal between the spring housing and the regulator body.

Principle of Operation

When the fluid supply is cut in, the regulator is in wide open position. Fluid flowing to the system creates a rising delivery pressure which feeds back through the control ports to the underside of diaphragm. As the pressure on diaphragm approaches a balance with the force exerted by adjusting spring, disk is throttled to a position where just enough water flows to maintain the set delivery pressure.

Installation

⚠ WARNING

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

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

All pressure equipment should be installed in a non-seismic area; should not be exposed to fire; and should be protected from thunderbolt (lightning) strikes.

1. Install a strainer upstream of the Type D50A. The built-in strainer screen is secondary protection only.
2. Install Type D50A regulator in a horizontal position with the spring chamber upright. For other installation requirements, consult the factory.
3. Before installing the regulator, thoroughly flush out the piping and the regulator to remove any foreign material.
4. Install the regulator with the inlet pipe fitted to the inlet connection identified on the regulator body. Use a good pipe joint compound on the male pipe threads and do not over tighten the regulator connections.

Adjusting the Delivery Pressure

1. Loosen the adjusting screw lock nut (key 3).
2. Adjust the regulator's delivery pressure setting by turning the adjusting screw (key 2) or optional T-handle (key 1) at the top of the spring chamber (key 5).
3. To increase the delivery pressure, turn the adjusting screw clockwise (into the spring chamber). To decrease the delivery pressure, turn the adjusting screw counter-clockwise (out of the spring chamber).
4. Tighten the adjusting screw lock nut after the adjustment has been made.
5. Draw flow through the regulator and shutoff, after adjustment, to check for proper set pressure.

Maintenance

WARNING

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 pressure regulator from system pressure and relieving all internal pressure from the pressure regulator.

Pressure regulator 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 pressure regulator.

Due to normal wear or damage that may occur from external sources, this pressure 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.

CAUTION

Before attempting to replace any spare parts, be sure to shut off all pressure connections to the regulator. With the regulator closed however, system pressure could still be locked between the shutoff valve and the inlet and/ or outlet sides of the regulator. Before proceeding with any regulator service, be certain to relieve the pressure from both sides of the regulator.

For ease of operation and maintenance, install the manual shutoff valves upstream and downstream from the regulator.

Servicing Diaphragm(s) and Pressure Spring

1. Loosen the lock nut and turn the adjusting screw counterclockwise until the pressure spring is no longer under tension. When reassembling, run the adjusting screw down until the lock nut almost touches the spring chamber. This will give you approximately the same set as before disassembly.
2. Remove the assembly screws securing the spring chamber to the body. During reassembly, tighten the screws evenly in a star pattern. See Table 2 for torque values.
3. Remove the spring chamber, then remove the spring button, pressure spring and pressure plate.
4. Remove the diaphragm(s) and diaphragm gasket (a diaphragm gasket is only present when construction calls for metal diaphragms).
5. Remove the pusher post button. During reassembly, ensure the pusher post button is centered properly on the pusher post.
6. Inspect all parts for wear and damage and replace if necessary. Reassemble parts in reverse order. Do not overtighten. Follow the Operation Instructions to reset the delivery pressure.

Servicing the Cylinder, Piston, Strainer Screen and Plug Gasket

1. Loosen the lock nut and turn the adjusting screw counterclockwise until the pressure spring is no longer under tension. When reassembling, run the adjusting screw down until the lock nut almost touches the spring chamber. This will give you approximately the same set as before disassembly.
2. Remove the bottom plug. Take care, as the bottom plug is under slight tension as a result of the piston spring acting against the bottom plug. Remove the piston, piston spring and strainer screen.
3. Thoroughly clean the strainer screen and remove any debris from the valve body.
4. Remove the hexagon cylinder.
5. Inspect all parts for wear and damage. If either the cylinder or piston need replacing, it is necessary to replace both as both parts wear equally.
6. Reassemble the valve in reverse order. Do not overtighten. Follow the Operation Instructions to reset the delivery pressure.

Parts Ordering

When corresponding with your local Sales Office about this equipment, always reference the equipment regulator size, service and serial number.

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

Parts List

Key	Description	Part Number
1	Adjusting screw	
	Standard	
	1/4 NPT	GT11312106
	3/8, 1/2 and 3/4 NPT	GT11312097
	1 and 1-1/4 NPT	GT11312094
	1-1/2 NPT	GT11312095
	2 NPT	GT11312354
	T-Handle	
	1/4 NPT	GT11424490
	3/8, 1/2 and 3/4 NPT	GT11318293
	1, 1-1/4 and 1-1/2 NPT	GT11318307
2	Lock nut	
	1/4 NPT	GT11312107
	3/8, 1/2 and 3/4 NPT	GT11312099
	1, 1-1/4 and 1-1/2 NPT	GT11312104
	2 NPT (Standard)	GT11312105
3	Nameplate	- - - - - - - - - -
4	Spring Chamber, Iron	
	1/4 NPT	GT11516430
	3/8 NPT	GT11516431
	1/2 NPT	GT11516432
	3/4 NPT	GT11516434
	1 NPT	GT11516437
	1-1/4 and 1-1/2 NPT	GT11516439
	2 NPT	GT11516440
5	Spring Button	
	1/4 NPT	GT11312572
	3/8, 1/2, 3/4, 1, 1-1/4 and 1-1/2 NPT	GT11312187
	2 NPT	GT11318131
6	Spring, Steel	See Table 3
7	Pressure Plate	
	1/4 NPT	GT11312588
	3/8 NPT	GT11314448
	1/2 NPT	GT11312454
	3/4 NPT	GT11312994
	1, 1-1/4 and 1-1/2 NPT	GT11312455
	2 NPT	GT11314447
8	Diaphragm	
	Air or Water, Nitrile (NBR)	
	1/4 NPT	GT11312394
	3/8 NPT	GT11312404
	1/2 NPT	GT11312379
	3/4 NPT	GT11312382
	1 NPT	GT11312408
	1-1/4 and 1-1/2 NPT	GT11312413
	2 NPT	GT11312417
	Steam, Bronze	
	1/4 NPT (3 required)	GT11312392
	3/8 NPT (3 required)	GT11312406
	1/2 NPT (3 required)	GT11312383
	3/4 NPT (3 required)	GT11312385
	1 NPT (4 required)	GT11312411
	1-1/4 and 1-1/2 NPT (4 required)	GT11312415
	2 NPT (4 required)	GT11312534
9	Diaphragm Gasket (For Steam only)	
	1/4 NPT	GT11312393
	3/8 NPT	GT11312407
	1/2 NPT	GT11312384
	3/4 NPT	GT11312386
	1 NPT	GT11312412
	1-1/4 and 1-1/2 NPT	GT11312416
	2 NPT	GT11312535
10	Screw (6 required)	
	1/4 NPT	GT11312276
	3/8 NPT	GT11312088
	1/2 and 3/4 NPT	GT11312102
	1 NPT	GT11312089
	1-1/4 and 1-1/2 NPT	GT11312093
	2 NPT	GT11312090
11	Nut (6 required) (not shown)	
	1/4 NPT	GT11312280
	3/8 NPT	GT11312086
	1/2, 3/4 and 1 NPT	GT11312103
	1-1/4 and 1-1/2 NPT	GT11312091
	2 NPT	GT11312092
12	Pusher Post Button	
	1/4 NPT	GT11312258
	3/8 NPT	GT11312405
	1/2 and 3/4 NPT	GT11312366
	1 NPT	GT11312442
	1-1/4 and 1-1/2 NPT	GT11310766
	2 NPT	GT11310026
13	Screen	
	1/4 and 3/8 NPT	GT11312395
	1/2 and 3/4 NPT	GT11312380
	1 NPT	GT11312488
	1-1/4 and 1-1/2 NPT	GT11312489
	2 NPT	GT11312525
14	Cylinder	
	1/4 NPT	GT11312559
	3/8 NPT	
	Air or Water	GT11312560
	Steam	GT11312559
	1/2 and 3/4 NPT	GT11312443
	1 NPT	GT11313032
	1-1/4 and 1-1/2 NPT	GT11317832
	2 NPT	GT11327029
15	Piston Assembly	
	Air or Water, Nitrile (NBR)	
	1/4 NPT	GT11312587
	3/8 NPT	GT11312708
	1/2 and 3/4 NPT	GT11318275
	1 NPT	GT11310769
	1-1/4 and 1-1/2 NPT	GT11325019
	2 NPT	GT11312709
	Steam, Bronze	
	1/4 NPT	GT11320549
	3/8 NPT	GT11320550
	1/2 and 3/4 NPT	GT11320196
	1 NPT	GT11319040
	1-1/4 and 1-1/2 NPT	GT11319042
	2 NPT	GT11319043
16	Piston Spring	
	1/4 and 3/8 NPT	GT11312214
	1/2, 3/4 and 1 NPT	GT11312192
	1-1/4 and 1-1/2 NPT	GT11312414
	2 NPT	GT11312528

Table 3. *Key 6, Spring Part Number*

BODY SIZE, NPT	SPRING RANGE				PART NUMBER
	Air or Water		Steam		
	psi	bar	psi	bar	
1/4	2 to 25	0.14 to 1.72	2 to 25	0.14 to 1.72	GT11312401
	20 to 60	1.38 to 4.14	20 to 60	1.38 to 4.14	GT11312402
	30 to 100	2.07 to 6.90	30 to 100	2.07 to 6.90	GT11312537
	50 to 150	3.45 to 10.3	50 to 125	3.45 to 8.62	GT11312583
3/8	2 to 30	0.14 to 2.07	2 to 30	0.14 to 2.07	GT11312188
	20 to 70	1.38 to 4.83	20 to 70	1.38 to 4.83	GT11312189
	40 to 110	2.76 to 7.58	40 to 110	2.76 to 7.58	GT11312190
	90 to 150	6.21 to 10.3	90 to 125	6.21 to 8.62	GT11312191
1/2	2 to 30	0.14 to 2.07	2 to 30	0.14 to 2.07	GT11312189
	10 to 50	0.69 to 3.45	10 to 50	0.69 to 3.45	GT11312190
	30 to 125	2.07 to 8.62	30 to 125	2.07 to 8.62	GT11312191
	50 to 150	3.45 to 10.3	50 to 125	3.45 to 8.62	GT11314453
3/4	2 to 20	0.14 to 1.38	2 to 20	0.14 to 1.38	GT11312189
	10 to 35	0.69 to 2.41	10 to 35	0.69 to 2.41	GT11312190
	30 to 75	2.07 to 5.17	30 to 75	2.07 to 5.17	GT11312191
	50 to 110	3.45 to 7.58	50 to 110	3.45 to 7.58	GT11314453
	105 to 150	7.24 to 10.3	105 to 125	7.24 to 8.62	GT11312196
1	2 to 20	0.14 to 1.38	2 to 20	0.14 to 1.38	GT11313528
	10 to 45	0.69 to 3.10	10 to 45	0.69 to 3.10	GT11312221
	20 to 60	1.38 to 4.14	20 to 60	1.38 to 4.14	GT11310547
	55 to 100	3.79 to 6.90	55 to 100	3.79 to 6.90	GT11312257
	90 to 150	6.21 to 10.3	90 to 125	6.21 to 8.62	GT11313564
1-1/4 and 1-1/2	2 to 15	0.14 to 1.03	2 to 15	0.14 to 1.03	GT11313528
	10 to 30	0.69 to 2.07	10 to 30	0.69 to 2.07	GT11312221
	20 to 50	1.38 to 3.45	20 to 50	1.38 to 3.45	GT11310547
	45 to 100	3.10 to 6.90	45 to 100	3.10 to 6.90	GT11312257
	90 to 150	6.21 to 10.3	90 to 125	6.21 to 8.62	GT11313564
2	2 to 20	0.14 to 1.38	2 to 20	0.14 to 1.38	GT11313529
	10 to 60	1.69 to 4.14	10 to 60	1.69 to 4.14	GT11312744
	20 to 100	1.38 to 6.90	20 to 100	1.38 to 6.90	GT11312238
	90 to 150	6.21 to 10.3	90 to 125	6.21 to 8.62	GT11312538

Key	Description	Part Number
17	Body, Iron	
	1/4 NPT	GT11516421
	3/8 NPT	GT11516422
	1/2 NPT	GT11516423
	3/4 NPT	GT11516424
	1 NPT	GT11516425
	1-1/4 NPT	GT11516427
	1-1/2 NPT	GT11516428
	2 NPT	GT11516429
18	Bottom Plug Gasket	
	1/4 and 3/8 NPT	GT11464918
	1/2 and 3/4 NPT	GT11464919
	1, 1-1/4 and 1-1/2 NPT	GT11313278
	2 NPT	GT11464920

Key	Description	Part Number
19	Bottom Plug Assembly, Brass	
	1/4 and 3/8 NPT	GT11318731
	1/2 and 3/4 NPT	GT11330000
	1 NPT	GT11318746
	1-1/4 and 1-1/2 NPT	GT11318744
	2 NPT	GT11469313
22	Screw (Bottom Plug) (6 required), For 2 NPT only	GT11312113

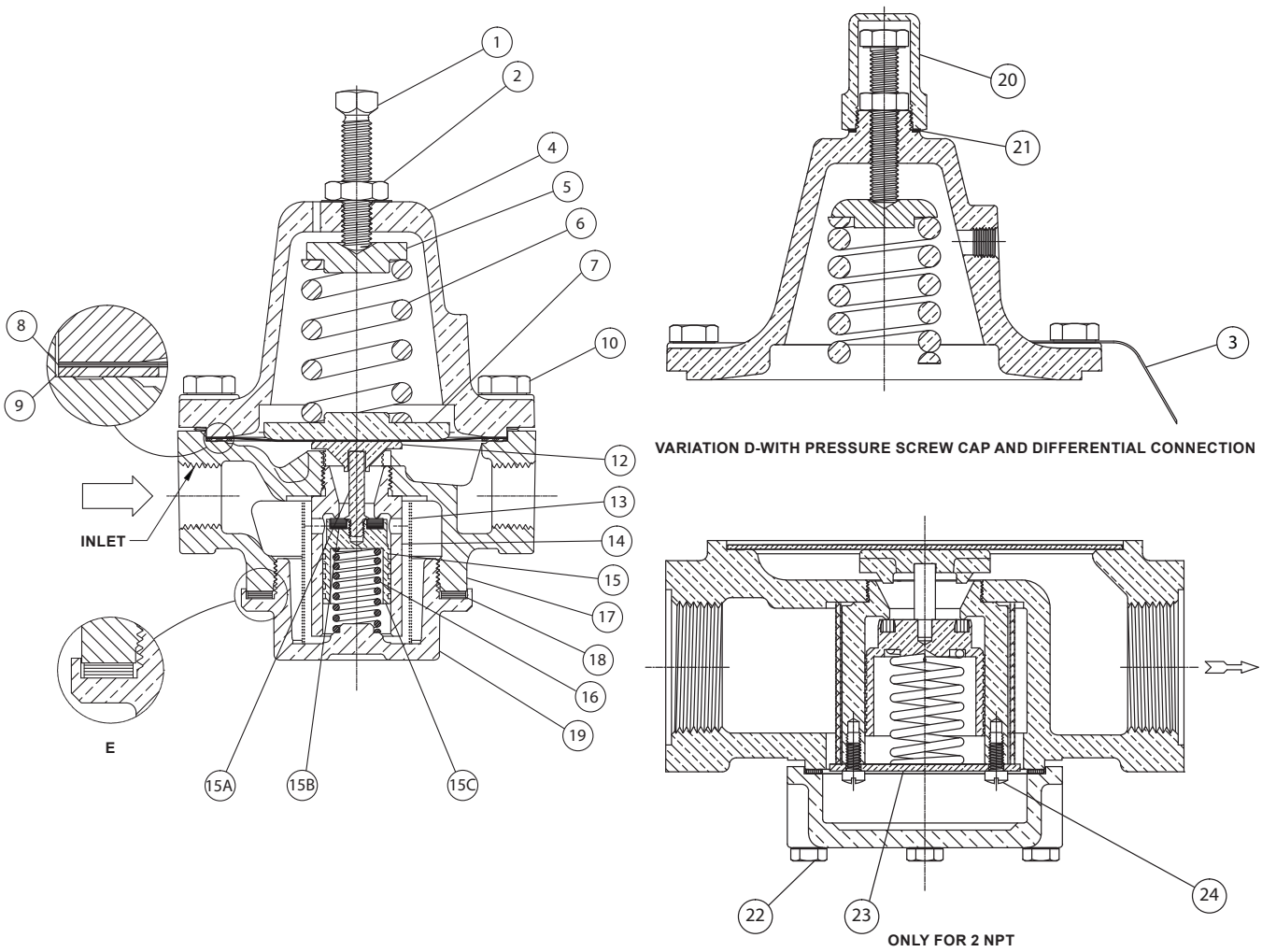


Figure 4. *Type D50A Pressure Regulator Assembly*

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SPENCE™

Spence Type N6 Differential Pressure Valves

⚠ WARNING

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

Type N6 differential pressure valves 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 valve 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 Type N6 differential pressure valves.

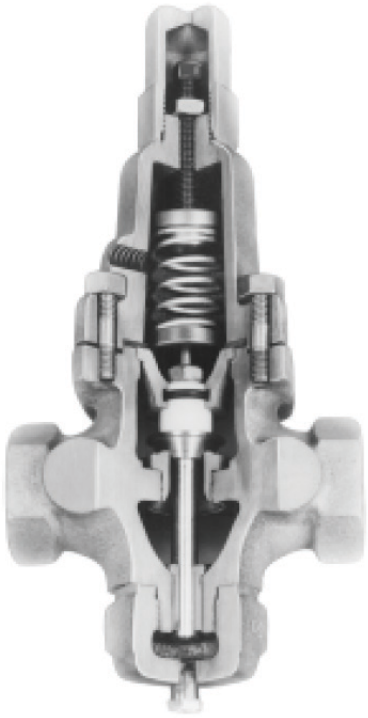

Figure 1. *Type N6 Differential Pressure Valves*

Introduction

Scope of the Manual

This manual provides instructions for the installation, troubleshooting, maintenance, valve setting and parts ordering for Type N6 differential pressure valves.

Product Description

Type N6 differential pressure valves are designed to maintain pump discharge pressures at a constant differential above a separate source of pressure. When installed in a boiler feed pump discharge line as a by-pass valve, a connection from the stream drum is made to the top chamber of the Type N6. The desired differential is made by adjusting the spring. The boiler feed-water pressure will then be maintained by Type N6 at a constant pressure above steam drum pressure by modulating the quantity of water by-passed to pump section. When installed in a by-pass line across a pumped system, Type N6 will maintain a constant differential of supply main pressure over return main pressure by modulating the quantity of by-passed water.

Specifications

This section lists the specifications for the Type N6 differential pressure valves. Factory specifications are stamped on the nameplate fastened on the valve at the factory.

Valve Sizes
NPS 3/4, 1, 1-1/4, 1-1/2, 2 and 2-1/2 /
DN 20, 25, 32, 40, 50 and 65

End Connection Styles
NPT and CL250

Pressure Rating[1]
250 psig / 17.2 bar

Temperature Rating[1]
350°F / 177°C

Spring Ranges
5 to 50 psid / 0.34 to 3.4 bar d
40 to 125 psid / 2.76 to 8.62 bar d
100 to 200 psid / 6.89 to 13.8 bar d

Rated Flow Coefficient
See Table 1

Materials of Construction
Body: Cast iron
Stem, Disk, Seat Ring, Piston and Spring: Stainless steel
Sealing Ring: Fluorocarbon (FKM)
Gasket: Graphite

Approximate Weight
See Table 2

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

Table 1. *Type N6 Differential Pressure Valve Rated Flow Coefficients*

BODY SIZE		FLOW COEFFICIENTS (C_v)
NPS	DN	
3/4	20	7.1
1	25	13.3
1-1/4	32	22.0
1-1/2	40	32.5
2	50	51.0
2-1/2	65	88.0

Table 2. *Type N6 Differential Pressure Valve Approximate Weight*

BODY SIZE		APPROXIMATE WEIGHT	
NPS	DN	lbs	kg
3/4	20	10	4.5
1	25	12	5.5
1-1/4	32	19	8.6
1-1/2	40	26	12
2	50	39	18
2-1/2	65	74	34

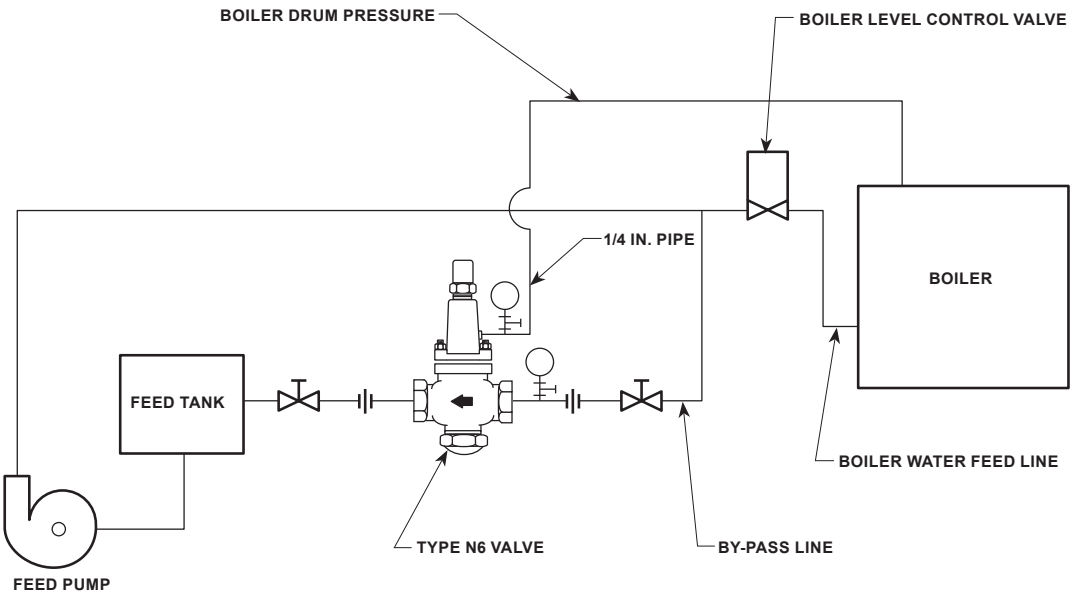

Figure 2. *Type N6 Installation Drawing*

Principle of Operation

Flow enters the valve such that the initial pressure acts against the working face of the disk and tends to move it open. Opposing the opening are the forces of the differential adjusting spring and the loading pressure acting on the piston. The differential adjusting spring force creates the differential between the retained pressure (supply main or boiler feed water) under the disk and the loading pressure (return main or boiler drum) on top of the piston.

Installation

WARNING

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

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

All pressure equipment should be installed in a non-seismic area; should not be exposed to fire; and should be protected from thunderbolt (lightning) strikes.

CAUTION

After the valve is in service at operating pressure and temperature, check all gasketed joints and re-tighten. Failure to follow these instructions may result in damage to gaskets and mating surfaces.

- Carefully clear inlet piping system of foreign matter such as: welding beads, scale, sand, pipe compound, etc.
- Allow head room above the valve for maintenance.
- Provide a three-valve by-pass to facilitate inspection of the regulator without interrupting service.
- Preferred position for Type N6 valve is in a horizontal line with spring chamber up and arrow on body pointing in direction of flow.
- The loading line should be 1/4-in. pipe connected to the spring chamber tap.
- Avoid damaging effects of foreign matter in the flow by using Emerson strainer ahead of the valve.

Startup and Adjustment

1. Type N6 valves are shipped with the adjusting spring precompressed. This precompression may result in a differential pressure higher than desired. Remove adjusting screw cover and loosen adjusting screw locknut. It is recommended that the precompression be removed by turning the adjusting screw counter-clockwise until the screw turns easily indicating the spring load has been removed.
2. Open the inlet stop valve gradually until the Type N6 differential valve takes control as indicated by the differential pressure gauge.
3. Turn adjusting screw clockwise to increase the differential pressure and counter-clockwise to decrease it.
4. With no compression on the adjusting spring the pump discharge pressure and the boiler pressure applied to the spring chamber will be the same, due to the fact that the piston and the disk have the same area and are balanced. To increase differential pressure, compress adjusting spring until desired differential is obtained.

Maintenance

WARNING

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 valve from system pressure and relieving all internal pressure from the valve.

To avoid possible personal injury from spring or pressure-loaded actuator, make sure that the adjusting screw is completely backed off or the spring case pressure is vented prior to disassembly. Otherwise, the spring load or loading pressure could forcefully eject the spring case.

Valves 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 valve.

Under normal conditions, complete dismantling at regular intervals is not recommended. A valve kept relatively free of dirt will function for years with minimum attention.

After the first few days of operation and twice a year:

1. Inspect for dirt collected in chamber "C". Remove plug (key 22) to "blow down".
2. Inspect for dirt collected in cylinder (key 12).
3. Inspect all joints for leakage. Keep all joints tight, never allow a leak to persist.

Dismantling Type N6 Valve for Cleaning

1. Shut off supply and discharge valves and line from steam headers.
2. Remove top cap (key 1).
3. Loosen lock nut (key 3) and unscrew adjusting screw (key 2) until spring tension is released. (This step can be omitted if setting adjustments cannot be made after cleaning).
4. Disconnect pressure sensing line from boiler steam header.
5. Remove the four spring chamber hex head nuts (key 9).
6. Separate spring chamber (key 6) from the valve body (key 20). Spring (key 7) and buttons (key 5) will drop out.
7. Remove valve disk assembly which consists of keys 11, 12, 13, 14, 15 and 18.
8. Assemble in reverse order. Use silicone lubricant on piston (key 14) so that it will move freely through sealing ring (key 13).

Valve Grinding

1. Use fine (grit 400 to 800) compound on the seat, using light pressure.
2. Check seating by blueing the valve disk bevel face before reassembling.
3. Clean all parts with kerosene or carbon tetrachloride before reassembling.
4. Lubricate sealing ring (key 13) with a silicone lubricant or soap solution to facilitate insertion into guide area of body. Do not use petroleum base lubricants on rubber sealing rings.

Troubleshooting

1. Failure to Open—differential too high.
   a. Differential adjusting spring setting may have been tampered with.
   b. Valve piston (key 14) and sealing ring (key 13) may be binding.
   c. Valve stem (key 18) and bushing (key 19) may be binding.
2. Failure to Close—differential too low.
   a. Foreign material may be between the seat and disk of the main valve.
   b. Line from steam header may be plugged, restricted or broken.
   c. Differential adjusting spring setting may have been tampered with.
   d. Chamber "C" may be dirt plugged or port in bushing (key 19) may be plugged.
   e. O-ring or piston may be damaged and leaking.

Parts Ordering

When corresponding with your local Sales Office about this equipment, always reference the equipment serial number that can be found on the nameplate.

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

Parts List

Type N6

See Table 3

Table 3. *Type N6 Parts List*

KEY	DESCRIPTION	MATERIAL	VALVE SIZE, IN. / mm					
			3/4 / 19.05	1 / 25.4	1-1/4 / 31.75	1-1/2 / 38.1	2 / 50.8	2-1/2 / 63.5
1	Top Cap(1)	Steel	WAL04-01303-00	WAL04-01303-00	WAL04-01303-00	WAL04-01331-00	WAL04-01331-00	WAL04-01331-00
2	Adjusting Screw	Steel	WAL05-04860-00	WAL05-04860-00	WAL05-04860-00	WAL05-04863-00	WAL05-04864-00	WAL05-04864-00
3	Adjusting Screw Locknut	Steel	WAL05-02942-00	WAL05-02942-00	WAL05-02942-00	WAL05-02943-00	WAL05-02943-00	WAL05-02943-00
4*	Top Cap Gasket	Copper/ Graphite	WAL05-02356-00	WAL05-02356-00	WAL05-02356-00	WAL05-02357-00	WAL05-02357-00	WAL05-02357-00
5	Spring Buttons	Steel	WAL00-01040-00	WAL00-01040-00	WAL00-01040-00	WAL05-01060-00	WAL05-01050-00	WAL05-01062-00
6	Spring Chamber	Cast iron	WAL04-01398-00	WAL04-01399-00	WAL04-01400-00	WAL04-01401-00	WAL04-01402-00	WAL04-01403-00
7	Adjusting Spring							
	5 to 50 psi / 0.35 to 3.45 bar	Aluminum Steel	WAL05-04957-00	WAL05-04958-00	WAL05-04959-00	WAL05-04960-00	WAL05-04961-00	WAL05-04962-00
	40 to 125 psi / 2.75 to 8.62 bar	17-7 PH	WAL05-04972-01	WAL05-04973-01	WAL05-04974-01	WAL05-04975-01	WAL05-04976-01	WAL05-04977-01
	100 to 200 psi / 6.89 to 13.79 bar	Aluminum Steel	WAL05-10327-00	WAL05-10328-00	WAL05-10329-00	WAL05-10330-00	WAL05-10331-00	WAL05-10332-00
8	Spring Chamber Studs	Steel	WAL04-05516-00	WAL04-10118-00	WAL04-05442-00	WAL04-05443-00	WAL04-10119-00	WAL04-05447-00
9	Spring Chamber Nuts	Steel	WAL05-02847-00	WAL05-02851-00	WAL05-02854-00	WAL05-02856-00	WAL05-02860-00	WAL05-02862-00
10*	Spring Chamber Gasket	Graphite Laminate Grafoil	WAL05-02381-00	WAL05-02362-00	WAL05-02382-00	WAL05-02365-00	WAL05-02366-00	WAL05-02367-00
11	Cylinder	Bronze	WAL04-01569-01	WAL04-01570-01	WAL04-01571-01	WAL04-01572-01	WAL04-01573-01	WAL04-01574-01
12*	Sealing Ring	Viton®	WAL05-04021-00	WAL05-04026-00	WAL05-10463-00	WAL05-04034-00	WAL05-04044-00	WAL05-04048-00
13	Stem Locknut	Steel	WAL05-03015-00	WAL05-03016-00	WAL05-03016-00	WAL05-03017-00	WAL05-03017-00	WAL05-03018-00
14	Piston	Stainless steel	WAL04-03336-00	WAL04-03337-00	WAL04-03338-00	WAL04-03339-00	WAL04-03340-00	WAL04-03341-00
15	Disk	Stainless steel	WAL04-02007-00	WAL04-01832-02	WAL04-01850-02	WAL04-01870-02	WAL04-01888-02	WAL04-01906-01
16	Seat Ring	Stainless steel	WAL04-04075-01	WAL04-04084-01	WAL04-04092-01	WAL04-04496-01	WAL04-11544-00	WAL04-11539-00
17	Body(2)	Cast iron	- - - - - - -	- - - - - - -	- - - - - - -	- - - - - - -	- - - - - - -	- - - - - - -
18	Stem	Stainless steel	WAL04-05311-01	WAL04-05312-01	WAL04-05313-01	WAL04-05314-01	WAL04-05315-01	WAL04-05316-02
19	Bushing(2)	17-7 PH	WAL04-01094-01	WAL04-01099-02	WAL04-01095-01	WAL04-10630-00	WAL04-10630-00	WAL04-10522-00
20	Body Cap	Cast iron	WAL04-01300-00	WAL04-01300-00	WAL04-01301-00	WAL04-01301-00	WAL04-01302-00	WAL04-01325-00
21	Pipe Plug, 1/8 NPT	Steel	WAL04-03769-00	WAL04-03769-00	WAL04-03769-00	WAL04-03769-00	WAL04-03769-00	WAL04-03769-00
22	Piple Plug, 1/4 NPT	Steel	WAL04-03772-00	WAL04-03772-00	WAL04-03772-00	WAL04-03772-00	WAL04-03772-00	WAL04-03772-00
23	Body and Bushing	Cast iron	WAL07-42862-01	WAL07-42863-01	WAL07-42864-01	WAL07-42865-01	WAL07-42866-01	WAL07-42867-01
	Repair Kit (4, 10, 11, 12, 13, 14, 15, 16 and 18)	- - - - - - -	WAL07-08362-01	WAL07-08363-01	WAL07-08364-01	WAL07-08365-01	WAL07-08366-01	WAL07-08367-01

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*Recommended Spare Parts
1. Top Cap for 1-1/2, 2 and 2-1/2 in. / 38.1, 50.8 and 63.5 mm is Cast iron.
2. Included in Item 23:
   Sizes 3/4 to 2 in. / 19.05 to 50.8 mm inclusive are screwed ends
   Sizes 2-1/2 in. is 250 lbs / 113 kg

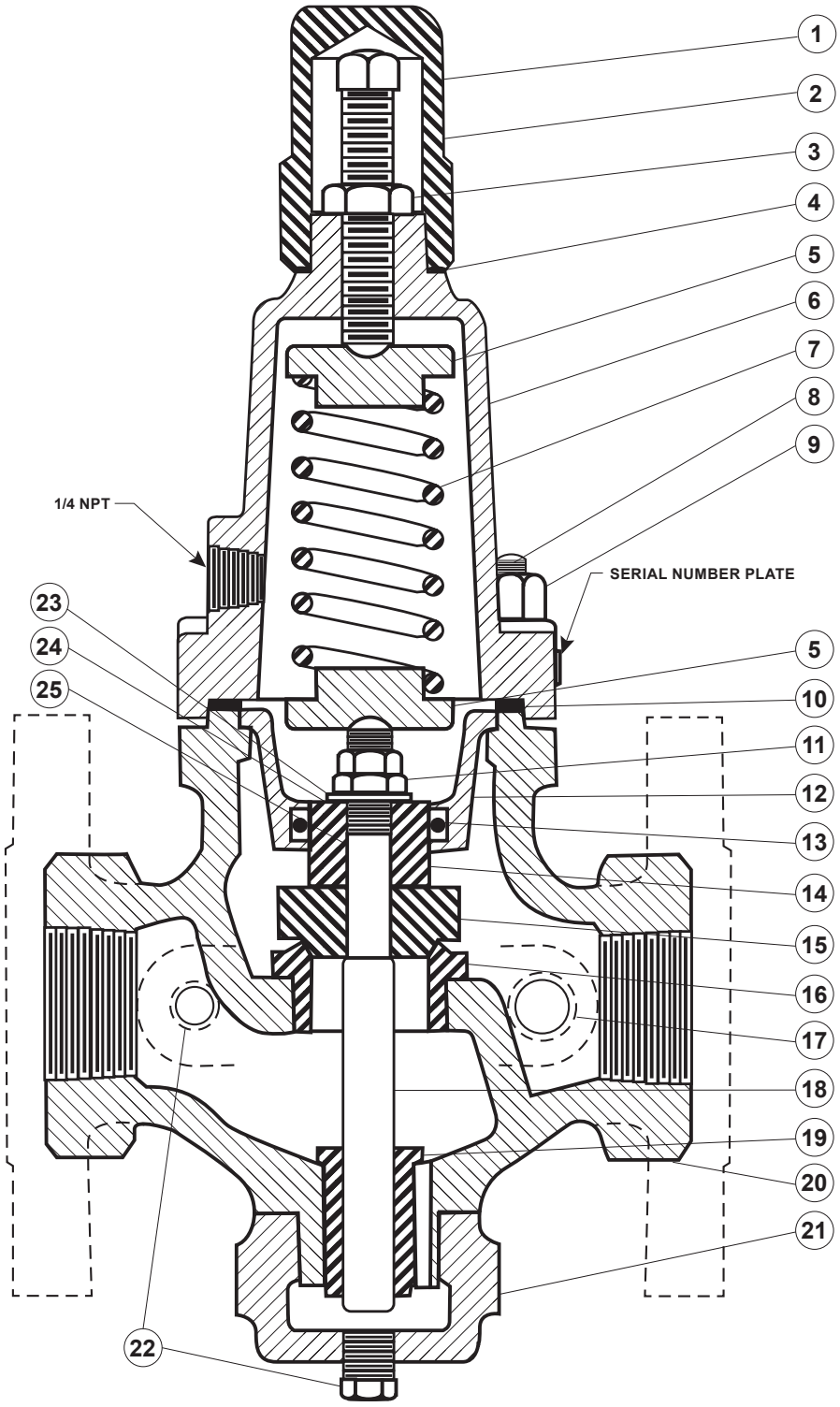

Figure 3. *Type N6 Assembly Drawing*

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SIOI97

SPENCE™

Spence D Series Pressure Reducing Valve

WARNING

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

Emerson Pressure Reducing Valve 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 valve vents gas or a leak develops in the system, service to the unit may be required. Failure to correct trouble could result in a hazardous condition.

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

Introduction

Scope of the Manual

This manual provides instructions for the installation, start-up, maintenance, disassembly, troubleshooting and parts ordering for D Series pressure reducing valve.

Figure 1. *D Series Pressure Reducing Valve*

Product Description

D Series pressure reducing valves are designed for air and steam services. They are direct-acting and are used on small delivery systems where pilot-operated regulators are not practical to use.

The vavle is single-seated, normally open, springloaded and diaphragm-operated. Delivery pressure is transmitted to the diaphragm through an internal control port connecting the outlet side of the valve body with the diaphragm chamber.

D Series Valve

Specifications

This section lists the specifications for D Series pressure reducing valve. Factory specification are stamped on the nameplate fastened on the valve at the factory.

Available Types

Type D: ± 1 psi / 0.07 bar control of delivery pressure from 3 to 150 psi / 0.21 to 10.3 bar
Type D2: ± 2 psi / 0.14 bar control of delivery pressure from 100 to 300 psi / 6.89 to 20.7 bar

Valve Sizes

NPS 1/4 and 1/2 / DN 8 and 15

End Connection Styles

NPT, CL125 and CL250

Maximum Temperature(1)

750°F / 400°C

Spring Pressure Rating(1)

Cast Iron: 250 psig / 17.2 bar at 400°F / 204°C
Cast Steel: 600 psig / 41.4 bar at 750°F / 400°C

Spring Pressure Ranges(1)

Type D
5 to 50 psig / 0.34 to 3.45 bar
10 to 100 psig / 0.69 to 6.89 bar
20 to 150 psig / 1.38 to 10.3 bar
Type D2
100 to 300 psig / 6.89 to 20.7 bar

Construction Materials

Body: Cast Steel or Cast Iron
Stem, Seat, Disc and Diaphragm: Stainless steel
Spring: Inconel®
Gasket: Grafoil

Options

Enclosed Spring Chamber
Composition Disc
Wall Bracket
Adjusting Handwheel
Locking Device

Application

Pressure Regulating for Steam Distribution
Regulating for Fluid, Gas and Vapor
Process Control
Processes with Small, Relatively Steady Flow Rates

Approximate Weight

Type D: 7.3 lbs / 3.3 kg
Type D2: 10.6 lbs / 4.8 kg

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

Principle of Operation

When steam is turned on, the valve is in the wide open position. Steam flowing to the system creates a rising delivery pressure which feeds back through the control port to the underside of the diaphragm. As pressure on diapragm approaches a balance with the force exerted by the adjusting spring, the disc is throttled to a position where just enough steam flows to maintain the set delivery pressure.

Installation

⚠ WARNING

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

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

All pressure equipment should be installed in a non-seismic area; should not be exposed to fire; and should be protected from thunderbolt (lightning) strikes.

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- Carefully clear inlet piping system of foreign matter and mount regulator with the flow arrow pointing in the direction of flow.
- Preferred position for D Series valve is in a horizontal line with spring down. When so mounted, the tendency of sediment to settle in the control ports is practically eliminated.

Start-up

On starting up, follow these steps:

1. Open the inlet stop valve gradually until the reducing valve takes control as indicated by the delivery pressure gauge.
2. Turn adjusting screw clockwise to increase the set pressure, counterclockwise to lower it.

Maintenance

WARNING

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 pressure reducing valve from system pressure and relieving all internal pressure from the pressure reducing valve.

Pressure reducing valves 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 pressure reducing valve.

Due to normal wear or damage that may occur from external sources, this pressure reducing valve 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.

Disassembly

To change or inspect disc and stem:

1. Remove compression on adjusting spring.
2. Remove adjusting spring.
3. Remove diaphragm bolts; take off cowl and diaphragm.
4. Hold pusher plate with socket wrench or pliers and turn off stem nuts.

Troubleshooting

Inadequate Flow or Delivery Pressure

Check initial pressure to see if full intended line pressure is applied at valve inlet.

Reduced Pressure Builds Up

1. Foreign matter may be lodged between seat and disc. Remove blind flange to inspect.
2. Diaphragm may be ruptured as evidenced by steam discharging in the area of the adjusting spring.

Erratic Operation

1. Disassemble the valve.
2. Check for clogged control port connecting body outlet with diaphragm chamber.
3. Check for deposits causing sticking of stem.

Parts Ordering

When corresponding with your local Sales Office about this equipment, always reference the equipment valve size, service and serial number.

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SPENCE™

Spence Type D34 Water Pressure Reducing Valve

⚠ WARNING

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

Emerson Pressure Reducing Valve 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 valve vents gas or a leak develops in the system, service to the unit may be required. Failure to correct trouble could result in a hazardous condition.

Installation, operation and maintenance procedures performed by unqualified personnel may result in improper adjustment and unsafe operation. Either condition may result in equipment damage or personal injury. Only a qualified person shall install or service the Type D34 pressure reducing valve.

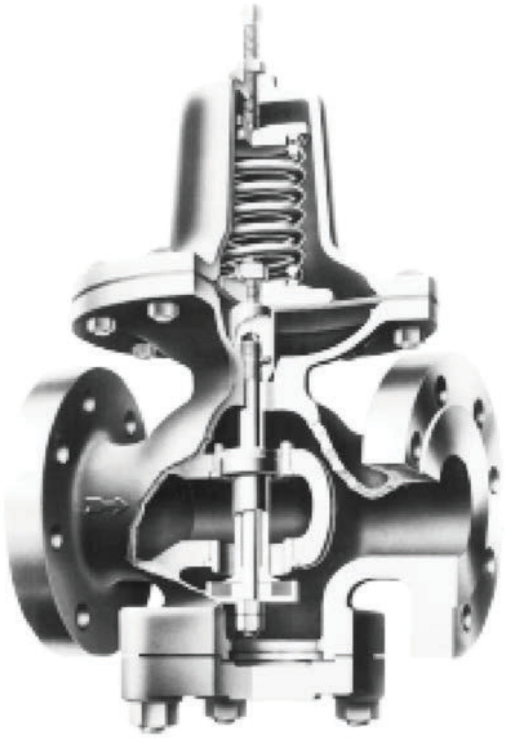

Figure 1. *Type D34 Pressure Reducing Valve*

Introduction

Scope of the Manual

This manual provides instructions for the installation, start-up, maintenance, troubleshooting and parts ordering for Type D34 pressure reducing valve.

Product Description

Type D34 water pressure reducing regulator is designed for dead-end water service where the flow is intermittent and changes rapidly, as on domestic water systems. It is especially effective in regulating the flow of water to such fast acting equipment as flushometers and snap cocks. The design is self-contained, direct operated regulator.

Specifications

This section lists the specifications for Type D34 water pressure reducing valve. Factory specification are stamped on the nameplate fastened on the valve at the factory.

Valve Sizes
NPS 1, 1-1/4, 1-1/2, 2, 2-1/2, 3, 4, 5 and 6 / DN 25, 32, 40, 50, 65, 80, 100, 125 and 150

End Connection Styles
NPT, CL125 and CL250

Maximum Temperature(1)
200°F / 93°C

Maximum Pressure(1)
CL125: 165 psig / 11.4 bar
NPT and CL250: 200 psig / 13.8 bar

Spring Ranges
10 to 40 psig / 0.69 to 2.76 bar
30 to 80 psig / 2.07 to 5.52 bar
70 to 140 psig / 4.8 to 9.65 bar

Flow Coefficient, C_v
NPS 1 / DN 25: 3.3
NPS 1-1/4 / DN 32: 7.5
NPS 1-1/2 / DN 40: 10.4
NPS 2 / DN 50: 14.4
NPS 2-1/2 / DN 65: 21.6
NPS 3 / DN 80: 32
NPS 4 / DN 100: 52
NPS 5 / DN 125: 84
NPS 6 / DN 150: 118

Construction Materials
Body: Cast Steel or Cast Iron
Stem and Seat: Stainless steel
Disc and Diaphragm: Nitrile (NBR)
Spring: Steel
Gasket: Grafoil

Approximate Weight
See Table 1

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

Table 1. *Type D34 Approximate Weight*

VALVE SIZE		NPT		CL125		CL250	
NPS	DN	lbs	kg	lbs	kg	lbs	kg
1	25	22	10.0	- - - -	- - - -	- - - -	- - - -
1-1/4	32	24	10.9	- - - -	- - - -	- - - -	- - - -
1-1/2	40	34	15.4	- - - -	- - - -	- - - -	- - - -
2	50	44	20.0	51	23.1	57	25.9
2-1/2	65	- - - -	- - - -	78	35.4	89	40.4
3	80	- - - -	- - - -	108	49.0	128	58.1
4	100	- - - -	- - - -	198	89.8	225	102
5	125	- - - -	- - - -	352	160	394	179
6	150	- - - -	- - - -	500	227	550	249

Principle of Operation

The Type D34 is a direct-operated regulator. When the water supply is cut in, the valve is in wide open position. Water flowing to the system creates a rising delivery pressure which feeds back through the control ports to the underside of diaphragm (key 8). As the pressure on diaphragm approaches a balance with the force exerted by adjusting spring (key 5), disc (key 20) is throttled to a position where just enough water flows to maintain the set delivery pressure.

Installation

WARNING

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

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

All pressure equipment should be installed in a non-seismic area; should not be exposed to fire; and should be protected from thunderbolt (lightning) strikes.

- Carefully clear inlet piping system of foreign matter and mount regulator with the flow arrow pointing in the direction of flow.
- Preferred position for Type D34 valve is in a horizontal line with spring chamber up. When so mounted, the tendency of sediment to settle in the control ports is practically eliminated.
- Provide a three-valve by-pass to facilitate inspection of the reducing valve without interrupting service.
- Avoid damaging effects of foreign matter in the flow by using a strainer ahead of the valve.

Start-up

On starting up, follow these steps:

1. Open the inlet stop valve gradually until the reducing valve takes control as indicated by the delivery pressure gage.
2. Turn adjusting screw (key 1) clockwise to increase the set pressure, counterclockwise to lower it.

Maintenance

WARNING

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 pressure reducing valve from system pressure and relieving all internal pressure from the pressure reducing valve.

Pressure reducing valves 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 pressure reducing valve.

Due to normal wear or damage that may occur from external sources, this pressure reducing valve 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.

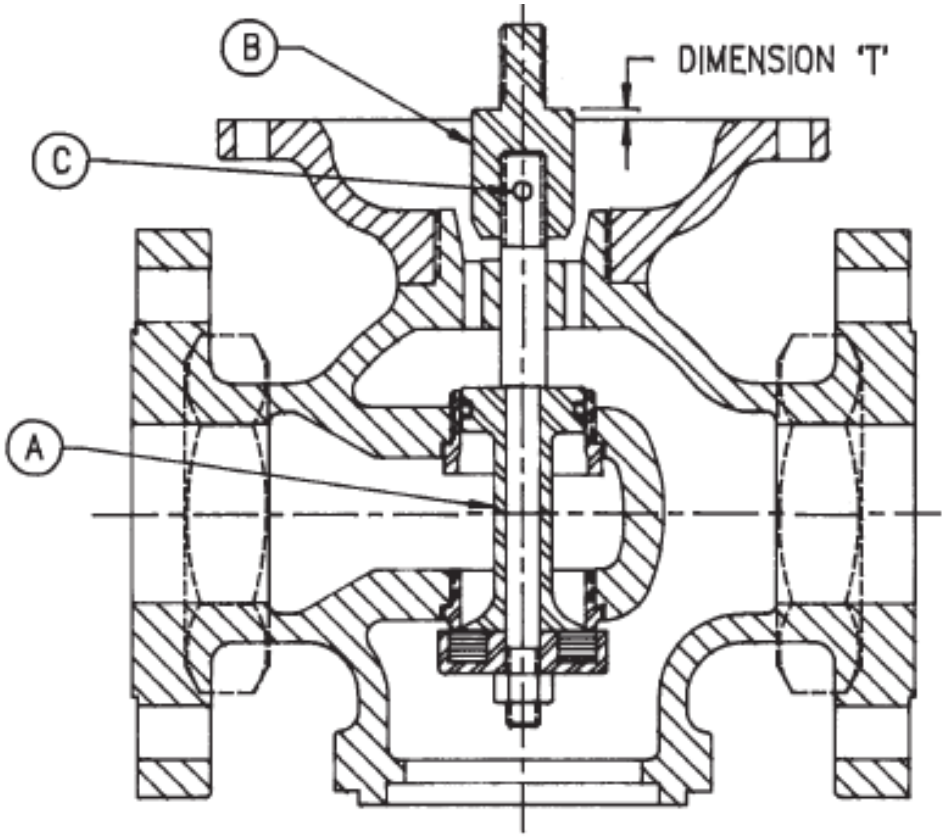

Figure 2. *Type D34 Pressure Reducing Valve Setting*

Valve Setting (Refer to Figure 2)

If the threaded connection between stem coupling (key 11) and stem (key 14) is disturbed, follow these steps:

1. Insert stem assembly (A) and hold disc on seat ring in closed position, as shown in Figure 2.
2. Screw stem coupling (B) on stem until travel setting T is reached.
3. Remove stem assembly (A) and lock setting by drilling hole and inserting dowel pin (C).

Dismantling

To change or inspect composition disc or sealing ring:

1. Remove blind flange (key 24).
2. Remove stem nuts (key 22). Keep stem from turning by inserting screw driver in slot on end of stem.
3. Disc holder (key 21) drops out. Carefully remove balance piston (key 18) so as not to damage sealing ring (key 16) as it is pulled through seat ring (key 19).

To examine diaphragm or stem:

1. Remove compression from spring by turning adjusting screw (key 1) counter-clockwise.
2. Remove diaphragm bolts (key 9) and lift off spring chamber (key 4).
3. Lift pressure plate (key 7) to withdraw diaphragm and stem from valve.
4. To examine diaphragm, disassemble coupling nut (key 6) and lift off pressure plate (key 7).

Troubleshooting

Inadequate flow or delivery pressure:

1. Check for clogged control ports connecting body outlet with diaphragm chamber.
2. Check for deposits causing sticking of sealing ring (key 16) or stem (key 14) in their respective guides.

   Check initial pressure to see if full intended line pressure is applied at the valve inlet.

Reduced pressure builds up:

1. Foreign matter may be lodged between disc (key 20) and seat ring (key 19). Remove blind flange (key 24) and inspect it.
2. Diaphragm (key 8) may be ruptured. Remove spring chamber (key 4) and inspect it.
3. Sealing ring (key 16) may be damaged. See dismantling instructions to replace sealing ring.

Parts Ordering

When corresponding with your local Sales Office about this equipment, always reference the equipment valve size, service and serial number.

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

Parts List

Key	Description	Part Number
	Spare Parts Kit (included are keys 6, 7, 8, 11, 13, 14, 16, 20, 21, 22 and 23)	
	NPS 1 / DN 25	WAL33162
	NPS 1-1/4 / DN 32	WAL33163
	NPS 1-1/2 / DN 40	WAL33164
	NPS 2 / DN 50	WAL33165
	NPS 2-1/2 / DN 65	WAL33166
	NPS 3 / DN 80	WAL33167
	NPS 4 / DN 100	WAL33168
	NPS 5 / DN 125	WAL33169
	NPS 6 / DN 150	WAL33170
	Type D34 Pressure Reducing Valve	See Table 2

Table 2. *Type D34 Parts List*

ITEM NO.	PART NAME	MATERIAL	VALVE SIZE, NPS / DN			
			1 / 25	1-1/4 / 32	1-1/2 / 40	2 / 50
1	Adjusting Screw	Steel	WAL05-04860-00	WAL05-04862-00	WAL05-04864-00	WAL05-04865-00
2	Adjusting Screw Locknut	Steel	WAL05-02942-00	WAL05-02942-00	WAL05-02943-00	WAL05-02944-00
3	Spring Button	Cast Iron	WAL04-01042-00	WAL04-01042-00	WAL04-01043-00	WAL04-01044-00
4	Spring Chamber	Cast Iron	WAL04-01410-00	WAL04-01410-00	WAL04-01409-01	WAL04-01412-00
5	Adjusting Spring, 10-40 psi	Steel	WAL05-05111-01	WAL05-05111-01	WAL05-05154-00	WAL05-05112-01
	Adjusting Spring, 30-80 psi	Steel	WAL05-05144-00	WAL05-05144-00	WAL05-05145-00	WAL05-05146-00
6(1)	Coupling Nut	Steel	WAL05-03016-00	WAL05-03016-00	WAL05-03016-00	WAL05-03018-00
7(1)	Pressure Plate	Cast Iron	WAL04-03702-00	WAL04-03702-00	WAL04-03703-00	WAL04-03645-00
8*(1)	Diaphragm	Hycar	WAL05-01608-00	WAL05-01608-00	WAL05-01609-00	WAL05-01610-00
9	Diaphragm Bolts	Steel	WAL05-04771-00	WAL05-04771-00	WAL05-04771-00	WAL05-04771-00
10	Base	Cast Iron	WAL04-00454-01	WAL04-00454-01	WAL04-00456-00	WAL04-00457-00
11(1)	Stem Coupling	Stainless Steel	WAL04-09484-00	WAL04-09485-00	WAL04-11371-00	WAL04-09486-00
12	Diaphragm Nut	Steel	WAL05-02872-00	WAL05-02872-00	WAL05-02872-00	WAL05-02872-00
13(1)	Dowel Pin	Steel	WAL05-03864-00	WAL05-03245-00	WAL05-03247-00	WAL05-03251-00
14(1)	Stem	Stainless Steel	WAL04-05333-01	WAL04-05335-01	WAL04-05336-01	WAL04-05339-01
15	Body - ANSI NPT Scr	Cast Iron	WAL04-00921-00	WAL04-00922-00	WAL04-00923-00	WAL04-00926-00
	Body - ANSI 125 Flg	Cast Iron	- - - -	- - - -	- - - -	WAL04-00914-00
	Body - ANSI 250 Flg	Cast Iron	- - - -	- - - -	- - - -	WAL04-00925-00
16*(1)	Sealing Ring	Hycar	WAL05-04015-00	WAL05-04019-00	WAL05-04023-00	WAL05-04028-00
17	Guide Ring	Stainless Steel	WAL04-04397-01	WAL04-04399-01	WAL04-04401-01	WAL04-04403-01
18	Balanced Piston	Stainless Steel	WAL04-09476-00	WAL04-09477-00	WAL04-09478-00	WAL04-09479-00
	Balanced Piston Assembly	Stainless Steel	- - - -	- - - -	- - - -	- - - -
19	Seat Ring	Stainless Steel	WAL04-04167-02	WAL04-04169-02	WAL04-04171-02	WAL04-04172-02
20*(1)	Composition Disk	Nitrile	WAL05-01715-00	WAL05-01716-00	WAL05-01716-00	WAL05-01717-00
21(1)	Composition Disk Holder	Stainless Steel	WAL04-09488-00	WAL04-09489-00	WAL04-09490-00	WAL04-09491-00
22(1)	Stem Nut	Steel	WAL05-03014-00	WAL05-03015-00	WAL05-03016-00	WAL05-03016-00
23*(1)	Blind Flange Gasket	Graphite	WAL05-02381-01	WAL05-02362-01	WAL05-02382-01	WAL05-02365-01
24	Blind Flange	Cast Iron	WAL04-02171-01	WAL04-02173-00	WAL04-02176-00	WAL04-02178-00
25	Blind Flange Nut	Steel	WAL05-02847-00	WAL05-02851-00	WAL05-02854-00	WAL05-02856-00
26	Blind Flange Studs	Ledloy	WAL04-05516-00	WAL04-10118-00	WAL05-05507-00	WAL04-05443-00
27	Range Tag, 10-40 psi	Aluminum	WAL05-06221-00	WAL05-06221-00	WAL05-06221-00	WAL05-06221-00
	Range Tag, 30-80 psi	Aluminum	WAL05-06222-00	WAL05-06222-00	WAL05-06222-00	WAL05-06222-00

* Recommended Spare Part
1. These parts furnished in Repair Kit.
For NPS 6 / DN 150, please contact Factory.

Table 2. *Type D34 Parts List (continued)*

ITEM NO.	PART NAME	MATERIAL	VALVE SIZE, NPS / DN			
			2-1/2 / 65	3 / 80	4 / 100	6 / 150
1	Adjusting Screw	Steel	WAL05-04866-00	WAL05-04867-00	WAL05-04869-00	WAL05-04871-00
2	Adjusting Screw Locknut	Steel	WAL05-02944-00	WAL05-02945-00	WAL05-02946-00	WAL05-02946-00
3	Spring Button	Cast Iron	WAL04-01045-00	WAL05-01046-00	WAL05-01047-00	WAL04-01048-00
4	Spring Chamber	Cast Iron	WAL04-01413-00	WAL04-01414-00	WAL04-01417-00	WAL04-01416-00
5	Adjusting Spring, 10-40 psi	Steel	WAL05-05114-00	WAL05-05115-01	WAL05-05155-00	WAL05-05156-00
	Adjusting Spring, 30-80 psi	Steel	WAL05-05147-00	WAL05-05148-00	WAL05-05150-00	WAL05-05151-00
6(1)	Coupling Nut	Steel	WAL05-03019-00	WAL05-03019-00	WAL05-03020-00	WAL05-03020-00
7(1)	Pressure Plate	Cast Iron	WAL04-03646-00	WAL04-03647-00	WAL04-03649-00	WAL04-03650-00
8*(1)	Diaphragm	Hycar	WAL05-01611-00	WAL05-01612-00	WAL05-01614-00	WAL05-01615-00
9	Diaphragm Bolts	Steel	WAL05-04778-00	WAL05-04777-00	WAL05-04782-00	WAL05-04783-00
10	Base	Cast Iron	WAL04-00458-00	WAL04-00459-00	WAL04-00461-00	WAL04-00462-00
11(1)	Stem Coupling	Stainless Steel	WAL04-09487-00	WAL04-09487-00	WAL04-01496-01	WAL04-01496-01
12	Diaphragm Nut	Steel	WAL05-02875-00	WAL05-02875-00	WAL05-02877-00	WAL05-02877-00
13(1)	Dowel Pin	Steel	WAL05-03251-00	WAL05-03251-00	WAL05-03254-00	WAL05-03254-00
14(1)	Stem	Stainless Steel	WAL04-05341-00	WAL04-05343-00	WAL04-05346-00	WAL04-08679-00
15	Body - ANSI NPT Scr	Cast Iron	- - - -	- - - -	- - - -	- - - -
	Body - ANSI 125 Flg	Cast Iron	WAL04-00915-00	WAL04-00918-00	WAL04-00920-00	WAL04-00913-00
	Body - ANSI 250 Flg	Cast Iron	WAL04-00927-00	WAL04-00928-01	WAL04-00930-00	WAL04-00931-00
16*(1)	Sealing Ring	Hycar	WAL05-04033-00	WAL05-04038-00	WAL05-04045-00	WAL05-04050-00
17	Guide Ring	Stainless Steel	WAL04-04405-00	WAL04-04407-00	WAL04-04411-01	WAL04-08680-00
18	Balanced Piston	Stainless Steel	WAL04-09480-00	WAL04-09481-00	- - - -	- - - -
	Balanced Piston Assembly	Stainless Steel	- - - -	- - - -	WAL22445	WAL22525
19	Seat Ring	Stainless Steel	WAL04-04175-01	WAL04-04177-01	WAL04-04180-02	WAL04-08681-01
20*(1)	Composition Disk	Nitrile	WAL05-01718-00	WAL05-01719-00	WAL05-01721-00	WAL05-01722-00
21(1)	Composition Disk Holder	Stainless Steel	WAL04-09492-00	WAL04-09493-00	WAL04-09494-00	WAL04-02531-00
22(1)	Stem Nut	Steel	WAL05-03017-00	WAL05-03017-00	WAL05-03018-00	WAL05-03019-00
23*(1)	Blind Flange Gasket	Graphite	WAL05-02366-01	WAL05-02367-01	WAL04-02369-01	WAL05-02371-00
24	Blind Flange	Cast Iron	WAL04-02180-00	WAL04-02183-00	WAL04-02186-00	WAL04-02159-00
25	Blind Flange Nut	Steel	WAL05-02860-00	WAL05-02862-00	WAL05-02860-00	WAL05-02862-00
26	Blind Flange Studs	Ledloy	WAL04-10119-00	WAL04-05448-00	WAL04-10119-00	WAL04-05448-00
27	Range Tag, 10-40 psi	Aluminum	WAL05-06221-00	WAL05-06221-00	WAL05-06221-00	WAL05-06221-00
	Range Tag, 30-80 psi	Aluminum	WAL05-06222-00	WAL05-06222-00	WAL05-06222-00	WAL05-06222-00

* Recommended Spare Part
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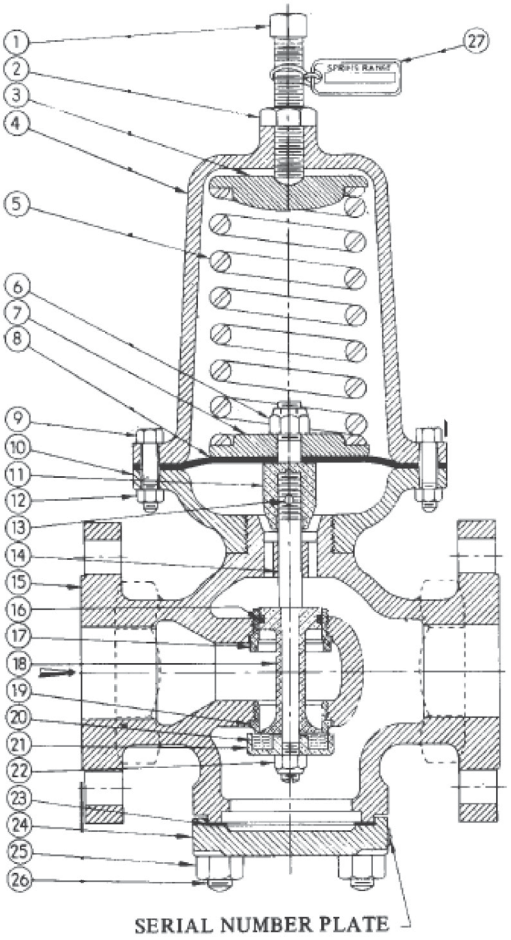

Figure 3. *Type D34 Pressure Reducing Valve Assembly Drawing*

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SPENCE™

Spence Types K1 and K4 Control Valve

⚠ WARNING

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

Emerson Control Valve 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 control valve vents gas or a leak develops in the system, service to the unit may be required. Failure to correct trouble could result in a hazardous condition.

Installation, operation and maintenance procedures performed by unqualified personnel may result in improper adjustment and unsafe operation. Either condition may result in equipment damage or personal injury. Only a qualified person shall install or service the Types K1 and K4 control valve.

Figure 1. *Type K1 Control Valve*

Introduction

Scope of the Manual

This manual provides instructions for the installation, start-up, setting, maintenance, troubleshooting and parts ordering for Types K1 and K4 control valve

Product Description

Types K1 and K4 control valve is designed for economical control of steam, water, gas and process applications in typical institutional, commercial and industrial processes. Types K1 and K4 are available with either a direct or reverse acting actuator that meets most application requirements.

Specifications

This section lists the specifications for the Types K1 and K4. Factory specification are stamped on the nameplate fastened on the control valve at the factory.

Control Valve Types

Type K1: Single-seat, bronze with union ends and pneumatic actuator

Type K4: Single-seat, flanged, cast iron and pneumatic actuator

Control Valve Sizes

Type K1: NPS 1/2, 3/4, 1, 1-1/4, 1-1/2 and 2 / DN 15, 20, 25, 32, 40 and 50

Type K4: NPS 2-1/2, 3 and 4 / DN 65, 80 and 100

Pressure and Temperature Chart[1]

See Figure 2

Available Configurations

See Figure 4

End Connection Styles

NPT, CL125 and CL250

Flow Coefficient, C_v

NPS 1/2 / DN 15: 5.2
NPS 3/4 / DN 20: 7.0
NPS 1 / DN 25: 11
NPS 1-1/4 / DN 32: 20
NPS 1-1/2 / DN 40: 25
NPS 2 / DN 50: 30

Flow Coefficient, C_v (continued)

NPS 2-1/2 / DN 65: 71
NPS 3 / DN 80: 94
NPS 4 / DN 100: 146

Construction Materials

Body: Bronze or Cast iron
Seat: Stainless steel
Bonnet: Ductile Iron
Plug, Stem and Stem Assembly: Stainless steel
Stem Guide: Stainless steel or Brass
Actuator Casing: Steel
Actuator Spring: Steel Wire
Diaphragm: Nitrile (NBR)/Polyester
Yoke: Ductile Iron

Options

36 or 60 sq. in. / 0.02 or 0.04 sqm actuators
Electric Actuator

Applicable Codes

Meets or exceeds ANSI B16.15 Class 250 or ANSIB16.1 Class 125
ANSI/FCI 70-2 Class IV Seat Leakage

Approximate Weight

See Table 1

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

Table 1. *Approximate Weight*

VALVE SIZE		36 SQ.IN. / 0.02 SQM		60 SQ.IN. / 0.04 SQM	
NPS	DN	lbs	kg	lbs	kg
1/2	15	21.0	9.5	- - - -	- - - -
3/4	20	21.0	9.5	- - - -	- - - -
1	25	25.5	11.6	39	17
1-1/4	32	31.5	14.3	45	20
1-1/2	40	31.5	14.3	45	20
2	50	33.5	15.2	47	21
2-1/2	65	- - - -	- - - -	72	33
3	80	- - - -	- - - -	84	39
4	100	- - - -	- - - -	145	66

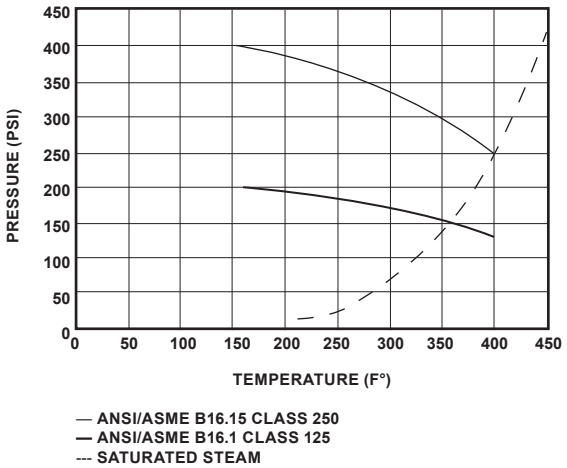

Figure 2. *Types K1 and K4 Pressure and Temperature Chart*

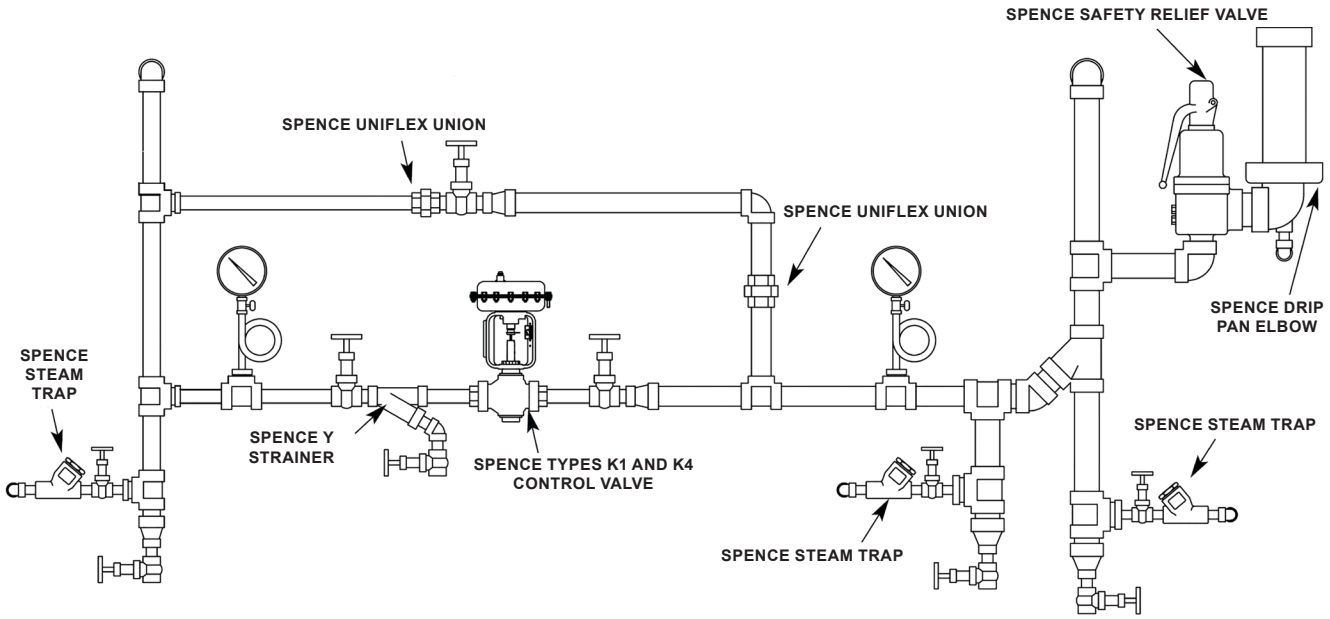

Figure 3. *Types K1 and K4 Control Valve Recommended Installation for Steam Application*

Principle of Operation

The Types K1 and K4 Control Valves are flow to open, globe style, pneumatic diaphragm control valves. The pneumatic actuator can be arranged to operate with either air to close or air to open control.

A controller sensing the controlled variable provides a signal to the actuator of the control valve to obtain the desired control.

Installation

WARNING

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

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

All pressure equipment should be installed in a non-seismic area; should not be exposed to fire; and should be protected from thunderbolt (lightning) strikes.

CAUTION

The piping system must be adequately designed and supported to prevent extraordinary loads to the pressure equipment.

Note

- **Locate the valve in a straight run of horizontal pipe as shown in Figure 3. Mount the valve with the actuator in the upright position. Allow room for removal of the actuator.**
- **Prevent pipeline hammering in compressible fluid service by providing proper drainage before and after the valve.**
- **Avoid damaging effects of scale and dirt in pipelines by using a strainer.**
- **A three-valve by-pass to facilitate inspection and maintenance without interrupting service is recommended.**

- **To eliminate excessive noise with steam and other compressible fluids, enlarge the delivery pipe size to allow a reasonable flow velocity at the reduced pressure. A concentric transition is recommended.**
- **If possible, avoid sharp turns close to the valve.**
- **Install upstream and downstream pressure gauges to indicate performance.**
- **If the rating of the delivery system or connected equipment is less than the initial pressure, provide a safety relief valve.**
- **Use Uniflex Pipe Coupling for ease of maintenance. The spiral wound gasket provides a high performance seal similar to that of a flanged connection, yet retains the convenience of a ground joint union.**

Start-up and Setting

WARNING

The valve may be handling hazardous fluids. Only qualified personnel, who are familiar with the installation, should be permitted to install, readjust, inspect or maintain the valve.

CAUTION

Insulation, may be applied to the valve body only. Do not insulate the bonnet.

1. Flush the piping system thoroughly to clear it of welding beads, scale, sand, etc.
2. Install the valve with the arrow on the side of the valve body pointing in the direction of fluid flow.
3. Install controller and accessories in accordance with instructions furnished by the manufacturer of these items.
4. Connect necessary air lines and/or electrical connections to the diaphragm chamber and valve mounted accessories. Use 1/4 in. / 6.35 mm outside diameter tubing for all air lines. If the length of the air line exceeds 25 ft / 7.62 m, use 3/8 in. / 9.53 mm outside diameter tubing.

Maintenance

WARNING

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 control valve from system pressure and relieving all internal pressure from the control valve.

Control valves 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 control valve.

Due to normal wear or damage that may occur from external sources, this control valve 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.

Removal of the Actuator from the Valve Body Assembly (Refer to Figures 7 to 8)

1. Close inlet and outlet stop valves.
2. Be sure valve body is not under pressure.
3. Remove all accessories from the control valve.

Reverse Acting Actuator

1. Loosen stem nuts (key 24) and move to approximately 1/3 down valve stem.
2. Retighten the stem nuts (key 31), being careful not to move valve stem.
3. Energize actuator with air to lift plug off seat.
4. Disengage lock nut (26) from bonnet (key 25).
5. De-energize actuator.
6. Move the actuator and yoke away from bonnet.

7. Lift actuator and yoke assembly along with plug (key 39) off the seat.
8. With an adjustable wrench, unthread valve stem from the actuator stem (key 16) until valve stem is dise ngaged from actuator stem.
9. Remove stem nuts, indicator and lock nut.

Direct Acting Pneumatic Actuator

1. Energize actuator with air slightly (in case of back seating).
2. Loosen stem nuts (key 24) and re-tighten approximately 1/8 in. / 3.18 mm away from actuator stem (key 16).
3. Disengage lock nut (key 26) from bonnet (key 25). With an adjustable wrench, unscrew valve stem from actuator stem.
4. When valve stem reaches seat, lift actuator (to prevent galling the seat and plug).
5. Remove stem nuts, indicator and lock nut.

Disassembly of the Valve Body

1. Remove stem nuts (key 24), indicator (key 32), and lock nut (key 26) as shown in Figures 4 and 5.
2. To complete body disassembly, unscrew bonnet for Type K1 and cap (key 42) for Type K4. For Type K4 remove bonnet nuts (key 34) and lift off blind flange (key 35), bonnet, stem and plug assembly (key 37).
3. Remove gasket (key 26). A new gasket should be installed each time the valve body is disassembled.
4. Turn stem and plug assembly out of the bonnet through packing.
5. Replace packing if necessary.
6. All parts should be inspected for wear and cleaned thoroughly before reassembling the valve body.

Disassembly of the Actuator

1. Remove actuator from the valve.
2. Remove regular casing bolts (key 4) and casing nuts (key 5).
3. Gradually loosen nuts on the remaining long casing bolts (key 14) to allow pre-compression of actuator springs.
4. Remove upper casing (key 2).
5. Pull actuator stem (key 16), along with diaphragm (key 15), springs (key 3) and piston (key 13), out through bushing (key 7).
6. Place a wrench on machined flats of the actuator stem and remove stem nut (key 10) or travel stop (key 22), seal washer (key 12) and stem washer (key 11).
7. Remove o-ring (key 8) from the bushing and replace if necessary. Lubricate o-ring after installing.

Reassembly of the Actuator

1. Refer to Figures 4 and 5 for correct orientation of casings, diaphragm (key 15), piston (key 13), stem (key 16) and springs (key 3) for direct or reverse action.
2. Be sure that piston spring recesses line up between casing ribs as shown in Figure 6.
3. Lubricate bushing o-ring (key 8) and insert actuator stem through the bushing.
4. Reattach upper casing (key 2) with long bolts (key 14) and nuts (key 5), tightening alternately.
5. Install remaining casing nuts and bolts.
6. Apply air to diaphragm case and check for leakage, full travel and dead band less than 0.2 psi./ 0.14 bar

Lapping Plug into the Seat

CAUTION

Seats and plugs should never require more than the lightest touch up with very fine (400 grit) grinding compound. Heavy lapping will produce galling, a wider seating surface and a groove in the plug, all of which tend to cause leakage.

1. Reface a damaged surface before attempting to grind it in. Lap sparingly.
2. Replace stem and plug assembly (key 39) in bonnet (key 25) through packing .

3. Apply lapping compound to the plug.
4. Place bonnet and bonnet flange (key 24, for Type K4 only) on the body.
5. After lapping, disassemble and clean all parts thoroughly.

Packing Replacement

1. Check stem for gouges if packing leaks.
2. Install replacement packing cartridges.

Reassembly of Type K1 Valve Body

1. Tighten bonnet (25) to body.
2. Replace yoke (9), lock nut (26), stem nuts (24) and travel indicator (32) over stem (34).

Reassembly of Type K4 Valve Body

1. Install a new gasket (key 36).
2. Attach bonnet (key 26) and bonnet flange (key 35) to body with bonnet studs and nuts (keys 33 and 34). Be sure to tighten bolts alternately and evenly to ensure proper seating of the plug.
3. Replace yoke (key 9), lock nut (key 27), stem nuts (key 31), travel indicator (key 22), over stem (key 30).

Replacing the Actuator on the Valve Body

1. Put actuator assembly over the valve stem.
2. Place lock nut (key 26) and stem nuts (key 24) with travel indicator (key 32) on valve stem.
3. Rest actuator stem (key 16) on valve stem.
4. Tighten stem nuts approximately 2/3 down valve stem.
5. Lift actuator assembly and engage valve stem with actuator stem (be careful not to gall the plug and seat).

Reverse Acting

When sufficient engagement is met, actuator can be energized with air to place yoke on the bonnet (key 25) and lift plug off the seat. Tighten lock nut and packing nut.

Direct Acting

Engage valve stem with actuator stem so no contact is made between plug and seat when the bottom of the yoke is rested on the bonnet. Tighten lock nut and packing nut.

Actuator Adjustment - Pneumatic

1. Close inlet and outlet stop valves. Be sure valve body is not under pressure.
2. Place wrench on machined flats of actuator stem (key 16). Counter two stem nuts (key 24) approximately halfway down the threads of the stem (key 34).

Reverse Acting

1. Apply sufficient air pressure to diaphragm case to start moving the valve through its rated travel. This is shown by the travel indicator (key 32).
2. Engage lower stem nut (key 24) and turn body stem (key 34) into actuator stem (key 16) until pre-compression of actuator springs (key 3) is relieved.

Note

Plug should not be seating on seat ring when air pressure is removed from actuator case.

3. Apply prescribed setting pressure to actuator. This is determined by specific operating conditions.
4. Turn body out of actuator stem until plug seats on seat ring (key 28). To prevent galling, do not turn bidy stem after plug has contacted seat ring. Turn stem nuts up plug and stem assembly and tighten to lock it in position.
5. Reduce air signal to 0 psi/bar and calibrate indicator scale (key 20). Check that full travel is achieved with a 15 psi signal, except for 22 to 30 psi / 1.52 to 2.07 bar springs.

Direct Acting

1. Engage lower stem nut (key 24) and turn body stem (key 34) into actuator stem (key 16) until plug and stem assembly stops at upper limit of travel and/or a slight downward movement of actuator stem is detected.

2. Turn stem nut up the body stem and tighten to lock in position.
3. Calibrate indicator scale (key 20). Check that full travel is achieved at a 3 psi signal.

Troubleshooting

WARNING

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

Control valves 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 control valve.

To troubleshoot the valve and actuator, check for the following: change in operating conditions; pneumatic signal failure; diaphragm failure; foreign matter lodged between seat ring and plug; actuator vent plug may be: plugged, missing, replaced with a solid plug; packing leakage.

Parts Ordering

When corresponding with your local Sales Office about this equipment, always reference the equipment valve size, service and serial number.

When ordering replacement parts, reference the key number of each needed part as found in the following parts list and indicate the part number. Separate kits containing all recommended spare parts are available.

Parts List

Valve Body Assembly (See Tables 2 and 3, Figures 4 and 5)

Actuator Parts (Figures 6 and 7)

Key	Description	Part Number
	Repair Part Kit	
	36 sq. in. / 0.02 sqm	WAL51447
	60 sq. in. / 0.04 sqm	WAL51448
	Actuators and Spring Kit	See Table 4
	Actuator Connector Kits	See Table 5
1	Vent Plug, High-density polyethylene	
2	Upper Casing, Steel/powder	
3	Springs, Steel	
4	Casing Bolt, Regular, 10/14 required, 304 Stainless steel	
5	Casing Nut, 12/16 required, 316 Stainless steel	
6	Lower Casing, Steel/powder	
7	Bushing, Bronze	
8*	O-ring, Nitrile (NBR)	WAL05-04017-00
9	Yoke, Cast Iron/Powder	
10'	Stem Nut, Steel	WAL05-13374-00
11*	Stem Washer, 1/3 required, 316 Stainless steel	WAL05-12963-00
12*	Seal Washer, Steel	WAL05-13203-00
13	Piston, 316 Stainless steel	
14*	Casing Bolt, Long, 2 required, 304 Stainless steel	WAL05-04889-00
15*	Diaphragm, Nitrile	
	36 sq. in. / 0.02 sqm	WAL00-12968-00
	60 sq. in. / 0.04 sqm	WAL00-12986-00
16	Actuator Stem, 303 Stainless steel	
17	Machine Screw, 3 required, Steel	
18	Casing Gasket, Nitrile	
19	Machine Screw, 2 required, Steel	
20*	Indicator Scale, Aluminum	WAL05-13190-00
21*	Specification Plate, Aluminum	WAL05-13199-00
22	Stop, For Type K4 only, Brass	
	12 to 15 psi / 0.83 to 1.03 bar	WAL05-17360-00
	10 to 15 psi / 0.69 to 1.03 bar and 22 to 30 psi / 1.52 to 2.07 bar	WAL05-17362-00

*These parts furnished in Actuator Repair Kit.

***Table 2**. Type K1 Valve Body Assembly Parts List*

KEY	PART NAME	MATERIAL	VALVE SIZE, NPS / DN					
			1/2 / 15	3/4 / 20	1 / 25	1-14 / 32	1-1/2 / 40	2 / 50
23A[1]	Stem Bolt - Short	Brass	WAL04-17277-00	WAL04-17277-00	WAL04-17277-00	WAL04-17277-00	WAL04-17277-00	WAL04-17277-00
23B[2]	Stem Bolt - Long	Brass	WAL04-17281-00	WAL04-17281-00	WAL04-17281-00	WAL04-17281-00	WAL04-17281-00	WAL04-17281-00
24	Stem Nut	Brass	WAL05-17342-00	WAL05-17342-00	WAL05-17342-00	WAL05-17342-00	WAL05-17342-00	WAL05-17342-00
25	Bonnet Assembly	Brass	WAL558B109-02	WAL558B109-02	WAL558B107-02	WAL558B110-02	WAL558B110-02	WAL558B110-02
26	Lock Nut	Stainless Steel	WAL05-17330-00	WAL05-17330-00	WAL05-17330-00	WAL05-17330-00	WAL05-17330-00	WAL05-17330-00
27	Wave Washer	Stainless Steel	----------	----------	WAL122A155-01	WAL122A155-02	WAL122A155-02	WAL122A155-02
28A	Seat Ring, 1/2A K1	Stainless Steel	WALSN217	----------	----------	----------	----------	----------
	Seat Ring, 1/2B K1		WALSUU217	----------	----------	----------	----------	----------
	Seat Ring, 1/2C K1		WALSN217	----------	----------	----------	----------	----------
	Seat Ring, 1/2E K1		WALSN217	----------	----------	----------	----------	----------
	Seat Ring, T K1		WALSX217	WALSM217	WAL562A114-02	WAL562A114-03	WAL562A114-04	WAL562A114-05
28B	Seat Ring, 1/2A K5	Stainless Steel	WAL562A110-01	----------	----------	----------	----------	----------
	Seat Ring, 1/2B K5		WAL562A110-01	----------	----------	----------	----------	----------
	Seat Ring, 1/2C K5		WAL562A110-01	----------	----------	----------	----------	----------
	Seat Ring, 1/2E K55		WAL562A110-01	----------	----------	----------	----------	----------
	Seat Ring, T K5		WAL562A112-01	WAL562A113-01	WAL562A114-02	WAL562A114-03	WAL562A114-04	WAL562A114-05
29	Tailpiece	Galvanized Iron	WALSX227	WALSMP462	WALSMP463	WALSBB227	WALSMP465	WALSMP593
30	Body	Bronze	WAL292B110-01	WAL292B110-01	WALSAM1167B	WALSAN1167B	WALSAN1167B	WAL564B116-01
31	Cap	Brass	----------	----------	WAL557B101-01	WALSB312E	WALSB312E	WALSB312E
32	Travel Indicator	Aluminum	WAL05-12962-00	WAL05-12962-00	WAL05-12962-00	WAL05-12962-00	WAL05-12962-00	WAL05-12962-00
33	V-Ring Packing Set	TFE/Stainless Steel/Viton	WAL204A104-01	WAL204A104-01	WAL204A104-01	WAL204A104-01	WAL204A104-01	WAL204A104-01
34	Stem	Stainless Steel	WAL552A117-01	WAL552A117-01	WAL552A115-01	WAL552A115-02	WAL552A115-02	WAL552A115-02
35[1]	Yoke Bushing	Brass	WAL04-17278-00	WAL04-17278-00	WAL04-17278-00	WAL04-17278-00	WAL04-17278-00	WAL04-17278-00
36[2]	Spacer	Brass	WAL04-17280-00	WAL04-17280-00	WAL04-17280-00	WAL04-17280-00	WAL04-17280-00	WAL04-17280-00
37	Nut	Stainless Steel	WAL05-17342-00	WAL05-17342-00	----------	----------	----------	----------
38	Guide	Stainless Steel	----------	----------	WAL556A111-01	WAL556A111-02	WAL556A111-02	WAL556A111-02
39	Plug, 1/2A	Stainless Steel	WAL554A154	----------	----------	----------	----------	----------
	Plug, 1/2B		WAL554A158	----------	----------	----------	----------	----------
	Plug, 1/2C		WAL554A153	----------	----------	----------	----------	----------
	Plug, 1/2D		WAL554A156	----------	----------	----------	----------	----------
	Plug, 1/2E		WAL554A159	----------	----------	----------	----------	----------
	Plug, T		WAL554A157	WAL554A155	WAL554A146-02	WAL554A146-03	WAL554A146-04	WAL554A146-05
40	Union Nut	Galvanized Iron	WALSMP487	WALSMP467	WALSMP468	WALSMP470	WALSMP470	WALSMP592

1. Not included in body assembly; order K-KIT separately.
2. Not included in body assembly; order separately.

***Table 3**. Type K4 Valve Body Assembly Parts List*

KEY	PART NAME	MATERIAL	VALVE SIZE, NPS / DN		
			2-1/2 / 65	3 / 80	4 / 100
23	Pointer	Aluminum	WAL05-12962-00	WAL05-12962-00	WAL05-12962-00
24	Stem Bolt	Brass	WAL04-17277-00	WAL04-17277-00	WAL04-17277-00
25	Packing Box	Brass	WAL204A104-01	WAL204A104-01	WAL204A104-01
26	Bonnet	Ductile Iron	WAL558B113-02	WAL558B113-02	WAL558B113-02
27	Nut	Zinc-plated Steel	WAL05-17330-00	WAL05-17330-00	WAL05-17330-00
28	Yoke Bushing	Brass	WAL04-17278-00	WAL04-17278-00	WAL04-17278-00
29	Stem Bearing	303 Stainless Steel	WALSU260	WALSU260	WALSU260
30	Valve Stem	303 Stainless Steel	WAL552A117-02	WAL552A117-02	WAL552A117-02
31	Nut	316 Stainless Steel	WAL05-17342-00	WAL05-17342-00	WAL05-17342-00
32	Disk	420 Stainless Steel	WAL04-08242-00	WAL04-01918-00	WAL04-01931-00
33	Tap Stud	Steel	WAL04-10119-00	WAL04-05443-00	WAL04-10119-00
34	Nut	Steel	WAL05-02860-00	WAL05-02856-00	WAL05-02860-0
35	Blind Flange	Cast Iron	WAL04-17334-00	WAL04-17337-00	WAL04-17334-00
36	Gasket	Graphite	WAL05-02367-01	WAL05-02369-01	WAL05-02371-01
37	Disk Stem	304 Stainless Steel	WAL04-17333-00	WAL04-17340-00	WAL04-17344-00
38	Nut	C1018	WAL05-02973-00	WAL05-02973-00	WAL05-02974-00
39	Seat Ring	420 Stainless Steel	WAL04-11539-00	WAL04-11484-00	WAL04-11565-00
40	Body	Cast Iron	WAL04-00653-00	WAL04-00655-00	WAL04-00659-00
41	Cap	Cast Iron	WAL04-01325-00	WAL04-17339-00	WAL04-17346-00
42	Pipe Plug	12L14	WAL04-03769-00	WAL04-03769-00	WAL04-03769-00

***Table 4**. Types K1 and K4 Actuator Spring Kits*

PART NUMBER	NOTES	REVERSE SHUTOFF (AIR-TO-OPEN) BENCH RANGE				DIRECT SHUTOFF[1] (AIR-TO-CLOSE) BENCH RANGE				SPRING KIT INCLUDES:			
		Type K1		Type K4[2]		Type K1		Type K4		Spring			Other
		Code	Range	Code	Range	Code	Range	Code	Range	Quantity	Color	Part Number	
WAL36KIT100	3	36RA	6 to 15	- - - -	- - - -	36DA	3 to 12	- - - -	- - - -	6	Yellow	WAL05-12991-00	- - - -
WAL36KIT102	5	36RB	9 to 15	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	6	Yellow	WAL05-12992-00	- - - -
WAL36KIT104	4, 6	36RC	12 to 15	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	6	Red	WAL05-13090-01	- - - -
WAL36KIT108	4, 6	36RE	12 to 15	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	6	Green	WAL05-13085-00	WAL05-04889-00 (2) Bolts
WAL36KIT110	3	- - - -	- - - -	- - - -	- - - -	36DB	3 to 9	- - - -	- - - -	6	Metal	WAL05-05121-00	- - - -
WAL60KIT100	3, 6	60RG	12 to 15	- - - -	- - - -	60DG	3 to 7	- - - -	- - - -	6	Brown	WAL05-13093-01	- - - -
WAL60KIT102	3, 6	60RH	13 to 15	60RH	10 to 15	- - - -	- - - -	DH	3 to 8	4	Brown	WAL05-13093-01	- - - -
WAL60KIT104	7	- - - -	- - - -	60RQ	12 to 15	- - - -	- - - -	- - - -	- - - -	6	Black	WAL05-13097-00	WAL05-04889-00 (2) Bolts
WAL60KIT110	3	- - - -	- - - -	60RT	22 to 30	- - - -	- - - -	- - - -	- - - -	6	Brown	WAL05-13093-00	See details in Figure 5

1. For Direct Shutoff - Invert Springs, Piston and Diaphragm from Reverse Shutoff Actuator.
2. To convert a KI actuator to a K4 actuator you must add travel stop (WAL05-17362-00) into the actuator and vice versa.
3. Mounts using KKIT-1
4. For Type K1 only- Mounts using KKIT-2
5. For Types KI only - Mounts using KKIT-3
6. Includes J-Valve travel scale
7. For Type K4 only - Mounts using KKIT-1 and Spacer WAL04-17280-00

***Table 5**. Types K1 and K4 Actuator Connector Kits*

PART NUMBER	SIZE (NPS / DN)	ORIFICE	SEAT STYLE	FOR USE WITH		K KIT INCLUDES:		
				Type K1	Type K4	Stem Bolt	Bushing	Spacer
WALKKIT-1	1/2 to 4 / 15 to 100	All	All	X	X	WAL04-17277-00	WAL04-17278-00	- - - -
WALKKIT-2	1/2 to 2 / 15 to 50			X	- - - -	WAL04-17281-00	WAL04-17278-00	- - - -
WALKKIT-3	1/2 to 2 / 15 to 50			X	- - - -	WAL04-17281-00	WAL04-17278-00	WAL04-17280-00

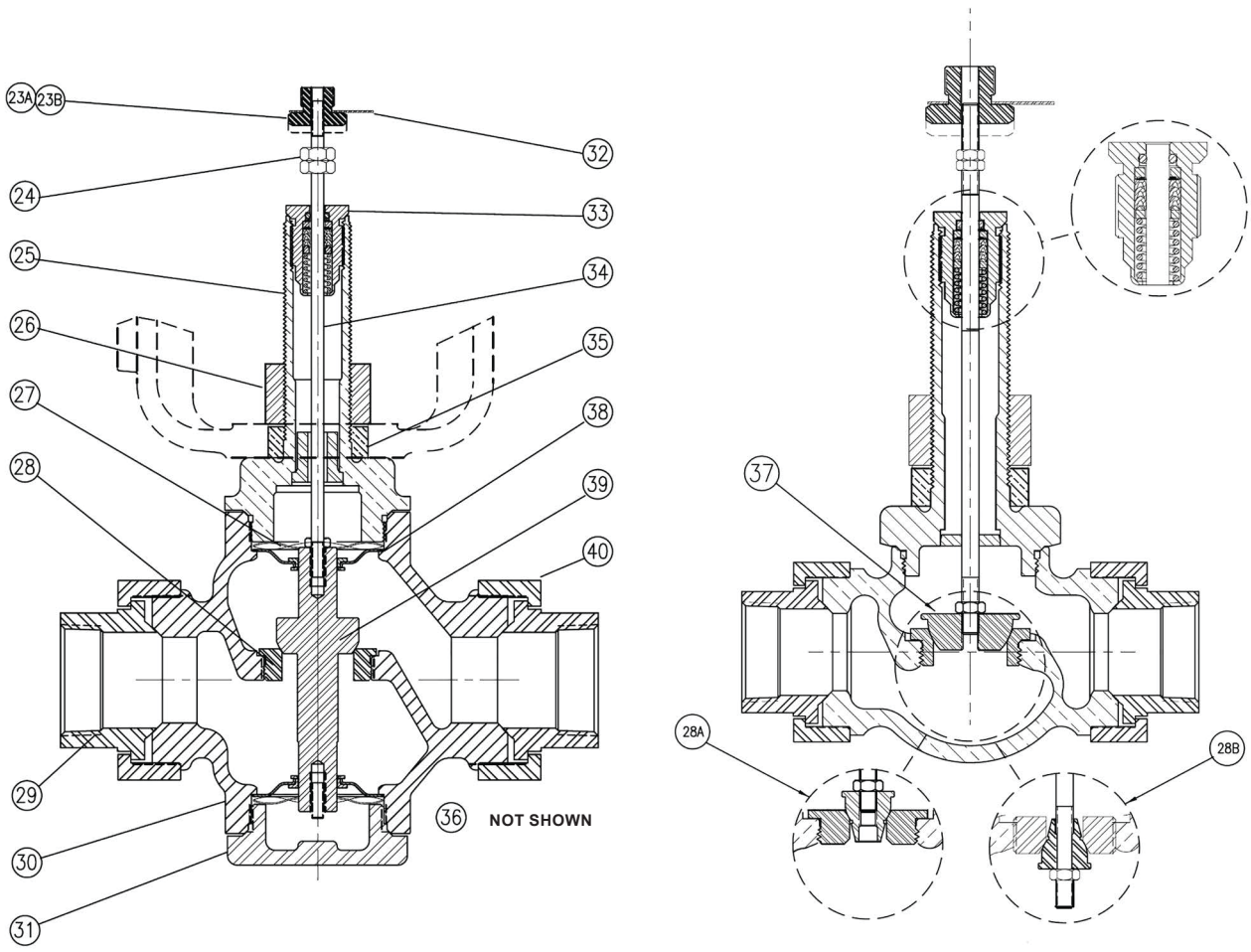

Figure 4. *Type K1 Control Valve Assembly Drawing*

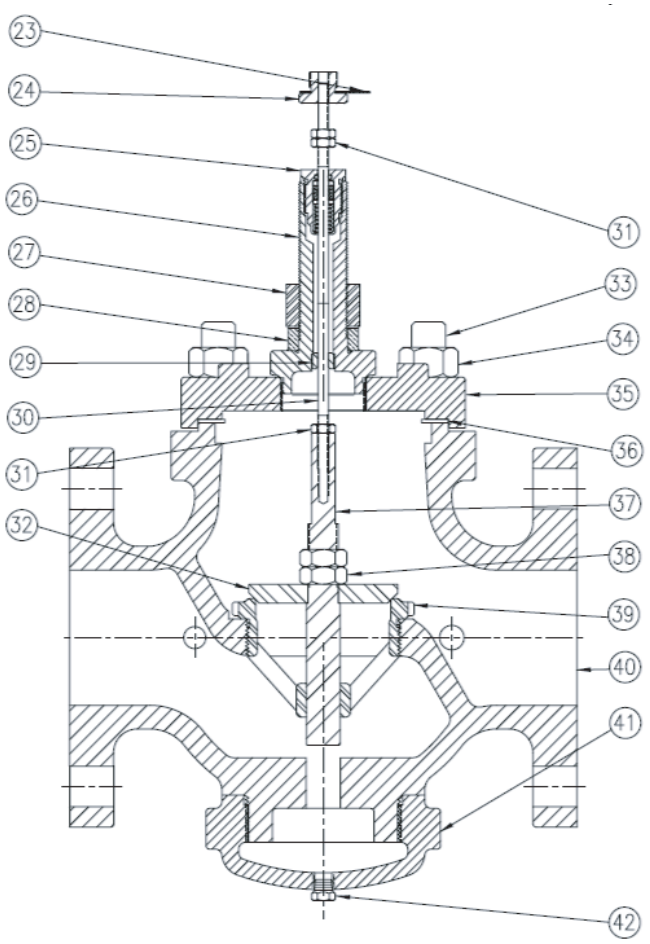

Figure 5. *Type K4 Control Valve Assembly Drawing*

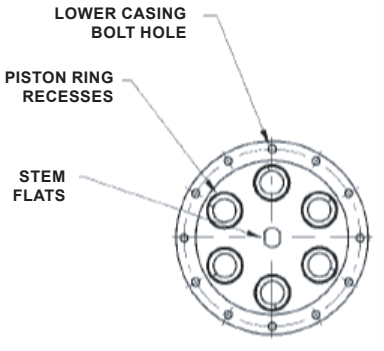

Figure 6. *Piston Diaphragm Assembly Drawing*

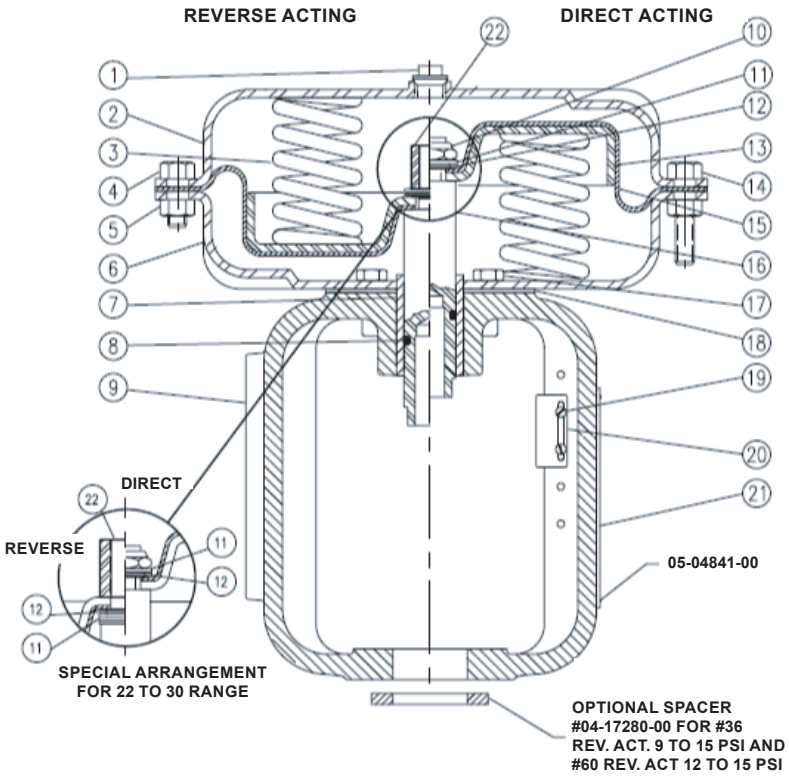

Figure 7. *Types K1 and K4 Actuator Assembly Drawing*

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SPENCE™

Spence Type K3 Control Valve

⚠ WARNING

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

Emerson Control Valve 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 control valve vents gas or a leak develops in the system, service to the unit may be required. Failure to correct trouble could result in a hazardous condition.

Installation, operation and maintenance procedures performed by unqualified personnel may result in improper adjustment and unsafe operation. Either condition may result in equipment damage or personal injury. Only a qualified person shall install or service the Type K3 control valve.

Figure 1. *Type K3 Control Valve*

Introduction

Scope of the Manual

This manual provides instructions for the installation, start-up, setting, maintenance, troubleshooting and parts ordering for Type K3 control valve.

Product Description

Type K3 control valve is designed for economical control of steam, water, gas and process applications in typical institutional, commercial and industrial processes. Type K3 is a three-way valve available with either a direct or reverse acting actuator that meets most mixing or diverting application requirements.

Specifications

This section lists the specifications for the Type K3. Factory specification are stamped on the nameplate fastened on the control valve at the factory.

Control Valve Type
Type K3: Three-way valve with union ends and pneumatic actuator

Control Valve Sizes
NPS 1/2, 3/4, 1, 1-1/4, 1-1/2 and 2 /
DN 15, 20, 25, 32, 40 and 50

Pressure and Temperature Chart(1)/
See Figure 2

Control Pressure Capabilities(1)
3 to 15 psi / 0.21 to 1.03 bar

End Connection Style
CL250

Flow Coefficient, C_v
NPS 1/2 / DN 15: 5.6
NPS 3/4 / DN 20: 7.1
NPS 1 / DN 25: 9.2
NPS 1-1/4 / DN 32: 22
NPS 1-1/2 / DN 40: 28
NPS 2 / DN 50: 35

Construction Materials
Body: Bronze
Seat: Stainless steel
Plug, Stem and Stem Assembly: Stainless steel
Stem Guide: Stainless steel, Monel or Brass
Actuator Casing: Steel
Actuator Spring: Steel Wire
Diaphragm: Nitrile (NBR)/Polyester
Yoke: Ductile Iron

Options
36 or 60 sq. in. / 0.02 or 0.04 sqm actuators
Electric Actuator

Applicable Codes
Meets or exceeds ANSI B16.15 Class 250
ANSI/FCI 70-2 Class IV Seat Leakage
Article 3, Section 3 of the
Pressure Equipment Directive.

Approximate Weight
See Table 1

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

Table 1. *Approximate Weight*

VALVE SIZE		36 in. sq / 0.02 sqm		60 in. sq / 0.04 sqm	
NPS	DN	lbs	kg	lbs	kg
1/2	15	28	12.7	41	18.6
3/4	20	28	12.7	41	18.6
1	25	27	12.3	40	18.2
1-1/4	32	35	15.9	48	21.8
1-1/2	40	37	16.8	50	22.7
2	50	42	19.1	55	25

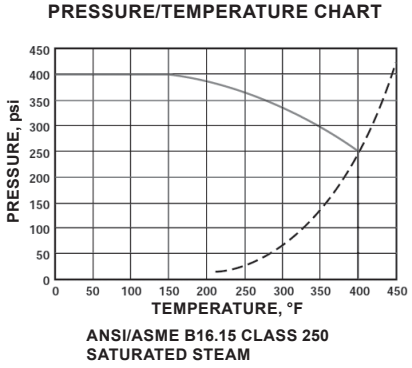

Figure 2. *Type K3 Pressure and Temperature Chart*

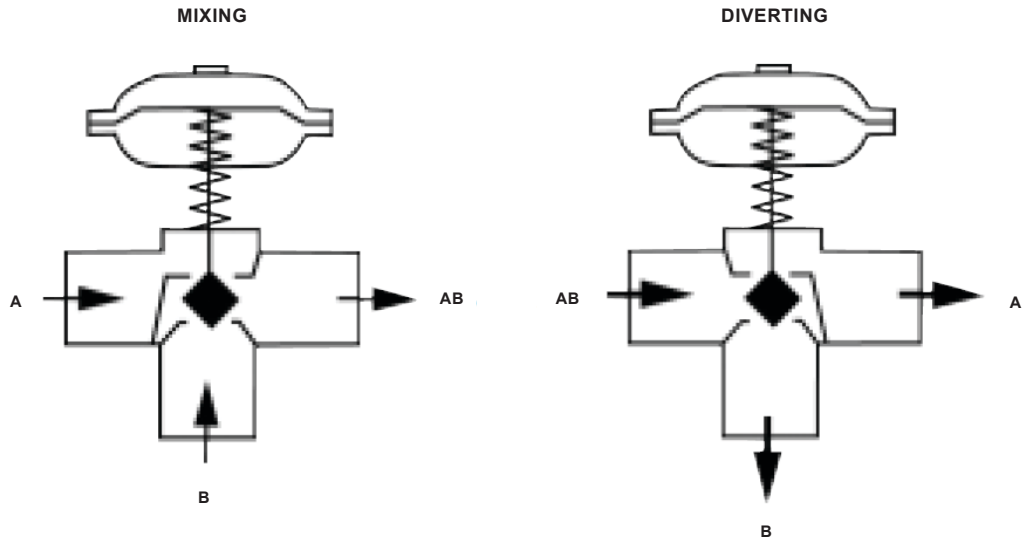

Figure 3. *Fluid Flow Direction for Mixing and Diverting Service*

Principle of Operation

Type K3 valve is a three-way, universal construction, globe style, pneumatic diaphragm control valve. The pneumatic actuator can be arranged as direct or reverse acting.

When selecting a direct acting actuator, upper port is failed closed on air loss. When selecting a reverse acting actuator, the lower port is failed closed on air loss. When used for mixing, the forces developed by the two inlet flows oppose each other and create a balanced environment. Thus, the actuator can control the flow efficiently without power lost to over come dynamic unbalance. When using the valve for diverting service, simply reverse the valve installation.

Installation

WARNING

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

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

All pressure equipment should be installed in a non-seismic area; should not be exposed to fire; and should be protected from thunderbolt (lightning) strikes.

CAUTION

The piping system must be adequately designed and supported to prevent extraordinary loads to the pressure equipment.

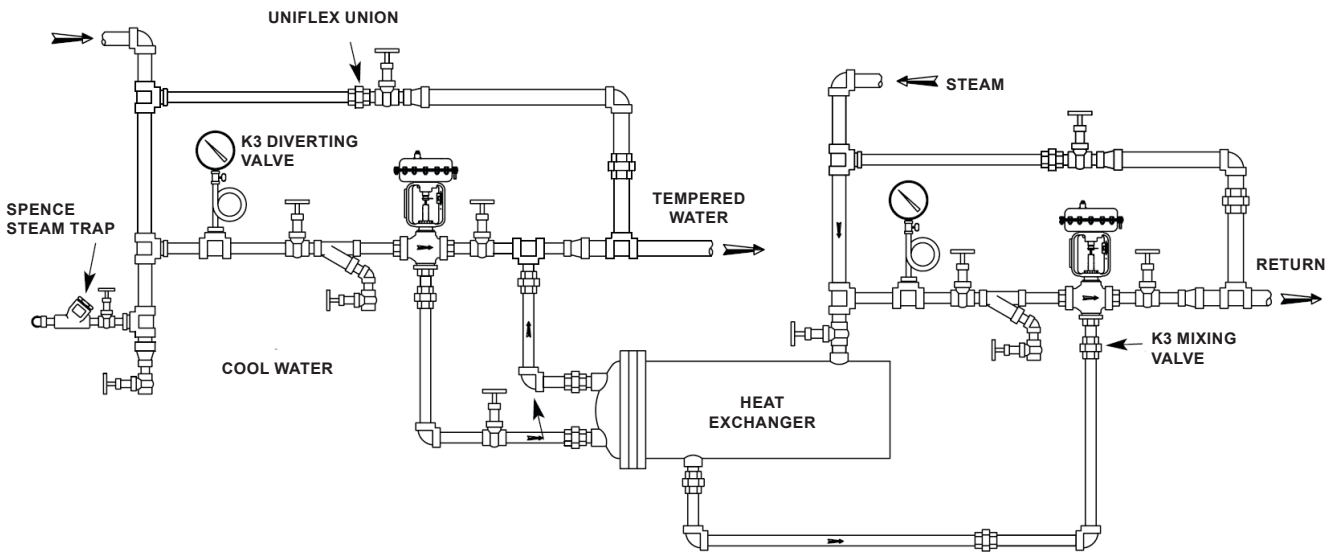

Figure 4. *Type K3 Control Valve Recommended Installation for Steam Application*

Planning

- Locate the valve in a straight run of horizontal pipe as shown in Figure 4. Mount the valve with the actuator in the upright position. Allow room for removal of the actuator.
- Prevent pipeline hammering in compressible fluid service by providing proper drainage before and after the valve.
- Avoid damaging effects of scale and dirt in pipelines by using a strainer.
- A three-valve by-pass to facilitate inspection and maintenance without interrupting service is recommended.
- To eliminate excessive noise with steam and other compressible fluids, enlarge the delivery pipe size to allow a reasonable flow velocity at the reduced pressure. A concentric transition is recommended.
- If possible, avoid sharp turns close to the valve.
- Install upstream and downstream pressure gauges to indicate performance.
- If the rating of the delivery system or connected equipment is less than the initial pressure, provide a safety relief valve.
- Use Uniflex Pipe Coupling for ease of maintenance. The spiral wound gasket provides a high performance seal similar to that of a flanged connection, yet retains the convenience of a ground joint union.

Start-up and Setting

WARNING

The valve may be handling hazardous fluids. Only qualified personnel, who are familiar with the installation, should be permitted to install, readjust, inspect or maintain the valve.

CAUTION

Insulation, may be applied to the valve body only. Do not insulate the bonnet.

1. Flush the piping system thoroughly to clear it of welding beads, scale, sand, etc.
2. Install the valve with the arrow on the side of the valve body pointing in the direction of fluid flow.

3. Install controller and accessories in accordance with instructions furnished by the manufacturer of these items.
4. Connect necessary air lines and/or electrical connections to the diaphragm chamber and valve mounted accessories. Use 1/4 in. / 6.35 mm outside diameter tubing for all air lines. If the length of the air line exceeds 25 ft / 7.62 m, use 3/8 in. / 9.53 mm outside diameter tubing.

Maintenance

WARNING

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 control valve from system pressure and relieving all internal pressure from the control valve.

Control valves 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 control valve.

Due to normal wear or damage that may occur from external sources, this control valve 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.

Removal of the Actuator from the Valve Body Assembly (Refer to Figures 5 to 6)

1. Close inlet and outlet stop valves.
2. Be sure valve body is not under pressure.
3. Remove all accessories from the control valve.

Reverse Acting Actuator

1. Loosen stem nuts (key 24) and move to approximately 1/3 down valve stem.
2. Retighten the stem nuts (key 31), being careful not to move valve stem.
3. Energize actuator with air to lift plug off seat.
4. Disengage lock nut (26) from bonnet (key 25).
5. De-energize actuator.
6. Move the actuator and yoke away from bonnet.
7. Lift actuator and yoke assembly along with plug (key 39) off the seat.
8. With an adjustable wrench, unthread valve stem from the actuator stem (key 16) until valve stem is dise ngaged from actuator stem.
9. Remove stem nuts, indicator and lock nut.

Direct Acting Pneumatic Actuator

1. Energize actuator with air slightly (in case of back seating).
2. Loosen stem nuts (key 24) and re-tighten approximately 1/8 in. / 3.18 mm away from actuator stem (key 16).
3. Disengage lock nut (key 26) from bonnet (key 25). With an adjustable wrench, unscrew valve stem from actuator stem.
4. When valve stem reaches seat, lift actuator (to prevent galling the seat and plug).
5. Remove stem nuts, indicator and lock nut.

Disassembly of the Valve Body

1. Remove stem nuts (key 24), indicator (key 32) and lock nut (key 26).
2. Lift yoke off bonnet (key 25).
3. To complete body disassembly, unscrew bonnet for Type K3. Turn stem and plug assembly out of bonnet through packing.
4. Replace packing if necessary.
5. Inspect all parts for wear and clean thoroughly before re-assembling valve body.

Disassembly of the Actuator

1. Remove actuator from the valve.
2. Remove regular casing bolts (key 4) and casing nuts (key 5).
3. Gradually loosen nuts on the remaining long casing bolts (key 14) to allow pre-compression of actuator springs.
4. Remove upper casing (key 2).
5. Pull actuator stem (key 16), along with diaphragm (key 15), springs (key 3) and piston (key 13), out through bushing (key 7).
6. Place a wrench on machined flats of the actuator stem and remove stem nut (key 10), seal washer (key 12) and stem washer (key 11).
7. Remove o-ring (key 8) from the bushing and replace if necessary. Lubricate o-ring after installing.

Reassembly of the Actuator

1. Refer to Figures 5 and 6 for correct orientation of casings, diaphragm (key 15), piston (key 13), stem (key 16) and springs (key 3) for direct or reverse action.
2. Be sure that piston spring recesses line up between casing ribs as shown in Figure 7.
3. Lubricate bushing o-ring (key 8) and insert actuator stem through the bushing.
4. Reattach upper casing (key 2) with long bolts (key 14) and nuts (key 5), tightening alternately.
5. Install remaining casing nuts and bolts.
6. Apply air to diaphragm case and check for leakage, full travel and dead band less than 0.2 psi./ 0.14 bar

Lapping Plug into the Seat

CAUTION

Seats and plugs should never require more than the lightest touch up with very fine (400 grit) grinding compound. Heavy lapping will produce galling, a wider seating surface and a groove in the plug, all of which tend to cause leakage.

1. Reface a damaged surface before attempting to grind it in. Lap sparingly.
2. Replace stem and plug assembly (key 39) in bonnet (key 25) through packing .
3. Apply lapping compound to the plug.
4. Place bonnet on the body.
5. After lapping, disassemble and clean all parts thoroughly.

Packing Replacement

1. Check stem for gouges if packing leaks.
2. Install replacement packing cartridges.

Reassembly of Valve Body

1. Insert plug and then tighten bonnet (key 25) to body. Note that “R” on body must be up for sizes NPS 1/2 to 1 / DN and the “D” up for sizes NPS 1-1/4 to 2 / DN.
2. Install Inlet (key 42).
3. Replace yoke (key 9), lock nut (key 26), stem nuts (key 24) and travel indicator (key 32) over stem (key 34).

Replacing the Actuator on the Valve Body - Pneumatic

1. Put actuator assembly over the valve stem.
2. Place lock nut (key 26) and stem nuts (key 24) with travel indicator (key 32) on valve stem.
3. Rest actuator stem (key 16) on valve stem.
4. Tighten stem nuts approximately 2/3 down valve stem.
5. Lift actuator assembly and engage valve stem with actuator stem (be careful not to gall the plug and seat).

Reverse Acting

1. When sufficient engagement is met, actuator can be energized with air to place yoke on the bonnet (key 25) and lift plug off the seat.
2. Tighten lock nut and packing nut.

Direct Acting

1. Engage valve stem with actuator stem so no contact is made between plug and seat when the bottom of the yoke is rested on the bonnet.
2. Tighten lock nut.

Actuator Adjustment - Pneumatic

1. Close inlet and outlet stop valves. Be sure valve body is not under pressure.
2. Place wrench on machined flats of actuator stem (key 16). Counter two stem nuts (key 24) approximately halfway down the threads of the stem (key 34).

Reverse Acting

1. Apply sufficient air pressure to diaphragm case to start moving the valve through its rated travel. This is shown by the travel indicator (key 32).
2. Engage lower stem nut (key 24) and turn body stem (key 34) into actuator stem (key 16) until pre-compression of actuator springs (key 3) is relieved.

Note

Plug should not be seating on seat ring when air pressure is removed from actuator case.

3. Apply prescribed setting pressure to actuator. This is determined by specific operating conditions.
4. Turn body out of actuator stem until plug seats on seat ring (key 28). To prevent galling, do not turn bidy stem after plug has contacted seat ring. Turn stem nuts up plug and stem assembly and tighten to lock it in position.
5. Reduce air signal to 0 psi/bar and calibrate indicator scale (key 20). Check that full travel is achieved with a 15 psi signal, except for 22 to 30 psi / 1.52 to 2.07 bar springs.

Direct Acting

1. Engage lower stem nut (key 24) and turn body stem (key 34) into actuator stem (key 16) until plug and stem assembly stops at upper limit of travel and/or a slight downward movement of actuator stem is detected.
2. Turn stem nut up the body stem and tighten to lock in position.
3. Calibrate indicator scale (key 20). Check that full travel is achieved at a 3 psi signal.

Troubleshooting

WARNING

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

Control valves 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 control valve.

To troubleshoot the valve and actuator, check for the following: change in operating conditions; pneumatic signal failure; diaphragm failure; foreign matter lodged between seat ring and plug; actuator vent plug may be: plugged, missing, replaced with a solid plug; packing leakage.

Parts Ordering

When corresponding with your local Sales Office about this equipment, always reference the equipment valve size, service and serial number.

When ordering replacement parts, reference the key number of each needed part as found in the following parts list and indicate the part number. Separate kits containing all recommended spare parts are available.

Parts List

Valve Body Assembly (See Table 2, Figure 5)

Actuator Parts (Figure 6)

Key	Description	Part Number
	Repair Part Kit	
	36 sq. in. / 0.02 sqm	WAL51447
	60 sq. in. / 0.04 sqm	WAL51448
	Actuators and Spring Kit	See Table 3
	Actuator Connector Kits	See Table 4
1	Vent Plug, High-density polyethylene	
2	Upper Casing, Steel/powder	
3	Springs, Steel	
4	Casing Bolt, Standard, 10/14 required, 304 Stainless steel	
5	Casing Nut, 12/16 required, 316 Stainless steel	
6	Lower Casing, Steel/powder	
7	Bushing, Bronze	
8*	Oring, Nitrile	WAL05-04017-00
9	Yoke, Cast Iron/Powder	
10'	Stem Nut, Steel	WAL05-13374-00
11*	Stem Washer, 1/3 required, 316 Stainless steel	WAL05-12963-00
12*	Seal Washer, Steel	WAL05-13203-00
13	Piston, 316 Stainless steel	
14*	Casing Bolt, Long, 2 required, 304 Stainless steel	WAL05-04889-00
15*	Diaphragm, Nitrile	
	36 sq. in. / 0.02 sqm	WAL05-12968-00
	60 sq. in. / 0.04 sqm	WAL05-12986-00
16	Actuator Stem, 303 Stainless steel	
17	Machine Screw, 3 required, Steel	
18	Casing Gasket, Nitrile	WAL05-12566-00
19	Machine Screw, 2 required, Steel	
20*	Indicator Scale, Aluminum	WAL05-17470-00
21*	Specification Plate, Aluminum	WAL05-13199-00

*These parts furnished in Actuator Repair Kit.

***Table 2**. Type K3 Valve Body Assembly Parts List*

ITEM	PART NAME	QUANTITY	MATERIAL	NPS 1/2 / DN 15	NPS 3/4 / N 20	NPS 1 / DN 25	NPS 1-1/4 / DN 32	NPS 1-1/2 / DN 40	NPS 2 / DN 50
23A[1]	Stem Bolt - Short	1	Brass	WAL04-17277-00	WAL04-17277-00	WAL04-17277-00	WAL04-17277-00	WAL04-17277-00	WAL04-17277-00
23B[2]	Stem Bolt - Long	1	Brass	WAL04-17281-00	WAL04-17281-00	WAL04-17281-00	WAL04-17281-00	WAL04-17281-00	WAL04-17281-00
24	Stem Nut	2	Brass	WAL05-17342-00	WAL05-17342-00	WAL05-17342-00	WAL05-17342-00	WAL05-17342-00	WAL05-17342-00
25	Bonnet	1	Brass	WAL558B107-02	WAL558B107-02	WAL558B107-02	WAL558B110-02	WAL558B110-02	WAL558B110-02
26	Lock Nut	1	Stainless steel	WAL05-17330-00	WAL05-17330-00	WAL05-17330-00	WAL05-17330-00	WAL05-17330-00	WAL05-17330-00
27	Wave Washer	1	Stainless steel	WAL122A155-01	WAL122A155-01	WAL122A155-01	WAL122A155-01	WAL122A155-01	WAL122A155-01
28	Seat	1	Stainless steel	WAL562A114-01	WAL562A114-01	WAL562A114-01	WAL562A114-03	WAL562A114-04	WAL562A114-05
29	Union Tailpiece	3	Galvanized Iron	WALSZ227	WALSAA227	WALSMP463	WALSBB227	WALSMP465	WALSMP593
30	Body	1	Bronze	WALSAM1167B	WALSAM1167B	WALSAM1167B	WALSAN1167B	WALSAN1167B	WAL564B116-01
31	Adapter	1	Stainless Steel	WAL141A166	WAL141A166	WAL141A166	WAL141A166	WAL141A166	WAL141A166
32	Travel Indicator	1	Aluminum	WAL05-12962-00	WAL05-12962-00	WAL05-12962-00	WAL05-12962-00	WAL05-12962-00	WAL05-12962-00
33	V-ring Packing Set	1	TFE/Stainless steel/Viton	WAL204A104-01	WAL204A104-01	WAL204A104-01	WAL204A104-01	WAL204A104-01	WAL204A104-01
34	Stem	1	Stainless steel	WAL552A110-03	WAL552A110-03	WAL552A110-03	WAL552A14-03	WAL552A14-03	WAL552A14-03
35	Yoke Bushing	1	Brass	WAL04-17278-00	WAL04-17278-00	WAL04-17278-00	WAL04-17278-00	WAL04-17278-00	WAL04-17278-00
36	Spacer	1	Brass	WAL04-17280-00	WAL04-17280-00	WAL04-17280-00	WAL04-17280-00	WAL04-17280-00	WAL04-17280-00
37	Bonnet Guide	1	Brass	WAL556A113-01	WAL556A113-01	WAL556A113-01	WAL556A113-01	WAL556A113-01	WAL556A113-01
38	Guide	1	Stainless steel	WAL556A111-01	WAL556A111-01	WAL556A111-01	WAL556A111-02	WAL556A111-02	WAL556A111-02
39	Plug	1	Stainless steel	WAL554A151-01	WAL554A151-01	WAL554A151-02	WAL554A151-03	WAL554A151-04	WAL554A151-05
40	Union Unit	3	Galvanized Iron	WALSMP468	WALSMP468	WALSMP468	WALSMP470	WALSMP470	WALSMP592
41	Guide	1	Brass	WALSK832	WALSK832	WALSK832	WALSL832	WALSL832	WALSM832
42	Inlet	1	Bronze	WAL562B105-01	WAL562B105-01	WAL562B105-02	WAL562B106-01	WAL562B106-02	WAL562B106-03

1. Not included in body assembly; order K-KIT separately.
2. Not included in body assembly: order separately.

***Table 3**. Type K3 Actuator Spring Kit*

PART NUMBER	NOTES	REVERSE - LOWER PORT NORMALLY CLOSED				DIRECT[1] - UPPER PORT NORMALLY CLOSED				SPRING KIT INCLUDES:			
		7/32 In. Travel		1/2 In. Travel		7/32 In. Travel		1/2 In. Travel		Spring			Other
		Code	Range	Code	Range	Code	Range	Code	Range	Quantity	Color	Part Number	
WAL36KIT098	2	- - - -	- - - -	- - - -	- - - -	36DM	4.5 to 13.5	- - - -	- - - -	6	Silver	WAL05-05007-00	- - - -
WAL36KIT100	2	36RA	5.5 to 12.5	- - - -	- - - -	36DA	6 to 12	- - - -	- - - -	6	Yellow	WAL05-12991-00	- - - -
WAL36KIT102	2	36RB	6.5 to 11.5	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	6	Yellow	WAL05-12992-00	- - - -
WAL36KIT104	3	36RC	8 to 11	36RC	5.5 to 12.5	- - - -	- - - -	36DC	6 to 12	6	Red	WAL05-13090-01	- - - -
WAL36KIT106	2	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	36DD	7 to 11	4	Red	WAL05-13090-01	- - - -
WAL36KIT108	3	- - - -	- - - -	36RE	7.5 to 10.5	- - - -	- - - -	- - - -	- - - -	6	Green	WAL05-13085-00	05-04889-00 (2) Bolts
WAL60KIT100	4	- - - -	- - - -	60RG	7.5 to 12	- - - -	- - - -	60DG	7 to 11	6	Brown	WAL05-13093-01	- - - -
WAL60KIT102	3	- - - -	- - - -	60RH	8 to 11	- - - -	- - - -	- - - -	- - - -	4	Brown	WAL05-13093-01	- - - -

1. For Direct Shutoff - Invert Springs, Piston and Diaphragm from Reverse Shutoff Actuator.
2. Mounts using KKIT-1
3. Mounts using KKIT-2
4. Mounts using KKIT-4

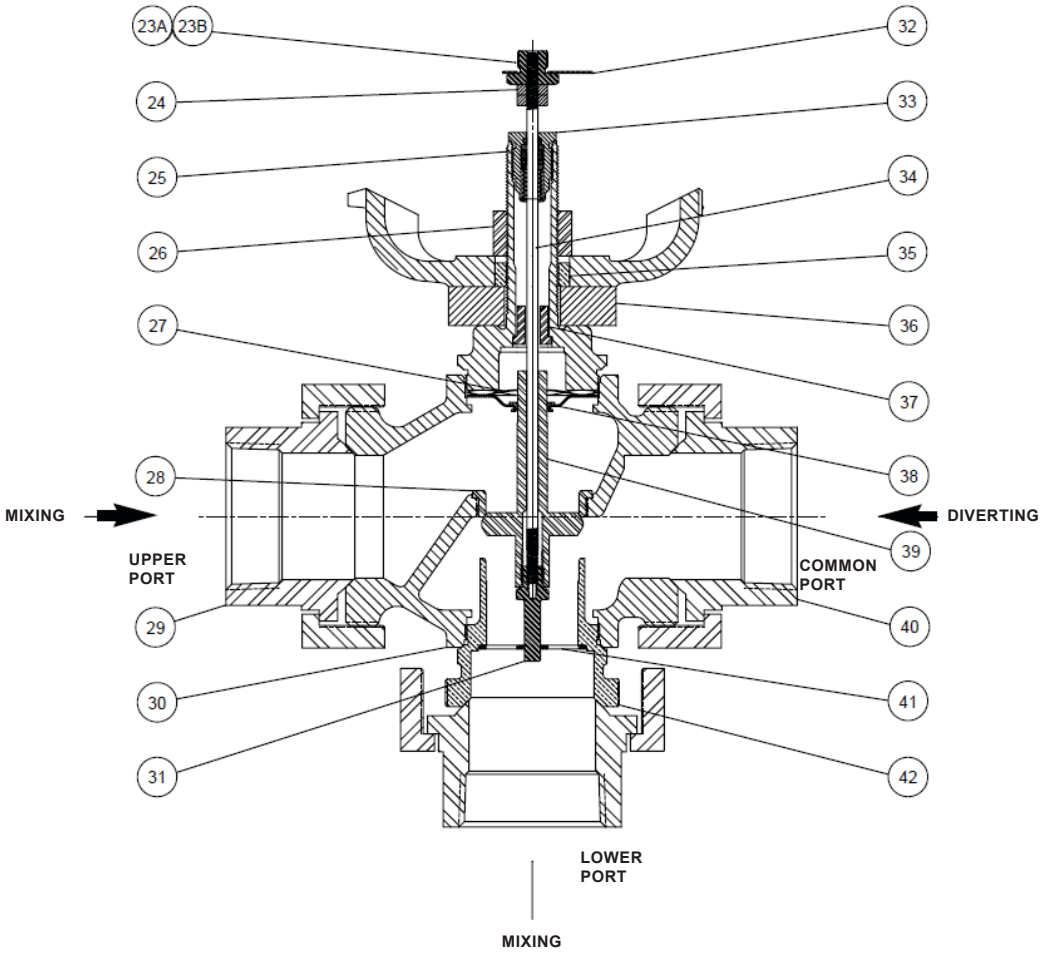

Figure 5. *Type K3 Control Valve Assembly Drawing*

Table 4*. Type K3 Actuator Connector Kits*

PART NUMBER	SIZE	K-KIT INCLUDES		
		Stem Bolt	Bushing	Spacer
WALKKIT-1	NPS 1/2 to 2 / DN 15 to 50	WAL04-17277-00	WAL04-17278-00	----------
WALKKIT-2	NPS 1/2 to 2 / DN 15 to 50	WAL04-17281-00	WAL04-17278-00	----------
WALKKIT-4	NPS 1/2 to 2 / DN 15 to 50	WAL04-17277-00	WAL04-17278-00	WAL04-17280-00

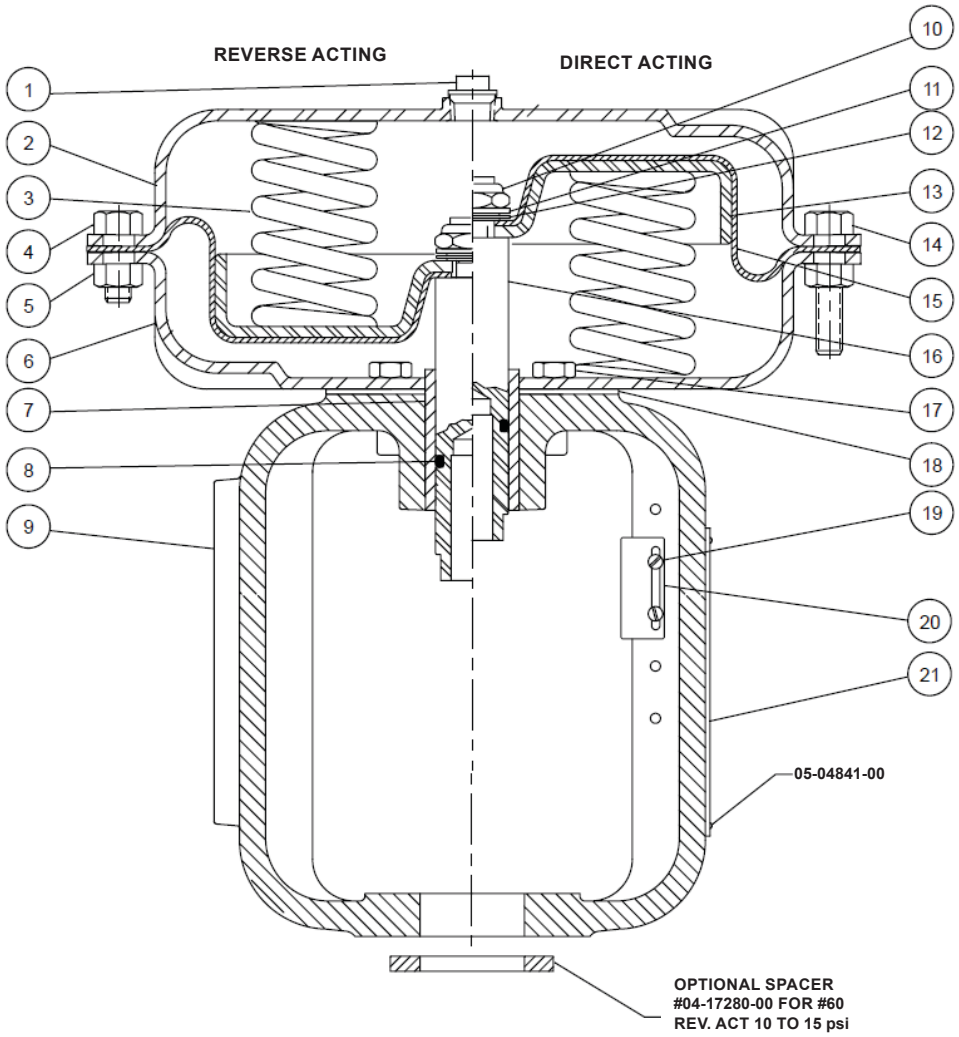

Figure 6. *Type K3 Actuator Assembly Drawing*

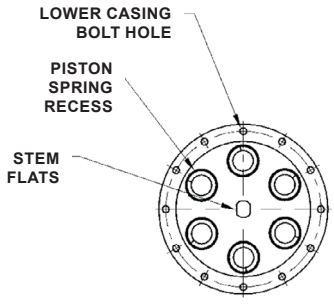

Figure 7. *Piston Diaphragm Assembly Drawing*

Type K3

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SD8013

SPENCE™

Spence Type J Control Valve

⚠ WARNING

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

Emerson Control Valve 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 control valve vents gas or a leak develops in the system, service to the unit may be required. Failure to correct trouble could result in a hazardous condition.

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

Introduction

Scope of the Manual

This manual provides instructions for the installation, start-up, setting, maintenance, troubleshooting and parts ordering for Type J control valve.

Product Description

Type J control valve is a single-seated, top-guided compact pneumatic globe control valve with a streamlined body designed for steam, water, gas and process applications in typical institutional, commercial and industrial processes. Type J is available with either a direct or reverse acting actuator and meets most installation requirements.

Figure 1. *Type J Control Valve*

The actuator is made of stainless steel hardware with a maximum deadband of 0.3 psig / 0.02 bar. The valve trim is made of 316 stainless steel with replaceable threaded seats for easy maintenance. Standard packing is spring-loaded Teflon V-Rings. Optional graphite or high temperature packing is available. The valve conforms to NEMUR 4 for mounting of accessories.

Principle of Operation

The Type J Control Valve is a flow-to-open, globe style, pneumatic diaphragm actuated control valve. It can be arranged to operate with either air-to-close or air-to-open control.

A controller sensing the controlled variable provides an air signal to the actuator of the control valve to obtain the desired control.

Type J

Specifications

This section lists the specifications for the Type J Control Valve. Factory specification are stamped on the nameplate fastened on the control valve at the factory.

Control Valve Types
Type J1: Cast Iron
Type J3: Stainless steel

Valve Sizes
NPS 1/2, 3/4, 1, 1-1/2 and 2 / DN 15, 20, 25, 40 and 50

Pressure and Temperature Chart(1)
See Figure 2

End Connection Styles
NPT, CL150, CL300 and CL600

Flow Coefficient, C_v
NPS 1/2 / DN 15: 5.1
NPS 3/4 / DN 20: 10.3
NPS 1 / DN 25: 18.2
NPS 1-1/2 / DN 40: 37
NPS 2 / DN 50: 67

Construction Materials
Body: Stainless steel or Cast iron
Seat Ring: Stainless steel
Packing: PTFE V ring, PTFE/Graphite or Graphite
Plug and Stem Assembly: Stainless steel
Yoke: Ductile iron
Diaphragm: Nitrile/Polyester
Piston: Stainless steel
Spring: Steel wire
Actuator Housing: Steel

Options
36 or 60 sq. in. / 0.02 or 0.04 sqm actuators
Soft Seats- 450°F / 232°C
Moore, PMV, Eckardt Positioner Accessories

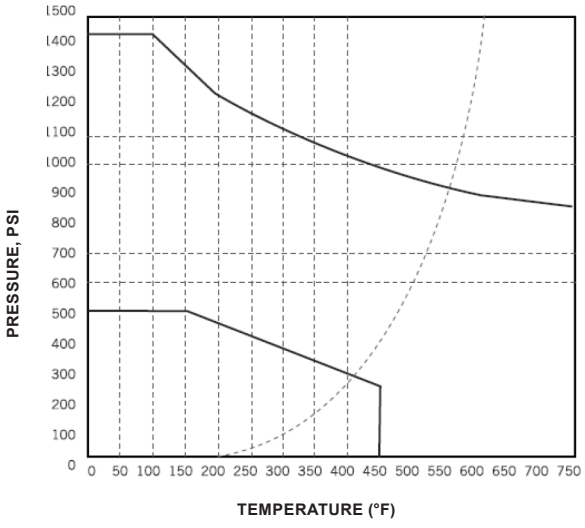
Approximate Weight
See Table 1

Seat Leakage Classifications
Metal Seats: ANSI/ISA 70-2 Class IV
Teflon Soft Seats: Class VI

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

Table 1. *Approximate Weight*

VALVE SIZE		SCREWED				FLANGED			
		36 in. sq / 0.02 sqm		60 in. sq / 0.04 sqm		36 in. sq / 0.02 sqm		60 in. sq / 0.04 sqm	
NPS	DN	lbs	kg	lbs	kg	lbs	kg	lbs	kg
1/2	15	20.5	9.3	36.5	16.6	23.5	10.7	39.5	17.9
3/4	20	20.5	9.3	36.5	16.6	25.75	11.7	41.75	18.9
1	25	22.5	10.2	38.75	17.6	29.0	13.2	45.25	20.5
1-1/2	40	29.25	13.3	45.5	20.6	40.25	18.3	57.5	26.1
2	50	38.25	17.3	54.25	24.6	50.25	22.8	68.25	31.0



– Saturated Steam
– J1 ANSI/ASME B16.1 Cast Iron
– J3 ANSI/ASME B16.34 Class 600 Stainless Steel

Figure 2. *Type J Pressure and Temperature Chart*

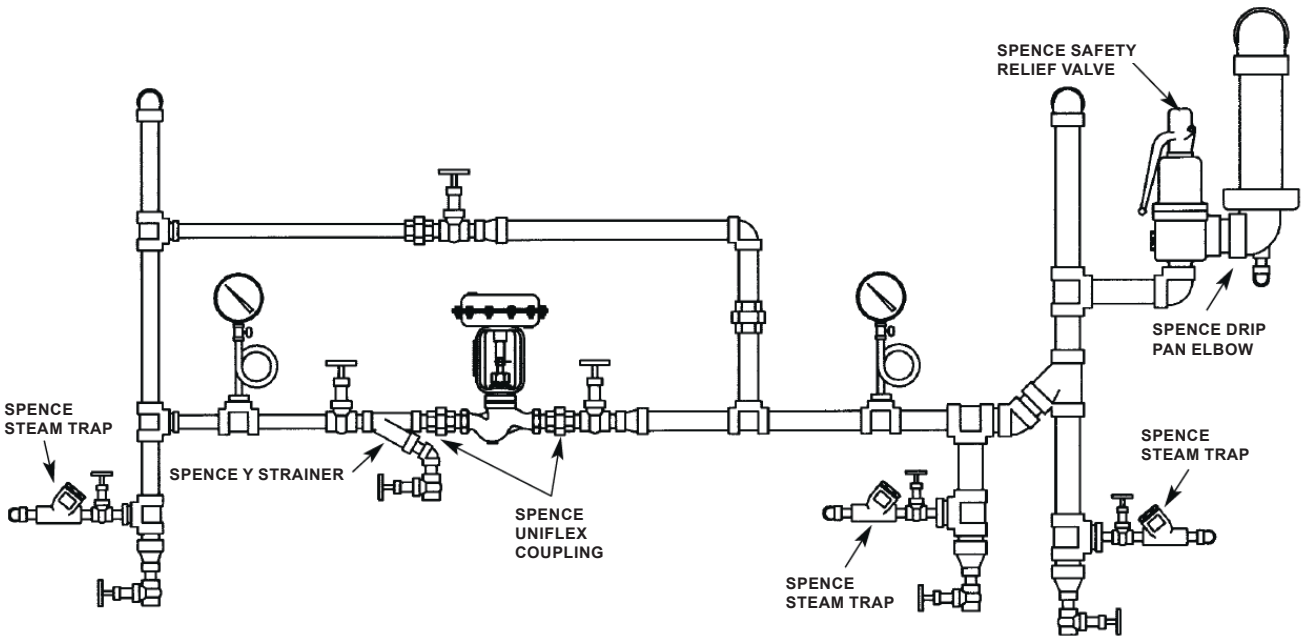


Figure 3. *Type J Control Valve Recommended Installation for Steam Application*

Installation

⚠ WARNING

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

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

All pressure equipment should be installed in a non-seismic area; should not be exposed to fire; and should be protected from thunderbolt (lightning) strikes.

Planning

- Locate the valve in a straight run of horizontal pipe as shown in Figure 3. Mount the valve with the actuator in the upright position. Allow room for removal of the actuator.
- Prevent pipeline hammering in compressible fluid service by providing proper drainage before and after the valve.
- Avoid damaging effects of scale and dirt in pipelines by using a strainer.
- A 3-valve by-pass to facilitate inspection and maintenance without interrupting service is recommended.
- To eliminate excessive noise with steam and other compressible fluids, enlarge the delivery pipe size to allow a reasonable flow velocity at the reduced pressure. A concentric transition is recommended.
- If possible, avoid sharp turns close to the valve.
- Install upstream and downstream pressure gauges to indicate performance.
- If the rating of the delivery system or connected equipment is less than the initial pressure, provide a safety relief valve.
- Use Pipe Coupling for ease of maintenance. The spiral wound gasket provides a high performance seal similar to that of a flanged connection, yet retains the convenience of a ground joint union.

Start-up and Setting

WARNING

The valve may be handling hazardous fluids. Only qualified personnel, who are familiar with the installation, should be permitted to install, readjust, inspect or maintain the valve.

CAUTION

Insulation, may be applied to the valve body only. Do not insulate the bonnet.

1. Flush the piping system thoroughly to clear it of welding beads, scale, sand, etc.
2. Install the valve with the arrow on the side of the valve body pointing in the direction of fluid flow. Screwed end valves should be mounted between unions.
3. Install controller and accessories in accordance with instructions furnished by the manufacturer of these items.
4. Connect necessary air lines and/or electrical connections to the diaphragm chamber and valve mounted accessories. Use 1/4 in. / 6.35 mm outside diameter tubing for all air lines. If the length of the air line exceeds 25 ft / 7.62 m, use 3/8 in. / 9.53 mm outside diameter tubing.

Maintenance

WARNING

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 control valve from system pressure and relieving all internal pressure from the control valve.

Control valves 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 control valve.

Due to normal wear or damage that may occur from external sources, this control valve 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.

Removal of the Actuator from the Valve Body Assembly (Refer to Figures 4 and 7)

Remove all accessories from the control valve.

Reverse Acting Actuator

1. Loosen stem nuts (key 31) and move to approximately 1/3 down valve stem.
2. Retighten the stem nuts (key 31), being careful not to move valve stem.
3. Energize actuator with air to lift plug off seat.
4. Disengage packing nut (key 32) and lock nut (key 33) from bonnet (key 25).
5. De-energize actuator.
6. Move the actuator and yoke away from bonnet.
7. Lift actuator and yoke assembly along with plug and stem assembly (key 27) off seat.
8. With a 1/4 ft / 76.2 mm wrench, unthread valve stem from the actuator stem (key 16) until valve stem is dise ngaged from actuator stem.
9. Remove stem nuts, indicator, packing nut and lock nut.

Direct Acting Actuator

1. Energize actuator with air slightly (in case of back seating).
2. Loosen stem nuts (key 31) and re-tighten approximately 1/8 in. / 3.18 mm away from actuator stem (key 16).
3. Disengage packing nut (key 32) and lock nut (key 33) from bonnet (key 25). With a 1/4 ft / 76.2 mm wrench, unscrew valve stem from actuator stem.
4. When valve stem reaches seat, lift actuator (to prevent galling the seat and plug).
5. Remove stem nuts, indicator, packing nut and lock nut.

Disassembly of the Valve Body

1. Remove stem nuts (key 31), indicator (key 22), packing nut (key 32) and lock nut (key 33) as shown in Figure 4.
2. Lift yoke off the bonnet (key 25).
3. Remove bonnet bolts (key 23) and lift off bonnet flange (key 24), bonnet and stem and plug assembly (key 27).
4. Remove gasket (key 26). A new gasket should be installed each time the valve body is disassembled.
5. Turn stem and plug assembly out of the bonnet through packing.
6. Replace packing if necessary.
7. All parts should be inspected for wear and cleaned thoroughly before reassembling the valve body.

Disassembly of the Actuator

1. Remove actuator from the valve.
2. Remove regular casing bolts (key 4) and casing nuts (key 5).
3. Gradually loosen nuts on the remaining long casing bolts (key 14) to allow pre-compression of actuator springs.
4. Remove upper casing (key 2).
5. Pull actuator stem (key 16), along with diaphragm (key 15), springs (key 3) and piston (key 13), out through bushing (key 7).
6. Place a wrench on machined flats of the actuator stem and remove stem nut (key 10), seal washer (key 12) and stem washer (key 11).
7. Remove O-ring (key 8) from the bushing and replace if necessary. Lubricate O-ring after installing.

Reassembly of the Actuator

1. Refer to Figure 4 for correct orientation of casings, diaphragm (key 15), piston (key 13), stem (key 16) and springs (key 3) for direct or reverse action.
2. Be sure that piston spring recesses line up between casing ribs as shown in Figure 8B for all springs except 05-13085-00 and 05-13097-00 which are assembled per Figure 8A.
3. Note that seal washer rings and stem washer are below the diaphragm for 8 to 15 psi / 0.55 to 1.03 bar on the 36 sq.in. / 0.02 sqm actuator as shown in Figure 9. For all other springs, the seal and stem washers are assembled above the diaphragm.
4. Lubricate bushing O-ring (key 8) and insert actuator stem through the bushing.
5. Reattach upper casing (key 2) with long bolts (key 14) and nuts (key 5), tightening alternately.
6. Install remaining casing nuts and bolts.

Lapping Plug into the Seat

CAUTION

Seats and plugs should never require more than the lightest touch up with very fine (400 grit) grinding compound. Heavy lapping will produce galling, a wider seating surface and a groove in the plug, all of which tend to cause leakage.

1. Remove old packing from the packing box with a hook type tool or with compressed air in the body.
2. Reface a damaged surface before attempting to grind it in. Lap sparingly.
3. Replace stem and plug assembly (key 27) in bonnet (key 25) through packing.
4. Apply lapping compound to the plug.
5. Place bonnet and bonnet flange (key 24) on the body and tighten bonnet bolt (key 23) finger tight. Do not tighten packing nut (key 32) during the lapping operation.
6. After lapping, disassemble and clean all parts thoroughly.

Packing Replacement

For the Teflon V-ring Packing

1. Install the spring, washer, and packing onto plug and stem assembly on valve sub-assembly.
2. Install O-ring followed by the packing follower and packing nut.
3. Lubricate O-ring with silicone lubricant.

For the Graphite and Hi-temp Graphite Packing

CAUTION

Stem should not be stroked without packing nut being tightened or packing O-ring may become dislodged. Forcing stem threads through installed packing will damage packing.

1. Install packing O-ring followed by a washer onto plug and stem assembly on valve sub-assembly.
2. Lubricate O-ring with silicone lubricant.
3. Use a 1/4 in. / 6.35 mm schedule 40 pipe to firmly seat the O-ring into the O-ring groove.
4. Install remaining packing, packing follower, and packing nut referring to Figure 5.

Reassembly of the Valve Body

1. Install a new gasket (key 26).
2. Attach bonnet (key 25) and bonnet flange (key 24) to body with bonnet bolts (key 23). Be sure to tighten bolts alternately and evenly to ensure proper seating of the plug.
3. Replace yoke (key 9), lock nut (key 33), packing nut (key 32), stem nuts (key 31), travel indicator (key 22), over plug and stem assembly (key 27).

Replacing the Actuator on the Valve Body

1. Put actuator assembly over the valve stem.
2. Place lock nut (key 33), packing nut (key 32) and stem nuts (key 31) with travel indicator (key 22) on valve stem.
3. Rest actuator stem (key 16) on valve stem.
4. Tighten stem nuts approximately 2/3 down valve stem.
5. Lift actuator assembly and engage valve stem with actuator stem (be careful not to gall the plug and seat).

Reverse Acting

When sufficient engagement is met, actuator can be energized with air to place yoke on the bonnet (key 25) and lift plug off the seat. Tighten lock nut and packing nut.

Direct Acting

Engage valve stem with actuator stem so no contact is made between plug and seat when the bottom of the yoke is rested on the bonnet. Tighten lock nut and packing nut.

Actuator Adjustment

1. Close inlet and outlet stop valves. Be sure valve body is not under pressure.
2. Place wrench on machined flats of actuator stem (key 16). Turn stem nuts (key 31) approximately halfway down threads of plug and stem assembly (key 27) and counter the two nuts.

Reverse Acting

1. Apply sufficient air pressure to diaphragm case to start moving the valve through its rated travel. This is shown by the travel indicator (key 22).
2. Engage lower stem nut (key 31) and turn plug and stem assembly (key 27) into actuator stem (key 16) until pre-compression of actuator springs (key 3) is relieved.

Note

Plug should not be seating on seat ring when air pressure is removed from actuator case.

3. Apply prescribed setting pressure to actuator. This is determined by specific operating conditions.
4. Turn plug and stem assembly out of actuator stem until plug seats on seat ring (key 28). To prevent galling, do not turn plug and stem assembly once plug has contacted seat ring. Turn stem nuts up plug and stem assembly and tighten to lock it in position.
5. Reduce air signal to 0 psi/bar and calibrate indicator scale (key 20). Check that full travel is achieved with a 15 psi signal, except for 20 to 60 psi / 1.38 to 4.14 bar springs.

Direct Acting

1. Engage lower stem nut (key 31) and turn plug and stem assembly (key 27) into actuator stem (key 16) until plug and stem assembly stops at upper limit of travel and/or a slight downward movement of actuator stem is detected.
2. Turn stem nut up the plug and stem assembly and tighten to lock in position.
3. Calibrate indicator scale (key 20). Check that full travel is achieved at a 0 psi signal, 20 to 60 psi / 1.38 to 4.14 bar springs.

Troubleshooting

WARNING

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

Control valves 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 control valve.

For troubleshooting of the controlling device and accessories, see the instruction furnished by the manufacturer of these items.

To troubleshoot the valve and actuator, check for the following: change in operating conditions; pneumatic signal failure; diaphragm failure; foreign matter lodged between seat ring and plug; actuator vent plug may be: plugged, missing, replaced with a solid plug; packing leakage.

Graphite Packing/Hi Temp Graphite Packing (Refer to Figure 5)

1. If packing (key 35 or 36) leaks, tighten packing nut as necessary until leakage stops. Over-tightening of packing nut may cause erratic operation.
2. Install additional center packing rings. This can be accomplished by loosening packing nut (key 32).
3. Lift packing nut,gland and end packing ring a sufficient height on stem and plug assembly (key 26) to apply packing ring.
4. Insert one skive cut center packing ring over diameter of stem and plug assembly into packing box.
5. Replace end packing ring and tighten packing nut as necessary to stop leakage.
6. Replace packing.

Teflon Packing (Refer to Figure 5)

1. If the packing (key 34) leaks, isolate and depressurize the valve.
2. Check the stem for gouges and that the O-ring is properly seated.
3. Install replacement packing, if necessary, then return the valve to service.

Parts Ordering

When corresponding with your local Sales Office about this equipment, always reference the equipment valve size, service and serial number.

When ordering replacement parts, reference the key number of each needed part as found in the following parts list and indicate the part number. Separate kits containing all recommended spare parts are available.

Table 2. *Valve Body Assembly Parts list*

KEY	PART NAME	MATERIAL	VALVE SIZE, NPS / DN				
			1/2 / 15	3/4 / 20	1 / 25	1-1/2 / 40	2 / 50
22	Travel Indicator	Aluminum	WAL05-12962-00	WAL05-12962-00	WAL05-12962-00	WAL05-12962-00	WAL05-12962-00
23	Bonnet Bolt	Steel	WAL05-17301-00	WAL05-17301-00	WAL05-17302-00	WAL05-17303-00	WAL05-17304-00
24	Bonnet Flange	Steel	WAL04-13918-00	WAL04-13918-00	WAL04-13919-00	WAL04-13920-00	WAL04-13921-00
25	Bonnet, 316 Stainless Steel Valves	316 Stainless steel	WAL04-13549-00	WAL04-13549-00	WAL05-13549-00	WAL04-13550-00	WAL04-13551-00
	Bonnet, Cast iron and Steel	Steel	WAL04-12983-00	WAL04-12983-00	WAL04-12956-00	WAL04-13125-00	WAL04-13189-00
	Bonnet, Bronze	Brass	WAL04-13870-00	WAL04-13870-00	WAL04-13871-00	WAL04-13872-00	WAL04-13873-00
26*	Gasket, Cast Iron and Bronze	Graphite	WAL05-13395-00	WAL05-13395-00	WAL05-13396-00	WAL05-13397-00	WAL05-16398-00
	Gasket, Steek and Stainless steel	Graphite	WAL05-13396-00	WAL05-13396-00	WAL05-13396-00	WAL05-13397-00	WAL05-13398-00
27	Plug/Stem, Eq.% 1/8	316 Stainless steel	WAL04-13848-00	WAL04-13848-00	----------	----------	----------
	Plug/Stem, Eq.% 3/16		WAL04-13178-00	WAL04-13178-00	----------	----------	----------
	Plug/Stem, Eq.% 1/4		WAL04-13564-00	WAL04-13564-00	WAL04-13564-00	----------	----------
	Plug/Stem, Eq.% 5/8		WAL04-13565-00	WAL04-13565-00	WAL04-13565-00	----------	----------
	Plug/Stem, Eq.% 7/8		----------	WAL04-13566-00	WAL04-13566-00	WAL04-13566-00	----------
	Plug/Stem, Eq.% 1-1/4		----------	----------	WAL04-13567-00	WAL04-13567-00	WAL04-13894-00
	Plug/Stem, Eq.% 1-3/4		----------	----------	----------	WAL04-13568-00	WAL04-13887-00
	Plug/Stem, Eq.% 2-1/4		----------	----------	----------	----------	WAL04-13569-00
	Plug/Stem, Comp.% 1/4		WAL0A-13412-00	WAL0A-13412-00	WAL0A-13412-00	----------	----------
	Plug/Stem, Comp.% 5/8	316 Stainless steel/ Tetrafluoroetheylene	WAL0A-13413-00	WAL0A-13413-00	WAL0A-13413-00	----------	----------
	Plug/Stem, Comp.% 7/8		----------	WAL0A-13414-00	WAL0A-13414-00	WAL0A-13414-00	----------
	Plug/Stem, Comp.% 1-1/4		----------	----------	WAL0A-13415-00	WAL0A-13415-00	WAL0A-13419-00
	Plug/Stem, Comp.% 1-3/4		----------	----------	----------	WAL0A-13416-00	WAL0A-13418-00
	Plug/Stem, Comp.% 2-1/4		----------	----------	----------	----------	WAL0A-13417-00
28	Seat Ring, 1/8 Cast iron/Bronze	17-4 PH	WAL04-13847-00	WAL04-13847-00	----------	----------	----------
	Seat Ring, 1/4 Cast iron/Bronze	316 Stainless steel	WAL04-13173-01	WAL04-13173-01	WAL04-13525-00	----------	----------
	Seat Ring, 5/8 Cast iron/Bronze		WAL04-12981-00	WAL04-12981-00	WAL04-13526-00	----------	----------
	Seat Ring, 7/8 Cast iron/Bronze		----------	WAL04-12982-00	WAL04-13527-00	----------	----------
	Seat Ring, 1/8 Stainless steel/Steel	17-4 PH	WAL04-14299-00	WAL04-14299-00	WAL04-14299-00	----------	----------
	Seat Ring, 1/4 Stainless steel/Steel	316 Stainless steel	WAL04-13525-00	WAL04-13525-00	WAL04-13525-00	----------	----------
	Seat Ring, 5/8 Stainless steel/Steel		WAL04-13526-00	WAL04-13526-00	WAL04-13526-00	----------	----------
	Seat Ring, 7/8 Stainless steel/Steel		----------	WAL04-13527-00	WAL04-13527-00	WAL04-13529-00	----------
	Seat Ring, 1-1/4	316 Stainless steel	----------	----------	WAL04-13528-00	WAL04-13530-00	WAL04-13532-00
	Seat Ring, 1-3/4		----------	----------	----------	WAL04-13531-00	WAL04-13533-00
	Seat Ring, 2-1/4		----------	----------	----------	----------	WAL04-13534-00
	Seat Ring, 1/4 Comp. Cast iron/Bronze	316 Stainless steel	WAL04-13399-00	WAL04-13399-00	WAL04-13400-00	----------	----------
	Seat Ring, 5/8 Comp. Cast iron/Bronze		WAL04-13401-00	WAL04-13401-00	WAL04-13402-00	----------	----------
	Seat Ring, 7/8 Comp. Cast iron/Bronze		----------	WAL04-13491-00	WAL04-13404-00	----------	----------
	Seat Ring, 1/4 Comp. Stainless steel/Steel	316 Stainless steel	WAL04-13400-00	WAL04-13400-00	WAL04-13400-00	----------	----------
	Seat Ring, 5/8 Comp. Stainless steel/Steel		WAL04-13402-00	WAL04-13402-00	WAL04-13402-00	----------	----------
	Seat Ring, 7/8 Comp. Stainless steel/Steel		----------	WAL04-13404-00	WAL04-13404-00	WAL04-13405-00	----------
	Seat Ring, 1-1/4 Comp.	316 Stainless steel	----------	----------	WAL04-13406-00	WAL04-13407-00	WAL04-13408-00
	Seat Ring, 1-3/4 Comp.		----------	----------	----------	WAL04-13409-00	WAL04-13410-00
	Seat Ring, 2-1/4 Comp.		----------	----------	----------	----------	WAL04-13411-00
29	Body NPT Ends	Steel	WAL04-12979-00	WAL04-12920-00	WAL04-13063-00	WAL04-13097-00	WAL04-13196-00
		Bronze	WAL04-13849-00	WAL04-13850-00	WAL04-13851-00	WAL04-13852-00	WAL04-13853-00
		316 Stainless steel	WAL04-13576-00	WAL04-13580-00	WAL04-13584-00	WAL04-13588-00	WAL04-13592-00
		Steel	WAL04-13596-00	WAL04-13600-00	WAL04-13604-00	WAL04-13608-00	WAL04-13612-00
	Body Flanged Ends	316 Stainless steel	WAL04-13579-00	WAL04-13583-00	WAL04-13587-00	WAL04-13591-00	WAL04-13595-00
		Steel	WAL04-13599-00	WAL04-13603-00	WAL04-13607-00	WAL04-13611-00	WAL04-13617-00
	Flange Slip-on 150#	Steel	WAL04-13628-00	WAL04-13631-00	WAL04-13634-00	WAL04-13637-00	WAL04-13640-00
	Flange Slip-on 300#		WAL04-13629-00	WAL04-13632-00	WAL04-13635-00	WAL04-13638-00	WAL04-13641-00
	Flange Slip-on 600#		WAL04-13630-00	WAL04-13633-00	WAL04-13636-00	WAL04-13639-00	WAL04-13642-00
30	Retainer Ring	Steel	WAL04-14077-00	WAL04-14078-00	WAL04-14079-00	WAL04-14080-00	WAL04-14081-00
31	Stem Nut	Steel	WAL05-12972-00	WAL05-12972-00	WAL05-12972-00	WAL05-12972-00	WAL05-12972-00
32	Packing Nut	Stainless Steel	WAL04-12958-00	WAL04-12958-00	WAL04-12958-00	WAL04-12958-00	WAL04-12958-00
33	Lock Nut	Plated Steel	WAL04-12961-00	WAL04-12961-00	WAL04-12961-00	WAL04-12961-00	WAL04-12961-00
34*	V-Ring Packing Set	- - - -	WAL07-12932-01	WAL07-12932-01	WAL07-12932-01	WAL07-12932-01	WAL07-12932-01
35*	Braided TFE/Graph Package Set	- - - -	WAL07-12933-00	WAL07-12933-00	WAL07-12933-00	WAL07-12933-00	WAL07-12933-00
36*	High Temperature Graph Package Set	- - - -	WAL07-12936-00	WAL07-12936-00	WAL07-12936-00	WAL07-12936-00	WAL07-12936-00

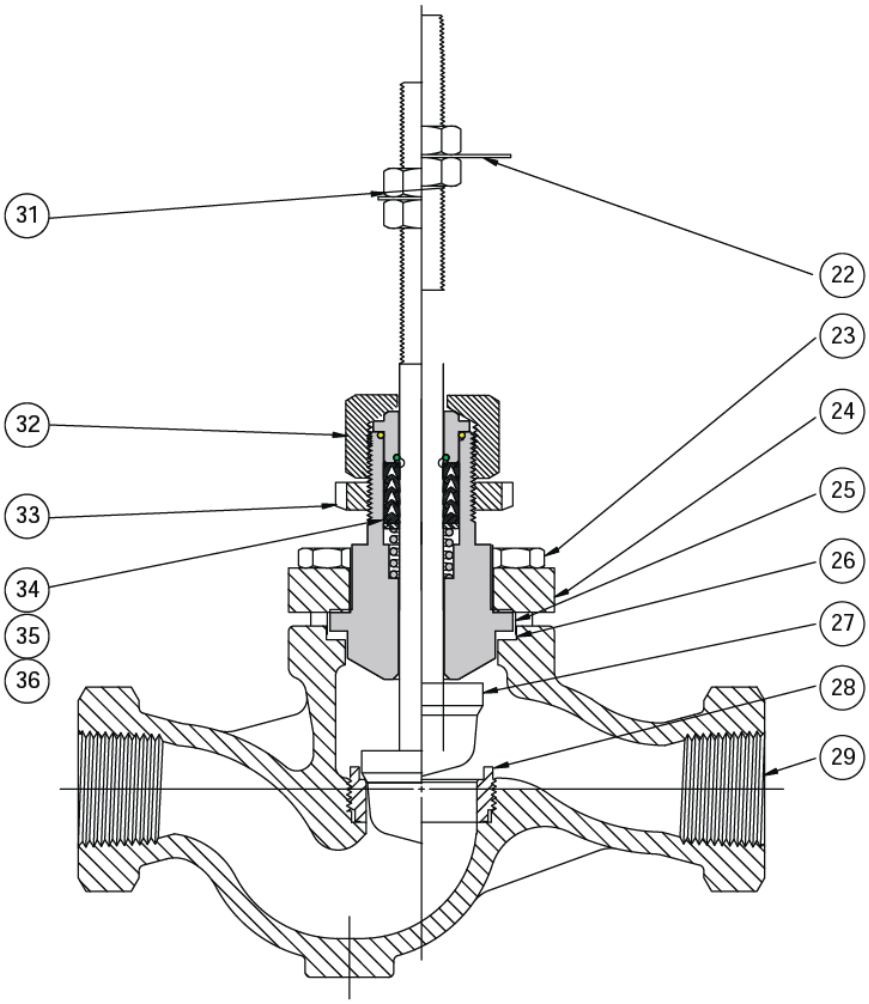


Figure 4. *Valve Body Assembly*

Parts List

Valve Body Assembly (See Table 2 and Figures 4 to 6)

Actuator Parts

Key	Description	Part Number
	Repair Part Kit	
	36 sq.in. / 0.02 sqm	WAL51447
	60 sq.in. / 0.04 sqm	WAL51448
	Actuators and Spring Kit	See Table 3
1	Vent Plug, High-density polyethylene	
2	Upper Casing, Steel/powder	
3	Springs, Steel	
3A	Spring Retainer. 12 required, Steel	
4	Casing Bolt, Regular, 10/14 required, 304 Stainless steel	
5	Casing Nut, 12/16 required, 316 Stainless steel	
6	Lower Casing, Steel/powder	
7	Bushing, Bronze	
8*	Oring, Nitrile	
9	Yoke, Cast Iron/Powder	
10'	Stem Nut, Steel	
11*	Stem Washer, 316 Stainless steel	
12*	Seal Washer, Steel	
13	Piston, 316 Stainless steel	
14	Casing Bolt, Long, 2 required, 304 Stainless steel	
14A[1]	Casing Bolt. Long, 2 required, Zinc-plated steel	
15*	Diaphragm, Nitrile	
16	Actuator Stem, 303 Stainless steel	
17	Machine Screw, 3 required, Steel	
18	Casing Gasket, Nitrile	
19	Machine Screw, 2 required, Steel	
20	Indicator Scale, Aluminum	
21	Specification Plate, Aluminum	

*These parts furnished in Actuator Repair Kit.
1. For spring range 10 to 15 psi / 0.69 to 1.03 bar on 36 sq. in. / 0.02 sqm actuator and 12 to 15 psi / 0.83 to 1.03 bar on 60 sq. in. / 0.04 sqm actuator.

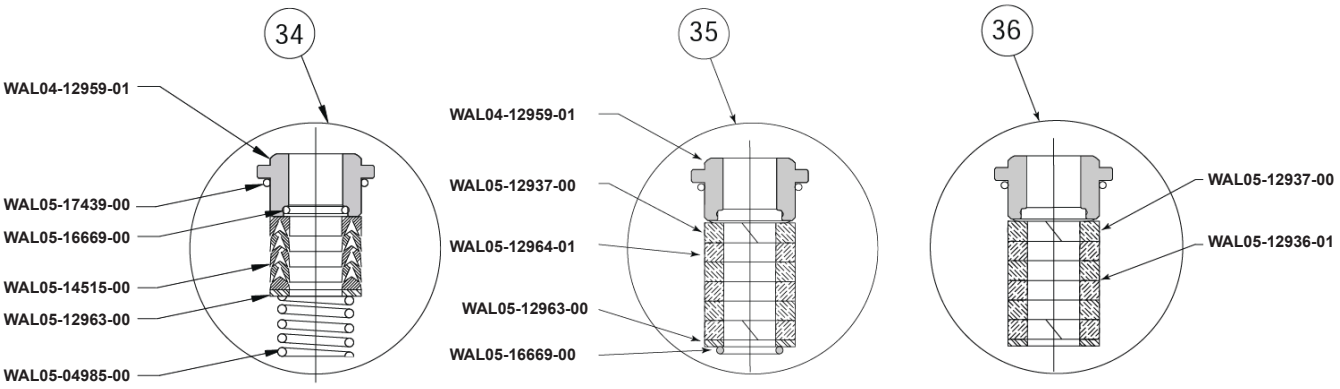


Figure 5. *Packing Assembly*

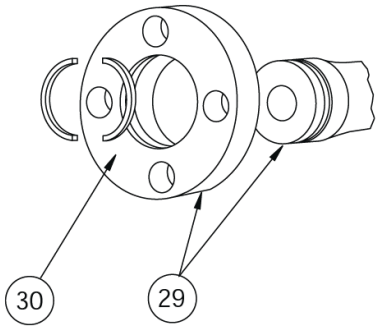


Figure 6. *Slip-on Flange Assembly*

Table 3. *Actuator, Spring Kit and Spring Part Numbers*

ACTUATOR ASSEMBLY	SPRING KIT PART NUMBER	BENCH RANGES		SPRINGS			BOLT (2)
		Reverse	Direct	Quantity	Part Number	Color	
36RC-ASM(1)	WAL36RC	5 to 15	3 to 13	6	WAL05-13090-01	Red	- - - -
36RD-ASM(1)	WAL36RD	8 to 15	3 to 10	4	WAL05-13090-01	Red	- - - -
36RE-ASM	WAL36RE	10 to 15	- - - -	6	WAL05-13085-00	Green	5-04889-0
36DE-ASM	WAL36DE	- - - -	3 to 5	3	WAL05-13087-00	Green	- - - -
60RG-ASM(1)	WAL60RG	8 to 15	3 to 11	6	WAL05-13093-01	Brown	- - - -
60RH-ASM(1)	WAL60RH	10 to 15	3 to 8(2) or 3 to 10(3)	4	WAL05-13093-01	Brown	- - - -
60RJ-ASM	WAL60RJ	12 to 15(2) or 11 to 15(3)	- - - -	6	WAL05-13097-00	Black	5-04889-0
60RK-ASM	WAL60RK	20 to 60	- - - -	6	WAL05-13094-00	Gray	- - - -
60RL-ASM	WAL60RL	20 to 60	- - - -	6	WAL05-13095-00	Blue	- - - -
				6	WAL05-13096-00	Blue	- - - -

1. Includes both J and K Valve travel scales.
2. 3/4 in. / 19.1 mm travel
3. 1-1/16 in. / 27 mm travel

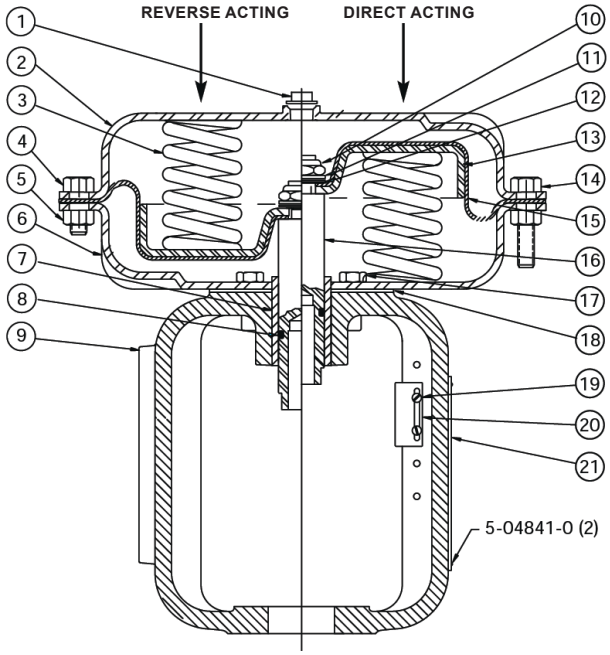


Figure 7. *Actuator Assembly*

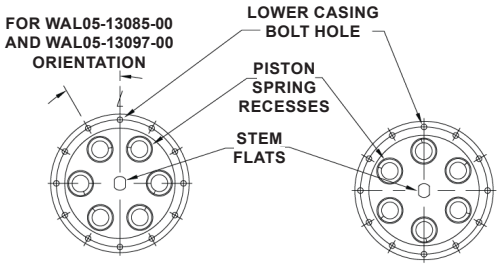


Figure 8. *Piston Diaphragm Assembly*

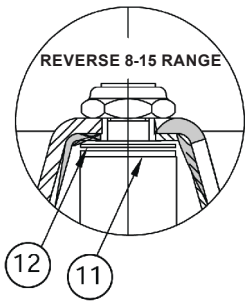


Figure 9. *Stem Assembly,*
Reverse 8 to 15 psi / 0.55 to 1.03 bar Spring Range Only

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SD8010B

SPENCE™

Spence Eliminator Series - Steam and Air Separator

Introduction

This installation sheet covers the installation and maintenance of the Eliminator Series.

Specifications

Models

ES-150
ES-300
ES-600

Maximum Temperature

650°F / 344°C

Maximum Pressure

990 psig / 68.2 bar

Installation

WARNING

Personal injury, property damage, equipment damage or leakage due to escaping steam or bursting of pressure containing parts may result if this separator is over pressured or is installed where service conditions could exceed the limits given in the specifications 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.

CAUTION

The piping system must be adequately designed and supported to prevent extraordinary loads to the pressure equipment.

1. Install the steam separator as close as possible to the point of use.
2. Install the steam separator in a horizontal pipe configuration with the drain directly below the line, see Figure 1.
3. Install the steam separator according to the directional flow arrow for effective operation. The flow is from left to right with the faceplate showing.
4. Install a properly sized mechanical steam trap on the NPT drain connection at a minimum of 6 in. / 152 mm below the steam separator.

Note

For every inch of horizontal piping to trap, add one inch to the vertical piping. Do not reduce separator drain size except at trap inlet. Never allow the top of the trap to extend above separator drain connection. A Y-strainer positioned after the steam separator drain and before the steam trap will help prevent dirt and scale from reaching the steam trap and is highly recommended.

5. For steam systems where air is present, install an air vent on the top NPT connection of the steam separator. If an air vent is not installed, the standard plug must remain in the NPT connection port.

Note

An insulated steam separator provides more efficient operation.

Maintenance

WARNING

Injury or death can occur from failure to completely isolate the separator from all sources of pressure before beginning disassembly. Do not proceed until unit has been completely isolated from process stream and vented to atmosphere.

- This equipment does not require to 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.
- Steam traps, Y-strainers and other associated components must be maintained and serviced as recommended. Refer to product literature for sizing information.
- When replacing a unit, the pressure in the system should be isolated and vented to atmosphere. Allow time for the unit temperature to normalize before conducting removal.

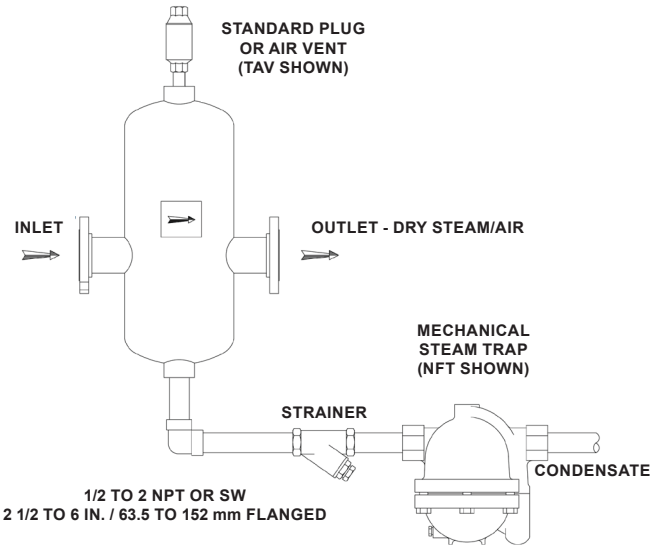

Figure 1. *Typical Installation*

SpenceValve.com

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0011535

SPENCE™

Air-Operated Steam-Atomizing and Mechanical-Atomizing Desuperheaters

⚠ WARNING

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

Air-Operated Desuperheater 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.

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 Air-Operated Desuperheater.

Figure 1. *Air-Operated Desuperheater*

Introduction

Scope of the Manual

This manual provides installation, operation and maintenance instructions for Spence air-operated, steam atomizing and mechanical-atomizing desuperheaters.

Product Description

The Steam-Atomizing and Mechanical-Atomizing Desuperheater are designed to reduce and control the temperature of superheated steam by the controlled injection of a cooling water mist.

Principle of Operation

Steam-Atomizing

The controls consist of two valves: one for cooling water and one for atomizing steam. The valve's position is determined by the air signal from a pneumatic temperature controller. On a rise in temperature, the controller's air signal varies and the control valves open. This provides a balanced flow of steam and water to the Spence injector nozzle.

Cooling water emerges from the nozzle in a swirling spray. Atomizing steam issues from the concentric impact nozzle and disperses the water spray in the form of a fine mist. The coolant is injected counterflow

Specifications

The specifications section on this page provides the ratings and other specifications for the air-operated, steam-atomizing and mechanical-atomizing desuperheater.

Available Types
1, 3, 5, 6 and 8

Maximum Temperature(1)
750°F / 399°C

Maximum Pressure(1)
600 psig / 41.4 bar

Material of Construction
Stainless steel

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

to the superheated steam to promote full evaporation. Coolant flow is modulated to maintain the desired temperature setpoint.

Mechanical-Atomizing

The control valve modulates the flow of cooling water. The valve is normally closed, air to open. The valve's position is determined by the air signal from a pneumatic temperature controller. On a rise in temperature, the controller's air signal increases and the control valve opens. This provides a flow of cooling water to the Spence injector nozzle.

Cooling water emerges from the nozzle in a swirling spray. The coolant is injected counterflow to the superheated steam to promote full evaporation. Coolant flow is modulated to maintain the desired temperature setpoint.

Installation

⚠ WARNING

Failure of the thermal system or foreign material lodged between the valve's closure members can lead to an over-temperature and/or an overpressure condition which may cause injury and/or property damage.

Never install an Air-Operated Desuperheater in a system, which does not have a properly installed, code approved temperature and pressure safety valve or other approved safety device.

These devices must be suitable for the equipment and processes involved and in conformance to applicable codes.

Planning the Installation

1. Locate the injector nozzle in the superheated steam main. There should be at least 8 diameters (6 ft / 1.83 m minimum) of straight run ahead of the nozzle. The nozzle will operate in any position in a horizontal or vertical pipe. The center-to-face dimension of the flanged connection must equal that of the nozzle. This will place the nozzle on the steam main's centerline. See Figure 2.
2. Locate the thermostat well at least 20 ft / 6.1 m of pipe run downstream of the injector nozzle. The well must extend fully across the inside of the pipe.
3. Position the control valves as close as practical to the injector nozzle. Locate where they can stand upright in horizontal water and steam lines.
4. Provide 3-valve bypasses around the control valves. Provide pressure gauges to monitor steam and water pressure at the inlet of both the control valves and the injector nozzle. These gauges should have equal ranges.
5. Provide a thermometer located at the thermostat and a pressure gauge to monitor steam properties.
6. Provide a suitable check valve for the water line of the control valve.
7. Supply a source of clean, dry air for the pneumatic temperature controller. Minimum supply pressure is 20 psig / 1.38 bar.

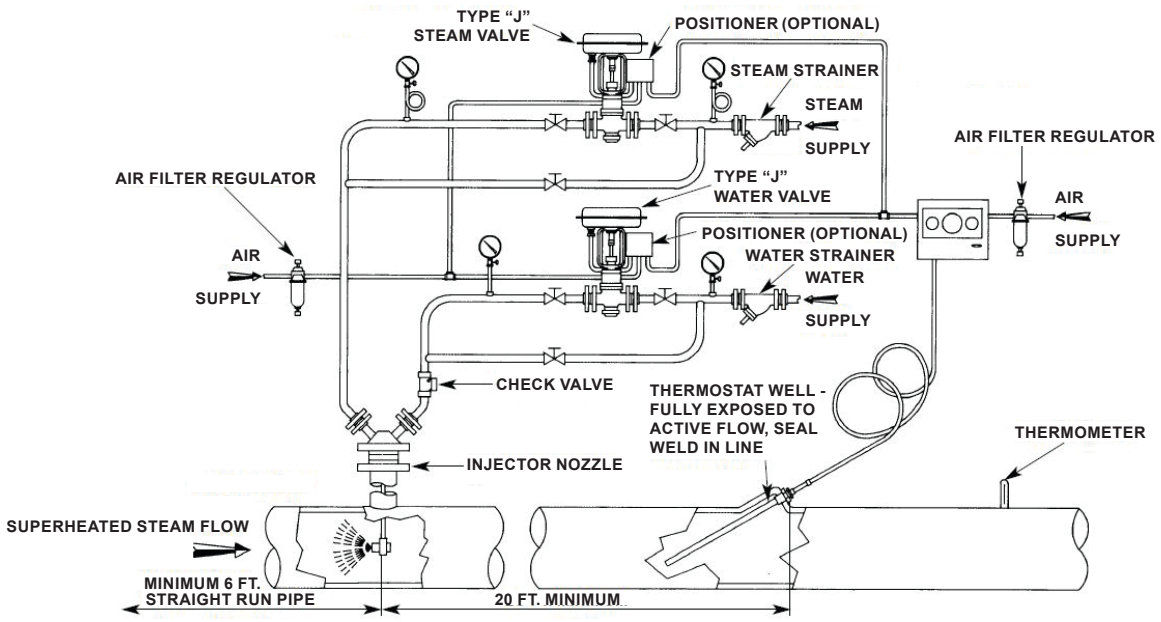

Figure 2. *Air-Operated Desuperheater Station Installation*

Desuperheater Installation

1. Install the injector assembly with the nozzle outlet facing upstream.

   Note

   The injector nozzle is orificed for specific water and steam supply pressures. Verify the actual pressures against your order specification.

2. Install the control valves and strainers as shown with the arrows pointing in the direction of flow. See Figure 2.
3. Install the thermostat well so that its full length extends across the inside of the pipe. Seal weld the well to the pipe.
4. Read the separate instructions supplied with the pneumatic controller. Then install the controller at a convenient location remote from the thermostat well.
5. Pour heat transfer oil into the thermostat well and install the thermostat bulb.
6. Connect the output connection of the controller to the control valves with 3/8 in. / 9.53 mm copper tubing.
7. Connect a regulated source of instrument air to the supply connection of the controller and the positioner, if required.
8. Install the required pressure gauges and thermometer as shown in Figure 2.

Startup and Adjustment

Initial startup on bypass:

1. Check water and steam supply gauges to confirm if proper pressures are available. If so, blow down strainers.
2. Cut in a moderate flow of superheated steam, crack open the atomizing steam bypass valve and monitor the temperature as the line warms up. Open the cooling water bypass valve slowly as required to hold the desired steam temperature.
3. Observe the dial of the controller to confirm that the controller thermostat is operating. DO NOT start the controller unless proper operation is observed.
4. Shut down the bypasses and superheated steam main.

Troubleshooting

WARNING

Steam is potentially dangerous and should be treated with respect. All installation, troubleshooting and maintenance should be performed by qualified personnel who are familiar with steam systems.

1. Steam temperature rises above normal:
   a. Low cooling water pressure. (Check pressure at source and control valve inlet. Blow down water strainer.)
   b. Injector nozzle plugged. (Use bypass to apply full water pressure. If temperature remains high, remove nozzle from main and back flush to wash away obstruction.
2. Steam temperature drops to saturation:
   a. Water bypass valve open (Check bypass.)
   b. Faulty nozzle installation.

Maintenance

See instructions for control valves, controllers and associated equipment.

Parts Ordering

When corresponding with your local Sales Office about this equipment, always reference the service and serial number.

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SPENCE™

Direct-Operated Steam and Mechanical-Atomizing Desuperheaters

⚠ WARNING

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

Direct-Operated Desuperheater 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.

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 Direct-Operated Desuperheater.

Figure 1. *Direct-Operated Desuperheater*

Introduction

Scope of the Manual

This manual provides installation, operation and maintenance instructions for Spence Direct-Operated, Steam and Mechanical-Atomizing Desuperheaters.

Product Description

The Steam and Mechanical-Atomizing Desuperheaters are designed to reduce and control the temperature of superheated steam by the controlled injection of a cooling water mist.

Principle of Operation

Steam-Atomizing

The desuperheater consists of a steam-atomizing injection nozzle assembly and a dual control valve.

The dual control valve consists of two valves: one for the cooling water and one for atomizing steam, operated in unison by a single diaphragm. The dual control valve is normally closed and actuated by a vapor-tension thermostat. The dual valves open on a rise in temperature and provide a balanced flow of atomizing steam and coolant to the injector nozzle.

Cooling water emerges from the nozzle in a swirling spray. Atomizing steam, issuing from the concentric impact nozzle is injected counterflow to the superheated steam to promote full evaporation.

Direct-Operated Desuperheater

Specifications

The specifications section on this page provides the ratings and other specifications for the direct-operated, steam-atomizing and mechanical-atomizing desuperheater.

Available Types 1, 3, 5, 6 and 8	**Maximum Pressure**[1] 600 psig / 41.4 bar
Maximum Temperature[1] 750°F / 399°C	**Material of Construction** Stainless steel

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

As the superheated steam temperature and flow rate vary, the thermal system modulates the flow of coolant to maintain the desired temperature setpoint. Temperature will increase slightly as the load increases.

Mechanical-Atomizing

The desuperheater consists of a mechanical-atomizing injection nozzle assembly and a water control valve.

The valve is normally closed and actuated by a vapor tension thermostat. The valve opens on a rise in temperature and provides a flow of coolant to the injector nozzle.

Cooling water emerges from the nozzle in a swirling conical spray pattern. The coolant is injected counterflow to the superheated steam to promote full evaporation.

As the superheated steam temperature and flow rate vary, the thermal system modulates the flow of coolant to maintain the desired setpoint. Temperature will increase slightly as the load increases.

Installation

⚠ WARNING

Failure of the thermal system or foreign material lodged between the valve's closure members can lead to an over-temperature and/or an overpressure condition which may cause injury and/or property damage.

Never install a Direct-Operated Desuperheater in a system, which does not have a properly installed, code approved temperature and pressure safety valve or other approved safety device.

These devices must be suitable for the equipment and processes involved and in conformance to applicable codes.

Planning the Installation

1. Locate the injector nozzle in the superheated steam main. There should be at least 8 diameters (6 ft / 1.83 m minimum) of straight run ahead of the nozzle. The nozzle will operate in any position in a horizontal or vertical pipe. The center-to-face dimension of the flanged connection must equal that of the nozzle. This will place the nozzle on the steam main's centerline. See Figure 2.
2. Locate the thermostat well at least 20 ft / 6.1 m of pipe run downstream of the injector nozzle. The well must extend fully across the inside of the pipe.
3. Position the control valves as close as practical to the injector nozzle. Locate where they can stand upright in horizontal water and steam lines.
4. Provide 3-valve bypasses around the control valves. Provide pressure gauges to monitor steam and water pressure at the inlet of both the control valves and the injector nozzle. These gauges should have equal ranges.
5. Provide a thermometer located at the thermostat and a pressure gage to monitor steam properties.
6. Provide a suitable check valve for the water line of the control valve.

Desuperheater Installation

1. Install the injector assembly with the nozzle outlet facing upstream.

Note

The injector nozzle is orificed for specific water and steam supply pressures. Verify the actual pressures against your order specification.

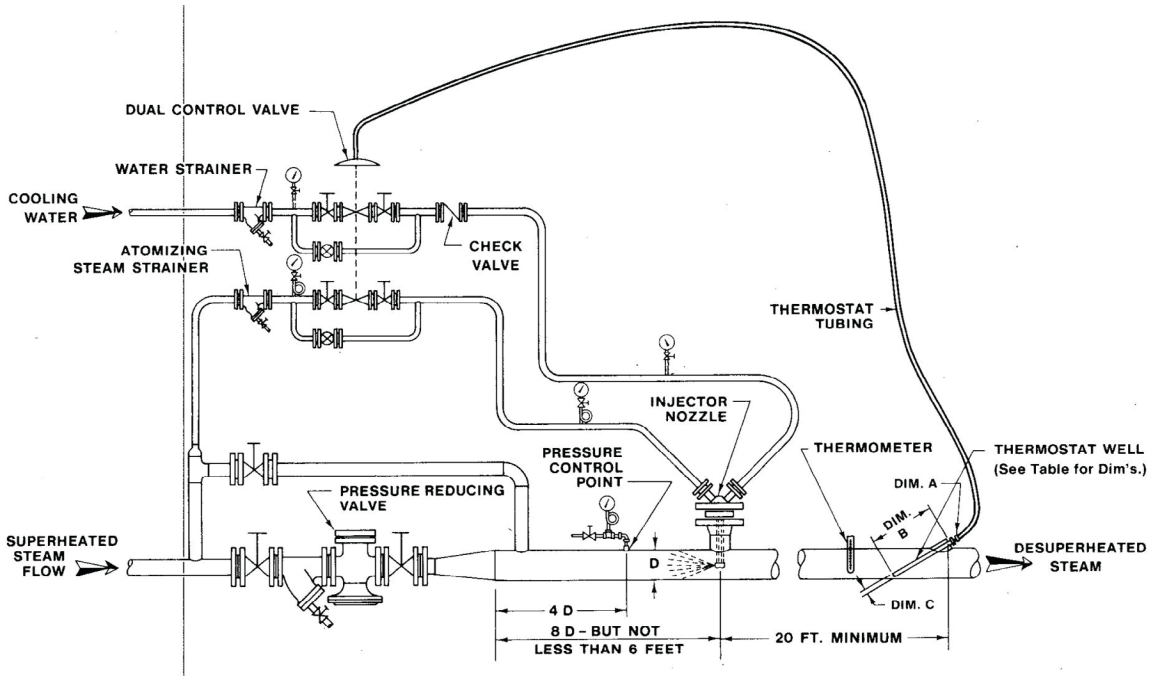

Figure 2. *Direct-Operated Desuperheater Station Installation*

2. Install the control valves and strainers as shown with the arrows pointing in the direction of flow. See Figure 2.
3. Install the thermostat well so that its full length extends across the inside of the pipe. Seal weld the well to the pipe.
4. Read the separate instructions supplied with the pneumatic controller. Then install the controller at a convenient location remote from the thermostat well.
5. Pour heat transfer oil into the thermostat well and install the thermostat bulb.
6. Connect the output connection of the controller to the control valves with 3/8 in. / 9.53 mm copper tubing.
7. Connect a regulated source of instrument air to the supply connection of the controller and the positioner, if required.
8. Install the required pressure gauges and thermometer as shown in Figure 2.

Startup and Adjustment

1. Check water and steam supply gauges to confirm proper pressures are available. If so, then blow down strainers.
2. Cut in a moderate flow of superheated steam, crack open the atomizing steam bypass valve and monitor the temperature as the line warms up. Open the cooling water bypass valve slowly as required to hold the desired steam temperature.

Note

Do not attempt to control at or below saturated temperature. The lowest practical setting is about 10°F / -12°C above saturation.

3. Open the dual control valve's outlet stop valves; crack the inlet stop valves. Slowly close down on the bypasses and open the inlet stop valves to bring the desuperheater on line.
4. The desuperheater is factory calibrated at the specified temperature. Always be governed by the temperature at the thermostat. The setpoint temperature can be raised (lowered) by increasing (decreasing) the compression of the adjusting spring. Remember that each increase in load will raise the temperature slightly.

Troubleshooting

WARNING

Steam is potentially dangerous and should be treated with respect. All installation, troubleshooting and maintenance should be performed by qualified personnel who are familiar with steam systems.

1. Erratic control:
   a. Faulty nozzle installation - See Installation Section.
   b. Stuffing boxes binding - See Maintenance Section.
2. Steam temperature drops to saturation:
   a. Water bypass valve open - Check bypass.
   b. Faulty nozzle installation - See Installation Section.
   c. Water valve held open by foreign matter - See Maintenance Section.
3. Steam temperature rises above normal:
   a. Low cooling water pressure - Check pressure a source and at control valve inlet. Blow down stainer.
   b. Injector nozzle fouled - Use bypass to apply full supply pressure. If temperature remains high, the nozzle is fouled by the foreign matter, remove mineral salts with suitable acid.
   c. Inoperative thermal system - See Maintenance Section.

Maintenance

1. Inspection:
   a. After the first few days of operation, and then twice a year, inspect all joints for leakage. Never allow a leak to persist.
   b. Stuffing boxes must be set up carefully to prevent binding and erratic operation. Tighten packing nuts just enough to prevent leakage. Allow a slight seepage of condensate to keep the packing moist. (#1 desuperheaters use bellows seals in lieu of stuffing boxes).
2. Dismantling:
   a. Inder normal conditions, complete dismantling at regular intervals is not recommended.
   b. If dismantling is required, refer to form SD 5002.
   c. The dual control valve's stem adjustments are factory set and tested. Do not disturb the settings.

Parts Ordering

When corresponding with your local Sales Office about this equipment, always reference the service and serial number.

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SPENCE™

Spence Noise Suppressor

⚠ WARNING

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

Noise Suppressor must be installed, operated and maintained in accordance with federal, state and local codes, rules and regulations and Emerson instructions.

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

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

Introduction

Scope of the Manual

This manual provides instructions for installation, operation and maintenance information for the Noise Suppressor.

Product Description

The Noise Suppressor is designed to attenuate the noise generated by a pressure reducing station. These devices are particularly effective in limiting the propagation of valve-generated noise into the downstream piping. Being of the dissipative reactive type, they are effective over a broad frequency band (up to 12,000 Hz). Depending upon the flow and piping configuration, noise attenuation of up to 20 decibels is obtainable.

***Figure 1**. Noise Suppressor*

Noise Suppression equipment is a dissipative reactive type. Suppressors do not induce back pressure. It has expanded outlet flange for attachment to downstream piping. Equipment provides a minimum of 10 dBA reduction in noise.

Principle of Operation

Noise Suppressor reduces pipeline carried noise by 10 to 20 dBA. Installed at the regulator outlet, the suppressor absorbs noise generated by the pressure regulator and limits its propagation through the piping system.

Noise Suppressor

Specifications

The Specifications section gives some general specifications for the Noise Suppressor.

Standard Sizes
3/8 to 8 in. / 9.53 to 203 mm

Temperature Rating[1]
500°F / 260°C

Frequency band
Up to 12,000 Hz

Noise Attenuation
Up to 26 dBA

Suppressor Ends
NPT x NPT
NPT x CL150 FF
NPT x CL300 RF
CL150 FF x CL150 FF
CL300 RF x CL150 FF
CL300 RF x CL300 RF

Maximum Outlet Velocity
17,000 ft/min. / 5182 m/min.

Construction
Pressure Shell: Welded steel components
Acoustic Material: Stainless steel

Approximate Weights
See Table 1

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

Installation (Figure 2)

WARNING

Personal injury or system damage may result if this equipment is installed where service conditions could exceed the limits given in the Specifications section.

Install the noise suppressor at the reducing valve outlet. Ensure that it is insulated to reduce condensation formation in the acoustic material.

Note

The required pipeline expansion takes place .outlet feature eliminates the expense and noise often associated with separate expansion fittings.

The straight through design minimizes pressure drop, permitting normal valve sizing.

Maintenance

WARNING

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 noise suppressor from system pressure and return lines.

Due to normal wear or damage that may occur from external sources, this noise suppressor 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.

If a leak develops, service to the unit may be required. Failure to correct trouble could result in a hazardous condition. Only a qualified person must install or service the unit.

The suppressor has no serviceable parts. However, during routine maintenance intervals it is important to do the following:

- Inspect the suppressor for damaged or cracked ends.
- The suppressor is either flanged or threaded in line. Remove only when it requires cleaning or replacement due to damage or wear.
- In the event the suppressor is not performing as expected, use a bore scope to examine the flow passages for blockages. Disassembly and removal is not needed.
- If blockages are present, clean the supressor by removing it and using a pressurized water stream to clear any blockages.
- If blockages are still present after cleaning, replace the unit.

Parts Ordering

When ordering parts, it is essential that the type and serial number be stated.

Select part by item number, but order by part number. Specify complete part number when ordering.

***Table 1**. Approximate Weights*

NOMINAL PIPE SIZE						APPROXIMATE WEIGHT											
Inlet		Outlet		Shell		NPT x NPT		NPT x CL150 FF		NPT x CL300 RF		CL150 FF x CL150 FF		CL300 RF x CL150 FF		CL300 RF x CL300 RF	
In.	mm	In.	mm	In.	mm	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg
3/8	9.53	3/4	19.1	2	50.8	8	4	9	4	10	5	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -
		12.7	25.4	2	50.8	8	4	10	5	11	5	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -
		19.1	38.1	2 1/2	63.5	12	5	15	7	18	8	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -
1/2	12.7	1	25.4	2	50.8	8	4	10	5	11	5	12	5	12	5	13	6
		31.8	31.8	2 1/2	63.5	12	5	13	6	16	7	15	7	15	7	17	8
		38.1	38.1	2 1/2	63.5	12	5	15	7	18	8	16	7	16	7	19	9
3/4	19.1	1 1/4	31.8	2 1/2	63.5	12	5	14	6	16	7	15	7	16	7	18	8
		63.5	50.8	3	76.2	16	7	21	10	23	10	22	10	23	10	25	11
1	25.4	1 1/2	38.1	2 1/2	63.5	13	6	16	7	19	9	18	8	19	9	22	10
		102	50.8	3	76.2	16	7	21	10	23	10	23	10	24	11	26	12
1 1/4	31.8	2	50.8	3	76.2	16	7	21	10	23	10	23	10	25	11	27	12
		152	76.2	4	102	- - - -	- - - -	40	18	47	21	42	19	45	20	51	23
1 1/2	38.1	3	76.2	4	102	- - - -	- - - -	39	18	44	20	43	20	46	21	52	24
2	50.8	3	76.2	4	102	- - - -	- - - -	40	18	46	21	45	20	47	21	53	24
		4	102	5	127	- - - -	- - - -	66	30	76	34	72	33	74	34	84	38
2 1/2	63.5	4	102	6	152	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	97	44	- - - -	- - - -	109	49
		5	127	6	152	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	99	45	- - - -	- - - -	115	52
3	76.2	4	102	6	152	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	99	45	- - - -	- - - -	103	47
		5	127	6	152	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	101	46	- - - -	- - - -	119	54
		6	152	8	203	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	150	68	- - - -	- - - -	181	82
4	102	5	127	6	152	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	105	48	- - - -	- - - -	129	59
		6	152	8	203	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	162	73	- - - -	- - - -	178	81
		8	203	10	254	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	256	116	- - - -	- - - -	299	136
5	127	6	152	8	203	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	180	82	- - - -	- - - -	167	76
		8	203	10	254	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	289	131	- - - -	- - - -	247	112
		10	254	12	305	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	455	206	- - - -	- - - -	428	194
6	152	8	203	10	254	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	295	134	- - - -	- - - -	299	136
		10	254	12	305	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	451	205	- - - -	- - - -	490	222
8	203	10	254	12	305	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	468	212	- - - -	- - - -	507	230

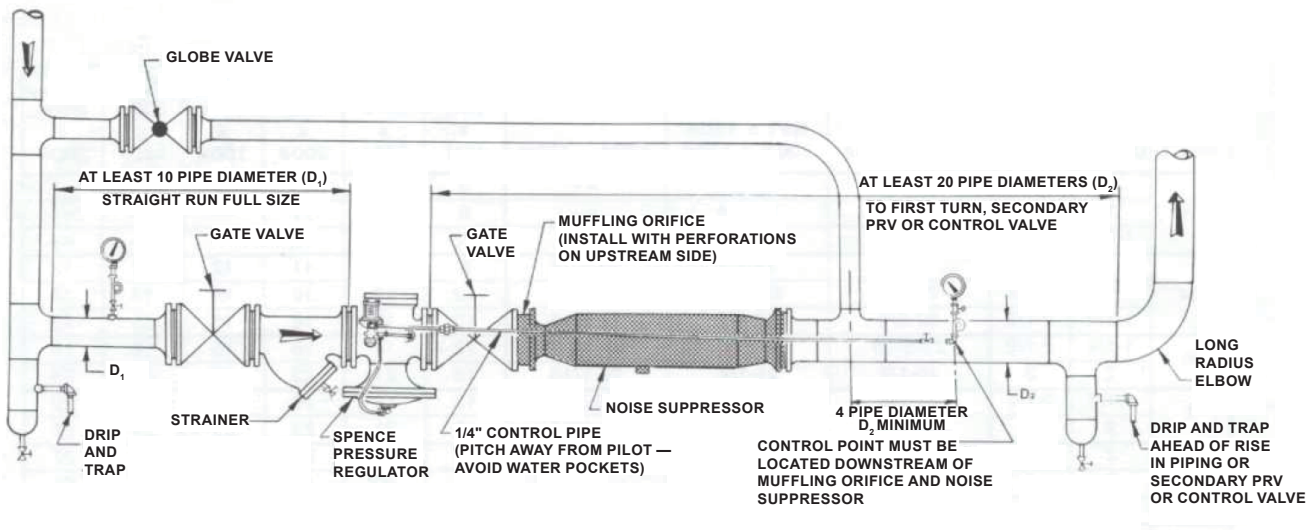

***Figure 2**. Recommended Installation of Pressure Regulator with Muffling Orifice and Noise Suppressor*

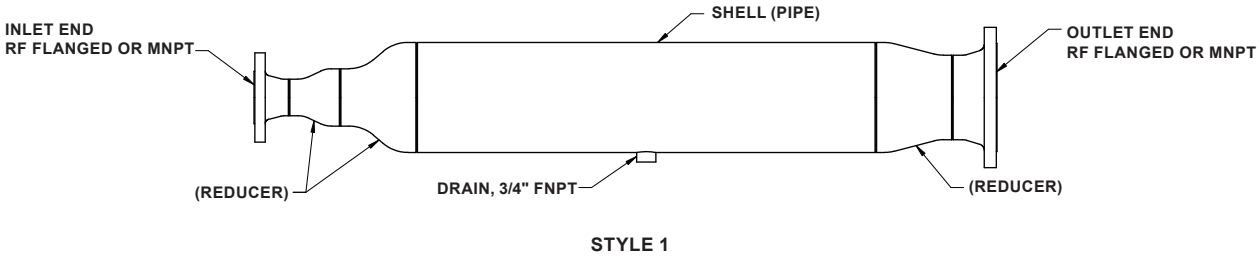

***Figure 3**. Noise Suppressor Assembly Drawing*

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SD6012A

SPENCE™

Spence Muffling Orifice

Introduction

This installation sheet covers the installation and maintenance of Muffling Orifice.

Product Description

Muffling Orifice reduces the generation of pressure regulator noise at its source. It provides an economical means of attenuating high flow PRV noise by 6 to 12 dBA.

The Muffling Orifice consists of a steel plate with primary orifices to which is welded a stainless steel plate with secondary orifices. It is engineered for each individual application to maximize noise reduction without reducing regulator capacity.

The Muffling Orifice is designed for installation between mating ANSI flanges. It is normally installed in the enlarged piping downstream of the pressure regulator.

When combined with a Spence Noise Suppressor, however, it is installed between the mating flanges of the regulator and noise suppressor.

Specifications

Available Sizes
NPS 1 to 18 / DN 50 to 450

End Connection Styles
CL125, CL150, CL250, CL300, CL400 and CL600

Materials of Construction
Plate: Steel
Disc: Stainless steel

Installation

⚠ WARNING

Personal injury, property damage, equipment damage or leakage due to escaping steam or bursting of pressure containing parts may result if this equipment is over pressured or is installed where service conditions could exceed the limits given in the specifications 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.

Maintenance

⚠ WARNING

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 equipment from system pressure and relieving all internal pressure from the equipment.

Muffling Orifice

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SD6001M

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