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's 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.

⚠ 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 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.

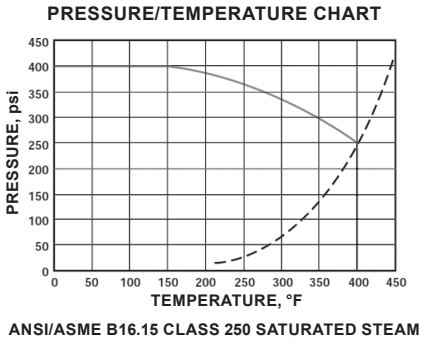

Figure 2. *Type K3 Pressure and Temperature Chart*

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

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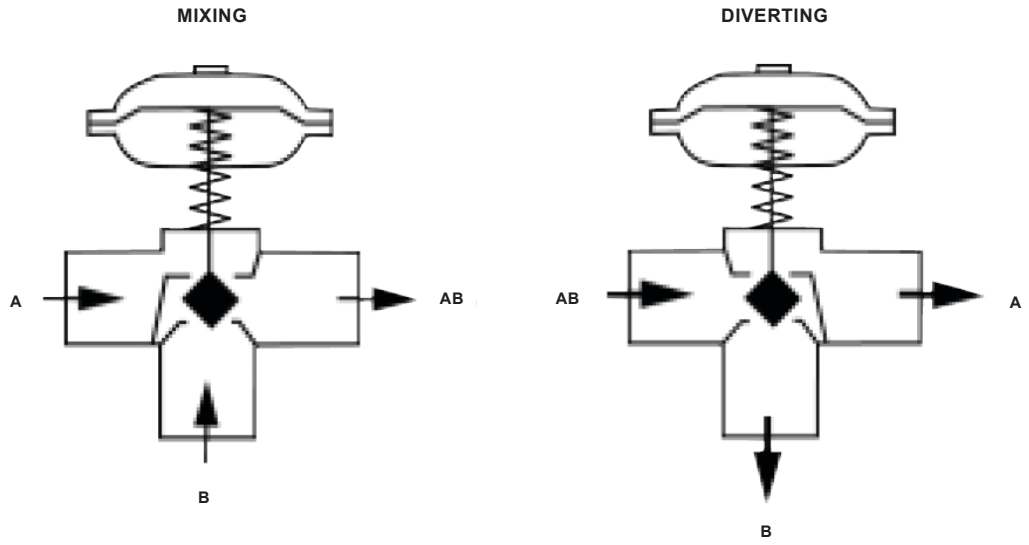

Figure 3. *Fluid Flow Direction for Mixing and Diverting Service*

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.

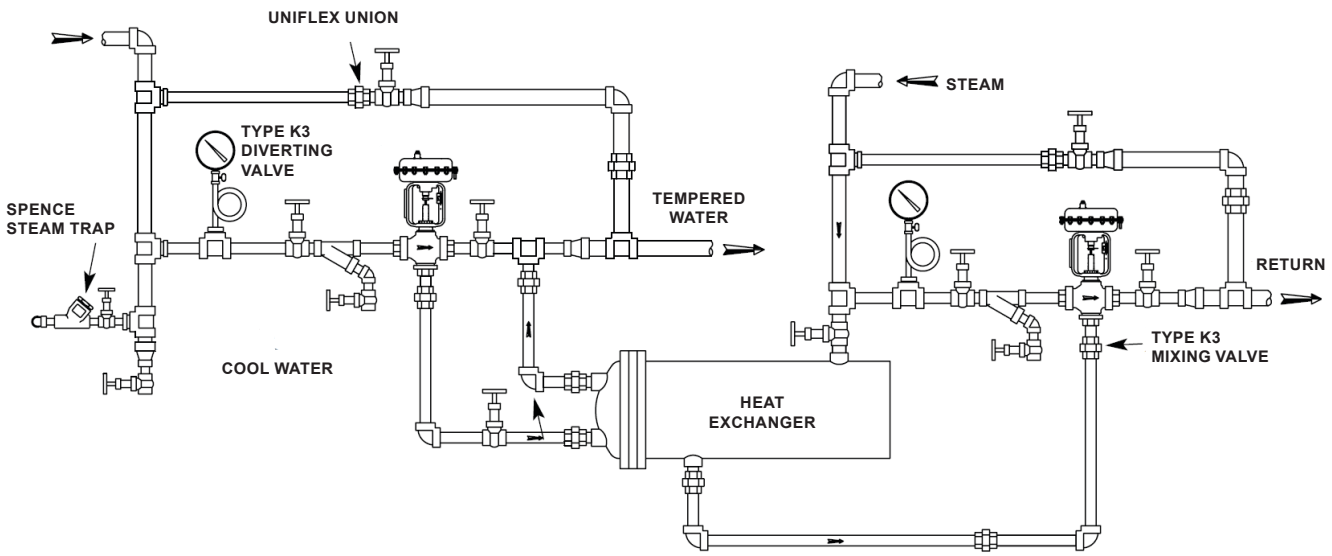

Figure 4. *Type K3 Control Valve Recommended Installation for Steam Application*

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. Re-tighten 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 (key 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 disengaged 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 15 to 25 and the “D” up for sizes NPS 1-1/4 to 2 / DN 40 to 50.
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 body 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*	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 (NBR)	
	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 (NBR)	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

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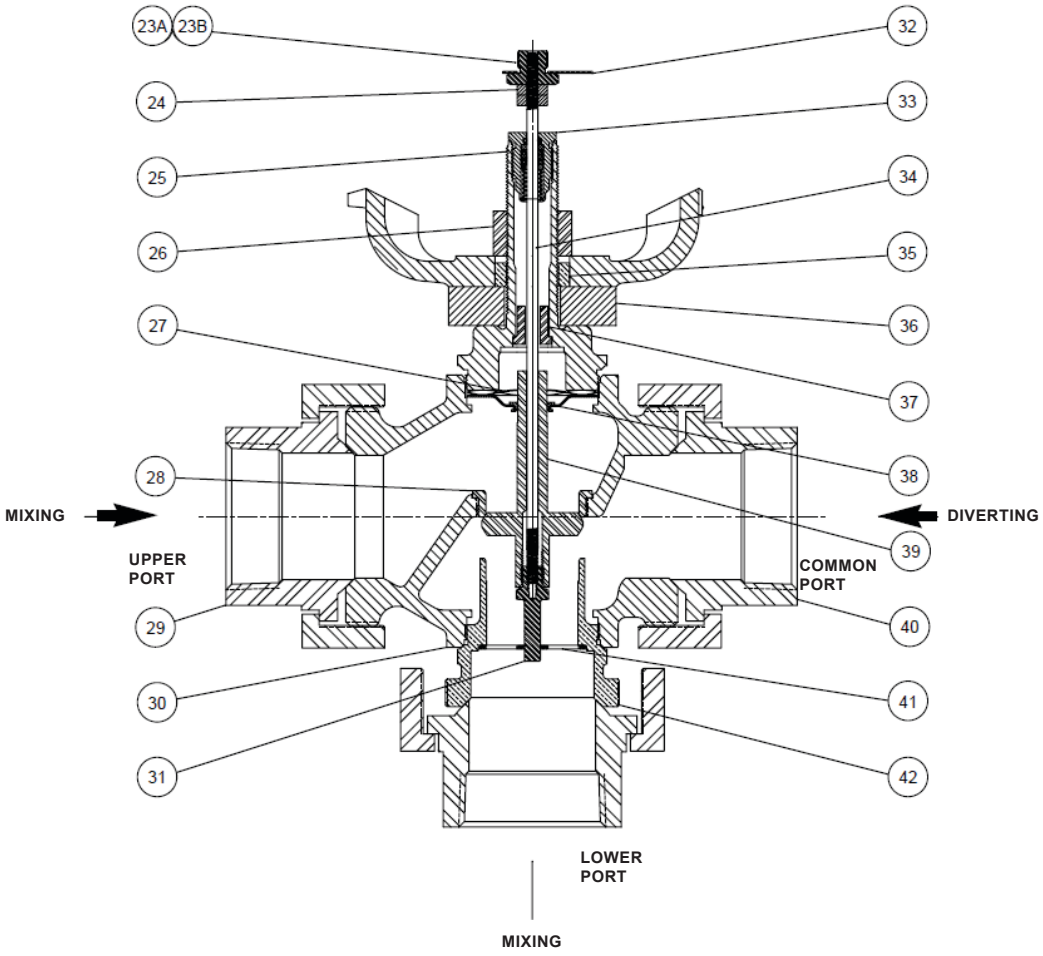

Figure 5. *Type K3 Control Valve Assembly Drawing*

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

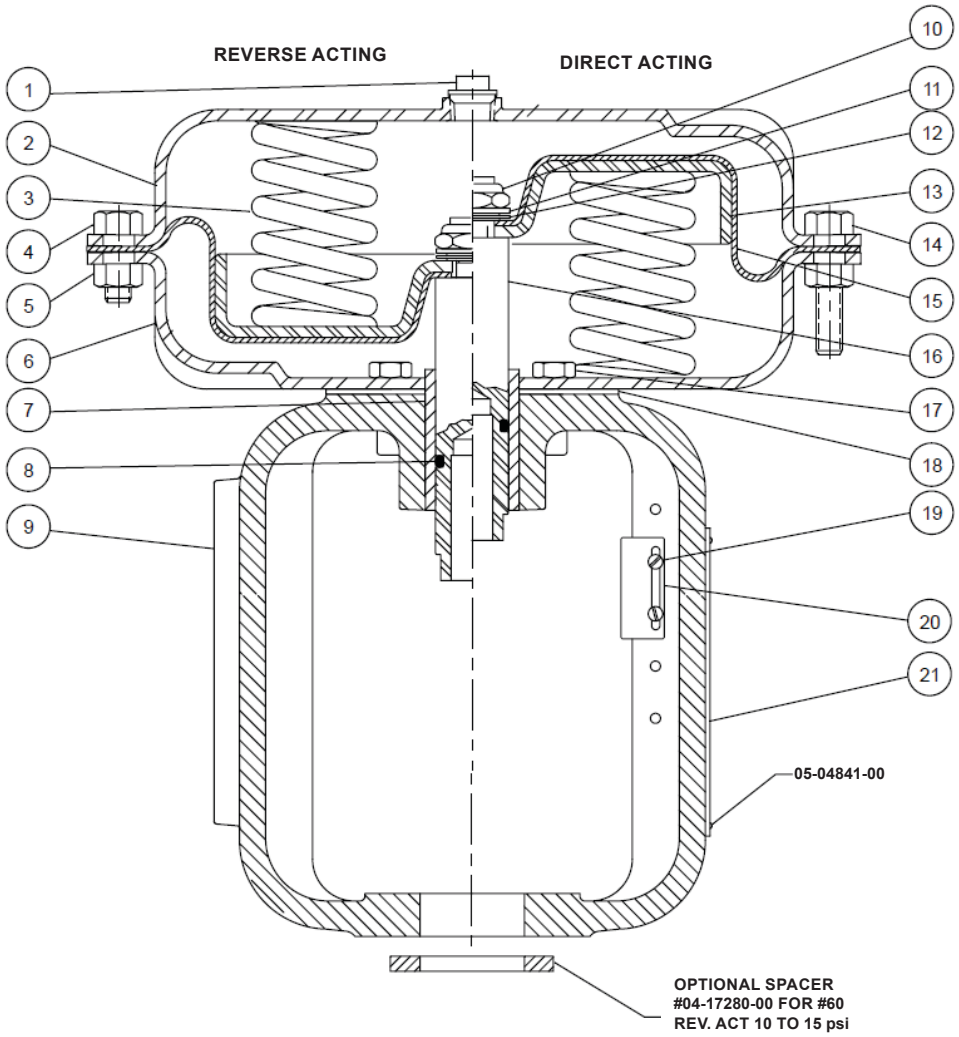

Figure 6. *Type K3 Actuator Assembly Drawing*

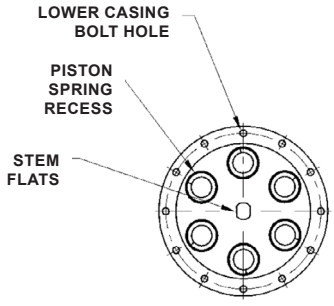

Figure 7. *Piston Diaphragm Assembly Drawing*

Type K3

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