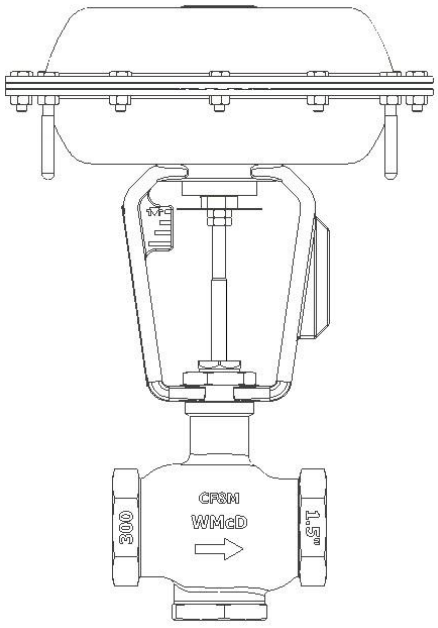
Installation & Maintenance Manual

HB Series General Service Control Valve



Model	HB Series
Service	Steam, Air, Water
Connections	NPT, 150#, 300#
Body Material	Stainless Steel
Plug and Seat	Stainless Steel
Body Sizes	½" to 4"
Max. Operating Pressure	720 psig
Max. Operating Temperature	450°F
Min. Operating Temperature	- 20°F
Max. Air Supply Pressure	50 psig
Max. Ambient Temperature	280°F
Min. Ambient Temperature	- 20°F

The HB Series is a high performance, general service control valve designed using CFD technology for high control accuracy and longevity. It is a two port valve range with a contoured plug design to withstand the rigorous nature of steam service. Stainless steel body material is standard making it compatible with many fluids and environments. Modern manufacturing techniques and a modular design allow this valve range to be extremely cost effective against valves with inferior body materials. The standard valve has an equal percentage flow characteristic with metal seating and live loaded, Teflon V-ring stem packing. The HB Series is available with pneumatic or electric actuation.

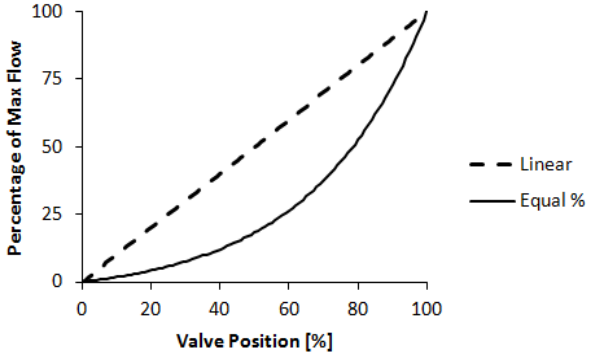
3-way Valve Bodies are available for mixing and diverting applications.

Maximum Flow Coefficient (Cv)							
1/2"	3/4"	1"	1-1/2"	2"	2-1/2"	3"	4"
5	6	10	22	42	70	110	170

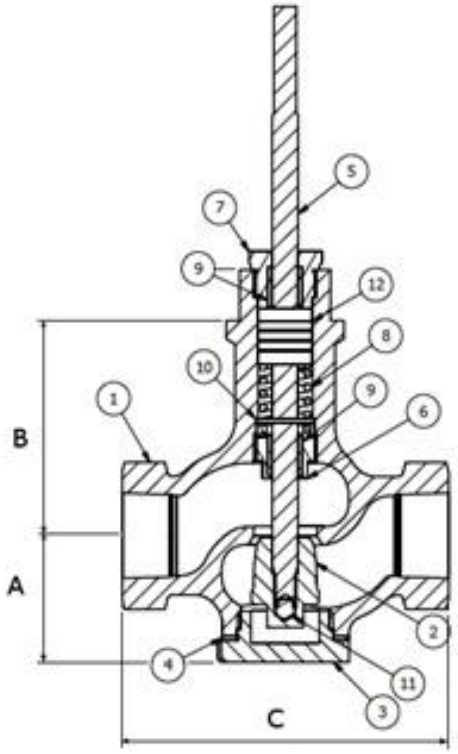
Technical Information

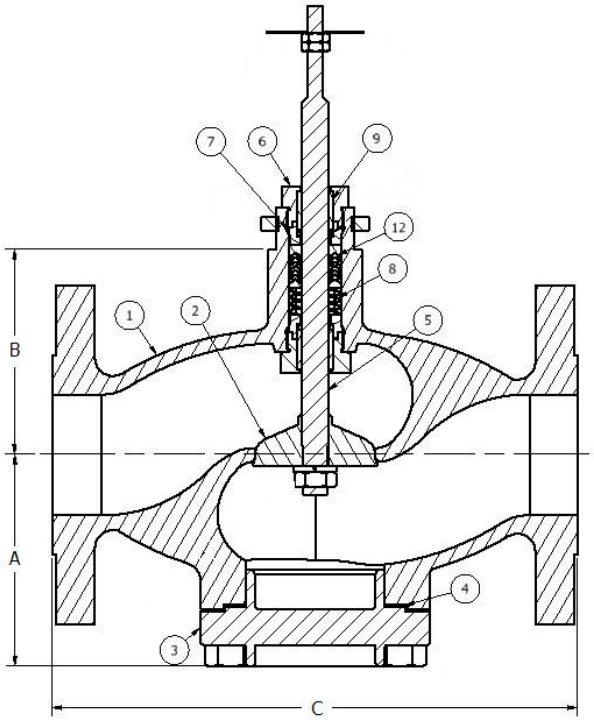
Plug design:	Equal Percentage, Linear, Soft Seat
Leakage rating:	ANSI/FCI 70-2 Class IV, VI
Rangeabilty:	50:1
Travel:	3/4" & 1-1/8"
Body design rating:	ASME 150/300
Stem Seals:	PTFE live loaded V-ring Graphite
Diaphragm design:	Semi-rolling
Pneumatic Design:	Multi-spring diaphragm
Action (options):	Fail Open Fail Close Field reversible
Positioner mounting:	IEC 60534-6-1 (NAMUR)

Flow Characteristic:



2-Way Weights & Dimensions





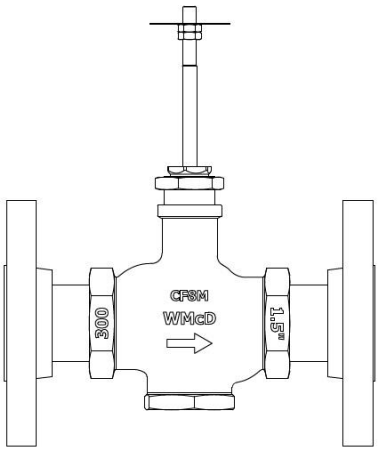
Item	Description	Material
1	Body	316 Stainless Steel
2	Valve Plug*	303 Stainless Steel
3	Body Plug	316 Stainless Steel
4	Body Gasket*	303 Stainless Steel
5	Stem*	316 Stainless Steel
6	Lower Seal Bushing	303 Stainless Steel
7	Gland Nut	303 Stainless Steel
8	Stem Seal Spring*	302 Stainless Steel
9	Guide Bushing*	Rulon 641 / PTFE
10	Washer	303 Stainless Steel
11	Staking Ball	440 Stainless Steel
12	V-ring Stem Seals*	PTFE

* Recommended Spare Parts

Size	A	B	C NPT	C 150#	C 300#	Weight (lbs)		
						NPT	150#	300#
½"	1.76	2.95	4.50	7.25	7.75	3.5	6	7
¾"	1.76	2.95	4.50	7.25	7.75	3.5	7	9
1"	1.74	2.95	4.50	7.25	7.75	5.5	10	13
1 ½"	2.15	2.95	5.00	8.75	9.25	6.8	14	19
2"	2.31	2.95	6.00	10	10.5	10	21	25
2 ½"	4.38	4.25	-	10.88	11.5	-	41	46
3"	5.56	4.25	-	11.75	12.5	-	65	74
4"	6.19	4.25	-	13.88	14.5	-	92	112

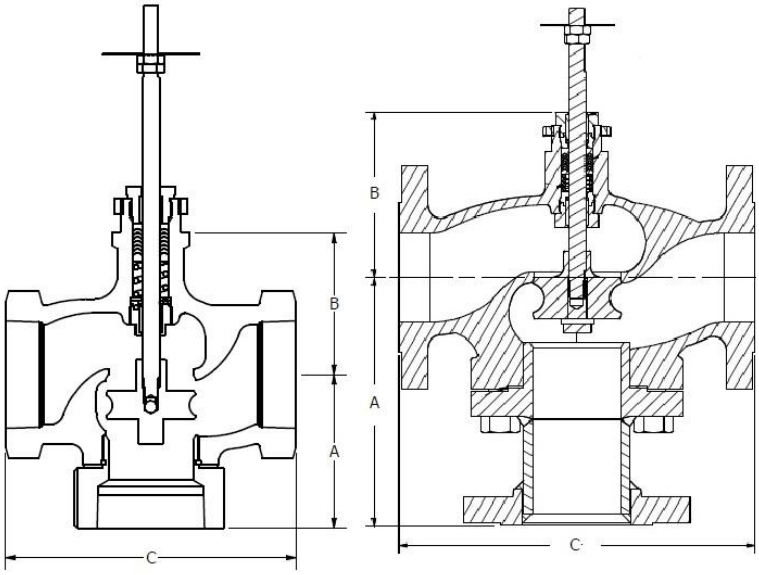
The HB Series valve is designed to be a rugged general service solution for flow control applications.

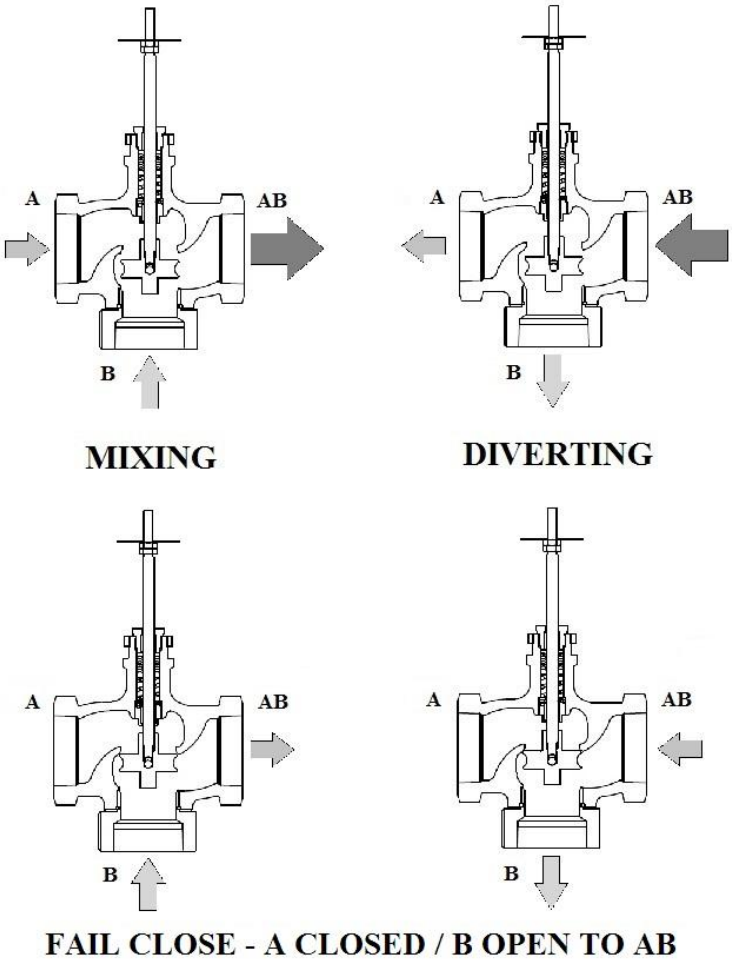
- Conforms to ASME B16.34 Standards
- All Stainless Steel Construction
- Minimal Parts for Long Service Life
- Simple and Easy to Maintain



Additional Flange Options for 1/2" to 2" HB Valve Bodies. Consult Factory.

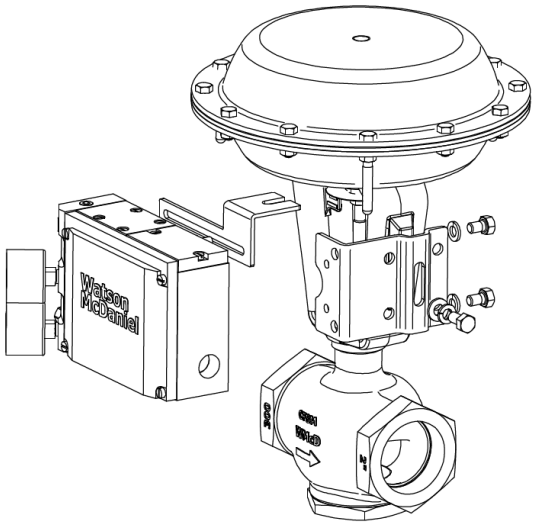
3-Way Weights & Dimensions





Size	A NPT	A 150	A 300	C NPT	C 150#	C 300#	Weight (lbs)		
							NPT	150#	300#
½"	2.31	4	4	4.50	7.25	7.75	4	8.5	9
¾"	2.31	4	4	4.50	7.25	7.75	4	8.5	9
1"	2.31	4	4	4.50	7.25	7.75	5.5	12	13.5
1 ½"	2.84	4.3	4.3	5.00	8.75	9.25	7	18.5	22
2"	3.19	5	5	6.00	10	10.5	11	26	35
2 ½"	-	7.13	7.38	-	10.88	11.5	-	50	58
3"	-	8.32	8.5	-	11.75	12.5	-	74	88
4"	-	9.19	9.5	-	13.88	14.5	-	106	136

Positioners



Pneumatic, electro-pneumatic, and digital positioners are available to be mounted on the HB series control valves

Technical Information

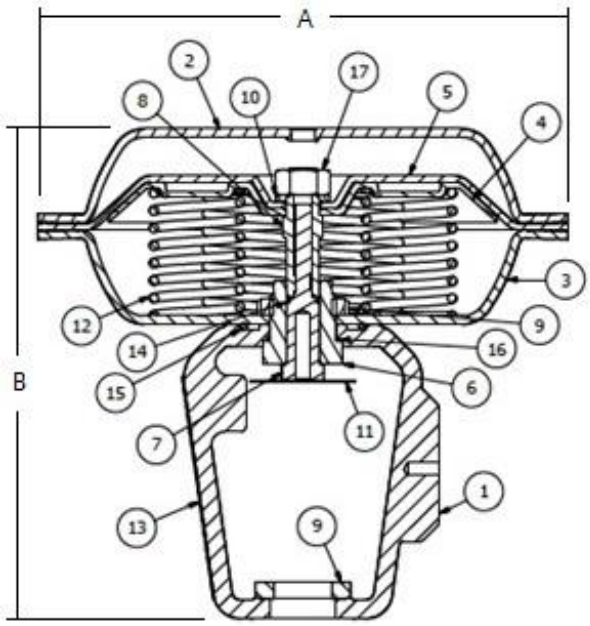
Input Signal:	Pneumatic = 3 -15psi air signal
	E/P & Digital = 4-20mA
Supply Pressure:	<145psig
Housing:	Nema 4X / IP66
Temp Range:	-40°F - 185°F
Weight:	3.5lbs

Options:

Feedback Signal	0-10V input signal
Explosion Proof	ATEX Approval
Intrinsically Safe	Gauge Block

Pneumatic Actuators

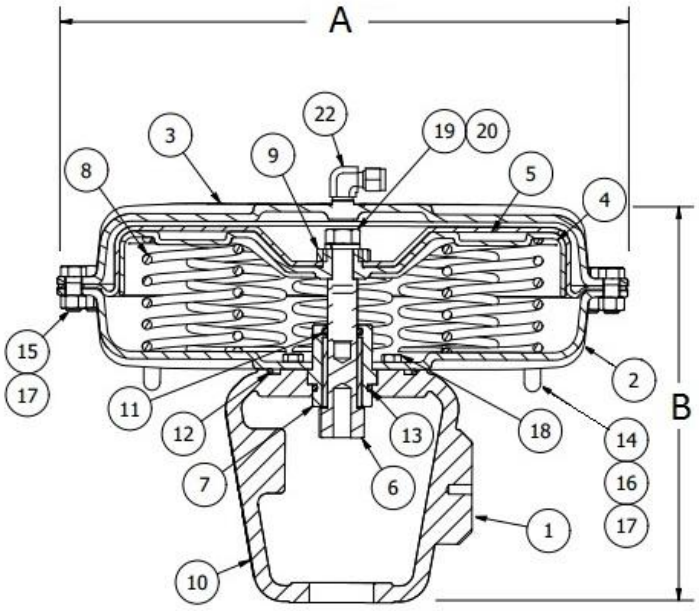
Pneumatic Actuator 50in^2



Item	Description	Material
1	Yoke	Stainless steel
2**	Upper diaphragm case	Epoxy painted steel
3**	Lower diaphragm case	Epoxy painted steel
4	Diaphragm plate	Nickel plated steel
5*	Diaphragm	Nylon reinforced Neoprene
6	Upper guide bush	Stainless Steel / Bronze
7	Lower actuator stem	Stainless steel
8	Upper actuator stem	Stainless steel
9*	Ring nut	Stainless steel
10	Diaphragm washer	Stainless steel
11	Position indicator disc	Stainless steel
12*	Spring**	Stainless steel
13	Nameplate	Stainless steel
14*	Stem O-ring	Viton
15*	Yoke O-ring	Viton
16*	Upper guide O-ring	Viton
17	Hex nut	Stainless steel

* Recommended Spare Parts / **Available in Stainless Steel

Pneumatic Actuator 100in^2



Item	Description	Material
1	Yoke	Stainless steel
2	Lower diaphragm case	Stainless steel
3	Upper diaphragm case	Stainless steel steel
4	Diaphragm plate	Stainless steel
5*	Diaphragm	Nylon reinforced Neoprene
6	Spindle	Stainless steel
7	Guide bushing Assembly	Stainless Steel / Bronze
8*	Spring (x8)	Stainless steel
9	Diaphragm nut	Stainless steel
10	Nameplate	Stainless steel
11*	Spindle O-ring	Viton
12*	Yoke O-ring	Viton
13*	Guide O-ring	Viton
14	Thread Protector	Viton

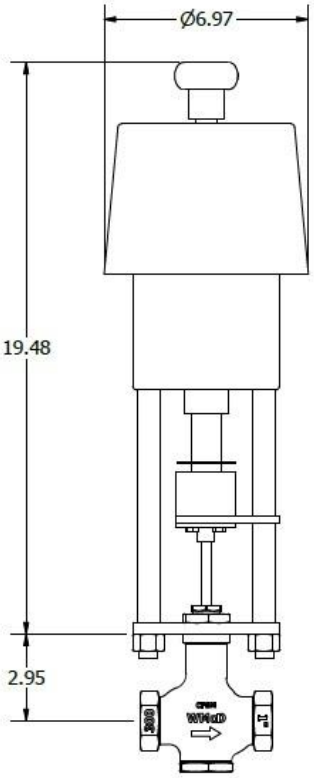
* Recommended Spare Parts

Actuator Size	A	B	Weight (lbs)
50in^2	10.00	9.25	18
100in^2	14.38	10.00	50

The HB series pneumatic actuators are field reversible and are offered in Air-To-Open or Air-To-Close configurations. These compact multi-spring actuators are designed to maximize the valve shut off pressures in a lightweight and efficient package.

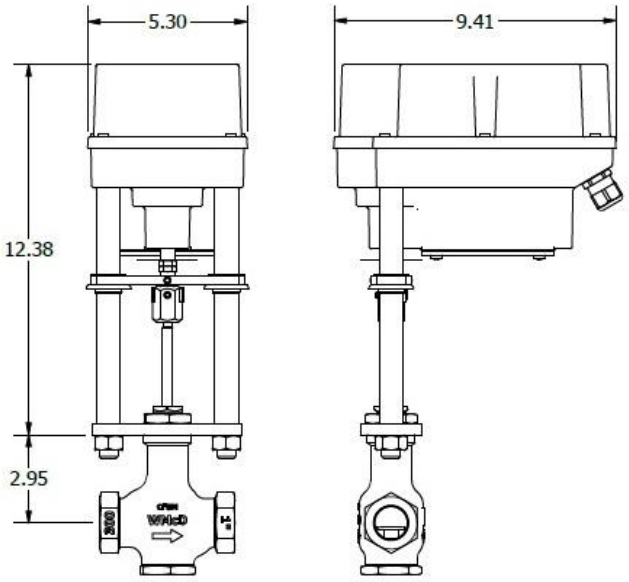
Electric Actuators

EC Fast Acting w/ Super Capacitors



The programmable EC actuator is fast acting and can be setup to fail open, closed, in place, or set point. Ideal for applications requiring a fast response such as semi-instantaneous water heaters.

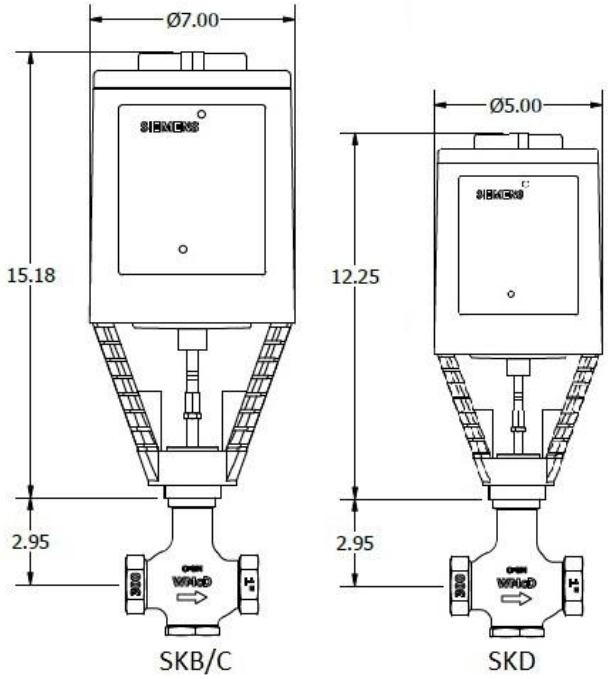
ES Economical w/ Spring Return



The ES is an economical actuator and can be ordered as spring return or spring extend. Ideal for slower HVAC applications.

Actuator	EC	ES	SKB	SKC	SKD
Voltage	24V / 115VAC		24VAC / 115VAC		
Ambient Temp	140°F		130°F		122°F
Enclosure Rating	IP65		IP54 / NEMA 1		
Stroke (in)	2.00	0.75	0.75	1.50	0.75
Thrust (lbs)	1,011	449	629		224
Cycle Time (s)	8	120	120	120	60
Weight (lbs)	18	12.4	18.9	22.5	8.5

SK Series w/ Spring Close



The HB series electric actuators are offered in multiple configurations. All actuators are available with standard options:

- 24V and 115VAC power supplies
- 4-20mA or 0-10V signal inputs
- 4-20mA or 0-10V signal inputs

The SK series are an economical actuator and can be ordered as spring return only and is only fail close. Ideal for slower HVAC applications.

HB Series Shutoff Pressures

HB 3/4" Travel		Max Operating Pressure (PSI)													
		Air to Open Signal (Fail Close)				Air to Close Signal (Fail Open)				3-Way		Electric Actuators			
Valve Size	Orifice	Bench Set	Range Code	3-15psi STD I/P	0-30psi Positioner	Bench Set	Range Code	3-15psi	0-30psi Positioner	3-15psi STD I/P	0-19psi Positioner	ES	EC	SKB SKC	SKD
1/2" thru 1"	0.89	5-15	05	145	350	-	-	-	-	-	-	605	720	720	290
		8-15	00	315	515	3-8	00	430	720	-	-				
		12-21	10	620	720	-	-	-	-	-	-				
		6-11	31	-	-	-	-	-	-	220	425				
		13-22	32	-	-	-	-	-	-	-	720				
1-1/2"	1.25	5-15	05	75	180	-	-	-	-	-	-	315	720	450	150
		8-15	00	170	270	3-8	00	220	665	-	-				
		12-21	10	320	430	-	-	-	-	-	-				
		6-11	31	-	-	-	-	-	-	110	215				
		13-22	32	-	-	-	-	-	-	-	430				
2"	1.75	5-15	05	40	95	-	-	-	-	-	-	160	380	230	75
		8-15	00	85	140	3-8	00	115	350	-	-				
		12-21	10	165	225	-	-	-	-	-	-				
		6-11	31	-	-	-	-	-	-	55	110				
		13-22	32	-	-	-	-	-	-	-	220				
2-1/2"	2.5	5-15	05	15	40	-	-	-	-	-	-	74	179	108	-
		8-15	00	35	60	3-8	00	50	160	-	-				
		12-21	10	75	100	-	-	-	-	-	-				

* Standard Spring Range Set

HB 1-1/8" Travel		Max Operating Pressure (PSI)													
		Air to Open Signal (Fail Close)				Air to Close Signal (Fail Open)				3-Way		Electric Actuators			
Valve Size	Orifice	Bench Set	Range Code	3-15psi STD I/P	0-30psi Positioner	Bench Set	Range Code	3-15psi	0-30psi Positioner	3-15psi STD I/P	0-36psi Positioner	ES	EC	SKC	SKB SKD
2-1/2"	2.5	8-15	00	100	160	3-8	00	140	435	-	-	74	179	109	-
		13-23	11	185	245	-	-	-	-	-	-				
		6-11	31	-	-	-	-	-	-	59	118				
		13-22	32	-	-	-	-	-	-	-	245				
3"	2.88	8-15	00	75	120	3-8	00	106	331	-	-	54	134	80	-
		13-23	11	140	185	-	-	-	-	-	-				
		6-11	31	-	-	-	-	-	-	44	90				
		13-22	32	-	-	-	-	-	-	-	185				
4"	3.88	8-15	00	40	65	3-8	00	56	180	-	-	29	72	43	-
		13-23	11	75	100	-	-	-	-	-	-				
		6-11	31	-	-	-	-	-	-	22	47				
		13-22	32	-	-	-	-	-	-	-	100				

* Standard Spring Range Set

Model Code Configuration Chart

Valve Body									Connection				Actuator					
Model	Code	Trim Style	Code	Seat Type	Code	Packing	Code	Port Type	Code	Size	Code	Connect	Code	Actuator	Code	Power Supply	Code	Bench Set
HB1	0	Equal %	0	Metal Seat	0	Teflon	F	Full	12	1/2"	N	NPT	PA1	50in Air to Open	-	-	00	8-15psi
					1	Graphite	R	Reduced	13	3/4"	1	150# FLG	PA2	50in Air to Close	1	115VAC	10	12-21psi
	1	Linear	1	Soft Seat PTFE					14	1"	3	300# FLG	PB1	100in Air to Open	2	24VAC/DC	05	5-15psi
									16	1-1/2"	B	BSP	PB2	100in Air to Close			11	13-23psi
	3	3-Way	CF	Elast.					17	2"	6	PN16	ECA	Capacitor Fail Close			00	ATC 3-8psi
									18	2-1/2"	2	PN20	ECB	Capacitor Fail Open			31	6-11psi
									19	3"			ESA	Spring Fail Close			32	13-22psi
									20	4"			ESB	Spring Fail Open				Electric Control Signal
													SKB62U	SKB Fail Close				
													SKC62U	SKC Fail Close			0	4-20mA
													SKD62U	SKD Fail Close			1	0-10V
																	2	0-20mA
																	3	2-10V

Optional Accessories

Air Filter Regulator

40 Micron & 5 Micron available

Orifice Plate

Used in steam applications to reduce noise and aid in large pressure drops

Cavitation Adapter

Used with water applications with large pressure drops and elevated temperatures

INTRODUCTION

The HB Series is a high performance; general service control valve designed using CFD technology for high control accuracy and longevity. Stainless steel body material is standard making it compatible with many fluids and environments. The standard valve has an equal percentage flow characteristic with metal seating and a live loaded, Teflon V-ring stem packing. The spring and diaphragm configuration allows the actuator to be used across the ½" to 4" valve size range with varying differential pressures. Easy field reversibility allows the actuator to be installed as either an ATO (air-to-open) or ATC (air-to-close) option. The use of a multi-spring setup permits the units to be compact and lightweight. This valve series can be used to automate control valves in both throttling and on/off control of liquids or gases. The HB Series is also available with electric actuation.

NOTE: This manual is intended to provide detailed information about the installation, operation, and maintenance of the HB series Actuator. Please refer to the factory for any clarifications about the instructions provided within or replacement parts required.

The information should be thoroughly reviewed prior to any installation or maintenance performed on the equipment. All personnel should be properly trained and aware of the instructions shipped with the valve/actuator assembly.

UNPACKING AND INSPECTING

After receiving valve, unpack and inspect to ensure it was not damaged. Verify that the valve stem is true and was not bent during shipping.

CAUTION	**When servicing or installing this valve in systems, all steam and /or water pressure must be turned off and any fluids should be drained completely. Lines must be free of pressure.**
CAUTION	**While air is applied to the actuator to retract the spindle, there is an extreme finger trapping danger if this air pressure is lost or reduced or if there is loss of air pressure due to diaphragm failure for example. Loss of air pressure can lead to rapid extension of the actuator spindle under high force.**
CAUTION	**Never clamp or use a tool to hold the valve on the sides of the body. Damage can occur. Clamp the valve end to end and use the hexes at the ends of the body for tightening.**
CAUTION	**PTFE under normal working temperatures is a safe product. Care should be taken avoid heating PTFE to its sintering temperatures which could give way to gaseous fumes that would require proper ventilation.**

INSTALLATION

1. The valve should be installed in horizontal piping with the actuator vertically positioned above the valve.
2. Be sure to clean and remove any scale or debris in piping prior to installation of valve.
3. Locate the Flow Arrow on the side of the valve body and verify the fluid flow will match the flow arrow orientation.
4. A strainer is recommended upstream of the valve to prevent any debris from potentially interfering with operation.
5. To ease maintenance procedures, it is recommended to have isolation valves installed with unions or flange connections before and after the valve.
6. An optional bypass line can be installed parallel to the control valve.
7. Thread sealant should be applied to connections.
8. Pipe insulation should only be installed on the body and not the actuator.
9. Install the control signal to the actuator via an air or current signal that may use an I/P or Positioner.

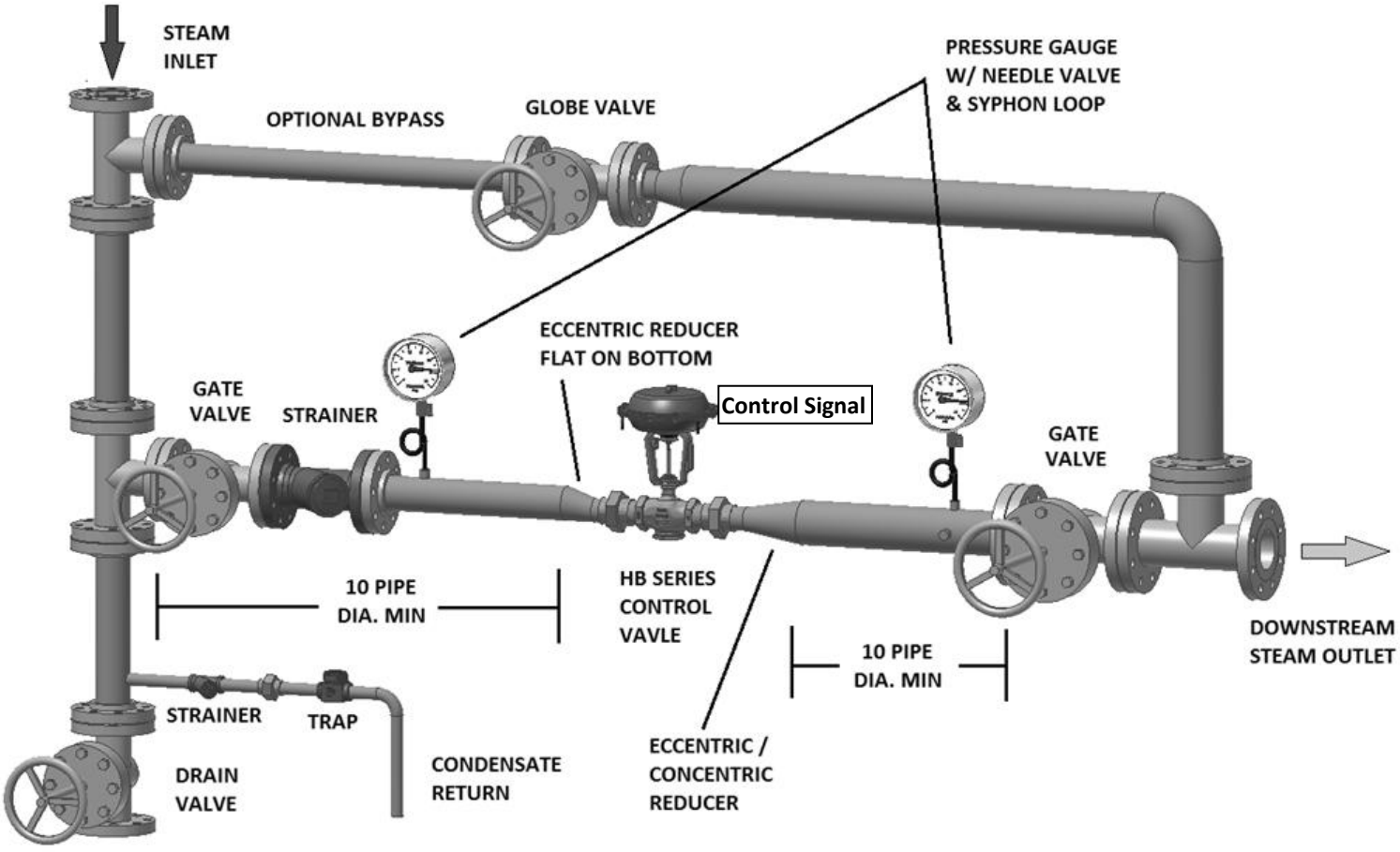


Figure 2: Recommended Valve Installation

START UP

1. All valves in the installation need to be closed.
2. Check to verify that the control signal properly connected to the valve and that the actuator responds to the signal.
3. Open the valve ahead of the steam trap or other drain valve to remove all condensate from the inlet piping. Follow the same procedure for a steam trap on the outlet piping. Note: Serious damage to the piping system and control valve could occur from the effects of water hammer.
4. Verify that the bypass valve is closed.
5. After the condensate has been removed from the system, slowly open the outlet gate valve.
6. Slowly open the inlet gate valve to the HB valve and verify there are no indications of water hammer.
7. Blow down the main inlet strainer.
8. Slowly adjust the control signal, via a controller or other device, so that the control valve begins to actuate.
9. Allow time for the system to adapt to the change due to the piping system volume.
10. After the system has stabilized check the control condition and readjust as required.
11. Inspect the piping system and valve for any leaks and tighten as required.

CAUTION
Never thread the valve stem into the actuator spindle while the valve plug is seated or close to seated. Damage to the seat and plug could occur.

REMOVING ACTUATOR

1. Place the valve body securely in a vise so that the end connection points are being clamped and not the sides of the body.

CAUTION
Improper positioning in a vise could cause the valve body to distort and permanently damage.

2. Loosen the two jam nuts on the valve stem that lock to the actuator spindle. Take care not to rotate the valve stem
3. Apply air pressure to the actuator so that the valve stem moves and is positioned at about the midpoint of the stroke. Take care to apply air only to the non-spring side of the diaphragm.
   a. For air-to-open (fail closed) valves this will be to the connection at the top of the actuator diaphragm case.
   b. For air-to-close (fail open) valves this will be to the connection on the side of the actuator yoke.
4. Unthread the valve stem from the actuator spindle. Be careful not to twist the actuator spindle which could damage the diaphragm.
5. Loosen the large actuator mounting nut that retains the actuator yoke to the valve body.
6. After the valve stem has been completely disconnected from the spindle, lift the actuator from valve.
7. Release the air pressure to the actuator.

INSTALLING ACTUATOR

1. Place the valve body securely in a vise so that the end connection points are being clamped and not the sides of the body. Note: Improper positioning in a vise could cause the valve body to distort causing permanent damage.
2. Apply air pressure to the non-spring actuator connection to position the actuator spindle in the approximate midpoint of travel. Take care not to exceed the maximum air pressure marked on the actuator nameplate.
    a. For air-to-open (fail closed) valves this will be to the connection at the top of the actuator diaphragm case.
    b. For air-to-close (fail open) valves this will be to the connection on the side of the actuator yoke.
3. Push down on the valve stem to ensure that the valve is in the open position.
4. Lower the actuator over the valve body and into place.
5. Fit the large actuator clamping nut to the valve body and tighten it. Do not over tighten
6. Actuator positioning:
    a. For air-to-open: Adjust the air pressure in the actuator so that the actuator spindle extends 1/3 to 1/2 of travel.
    b. For air-to-close: Adjust the air pressure in the actuator so that the actuator spindle extends 1/2 to 2/3 of travel.
7. Thread the valve stem into the actuator spindle approximately 3/4 of an inch.
    a. For air-to-open (fail closed) slowly remove air pressure from the actuator.
    b. For air-to-close (fail open) slowly apply air pressure to the actuator until it fully strokes.
8. Check the gap between the actuator spindle and the upper guide bushing. The gap should be between 0.02” & 0.06”. A thickness gauge will verify the gap.
9. Repeat steps 6 through 8 until the gap is properly set.
10. Thread the 2 stem jam nuts up to the actuator spindle and tighten the screws until secure.
11. Verification by applying air pressure to the valve inlet:
    a. For air-to-open: Reduce the actuator air pressure to 0psig.
    b. For air-to-close: Increase the actuator air pressure until the valve closes, over 18psig will be enough.
12. Apply approximately 40psig air pressure to valve inlet and check for leaks at valve outlet.
13. Re-adjust the stem coupling position if necessary.

SPRING RANGE VERIFICATION

Notes: To prevent any damage to the control valve, it is best to remove the actuator from the valve prior to testing.

Actuators will have this test performed at the factory and this will not be required for new installations.

If the actuator has not been removed from the valve, read the section below for proper disassembly instructions. The spring range will be labeled on the tag mounted on the side of the actuator yoke. The lower pressure value will indicate approximately when the stem will begin to actuate while the upper pressure value will indicate the diaphragm pressure at approximately full stroke.

1. Install a pressure gauge and regulator with an accurate range to the proper ¼" NPT inlet port
2. Slowly open the regulator until the stem begins to move
3. Compare the value with the lower spring range pressure
4. Continue to open the regulator until the stem reaches its max travel and observe the pressure reading
5. If the pressure reading does not match the range listed on the name tag then the wrong springs may be installed or internal components may not be functioning properly. Parts should be checked for wear or damage. Consult the factory with questions.

VALVE DISASSEMBLY / MAINTENANCE

NOTE: A spare parts kit is strongly recommended when disassembling the valve.

1. Make sure fluid supply is safely shut off.
2. Allow sufficient time for valve to cool if required.
3. Remove the actuator assembly from the valve. See the Removing Actuator section for instructions.
4. Remove the body plug from the bottom of the valve body
5. Loosen and remove the packing gland nut located at the top of the body.
6. Push down on the valve stem to remove from body.
7. Remove the packing and spring out of the packing chamber. Reinserting the valve stem back through the packing may help to push packing out of chamber.
8. From the bottom, use a socket to remove the lower seal bushing. The packing washer and o-ring should drop out with the bushing.
9. Inspect the guide bushings in the packing gland nut and lower seal bushing. Replace as required.
10. Replace the packing O-ring as required. Be sure to lubricate prior to install.
11. Clean all surfaces of the stuffing box, seat, stem, and plug. If the stem or plug is corroded, worn or marred, it must be replaced.

LAPPING THE SEAT AND PLUG

1. Follow the disassembly instructions above for the valve.
2. Loosely reinstall the gland nut and lower seal packing into the body.
3. Apply a thin amount of lapping compound around the plug at the taper near the bottom.
4. Slide the stem through the packing until the plug rests on the seat.
5. Apply a very light pressure to the plug on the seat and rotate back and forth. Rotation should not exceed 90 degrees.
6. Lift the plug away from the seat and rotate 90 degrees.
7. Repeat steps 5 and 6 several times to ensure a proper seat. Then remove the stem & plug and clean the lapping compound off of the parts.

VALVE ASSEMBLY

1. Install the packing washer, O-ring, and lower seal bushing from the bottom opening of the valve body. Be sure to lubricate the O-ring prior to install.

CAUTION
Packing must be clean and free of dirt or debris.

2. Install spring from the top of the valve body.
3. Slide the stem up through the packing area.

CAUTION
V rings must be carefully installed over the stem threads and into the stuffing bore to avoid snagging of the lips on threads or on the bore. A sharp edge on the lips is imperative for sealing.

4. Install new packing onto the stem and lower into the packing cavity. The V-ring packing should be installed so that the point of the V is aimed up toward the actuator.
5. Install and tighten the packing gland nut onto the valve body.
6. Verify that the stem slides through the packing without any binding or extreme sticking. Disassemble and check trueness and cleanliness of parts if issue occurs.
7. Install the bottom plug with gasket into the bottom of the valve body.
8. A leak test may be performed to verify all components have been properly installed and tightened prior to service install.

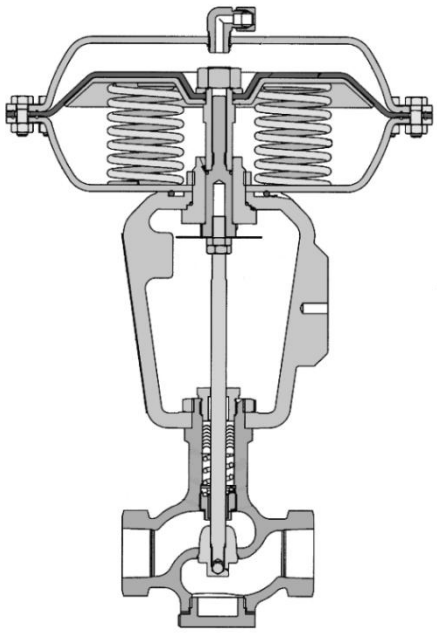


Figure 1: Air to Open

ACTUATOR ASSEMBLY / REVERSABILITY

NOTE: The actuator does not need to be completely removed from the valve body to reverse the actuation.

1. Remove air pressure from the actuator and shut off upstream and downstream isolation valves.
2. Disconnect the valve stem from the actuator spindle. See the Removing Actuator section for details.
3. Remove the thread protectors from the long screws on the actuator case.

CAUTION
The actuator springs are compressed when installed and care should be taken when relieving compression as to not cause injury or damage.

4. Slowly loosen the screws around the actuator case. Be sure to loosen the screws in a star pattern.
    a. For air-to-open (fail closed) the actuator case does not hold compression on the springs.
    b. For air-to-close (fail open) the actuator case does maintain compression on the springs. The long case screws must be used to slowly decompress the springs during removal.
5. Remove the upper case. For air-to-close (fail open) the springs should be removed at this time as well.
6. Now the actuator spindle needs to be separated from the upper actuator stem. Use the diaphragm nut or upper stem to hold the diaphragm and upper stem in place while unthreading the spindle.

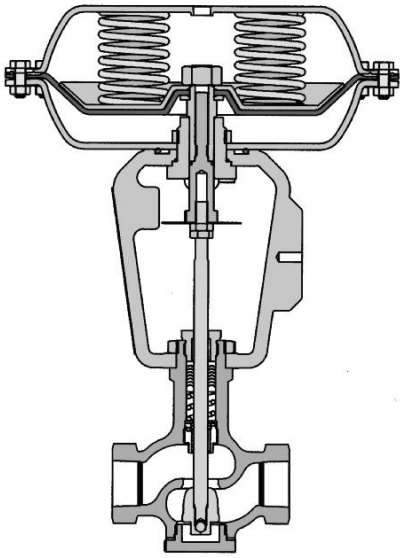


Figure 2: Air to Close

CAUTION
For air-to-open (fail closed) this will relieve the compression from the springs. The spindle must be rotated so the springs don't move out of position which could cause injury or damage.

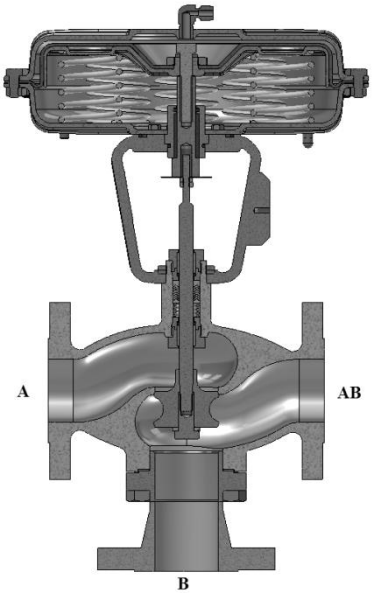
7. The diaphragm nut is then removed from the upper stem to free the diaphragm, diaphragm plate, and washer.
8. Inspect the diaphragm and stem O-ring for wear. Replace as required.
9. To reassemble the diaphragm, diaphragm plate, and washer will fit on the end of the upper stem and tightened with the diaphragm nut. See figures 1 & 2 for proper orientation of the ATO or ATC actuation.
10. Lubricate the stem O-ring and slide down onto the step of the spindle.
11. Assemble the upper stem to the spindle by sliding the spindle in from the bottom of the guide bushing and the upper stem from the top. Keep the outer diaphragm holes lined up with the lower case holes.
    a. If this is for air-to-open, 6 springs for 50in & 8 springs for 100in actuator must sit between the lower case and the diaphragm plate. Make sure to line the springs up with the depressions on the diaphragm plate and only rotate the spindle so that the springs remain seated while tightening. See Figure 1.
    b. For air-to close place 3 springs for 50in & 4 springs for 100in actuator on top of the diaphragm plate.
12. Add the top case.
13. For air-to-close use the long bolts, equally spaced around the case, to compress the springs.
14. Insert the small bolts around the perimeter of the cases and tighten in a star pattern.
15. Check that the air fitting is in the proper location, if not reposition.
    a. Air-to-open is on the top case.
    b. Air-to-close is located on the side of the yoke.

NOTE: The spring count will differ for ATO (6 springs on 50in & 8 springs on 100in) and ATC (3 springs on 50in & 4 springs on 100in)

3-WAY VALVE

The HB 3-Way valve will follow the same start up procedures. The Common Port, AB, will be used as an inlet for diverting applications and an outlet for mixing. The valve is set as a standard for Port A to fail close.

Consult factory for other options.



TROUBLESHOOTING

PROBLEM	POSSIBLE	CAUSE CORRECTION
1. Lack of fluid downstream flow	a) Valve undersized	a) Check capacity of valve against load
	b) Downstream piping undersize	b) Check velocity of steam in piping system
	c) Inlet or outlet gate valve partially closed	c) Open valves
	d) Upstream pipeline strainer blocked	d) Clean strainer screen
	e) Inlet pressure too low causing reduced capacity thru valve	e) Check with gage and correct as required
	f) Actuator diaphragm failed	f) Replace diaphragm
2. Flow conditions downstream are swinging and erratic	a) Valve is extremely oversized	a) Check catalog for rated capacities
	b) Bypass valve open	b) Close valve
	c) Control Loop issue	c) Readjust/check control loop
	d) Foreign object lodged between valve plug and seat	d) Check valve plug and seat. Check stem guide bushing for binding
3. Valve leaking	a) Foreign object lodged between valve plug and seat	a) Check valve plug and seat. Check stem guide bushing for binding
	b) Bypass valve open	b) Close valve
	c) Valve stem not set correctly with actuator	c) Readjust/check
	d) Inlet pressure is too high	d) Check shut off capacity of actuator against load
4. Packing leaking / Fluid around stem	a) Packing / O-Ring is worn	a) Replace packing
	b) Stem is worn or scratched	b) Replace stem