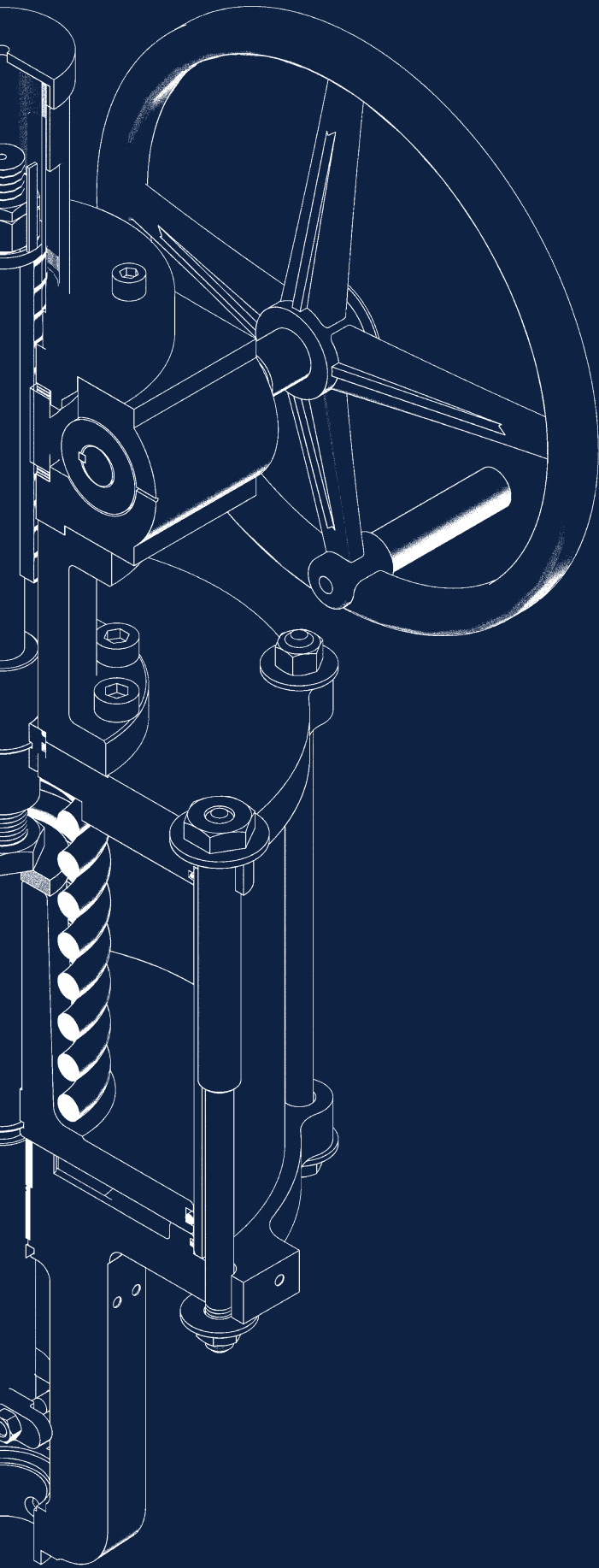


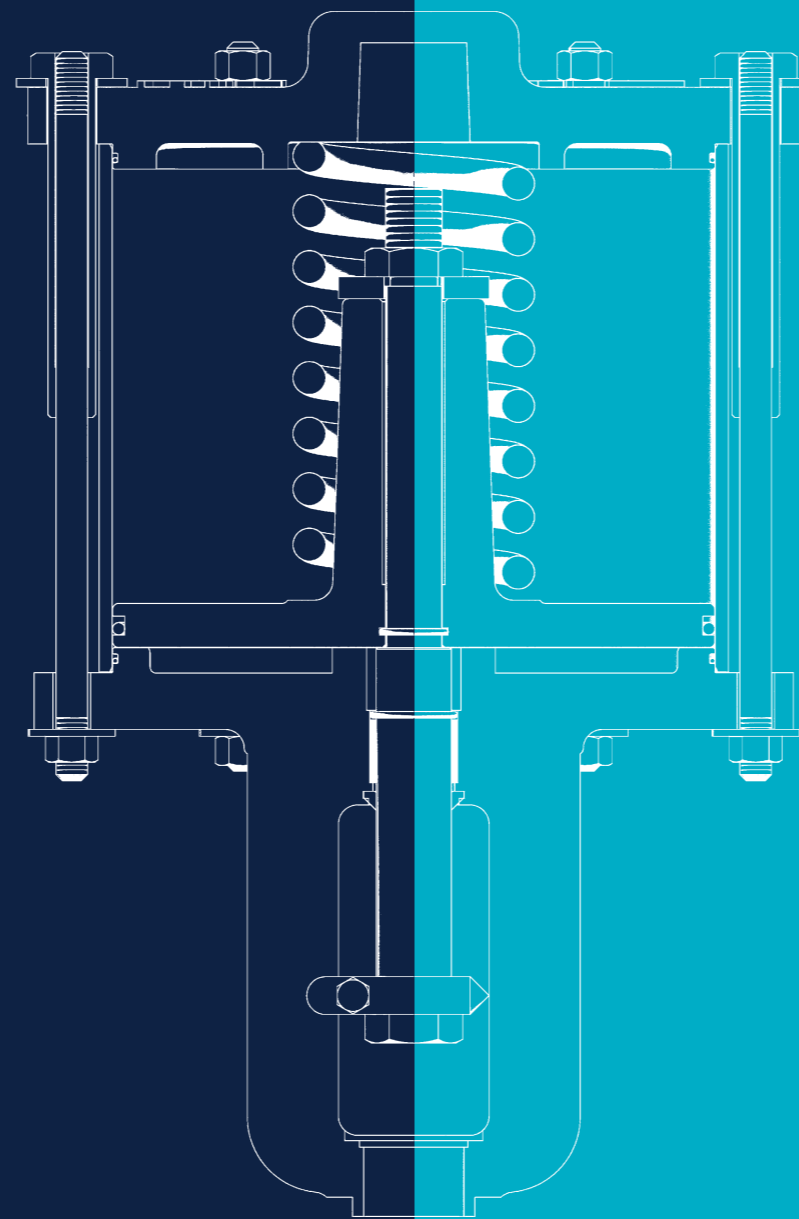
P-Series Linear Spring Cylinder Actuator



It all flows from expertise.

Contents

P-Series Linear Spring Cylinder Actuator overview	01
Design features & performance benefits	02
Engineering data	02
Component list and materials of construction	04
Principles of operation	05
Air fail action	06
Improving actuator stroking speeds	07
Hand wheel operators	08
Standard dimensions & weights	09



P-SERIES ACTUATOR

Designed for fitting onto a wide range of control valves, louvres or dampers, these high power actuating units are for use in on/off, or modulating service with increased thrust capacity compared to diaphragm actuators.

Available as either a single acting or double acting unit. The design is field reversible and utilizes a wide range of springs to provide positive fail action. Positioners are normally yoke mounted and of the double-acting type providing air to both sides of the piston and giving a robust and precise unit that is resistant to load fluctuations.

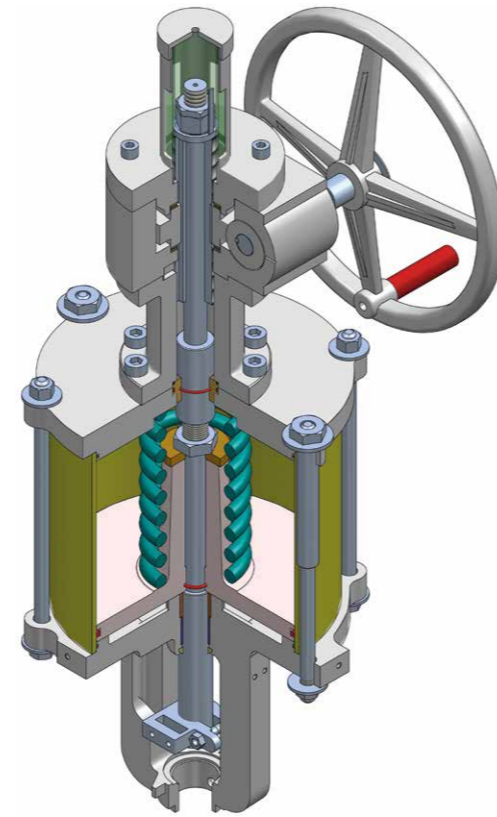


Design features

- ✓ High thrust capability capable of using air supplies up to 150psig (10bar)
- ✓ Multi-size options with long stroke capability
- ✓ Robust components for trouble free, low cost ownership
- ✓ Positive spring air fail action, which is field reversible
- ✓ Lightweight corrosion resistant construction
- ✓ Rotary options available

Performance benefits

- ✓ High degree of stem positioning accuracy
- ✓ Cylinder design has lower air consumption than a comparable diaphragm actuator
- ✓ Highly stable providing inherent stiffness over full stroke
- ✓ Highly responsive with minimum latency on movement or positioning
- ✓ High resolution of stem positioning for up to 12in strokes as standard with longer strokes available
- ✓ Adjustable actuating forces to suit different applications
- ✓ Rigorous in-field testing
- ✓ Manufactured to ISO 9001 certification



P-Series Linear Spring Cylinder Actuator

Engineering data

A range of compact, highly effective and reliable high-thrust pneumatic actuators, the Severn P-Series is capable of working in the most punishing environments. Designed for use in on/off or modulating applications, they are capable of working up to 150psig (10bar) pressure.

An internal spring allows for positive air fail action and the actuator is fully field reversible without any additional parts. The fitting of a yoke mounted double-acting positioner allows air to be fed to both sides of the piston, providing exceptionally stiff, precise movement, together with very high frequency response. This is of particular benefit to provide control where line pressure fluctuations are an issue.

Engineering data (continued)

Ambient operating temperature

For standard materials: -20 °C to +80 °C.
For special materials: -55 °C to +100 °C.
For other operating temperatures please contact us.

Actuator sizes

The range includes four standard sizes: 25, 50, 100, 200in² (nominal piston area). Please contact us for more information on oversized actuators up to 600in².

Actuator strokes

The range includes short stroke and long stroke actuators.

Hand wheels

A range of geared handwheels for top or underside cylinder mounting is available.

Positioner input signals

Using yoke mounted external positioners, normally double acting type, 3-15psig (0.2-1.0bar), 4-20, digital. Also spilt ranges of the above signals. Digital "Smart" positioners are available. A wide range of positioners are available to suit customer requirements.

Pneumatic supply pressure

Minimum 5psig (0.33bar) above calculated actuator requirement. Maximum to actuator is 150psig (10bar).

Operating supply gases

Air, nitrogen and oxygen. Options: methane (natural gas) filter regulator recommended to ensure clean supply.

Air fail action

Positive air fail action from internally mounted springs. Action is field reversible without additional parts.

Actuator mean thrust capability

Supply Pressure 150psig (10bar).

Actuator Size	Thrust available	
	lbF	kN
25	3,000	13.2
50	6,300	28.2
100	12,700	56.0
200	25,300	111.5

Hysteresis and linearity

Within +/- 2%.

Speed and sensitivity

Signal change of 0.01psig (0.013mA) reverses.

Table 1: P-Series Linear Spring Cylinder Actuator – Cylinder and stem size details

Cylinder Size	Actuator dimensions				Effective area of cylinders				Stem dimensions				Maximum volume over piston	
	Stroke		Bore diameter		Upper area		Lower area		Stem diameter		Stem area			
	in	cm	in	cm	in ²	cm ²	in ²	cm ²	ins	cm	in ²	cm ²	in ²	cm ²
25	0.75	20	6	15.2	28.3	182	278	179	0.75	1.90	0.44	2.80	105	1721
25B	4.0	100	6	15.2	28.3	182	278	179	1.38	3.50	1.48	9.70	185	3032
50	1.5	40	8	20.3	50.3	325	49	316	1.25	3.17	1.23	7.70	295	4834
50B	2.5	63	8	20.3	50.3	325	49	316	1.38	3.50	1.48	9.70	550	9013
100	2.5	63	12	30.5	113.1	729	111.3	718	1.5	3.81	1.76	11.60	930	15239
100-5	5.0	125	12	30.5	113.1	729	111.3	718	1.5	3.81	1.76	11.60	1320	21757
100-6	6	150	12	30.5	113.1	729	111.3	718	1.5	3.81	1.76	11.60	1820	29999
100-12	12	300	12	30.5	113.1	729	111.3	718	1.5	3.81	1.76	11.60	1820	29999
100B	4.0	100	12	30.5	113.1	729	111.3	718	1.5	3.81	1.76	11.60	1120	18354
200-5	5.0	125	16	40.6	197	1271	195	1258	2.25	5.72	3.98	25.70	3340	54732
200-6	6.0	150	16	40.6	197	1271	195	1258	2.25	5.72	3.98	25.70	3340	54732
200-12	12.0	300	16	40.6	197	1271	195	1258	2.25	5.72	3.98	25.70	4740	77675
200B	5.0	125	16	40.6	197	1271	195	1258	2.25	5.72	3.98	25.70	3340	54732
315-12	12	30.5	20	50.8	314.2	2027.1	30.59	1974	2.25	5.715	3.98	25.7	7886	129228.4
380-6	6	15.2	22	55.9	380.1	2452.3	376.2	2427.1	2.25	5.715	3.98	25.7	6983	114430.8
450-9	9	22.9	24	61.0	452.4	2918.7	444.1	2865.2	3.25	8.255	8.3	53.5	9974	163444.5
635-9	9	22.9	28.5	72.4	637.9	4115.5	625.4	4034.8	4	10.16	12.57	81.1	5952	97535.8

Note: **Suffix B** denotes baseplate actuators used to operate butterfly valves or similar and are not normally used to operate globe or angle control valves.

Component list and materials of construction

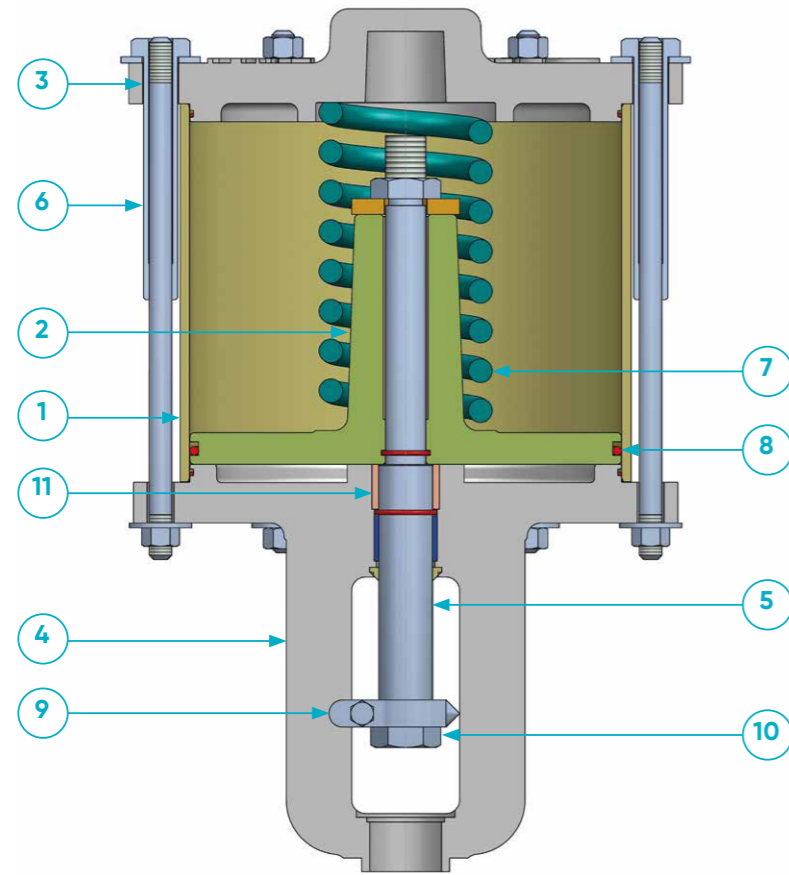


Table 2: P-Series Linear Spring Cylinder Actuator – Materials of construction

Key No.	Component	Materials of construction		
		Standard	Offshore 1	Offshore 2
1	Cylinder	GRP *	Carbon steel plated or stainless steel	Stainless steel
2	Piston	Carbon steel	Aluminium or carbon steel plated	Aluminium or stainless steel
3	Top plate	Carbon steel	Carbon steel plated	Stainless steel
4	Yoke & base plate **	Aluminium	Carbon steel plated	Carbon steel or stainless steel
5	Piston rod / actuator stem	Stainless steel	Stainless steel	Stainless steel
6	Tie rods / tension unit	Carbon steel	Stainless steel	Stainless steel
7	Air fail spring	Alloy steel – Epoxy painted	Alloy steel – Epoxy painted	Alloy steel – Epoxy painted
8	“O” ring seals	Nitrile	Nitrile / Viton	Nitrile / Viton
9	Stem clamp / anti rotation	Stainless steel	Stainless steel	Stainless steel
10	Plug lock nut	Stainless steel	Stainless steel	Stainless steel
11	Guide brushes	Bronze	Bronze	Bronze

* This material which is constructed of a fibre reinforced thermoset epoxy matrix has 25% the weight of steel or brass. It has excellent all round corrosion resistance with no problems in salt or chlorinated water environments. Ideal for all common gases, this material is suitable for the temperature range -73 °C to 132 °C and has low thermal expansion characteristics.

** The yoke & base plate is a 2 piece construction for sizes 100-5 and 200, normally in carbon steel.

Principles of operation

P-Series actuators are capable of operating as a spring-less double acting actuator if required. Offering lower combined valve heights and potentially faster operating speeds.

To achieve the air fail action a spring can be utilised and the wide range available allows the actuator to provide the best performance for your application.

Inherent actuator stiffness and stability

Actuator stiffness is defined as its ability to withstand suddenly changing dynamic forces acting on the valve trim as a result of varying process requirements. In order to be positioned accurately within the operator requirements, the actuator requires an inherent stiffness to minimise fluctuations in its position and this is achieved in the P-Series range by delivering air to both sides of the cylinder piston.

The result is a vast improvement over typical spring opposed diaphragm units in which spring rates remain the same throughout the stroke.

For example when a valve is operated close to its seat with the flow over the plug, sudden changes in the dynamic force can cause the valve to “bath-plug” and slam shut if the actuator has insufficient stiffness. For this reason flow over the plug options are to be avoided in control applications when specifying spring opposed diaphragm actuators. By contrast, P-Series products enable operation with the flow either over, or under, the valve plug with precise positioning under severe throttling conditions.

Table 4 (below) shows the maximum valve seating force available for standard spring and air pressure combinations, with the P-Series Actuators built for air fail close and alternatively air fail open operation.

Table 3: P-Series Linear Spring Cylinder Actuator – Cylinder spring data

Cylinder dimensions				Spring to close		Spring to open	
Cylinder size	Stroke (in)	Spring design	Spring rate (lb/in)	Spring extended (lb)	Spring retracted (lb)	Spring extended (lb)	Spring retracted (lb)
25	0.75	Light	100	175	250	250	175
25	0.75	Standard	180	315	450	450	315
25	0.75	Heavy	445	778	1112	1112	778
25B	4.00	Standard	75	247	547	N/A	N/A
50	1.50	Standard	163	326	570	570	328
50	1.50	Medium	398	796	1393	1393	796
50	1.50	Heavy	546	1092	1911	1911	1092
50B	4.00	Light	200	500	1300	N/A	N/A
50B	4.00	Standard	200	800	1600	N/A	N/A
100	2.50	Light	373	745	1675	1675	745
100	2.50	Standard	550	1100	2475	2475	1100
100	2.50	Heavy	700	1400	3150	3150	1400
100B	4.00	Standard	400	800	2400	N/A	N/A
100B	4.00	Heavy	600	1200	3600	N/A	N/A
200	5.00	Multi-pack	260	1560	2860	2860	1560
200	5.00	Heavy	800	4800	8800	8800	4800
200	5.00	Intermediate	100	600	1100	1100	600
200	5.00	Medium	90	540	990	990	540
200	5.00	Light	70	420	770	770	420
200B	5.00	Multi-pack	260	1560	2860	N/A	N/A

Note: **Suffix B** denotes baseplate actuators used to operate butterfly valves or similar.

Table 4: P-Series Linear Spring Cylinder Actuator – Maximum available seating trust lbF

Supply Pressure	Cylinder actuator size				Cylinder actuator size			
	Standard spring – Air fail close				Standard spring – Air fail open			
psig	25	50	100	200	25	50	100	200
40	1428	2780	5550	8320	663	1387	1987	6620
60	1985	3270	7780	12180	1220	2367	4205	10480
80	2540	4250	10000	16040	1776	3348	6432	14340
100	3098	5250	12230	19900	2333	4329	8659	18200
150	4490	7680	17800	29550	3724	6780	14226	27850

Note: The air pressure is applied above the piston in each case. Higher seating loads are available from using alternative springs.

Air fail action

The standard range of springs shown in Table 3 (page 5) provide the main source available thrust for the P-Series actuators in the event of air failure.

However, some applications require even greater actuator air failure thrusts and this can be provided with the fitting of auxiliary equipment to utilise the supply air held within the cylinder volume in order to provide the additional thrust.

Cylinder actuator with air spring

In this air fail safe system, the stored volume within the cylinder is used for failure protection and forms the air spring which is additional to any mechanical springs fitted internally in the cylinder. The normal double-acting positioner is operated as a three way unit to supply air to the underside of the cylinder piston. Should the valve drop below a predetermined level, air is locked onto the upper side of the cylinder piston in order to close the actuator. The control circuit includes a pressure regulator which is set to give the required level of pressure compatible with closing the actuator under failure conditions.

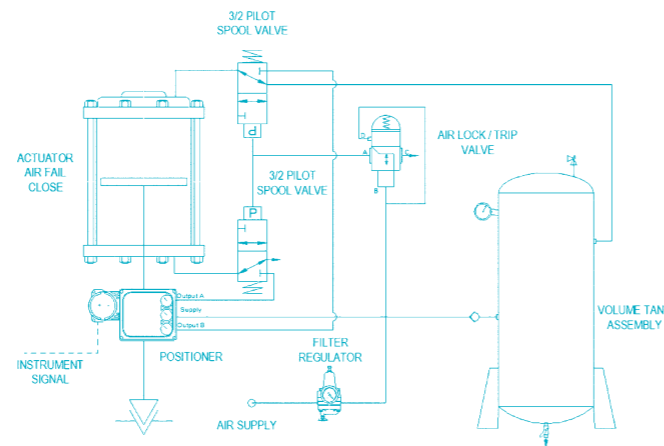


Diagram 1: Air spring using separate volume tank

Cylinder actuator with air spring and external volume tank

In some cases, the internal volume of the cylinder actuator is insufficient to cause the actuator/valve assembly to fully stroke upon air failure. To overcome this, an external volume tank is fitted to supply the additional air control circuit and the positioner now operates as a double-acting unit. Diagram 1 shows that additional lock-up valves have now been fitted to each side of the cylinder to both exhaust the underside of the piston and pressurise its topside in the event of air failure. The P-Series volume tank, along with the valve used for pressurising, is sized to ensure that the actuator will fully stroke.

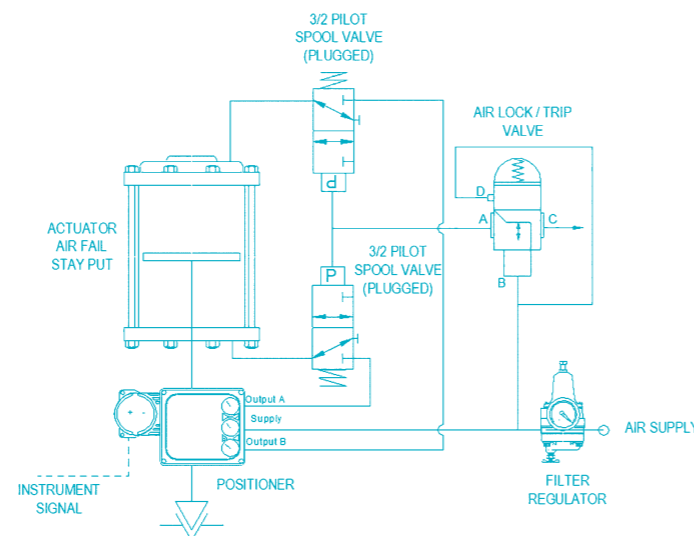


Diagram 2: Fail fix actuator lock-up configuration

Fail fix in the event of air failure

Where applications require the system to hold the actuator in its last operating position in the event of air failure, a three way switching valve is used to sense the air supply (Diagram 2).

Failure of the air supply causes the valve to operate and initiate the signal connections. The two lock-up valves hold the existing pressure on both sides of the cylinder piston, thus locking it into place.

Improving actuator stroking speeds

P-Series Linear Spring Cylinder Actuators can be fitted with volume boosters in order to improve the response times and actuator stroking speeds (for more information please see specification bulletin number (SGI-B 10).

Table 5: P-Series Linear Spring Cylinder Actuator – Stroking speeds

Actuator designation		With positioner *		With model IB10 booster		
Actuator	Stroke		Total time open	Total time close	Total time open	Total time close
Size	in	mm	sec	sec	sec	sec
25	0.75	20	<2	<2	1	1
25	4.00	100	<3	<3	<2	<2
50	1.50	40	<5	<5	<2	<2
50	4.00	100	<5	<4	3	<2
100	2.50	65	16	16	<4	<3.5
100	5.00	125	35	34	7	6.5
100	6.00	150	42	40	8	7.5
100	4.00	100	13.5	11	3	<2
200	5.00	125	65	62	15	14
200	6.00	150	75	73	15.5	14.5

* Speed depends upon positioner selected and size fittings and of pipe work. The illustration data is based on a digital positioner calibrated at 4-20mA and 7bar air supply. Linear Spring Cylinder Actuator fitted with fail close standard spring.

Note:

- 1 Model 1000 Boosters fitted to top and bottom ports of Actuator, with 1/4in fittings between cylinder and boosters, and separate 12mm diameter feed for boosters. 7bar air supply used.
- 2 For sizes or strokes outside these listed or faster stroke speeds such as those used for anti surge applications please contact us.

Hand wheel operators

Two types of geared hand wheel are available for fitting to the P-Series range of cylinder actuators, as follows:

- 1 Top mounted, continuously connected unit which is rated up to the full output thrust of the actuator.
- 2 Side mounted de-clutchable unit which is fitted below the actuator cylinder, leaving the top free for other accessories to be fitted. Table 6 shows the maximum output thrusts generated by these units.

Continuously connected hand wheel

Designed by Severn, this hand wheel can be used to extend, or retract the stem as well as acting as either a high, or low limit stop. A neutral position is indicated on the mechanism when the actuator is in automatic operational mode. The geared unit is sealed within a weather resistant enclosure and the ratios selected ensure a low torque input for high output thrusts.

Turning the wheel moves the screw against the locknut in order to retract the stem. Moving the wheel in a counter clockwise direction brings the lower portion of the screw into contact with the shoulder on the stem, forcing the stem to extend.

A neutral position is obtained with the handwheel screw in any position other than the indicated central neutral, providing a stop to limit travel in either direction.

De-clutchable hand wheel

Available throughout the range of actuator sizes up to 12in (300mm), the hand wheels are capable of providing forces in either direction. The gearing has been selected to ensure easy operation up to its maximum thrust capability (see Table 6 on page 8). The side mounted hand wheel unit may be fitted retrospectively if required. De-clutchable hand wheels provide the same positional accuracy as the positioning actuators. Fitted with a manual changeover valve the P-Series actuator is isolated during hand wheel operation.

Positional accuracy

The de-clutchable hand wheels provide the same positional accuracy as the positioning actuators. Fitted with a manual changeover valve the P-Series Actuator is isolated during hand wheel operation.

Hand wheel operators

Table 6: De-clutchable side mounted hand wheel specification

Actuator	Hand wheel diameter		Turns (in)	Turning force		Output thrust	
	in	mm	Travel	lbF	kgF	lbF	kgF
25	6	150	35	23	10	2000	910
50	8	203	45	45	20	3000	1360
100	10	254	45	46	21	5000	2270
200/5	12	305	60	50	23	7000	3180

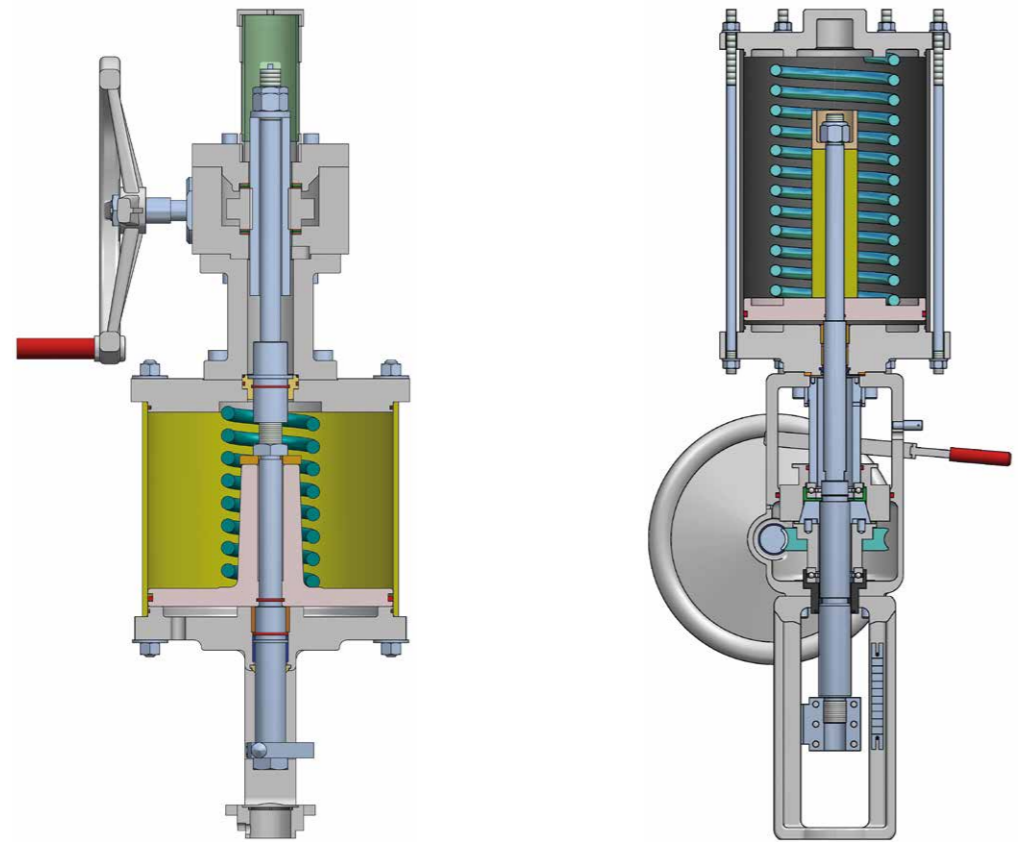
Standard dimensions & weights

Table 7: Dimensions

Actuator	Diameter D		Length E		Length M1		Length E1		Length M2		Length E2	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
25	8.25	210	14.38	365	8.63	211	27.25	692	-	-	-	-
50	10.25	260	18.62	472	9	229	31.75	806	-	-	-	-
100-2.5	15.375	390	23.88	605	10.13	257	39.88	1013	-	-	-	-
100-5	15.375	390	39.5	1005	-	-	-	-	8.63	220	54.75	1390
100-6	15.375	390	40.9	1040	-	-	-	-	8.63	220	55.71	1415
100-12	15.375	390	53	1346	-	-	-	-	8.63	220	82	2085
200-6	20.75	527	44.30	1125	-	-	-	-	8.63	220	59.10	1500
200-12	20.75	527	56	1425	-	-	-	-	8.63	220	85	2160

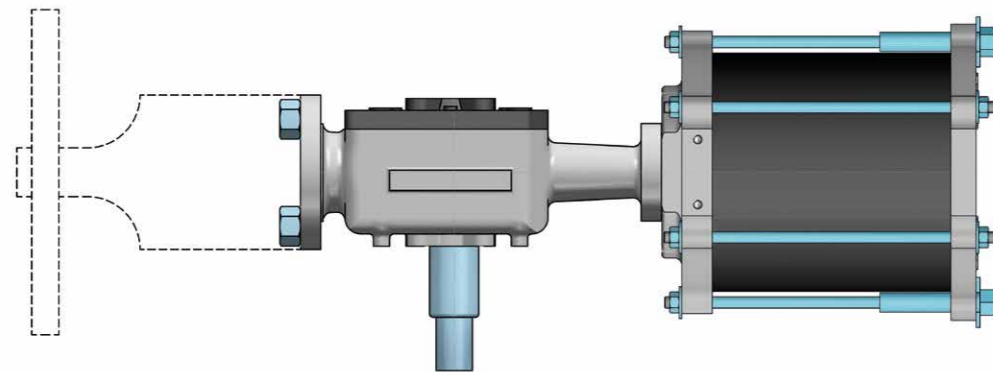
Table 8: Weights

Actuator	Actuator only		With top mounted hand wheel		With side mounted hand wheel	
	lb	kg	lb	kg	lb	kg
25	21	9.5	49	22.2	-	-
50	36	16.3	72	32.7	-	-
100-2.5	85	38.6	145	65.8	-	-
200-6	340	155	-	-	510	232

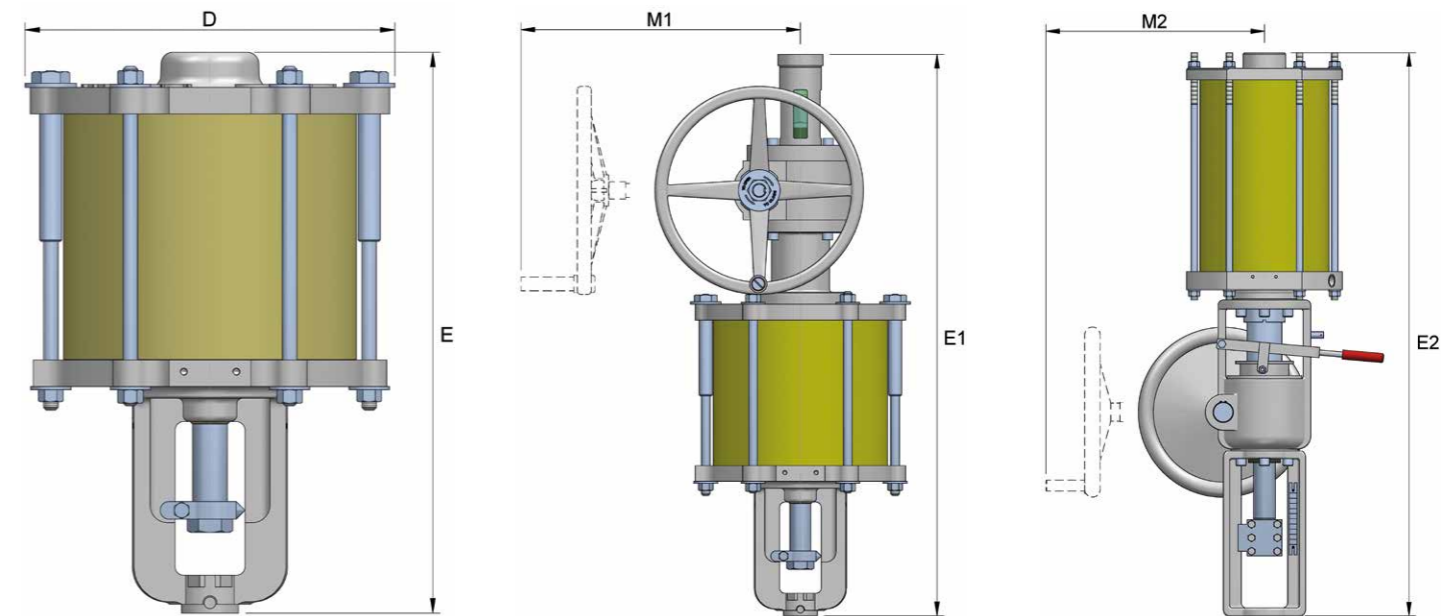


Top mounted continuously connected hand wheel and P-Series Actuator

Side mounted de-clutchable hand wheel and P-Series Actuator



Side mounted de-clutchable hand wheel and P-Series Actuator



P Series dimensions

Top mounted hand wheel dimensions

Side mounted hand wheel dimensions



Engineering
Excellence

Head Office – Brighouse UK
Heywoods Industrial Park,
Birds Royd Lane,
Brighouse, HD6 1NA.

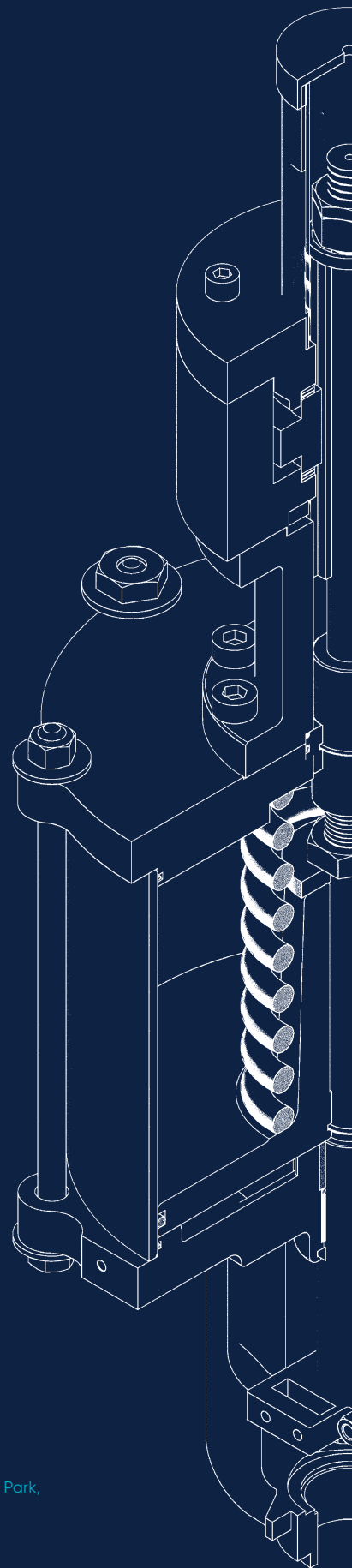
T: +44 (0)845 6070 710
E: sales@severnvalve.com

Gloucester UK
Olympus Park,
Quedgeley,
Gloucester, GL2 4NF.

T: +44 (0)845 223 2040
E: sales@severnvalve.com

Chennai India
F96 & F97, SIPCOT Industrial Park,
Irrungattukottai, Chennai,
Tamilnadu, India - 602 117.

T: +91 44 4710 4200
E: sales@severnvalve.com



www.severnvalve.com

Our policy is one of continuous improvement and we reserve the right to modify these specification details without notice.