CONTROL VALVE STANDARD SPECIFICATION

CYLINDER ROTARY ACTUATOR
SCOTCH-YOKE TYPE

B0S~B6S Series

http://www.proval.co.kr

PROVAL Co., Ltd.

[E-1]

# PNEUMATIC CYLINDER ROTARY ACTUATOR

SCOTCH-YOKE TYPE

☞ GENERAL

The **PROVAL** double acting and spring return cylinder actuators are powerful, high-performance pneumatic actuators that provide positive modulation or on-off operation for Rotary stem motion type control valve and many other quarter-turns (90°) Rotating mechanisms.

The well-accepted pneumatic Cylinder Torque Actuator is an actuator that has is possible to accommodate the variety of needs that continues to broaden. By accomplishing high power output, compactness and high dependability with accumulated improvements on the basis of rich experiences as well as performances.

The scotch-yoke mechanism produces a torque curve that most closely matches the requirements of valve actuation.

☞ FEATURES

- One-piece bottom-entry blow-out proof drive shaft. The centre of the shaft takes the load from the guide-bar in the piston.
- Precision-engineered pistons with our unique guide-bar prevent excess load on the Scotch Yoke, thus producing smooth operation.
- Springs are encapsulated in the pistons and end-cover to our space-saving, patented design. As a result, the S and SR versions have the same dimensions, making conversion of actuators simple and field-safe.
- Encapsulated POM (polyamide-nylon) wear pads eliminate metal-to-metal contact, ensuring smooth operation and long life.
- All "O"-seals are quality-controlled, and the highest quality.
- The travel end stop allows up to 5° (to 95°) adjustment, on site.
- End-cover bolting is long enough to fully relax the springs, which guarantees field safety when servicing the actuator.
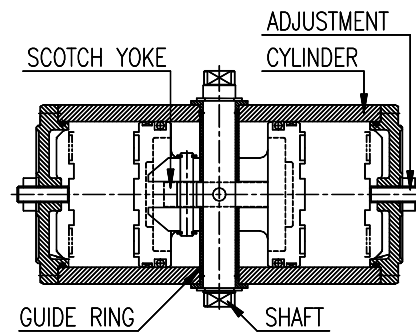
Part Name	Design Construction
Cylinder	Extruded, anodized aluminum die-casting Good corrosion resistance. Easy to clean.
Scotch-Yoke	Hardened Scotch-Yoke with angled slots. Higher start torque. Higher end torque.
Shaft	Stainless steel. Chemically nickel-plated. Flats for manual operation
Guide Ring	Guide Ring in acetal plastic. Low friction. Perfect guiding of piston.
Adjustment	Precise fine-adjustment of the remotest Piston position.

☞ STANDARD SPECIFICATION

Type	Scotch-yoke										
Action	Direct Action (D.A), Reverse Action (R.A)										
Function	Double Acting type, Spring Return type										
Actuator Model	Double Acting						Single Acting					
	B0S	B1S	B2S	B3S	B4S	B6S	B0SR	B1SR	B2SR	B3SR	B4SR	B6SR
Cylinder Diameter	Ø55	Ø70	Ø90	Ø105	Ø120	Ø180	Ø55	Ø70	Ø90	Ø105	Ø120	Ø180
Materials — Cylinder	Al-Alloy (Extrusion molding , Anodized)										
Materials — Scotch piston	Al-Alloy (Die-casting)										
Materials — Shaft	SUS304 (Hard face)										
Materials — O-Ring	EPDM (※ Viton)										
Supply Air Pressure kPa(kgf/cm²G)	400 ~ 700 (4.0 ~ 7.0)						500 ~ 700 (5.0 ~ 7.0)					
Output Shaft Rotation	0° ~ 90°										
Output Torque	See "TORQUE DATA" page 5										
Air Connection	B0S(R) ~B4S(R) : Rc 1/4″ , B6S(R) : Rc 3/8″										
Ambient Temperature	-10°C ~ +70°C (※0°C ~ +100°C)										
Option	Manual H/W , Rotation Stopper , Special Piping & Fitting, Low or high Temp Service, Non-Standard Painting, etc.										
Accessories	E/P Positioner, Air-Set, Limit S/W, Solenoid V/V, Position Transmitter, Speed Controller, Lock-Up V/V etc.										

[NOTE] ※: Manufactured and attached as according to customer's order.

☞ CONSTRUCTION
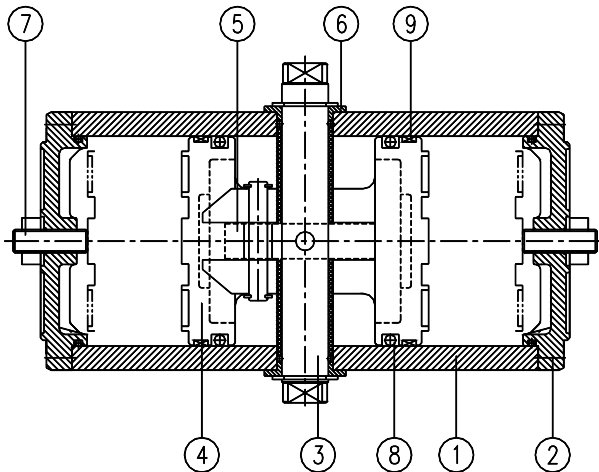
| No.	Parts Name	Materials
1	Cylinder	Al-Alloy (Anodized)
2	Cover	Al-Alloy (Die-casting)
3	Shaft	SUS304(Hard face)
4	Piston	Al-Alloy (Die-casting)
5	Scotch-yoke	S45C (Hard face)
6	Bushing	BsBMD2
7	Adjustment	SUS304
8	O-ring	N.B.R (※ Viton)
9	Backup-ring	PTFE+BsBMD2

☞ OPERATION

1. Double Action

B( )S is a double acting actuator – air operated in both directions. For each of the four cylinder sizes there is the two-piston type the two-piston units provide double the torque of single piston units. The end plates have adjustment screws for fine adjustment of actuator travel. In the normal execution the actuators are for clockwise closing but the **PROVAL** actuators can easily be changed (the pistons are turned 180°) so that from the same signal anti-clockwise opening can be achieved without altering position of actuator. An adjustment of ±5° can thus be made at open or as an alternative at closed position.

PORT 'A' PORT 'B'
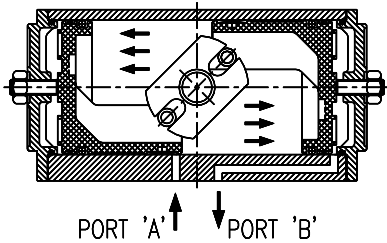
• Air supplied to port 'A' forces pistons apart and toward end positions with exhaust air exiting at port 'B'.


PORT 'A' PORT 'B'
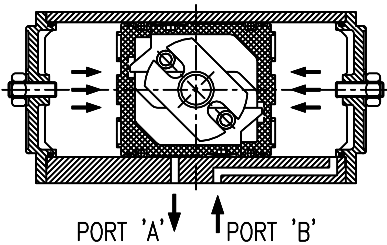
• Air supplied to port 'B' forces pistons toward center with exhaust air exiting at port 'A'

2. Single Acting (Spring return)

B(   )SR is the spring return actuator. It is air operated is one direction. This in turn compresses the spring. On venting actuator the spring returns shaft to start position. This consequently provides a "fail safe" operation in the case of power failure. Normally the SR actuators are delivered with spring closing function, but can easily be changed (the pistons are turned 180°) so that the spring pack opens the valve instead.

The spring packs are self contained units which are easy to it to existing actuators (no loose springs). Different standard spring combinations give many variation possibilities.
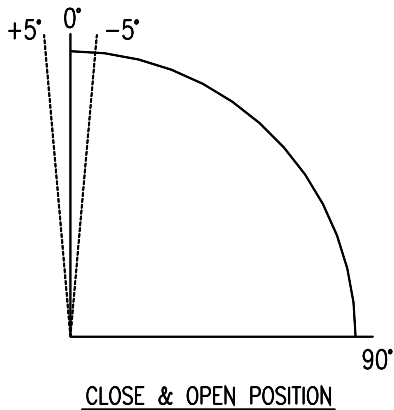

PORT 'A' PORT 'B'
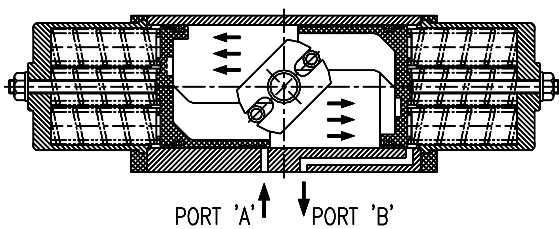
• Air supplied to port 'A' forces pistons apart and toward end positions, compressing spring. Exhaust air exist at port 'B'
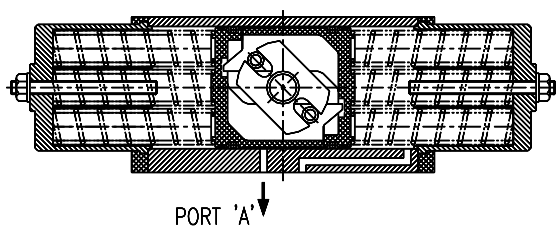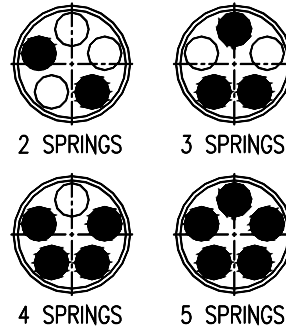

PORT 'A'

• Air or electric failure allows springs to force pistons toward center position with exhaust air exiting at port 'A'

☞ TRAVEL STOP ADJUSTMENT

CLOSE & OPEN POSITION

☞ SPRING ARRANGEMENT FOR EACH END OF ACTUATOR

2 SPRINGS   3 SPRINGS

4 SPRINGS   5 SPRINGS

SPRING ARRANGGEMENT
FOR EACH END OF ACTUATOR (B0SR~B2SR)

☞ HOW TO SELECT SIZE OF ACTUATOR AND INSTALLATION

1. Selecting double acting type

In case of double acting actuators it is enough to know the "needed torque" of valve and the available "air supply" and find immediately the value that must be equal or higher than "needed torque"

2. Selecting spring return type

① Determine break – away torque of valve to be automated and add 20 percent as a safety factor.

② Determine available "air supply" pressure to operate the actuator.

③ Next check under the proper "Air Supply" pressure column (90°column) the needed Torque Must be satisfy.

④ Ball and butterfly valves should have at least 60 percent of break or starting torque to close the valve. Lubricated plug valves and some damper operations require almost as much break torque, to close the valve.

⑤ Should the chart number be close to required torque needed for the valve, go to one size larger actuator.

3. Installation

The **PROVAL** actuators feature a female output drive shaft which permits close coupling of the valve/actuator assembles which minimizes misalignment.

① Determine mode of operation of the valve (normally open on closed). Mount bracket to actuator.

② Determine desired quadrant for bracket attachment and direction of mounting (in line or cross line). Rotate valve stem to position necessary to achieve desired operation after first determining if the valve is, or is not, under pressure and ensuring that rotation of the stem is a safe operation.

③ Never disassemble a valve that is under pressure. Use proper safety procedures to prepare the valve for actuator / bracket mounting.

④ Insert coupling into actuator drive shaft and inspect for proper engagement. Then lower the actuator / bracket coupling onto the valve, making sure that the valve stem engages the coupling properly.

⑤ Secure bracket to valve and inspect to verify that valves is in the desired operational mode for valve opening or closing positions. Some valves operate in only one 90° segment.

⑥ Attach air supply Air Torque actuators are factory lubricated. For best operation, use clean dry air or gas, as lubricated air is not necessary. Air to port A provides counter – clockwise / valve open. String return actuators require air supply connected to port A, as standard, port B is equipped with a plug for Spring Return actuators.

☞ TORQUE DATA

1. Double acting torque data (kg-m)

Actuator Model	Air supply (kgf/cm²)				
	3	4	5	6	7
B0S	1.9	2.6	3.2	3.8	4.5
B1S	4.2	5.5	6.9	8.3	9.7
B2S	7.6	10.2	12.7	15.4	17.8
B3S	15.3	20.4	2.3	30	35.6
B4S	22.4	29.8	37.2	41	52
B6S	68	90.7	113.4	136	158

2. Single acting torque data (kg-m)

Actuator Model	Actuator Action	Air supply (kgf/cm²)									
		3		4		5		6		7	
		0°	90°	0°	90°	0°	90°	0°	90°	0°	90°
B0SR	DA	1.5	0.5	2.5	1.5	3.5	2.6	4.6	3.5	-	-
	RA	-	-	2.1	0.5	3.1	1.5	4.1	2.6	5.2	3.6
B1SR	DA	2.9	1.0	4.8	2.9	6.7	4.9	8.7	6.7	-	-
	RA	-	-	3.9	1.0	5.8	2.9	7.8	4.9	9.7	6.8
B2SR	DA	5.5	1.8	9.1	5.9	12.7	9.1	16.3	12.7	-	-
	RA	-	-	7.3	1.9	10.9	5.5	14.6	9.2	18.2	12.7
B3SR	DA	9.3	3.4	15.4	9.4	21.5	15.5	27.7	21.6	-	-
	RA	-	-	12.4	3.5	18.6	9.6	24.6	15.6	30.7	21.7
B4SR	DA	14.5	4.9	24.1	14.5	33.7	24.1	43.3	33.7	-	-
	RA	-	-	19.3	4.9	28.9	14.5	38.5	24.1	48.1	33.7
B6SR	DA	38.6	13.4	64	38.8	89.4	64.2	114.8	89.7	-	-
	RA	-	-	51.4	13.7	76.8	39.1	102.2	64.5	127.7	89.9

☞ TORQUE DIAGRAM

1. Double acting actuator
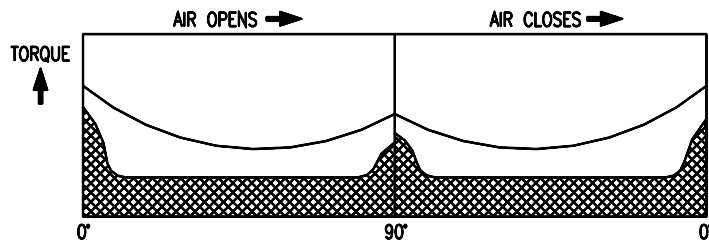
2. Single acting actuator
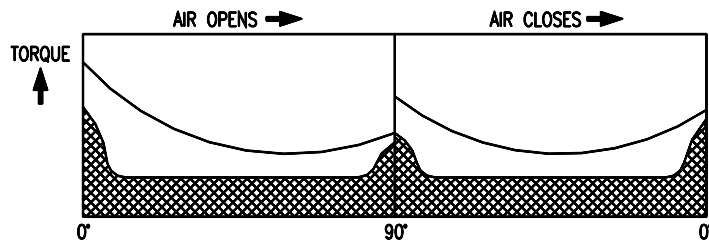
—— PROVAL ACTUATORS.

▨▨▨ GENERAL TORQUE REQUIREMENTS FOR BALL VALVES.

☞ CYLINDER VOLUME

1. Double acting type

Actuator Model	Cylinder Volume(ℓ)		
	A	B	A+B
B0S	0.13	0.15	0.28
B1S	0.27	0.3	0.57
B2S	0.51	0.54	1.05
B3S	1.0	1.5	2.5
B4S	1.5	2.1	3.6
B6S	2.8	4.1	6.9

"A"   "B"   "A"
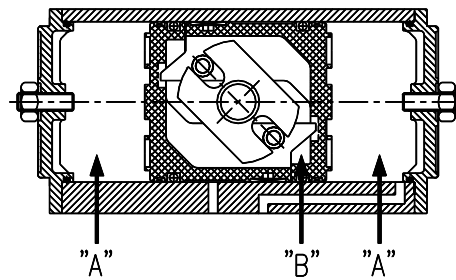
2. Single acting type

Actuator Model	Cylinder volume(ℓ)
	B
B0SR	0.15
B1SR	0.3
B2SR	0.54
B3SR	1.5
B4SR	2.1
B6SR	4.1

"B"
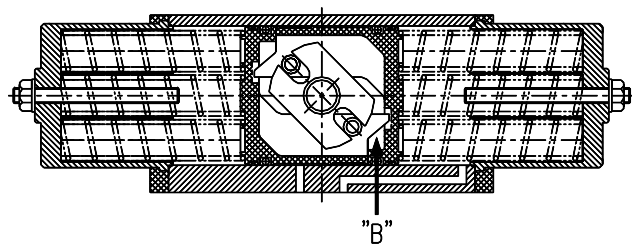
3. Air Consumption

- Double acting: $V = (A+B)(P+1)M$
- Single acting: $V = B(P+1)M$

$\begin{cases} \text{V: Air Consumption ------N } \ell \text{/min} \\ \text{P: Air supply----------------kgf/cm}^2\text{G} \\ \text{M: Action Cycle} \end{cases}$

☞ WEIGHT

[Unit: Kg]

Actuator Model	Weight	Actuator Model	Weight
B0S	1.4	B0SR	2.3
B1S	2.5	B1SR	4.1
B2S	4.2	B2SR	7.8
B3S	9.3	B3SR	16.3
B4S	14.2	B4SR	22.4
B6S	45	B6SR	67

DIMENSION DRAWING

MODEL : B0S(R)~B6S(R)
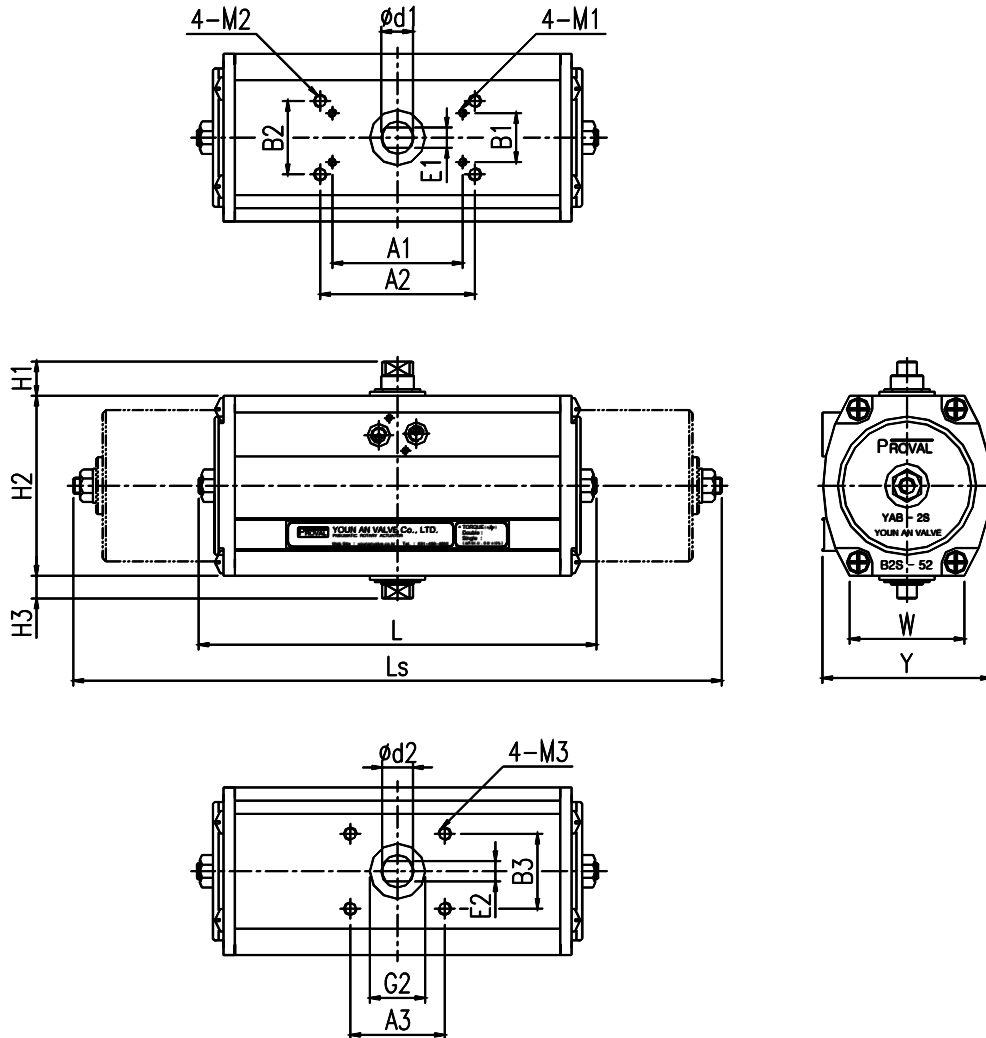
DIMENSIONS

[Unit: mm]

Actuator Model	L	Ls	H1	H2	H3	A1	A2	A3	B1	B2	B3	E1	E2	Ød1	Ød2	4-M1	4-M2	4-M3	W	Y
B0S(R)	175	273	13	66	13	56	90	56	47	47	44	8	8	13.5	13.5	5	5	5	60	65
B1S(R)	215	340	19	90	26	80	100	56	30	46	40	12	□14	17.5	17.5	5	8	8	54	82
B2S(R)	250	425	19	110	26	80	95	58	30	45	46	12	□14	19	19	5	8	8	72	104
B3S(R)	310	472	19	144	40	80	100	123	30	67	67	14	□22	28	28	5	10	10	88	137
B4S(R)	400	610	19	144	40	80	100	123	30	67	67	14	□22	28	28	5	10	10	88	137
B6S(R)	475	730	19	206	52	80	80	68	30	67	118	22	□27	34	34	5	12	12	152	206

MODEL	B0S(R) ~ B6S(R)	SIZE	Ø55 ~ Ø180

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DIMENSION DRAWING

MODEL : B1S(R)H~B6SH(R)
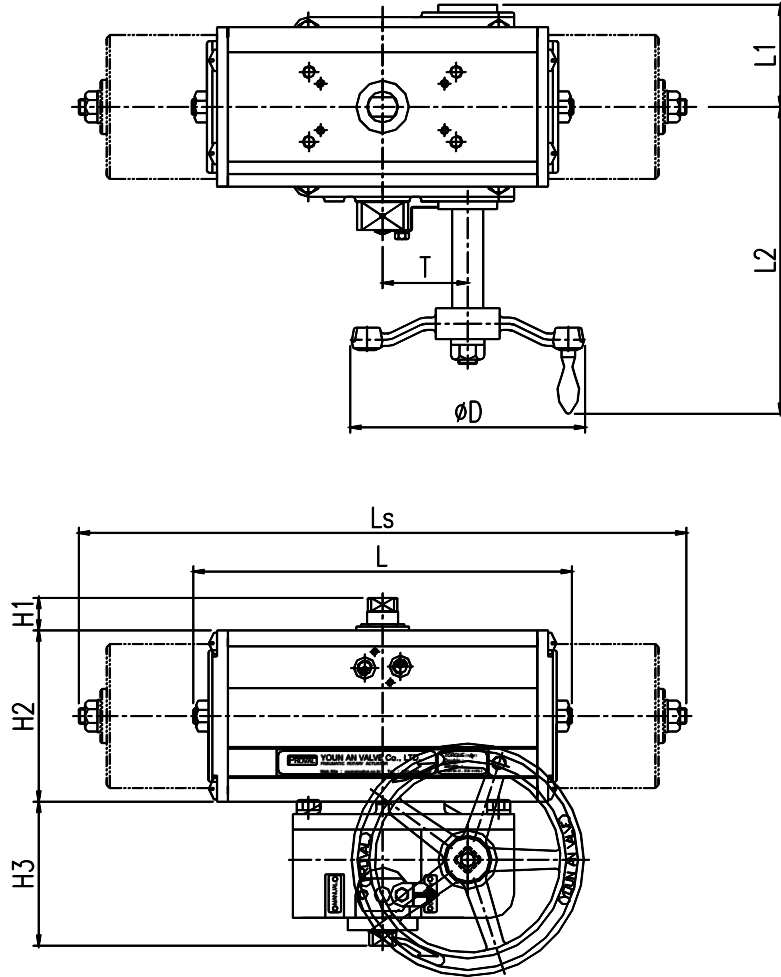
DIMENSIONS [Unit: mm]

Actuator Model	L	Ls	L1	L2	H1	H2	H3	T	ØD
B1S(R)H	215	340	66	198	21	90	100	55	200
B2S(R)H	250	405	66	198	21	110	100	55	200
B3S(R)H	310	560	100	250	40	144	150	120	250
B4S(R)H	400	610	100	250	40	144	150	120	250
B6S(R)H	475	700	130	370	50	206	180	150	400

MODEL	B1S(R)H ~ B6S(R)H	SIZE	Ø70 ~ Ø180
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DIMENSION DRAWING

MODEL : B1S(R)H, B4S(R)H
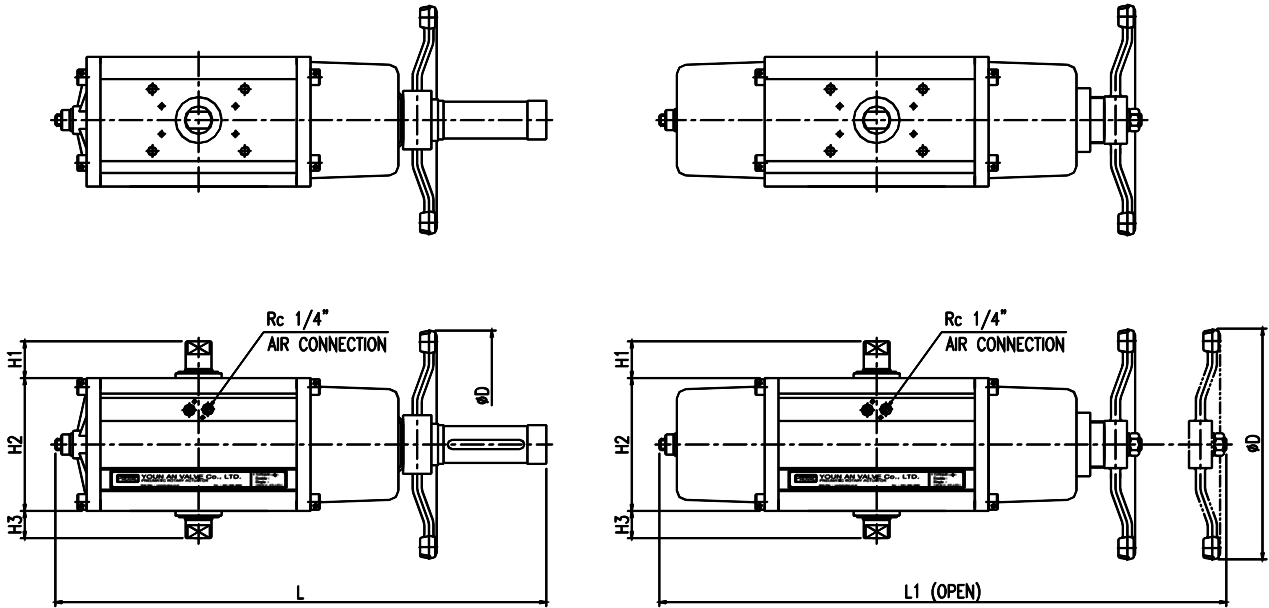
DIMENSIONS [Unit: mm]

Actuator Model	L	L1	H1	H2	H3	ØD
B1S(R)H	355	385	21	90	14	200
B2S(R)H	475	510	21	110	14	200
B3S(R)H	600	640	40	144	21	315
B4S(R)H	700	725	40	144	21	315

MODEL	B1S(R)H ~ B4S(R)H	SIZE	Ø70 ~ Ø120
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DIMENSION DRAWING

MODEL : B6S(R)H

Rc 3/8"
Air Connection

ØD

Double Acting

Rc 3/8"
Air Connection

ØD

Single Acting

DIMENSIONS
[Unit: mm]

Actuator Model	L	L1	H1	H2	H3	ØD Double / Single
B6S(R)H	750	880	50	206	22	430 / 315

MODEL	B6S(R)H	SIZE	Ø180
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