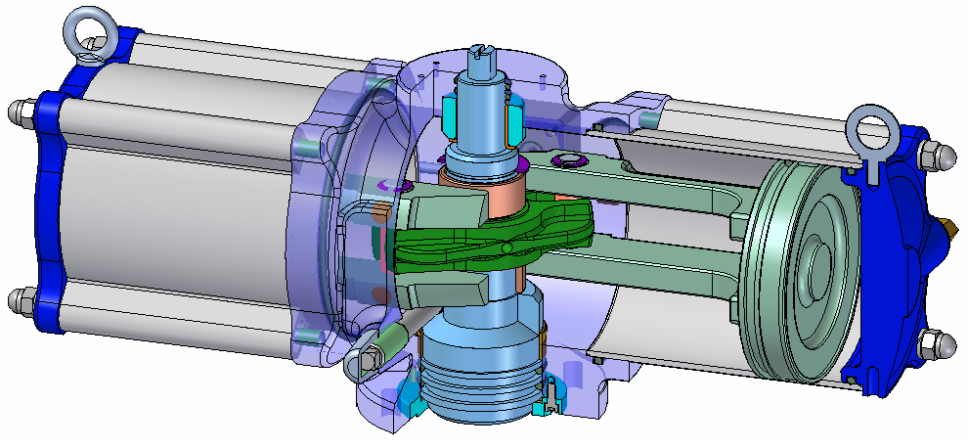
Technical Bulletin A – 380

Series 3800
Canted Scotch Yoke Actuator

Series 3800 Features

General

The Series 3800 Rotary piston actuator are designed to operate rotary valves, such as Ball valves. Butterfly valves and Plug valves for throttling or on-off service. These actuators are unique canted scotch-yoke mechanism. Canted scotch - yoke mechanism



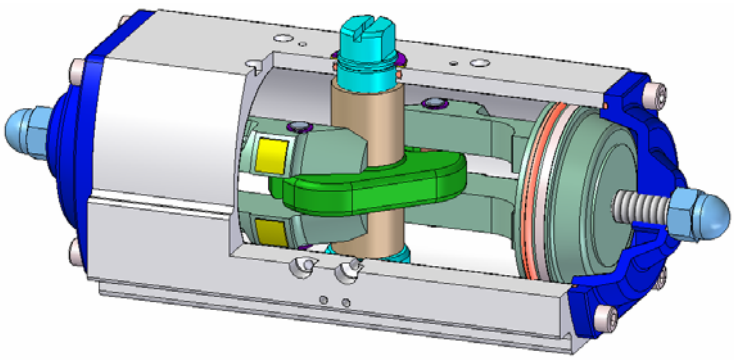
Type B

Performance :

- Ideal high torque.
- Reliability.
- Low hysteresis.
- Light weight.
- Easy maintenance.

Design Flexibility :

- Double acting and spring return acting.
- Double piston.
- Wide selection of optional accessories available.
- Wide adjustable range
  (Maximum rotation angle –100°).
- Manual overrides are option.
- Paint : NORSOK Offshore Standard.



Type A

Design Integrity :

- Over Stroke(-5~95) for all rotary valves.
- Mounting flange dimensions in accordance with ISO 5211.
- Solenoid valve pad in accordance “NAMUR.”

Kind of Actuators :

- 3800D : Double acting
- 3800S : Spring return acting (Air to clock-wise or counter clock-wise)

Scope of Design:

Maximum output torque : 3.6 to 3539 Kgf-m
Cylinder bore : 50 to 300 mm

Working conditions:

Maximum working pressure : 8 Kgf/Cm^{2}G

Temperature : Standard -20℃ ~ 80℃

Low -40℃ ~ 60℃

High 0℃ ~ 150℃

Canted scotch yoke mechanism.

Fig.2 shows the comparison between the output torque curves of a canted, as a constant torque actuator. (i.e. Rack and pinion type)

These graphs demonstrate that, being the same the arm length and the cylinder diameter, the canted scotch-yoke actuator have the most suitable mechanism, from technical and economical reason, to operate quarter turn valves.

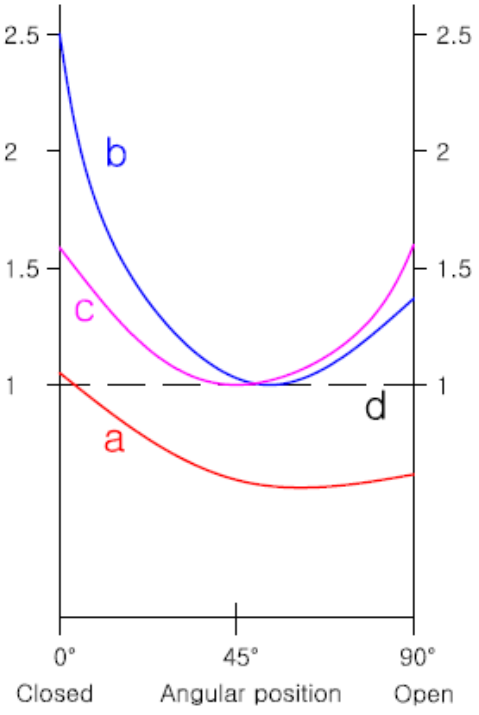


Fig.2

a) Valve Torque

b) Actual output Torque (Canted design)

c) Actual output Torque (Symmetric design)

d) Output torque actuator (Constant torque design)

Fig. 2

Over torque and travel stops

All manufactured valves have acceptable ± tolerance. When these tolerances of the components of an automated valve Assembly are add, the actuator must provide compensation by being able to rotate more than 90° with over travel in both directions, and then stop precisely at the required position.

Series 3800 actuator, with two way rotation travel stops, provide a minimum rotation of -5° to 95°, and positive, adjustable, rotation stopping(10° at each end). (See Fig.3)

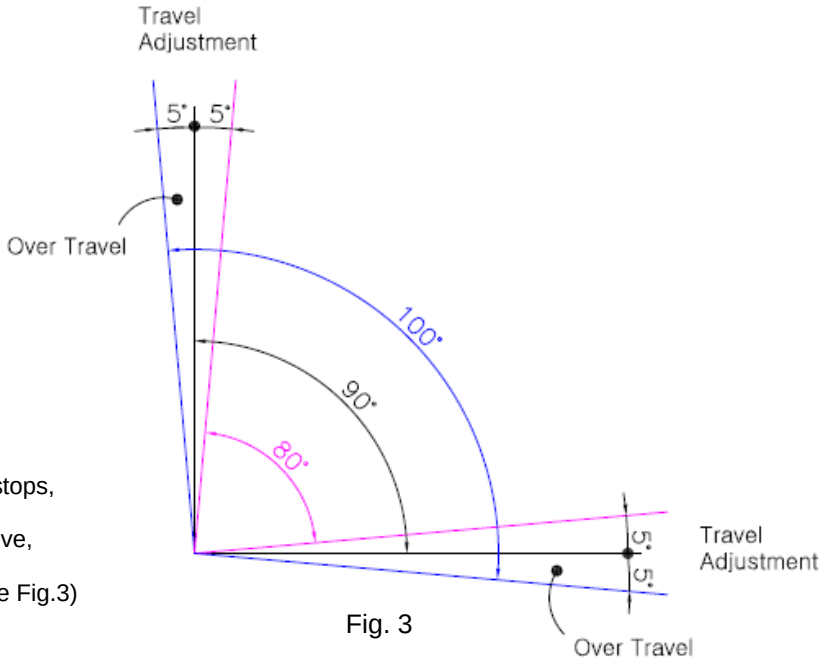


Fig. 3

TORQUE TABLE

1) DOUBLE ACTING

Supply Air : 5.0 kgf/cm²G

kgf• m

SIZE	TORQUE	ISO. BASE	SIZE	TORQUE	ISO. BASE
AC05	7.3	F05	**AC14**	141.8	F12
AC06	16.5	F05/F07	**AC17**	208.6	F14
AC08	32.4	F07	**AC20**	416.3	F16
AC10	72.1	F07/F10	**AC25**	817.9	F25
AC12	121.9	F07/F10	**AC30**	1415.7	F25

2) SPRING RETURN ACTING

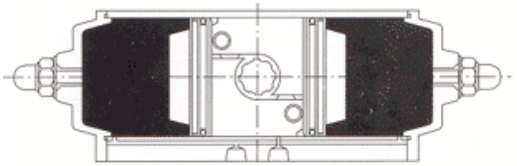
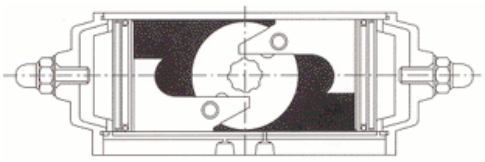
SPRING RANGE : 2~3kgf/cm²G

SUPPLY AIR : 5kgf/cm²G

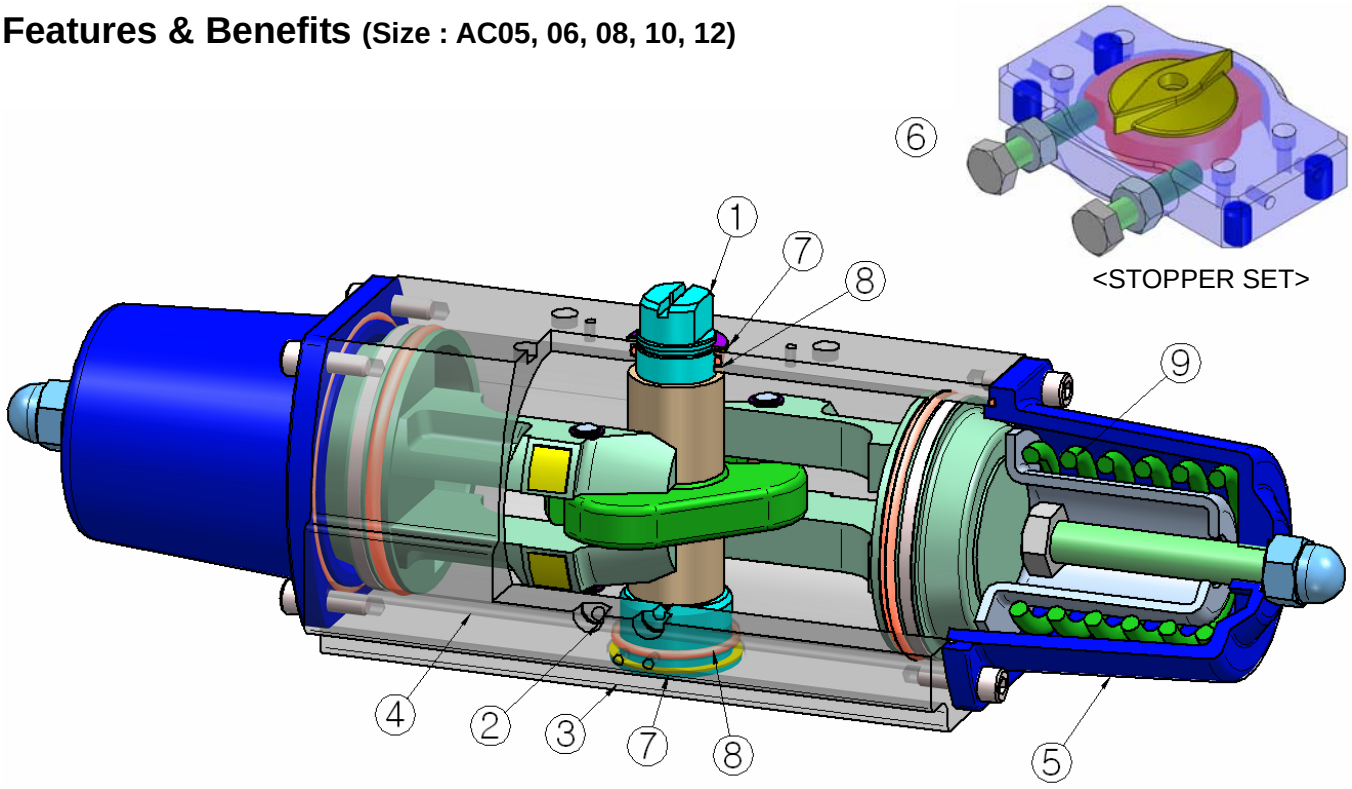
SIZE	NON AIR	0°	ISO. BASE	SIZE	NON AIR	0°	ISO. BASE
AC05	2.9	4.4	F05	**AC14**	56.7	85.1	F12
AC06	6.6	9.9	F05/F07	**AC17**	83.5	125.2	F14
AC08	13.0	19.5	F07	**AC20**	166.5	249.8	F16
AC10	28.9	43.3	F07/F10	**AC25**	327.2	490.8	F25
AC12	48.7	73.1	F07/F10	**AC30**	566.3	849.4	F25

Air Consumption:

SIZE	Cylinder Volume(liter)		
	A	B	A+B
AC05	0.14	0.14	0.28
AC06	0.31	0.31	0.62
AC08	0.6	0.6	1.2
AC10	1.12	1.12	2.24
AC12	2.27	2.27	4.54
AC14	2.76	2.76	5.52
AC17	4.17	4.17	8.34
AC20	8.15	8.15	16.3
AC25	15.57	15.57	31.14
AC30	27.12	27.12	54.24

A	B
	

Features & Benefits (Size : AC05, 06, 08, 10, 12)



<STOPPER SET>

1. NAMUR STANDARD SLOTTED SPINDLE (NAMUR Accessory mounting)

: Provide a self centering, positive, no slop drive for positioners and switches and eliminates the actuator/accessory coupling.

2. NAMUR SOLENOID MOUNTING PAD (An international Standard)

: Permits choice of various manufactures' solenoid valves to be direct mounted to the actuator. A single solenoid valve can be used for all actuator sizes.

3. ISO 5211 STANDARD MOUNTING PAD (An international Standard)

: Designed for optimum strength and interchangeability. Standardized mounting dimensions bolt diameters and bolt hole depths for ease and flexibility of mounting; with or without brackets.

4. VERSATILE MODULAR DESIGN

: Attach or remove double acting or spring modules in minutes, select any combination of fail position, spindle rotation or actuator alignment in minutes - Safety!

5. TWO DIRECTIONAL TRAVEL STOPS (Option Parts)

: Exclusive standard provides rotational adjustment for the actuator Spindle, in both directions of travel. Standard up to size AC12

6. SPINDLE THRUST AND RADIAL BEARINGS

: Acetal thrust bearings project against vertical forces and also seal against atmospheric intrusion. Acetal Radial Bearings support all radial forces.

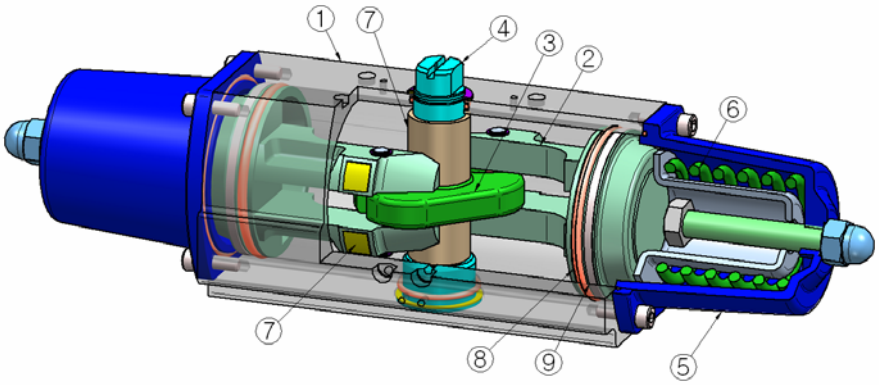
7. SPINDLE SEALS - TOP AND BOTTOM

: Seals to the atmosphere are located to minimize any crevices and maximize the protection against external corrosive build up.

8. INDESTRUCTIBLE FAIL SAFE SPRINGS

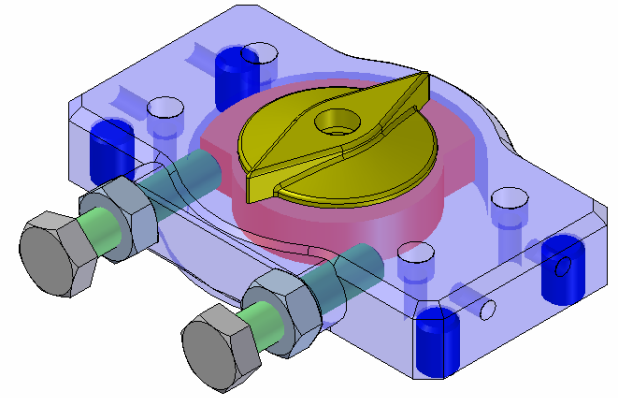
: Designed, built and protected to never break - rated to compensate for "spring set" for true fail safe confidence. Guaranteed and backed by a free complete actuator replacement. Highest "end of stroke" forces in the industry, for maximum reserve.

Part Material

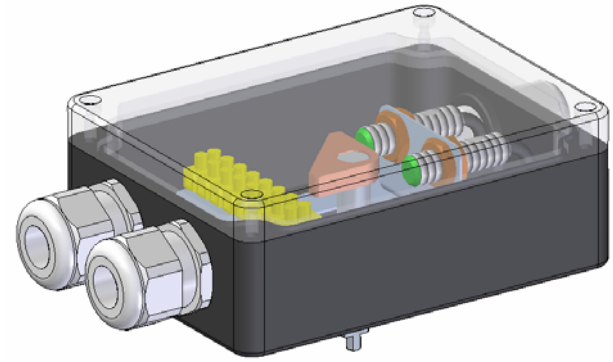


No.	Part Name	Material
1	BODY	A5083
2	PISTON LINK	AC4C
3	DISC	S25C
4	SPINDLE	SUS 303
5	SPRING CASE	AC4C
6	SPRING	SUP9
7	GUIDE	ACETAL
8	O-RING	HNBR
9	WEAR RING	PTFE

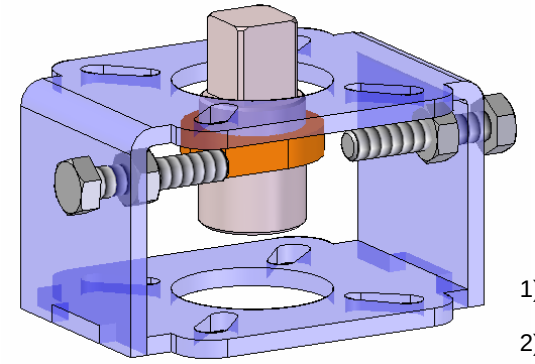
Option Parts



< Stopper Set >



< Limit Switch Box >

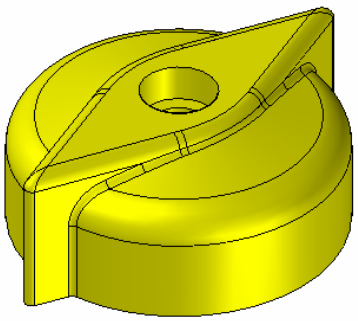


1) Adaptor

2) Yoke

3) Stopper

< Stopper Yoke Set >



< Indicate >

TORQUE CURVE

DOUBLE ACTING

SUPPLY AIR : 5.0kgf/cm2G

Size : AC05D, 06D, 08D, 10D, 12D

Size	0˚	15˚	30˚	45˚	60˚	75˚	90˚
AC05D	7.3	3.8	2.8	2.4	2.4	2.8	3..6
AC06D	16.5	8.7	6.4	5.3	5.5	6.2	8.1
AC08D	32.4	17.1	12.5	10.4	10.8	12.3	16.0
AC10D	72.1	38.0	27.9	23.2	24.0	27.3	35.6
AC12D	121.9	64.2	47.1	39.3	40.6	46.1	60.2

SPRING RETURN

SUPPLY AIR : 5.0 kgf/cm2G

SPRING RANGE : 2.0 ~ 3.0 kgf/cm2G

Size : AC05S, 06S, 08S, 10S, 12S

Size	0˚	15˚	30˚	45˚	60˚	75˚	90˚
AC05S	4.4	2.3	1.7	1.4	1.5	1.7	2.2
AC06S	9.9	5.2	3.8	3.2	3.3	3.7	4.9
AC08S	19.5	10.2	7.5	6.3	6.5	7.4	9.6
AC10S	43.3	22.8	16.7	13.9	14.4	16.4	21.4
AC12S	73.1	38.5	28.2	23.6	24.3	27.7	36.1

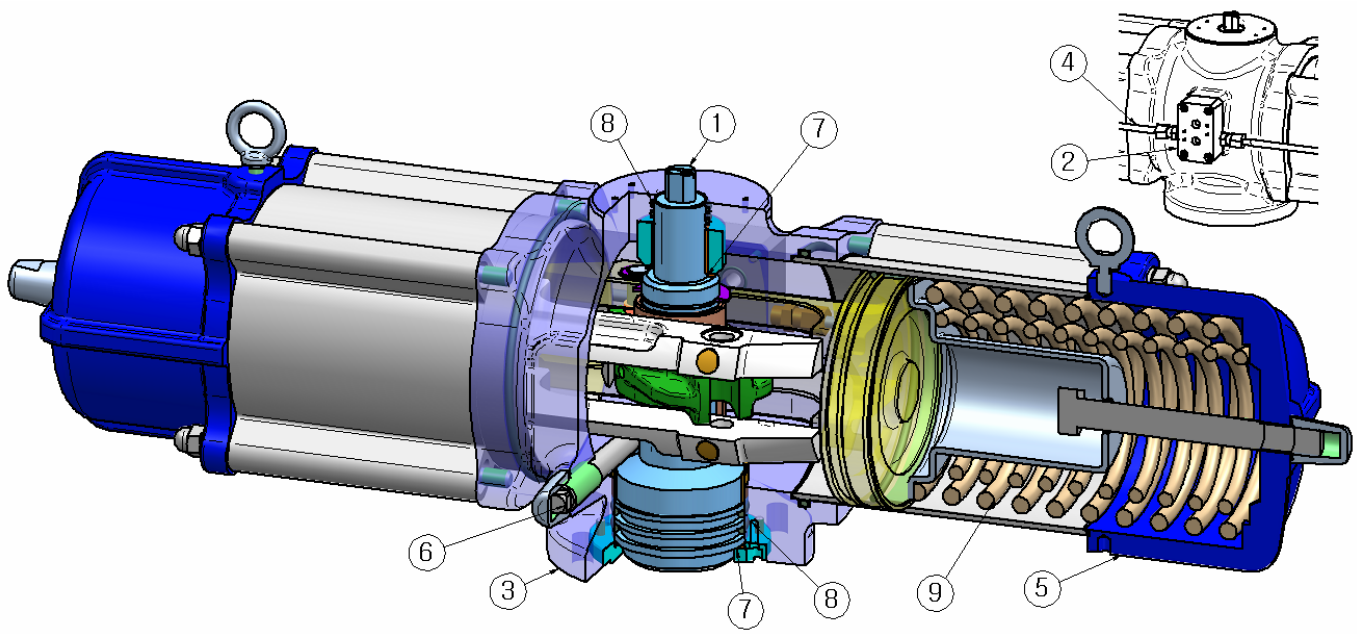
NON AIR

SPRING RANGE : 2.0 ~ 3.0 kgf/cm2G

Size : AC05S, 06S, 08S, 10S, 12S

Size	0˚	15˚	30˚	45˚	60˚	75˚	90˚
AC05S	2.9	1.5	1.1	0.9	1.0	1.1	1.4
AC06S	6.6	3.5	2.5	2.1	2.2	2.5	3.3
AC08S	13.0	6.8	5.0	4.2	4.3	4.9	6.4
AC10S	28.9	15.2	11.1	9.3	9.6	10.9	14.2
AC12S	48.7	25.7	18.8	15.7	16.2	18.4	24.1

Features & Benefits (Size : AC14, 17, 20, 25, 30)



1. NAMUR STANDARD SLOTTED SPINDLE (An international Standard)

: Provide a self centering, positive, no slop drive for positioners and switches and eliminates the actuator/accessory coupling.

2. NAMUR SOLENOID MOUNTING PAD (An international Standard)

: Permits choice of various manufactures' solenoid valves to be direct mounted to the actuator. A single solenoid valve can be used for all actuator sizes.

3. ISO 5211 STANDARD MOUNTING PAD (An international Standard)

: Designed for optimum strength and interchangeability. Standardized mounting dimensions bolt diameters and bolt hole depths for ease and flexibility of mounting; with or without brackets.

4. LARGE AIR PASSAGE

: This unique "supply-size" internal air passage permits obstruction free, fast operation and simple "air assist" when required.

5. VERSATILE MODULAR DESIGN

: Attach or remove double acting or spring modules in minutes, select any combination of fail position, spindle rotation or actuator alignment in minutes - Safety!

6. TWO DIRECTIONAL TRAVEL STOPS

: A unique, exclusive standard provides rotational adjustment for the actuator spindle, in both directions of travel. Standard from size AC14.

7. SPINDLE THRUST AND RADIAL BEARINGS

: Metal thrust bearings project against vertical forces and also seal against atmospheric intrusion. BC6 Radial Bearings support all radial forces.

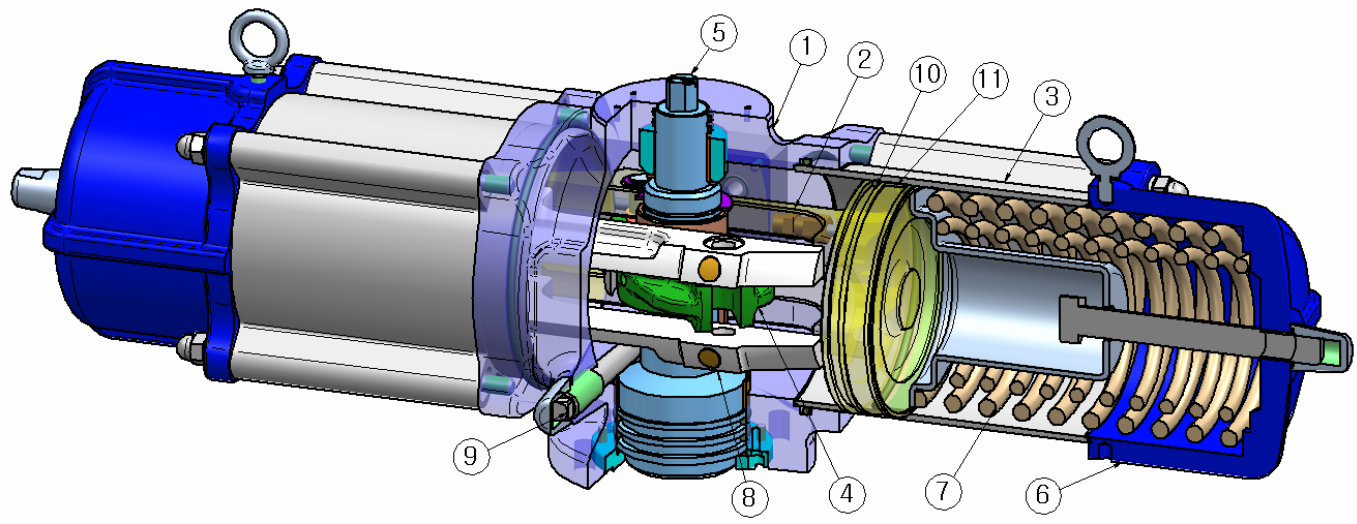
8. SPINDLE DOUBLE SEALS - TOP AND BOTTOM

: Seals to the atmosphere are located to minimize any crevices and maximize the protection against external corrosive build up.

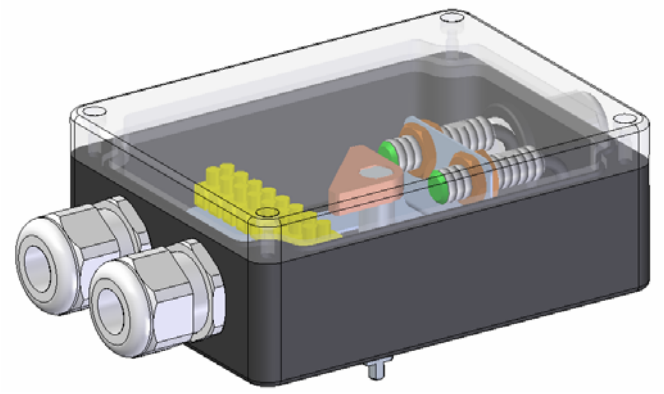
9. INDESTRUCTIBLE FAIL SAFE SPRINGS

: Designed, built and protected to never break - rated to compensate for "spring set" for true fail safe confidence. Guaranteed and backed by a free complete actuator replacement. Highest "end of stroke" forces in the industry, for maximum reserve.

Part Material

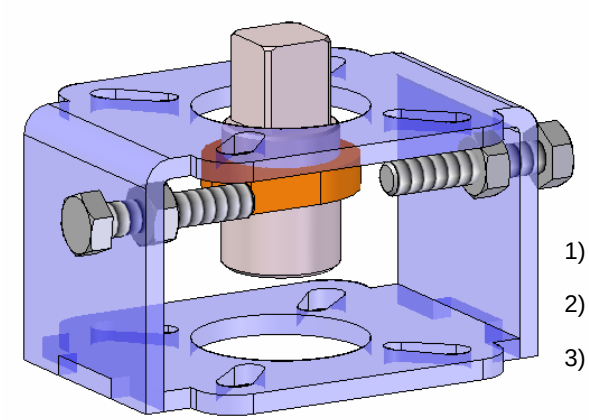


Option Parts



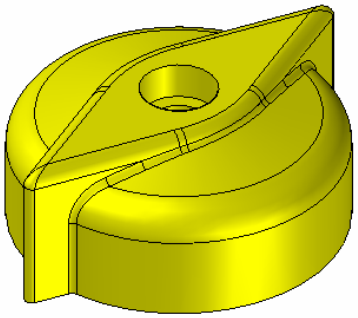
< Limit Switch Box >

No.	Part Name	Material
1	HOUSING	FC300
2	PISTON LINK	AC4C
3	CYLINDER	A5083, STPG370
4	DISC	S25C
5	SPINDLE	SC450
6	SPRING CASE	FC300
7	SPRING	SUP9
8	GUIDE	BC6
9	STOPPER BOLT	SNB7
10	O-RING	HNBR
11	WEAR RING	PTFE



1) Adaptor
2) Yoke
3) Stopper

< Stopper Yoke >



< Indicate >

TORQUE CURVE

DOUBLE ACTING

SUPPLY AIR : 5.0kgf/cm2G

Size : AC14D, 17D, 20D, 25D, 30D

Size	0˚	15˚	30˚	45˚	60˚	75˚	90˚
AC14D	141.8	76.0	55.0	48.4	49.3	57.8	76.3
AC17D	208.6	113.0	82.7	73.5	75.6	88.6	118.8
AC20D	416.3	223.4	162.2	142.9	145.8	169.5	226.5
AC25D	817.9	434.8	312.3	272.1	274.9	317.2	420.7
AC30D	1415.7	754.3	543.4	474.6	480.6	555.8	738.5

SPRING RETURN

SUPPLY AIR : 5.0 kgf/cm2G

SPRING RANGE : 2.0 ~ 3.0 kgf/cm2G

Size : AC14S, 17S, 20S, 25S, 30S

Size	0˚	15˚	30˚	45˚	60˚	75˚	90˚
AC14S	85.1	45.6	33.0	29.0	29.6	34.7	45.8
AC17S	125.2	67.8	49.6	44.1	45.4	53.1	71.3
AC20S	249.8	134.1	97.3	85.1	87.5	101.7	135.9
AC25S	490.8	260.9	187.4	163.2	164.9	190.3	252.4
AC30S	849.4	452.6	326.0	284.7	288.4	333.5	443.1

NON AIR

SPRING RANGE : 2.0 ~ 3.0 kgf/cm2G

Size : AC14S, 17S, 20S, 25S, 30S

Size	0˚	15˚	30˚	45˚	60˚	75˚	90˚
AC14S	56.7	30.4	22.0	19.4	19.7	23.1	30.5
AC17S	83.5	45.2	33.1	29.4	30.2	35.4	47.5
AC20S	166.5	89.4	64.9	57.2	58.3	67.8	90.6
AC25S	327.2	173.9	124.9	108.8	110.0	126.9	168.3
AC30S	566.3	301.7	217.3	189.8	192.3	222.3	295.4

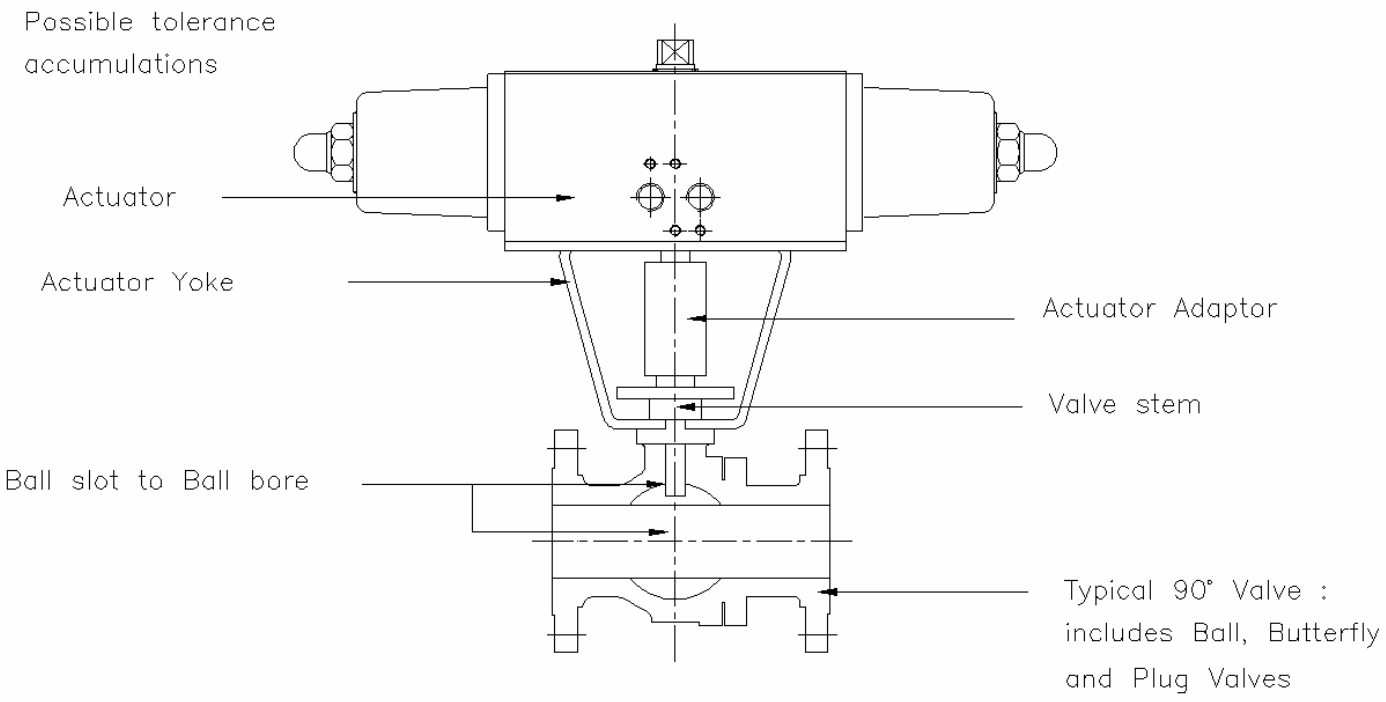
Necessity two directional travel stops :

- Increase valve life.
- Obtain maximum flow through valve.
- Minimize pressure drop through valve.
- Assure positive shut off.

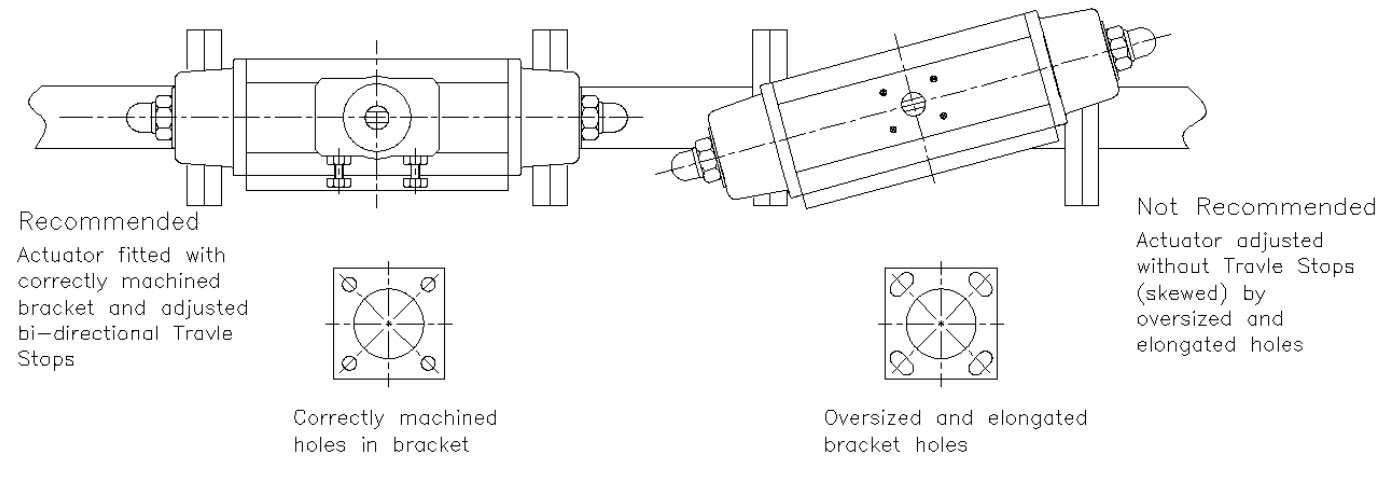
The purpose of a 90 degree rotation Actuator is to turn a quarter turn Valve or Damper to its Open and Closed positions.

Designers and manufactures of Valves and Dampers take great care to ensure that in these correct positions they will give optimum performance, efficiency and service life.

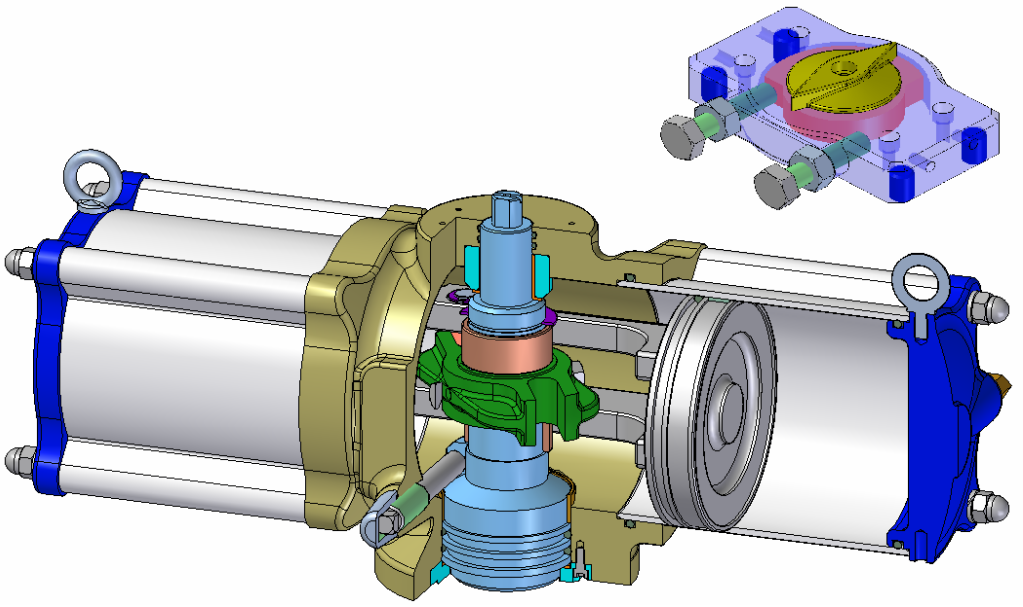
Due to acceptable manufacturing tolerance accumulations of all automation package parts, any accumulation of tolerances (non canceling) can adversely affect the performance, life and function of the Valve or Damper due to angular misalignment.



Many Actuator designs make no provision for this, producing a fixed 90 degree rotation with no adjustment or compensation capability. Suppliers of automated Valve packages and end users will try to compensate for their package angular misalignment by skewing the Actuator relative to the Valve. This procedure is strongly NOT recommended as often oversized mounting holes and slotted brackets are used which will eventually lead to loss of calibration or package failure.



KOMOTO Actuators are designed to permit the assembler to compensate for these conditions and obtain the intended performance for their valve or dampers.



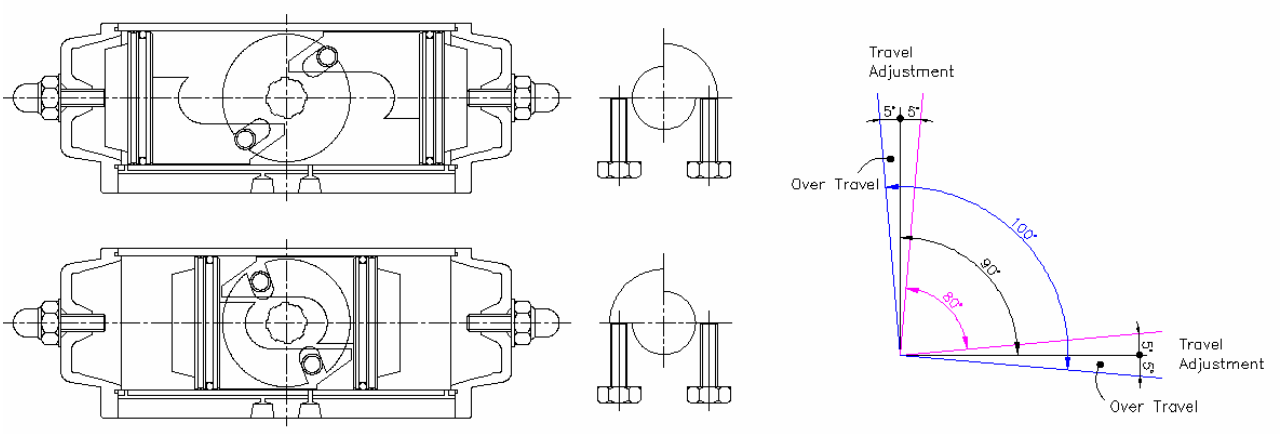
Over travel.

Actuators Actually have a minimum 100 degrees of rotational travel from minus 5 degrees to plus 95 degrees.

* Standard from size AC14

Adjustment.

This over travel is complemented by unique, patented Travel Stops with 10 degrees of rotational stopping adjustment in each direction of travel.



The combination of these two features allows for a very accurate Valve package assembly that can be complete quickly and easily and will compensate for the package tolerance build-up.

The following examples show how this correct position alignment improves the performance of Valves by preventing seat damaged, Closed position leaks, and reduced Open position flow.

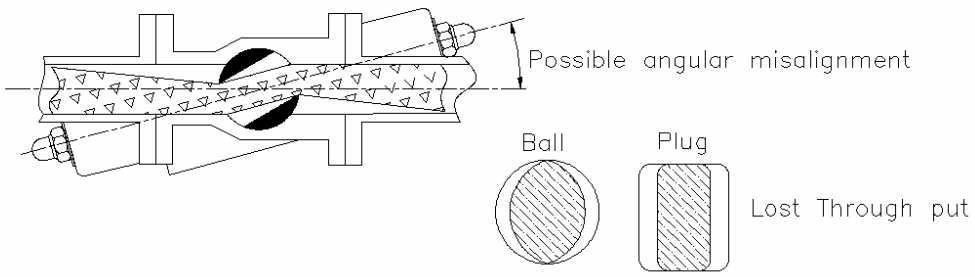
Ball valves

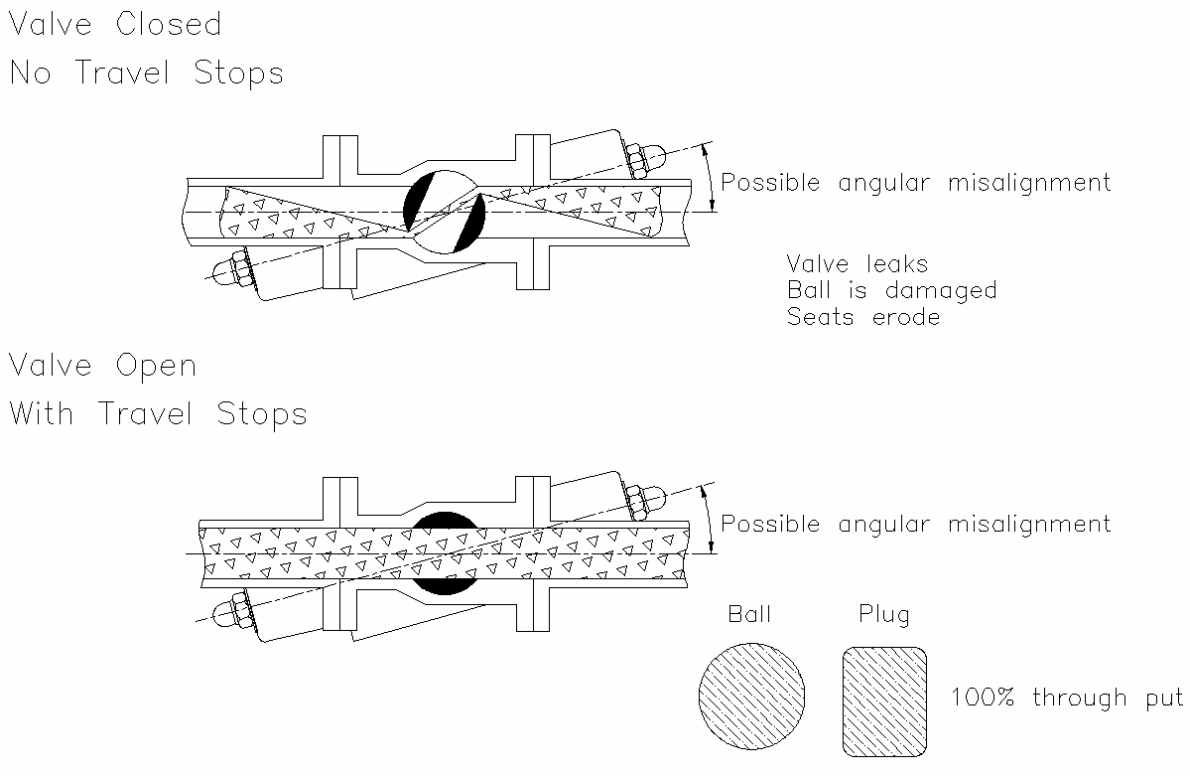
Ball Valves require exactly 90 degrees of travel if they are to close fully without damaging the seats and open correctly to stop cavitation and/or reduce flow due to less than full open alignment.

● Accurate ball alignment in both the Open and Closed positions is required to assure the intended performance of the Valve. (Maximum Flow, Lowest Possible Pressure Drop and intended Shut Off). Seat life is extended and rapid seat destruction on services like steam can avoided.

● To realise the paid for benefits of a Full Port Valve, the hole through the Ball must be perfectly aligned with the Valve body and pipeline. Any deviation from this totally eliminates the expensive Full Port advantage. Full Port valves used on a pipelines that are pigged, must be perfectly aligned to avoid costly damage and line blockage.

Valve Open
No Travel Stops





● High performance metal seated Valves require very accurate positioning of the seat lip on the Ball. Inaccurate positioning can deform the seat and cause

● Slurry service Valves can fill with the transported solids if Open and Closed Valve positions are not set accurately. This causes accelerated wear on all Valve Ports and can lead to Valve jamming.

Plug Valves - Sleeved and Lined

● The Port in a Plug Valve is generally a vertical rectangle with the vertical measurement significantly larger than the horizontal measurement.

● This design presents the most significant loss of flow area per degree of misalignment in the Valve Open position.

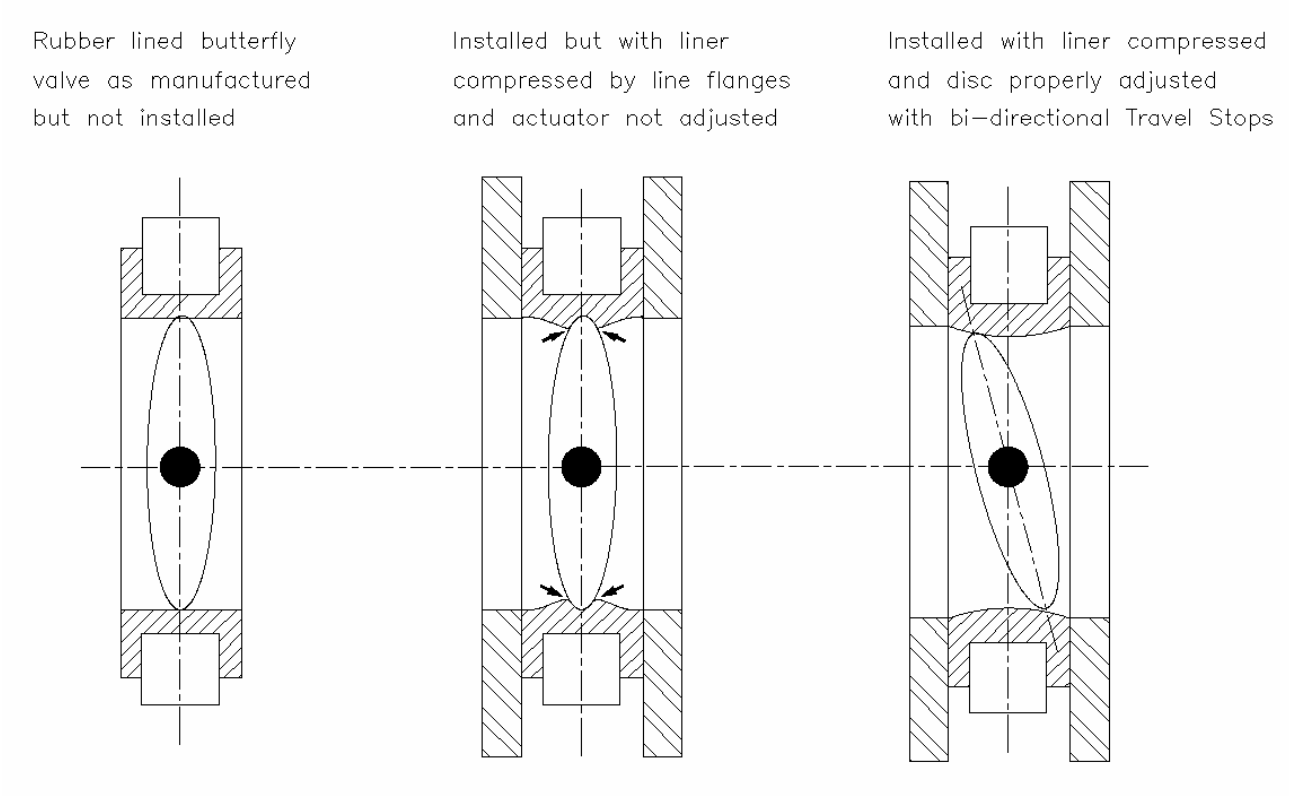
It is, therefore, critical that the precise angle of opening be found and the Travel Stops adjusted to this position.

● On slurry applications, often the media for Plug Valves, misalignment of the Plug in the Open position can cause excessive turbulence within the Valve that will cause premature wear of the sleeve or lining and erosion of the leading and trailing edges of the Plug itself. This will soon prevent intended shut off and cause rapid deterioration of the sleeve or lining.

● Misalignment of the Plug position at shut off can cause significant bypass leakage as the sallest opening is exaggerated by the large vertical opening of the port.

Soft Seated Butterfly Valves

● Soft Seated Butterfly Valves require 90degrees of rotation or less depending on type. Soft seated Valves are often fully shut at about 85degrees. If the Actuator forces the Valve to fully travel 90 degrees the Valve seat will wear rapidly and may jam.

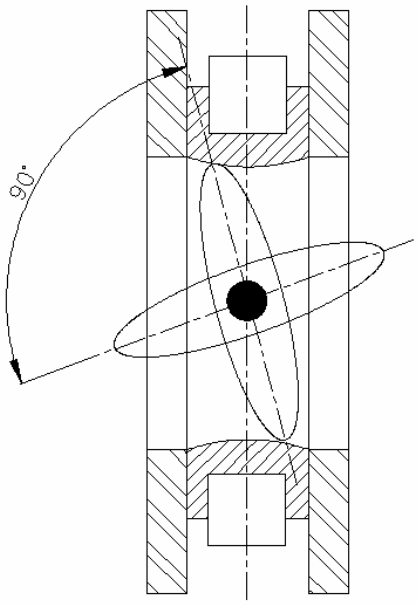


● The e`1lastomer seat on Butterfly Valves are bowed into the Valve opening as the Valve is compressed between the two pipeline flanges during installation. Correct positioning for shut off is no longer zero degrees, but between 3and 7degrees. If this position is not accurately set and maintained, seat life is quickly reduced as each cycle causes the disc to compress and tear the bowed elastomer. Travel Stops prevent this premature wear and permit re-setting the closed position as normal wear of the seat takes place.

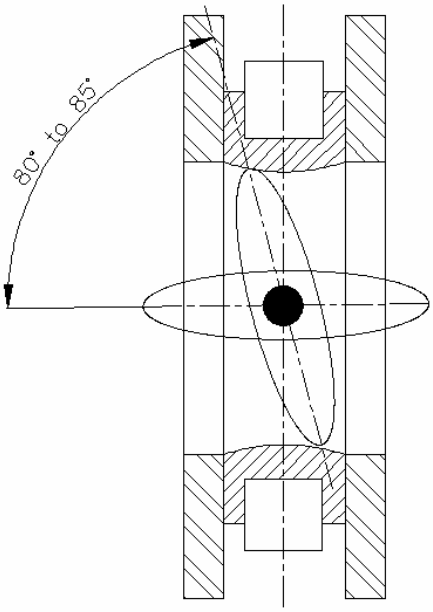
● This correct setting of the Closed and Open position reduces the excessive breakaway torque required to push the disc through the seat and can result in the selection of a smaller, less expensive Actuator.

● Correct positioning of the disc in the open position can reduce media turbulence and minimize pressure drop.

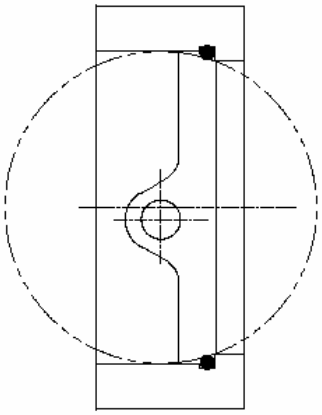
Effect of crude adjustment by skewing the Actuator on the Valve bracket causing the Open position to be incorrect



Valve correctly adjusted using bi-directional Travle Stops



High Performance Butterfly Valves

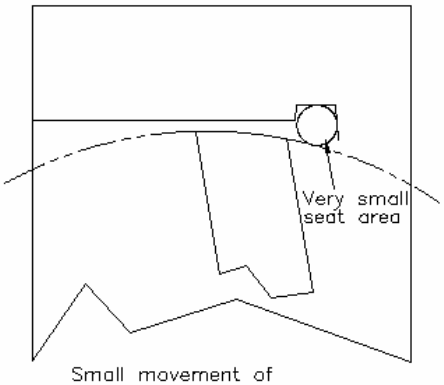


● High Performance Butterfly Valves require between 85 and 90degrees of travel rotation. they have narrow, highly engineered seats requiring very accurate adjustment in the Closed position if intended sealing and seat life is to be achieved.

● Torque seated High Performance Butterfly Valves require significant over travel into the seat to obtain intended shut off. 90degrees Actuators (no over travel) cannot provide this and custom made off-set couplings must be used. No problem for KOMOTO

● This uncontrolled over travel can also cause a significant increase in the torque needed to open the Valve, which may prevent operation completely or require a larger, more expensive Actuator selection.

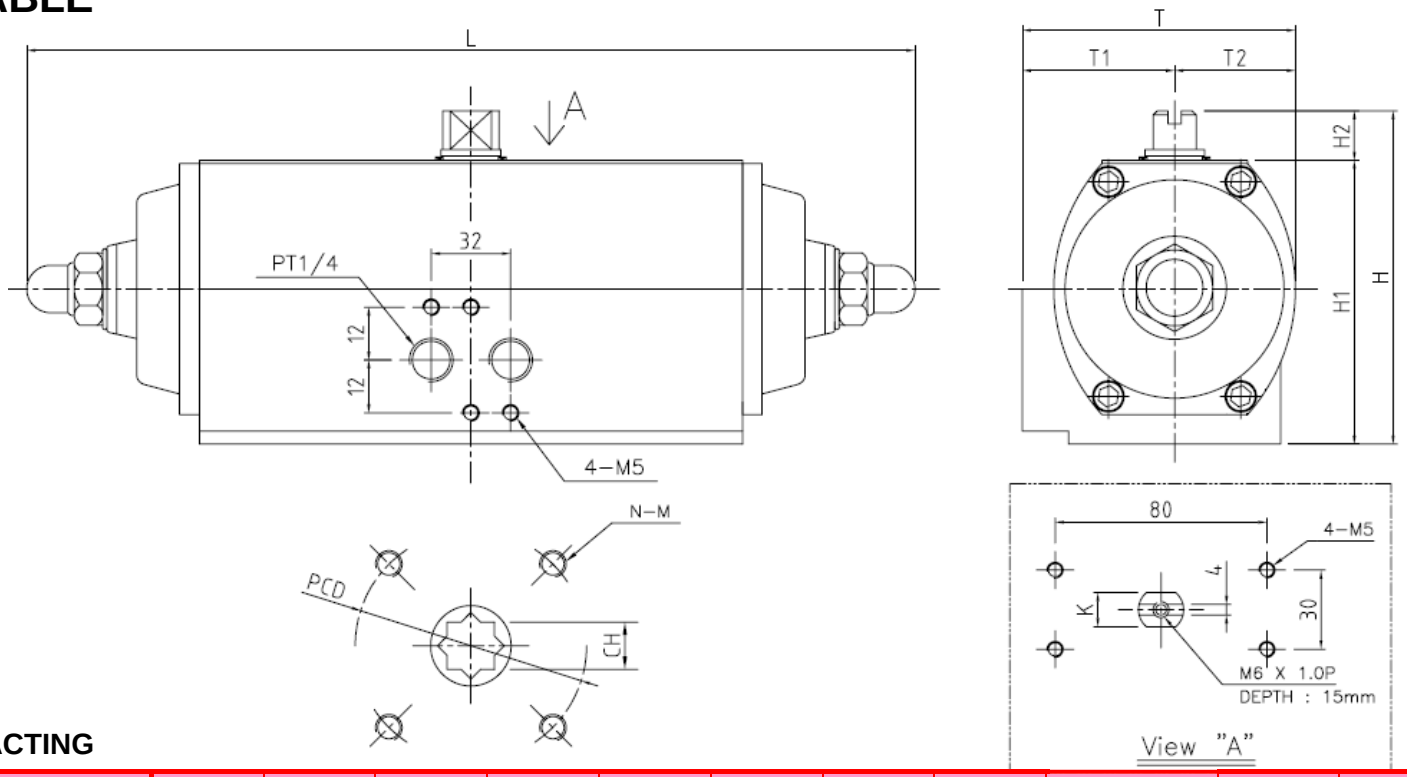
● Correct positioning of the disc in the open position can reduce media turbulence and minimize pressure drop.



Small movement of disc means that Valve will not seal

Bi-directional Travle Stops make adjustment simple and accurate

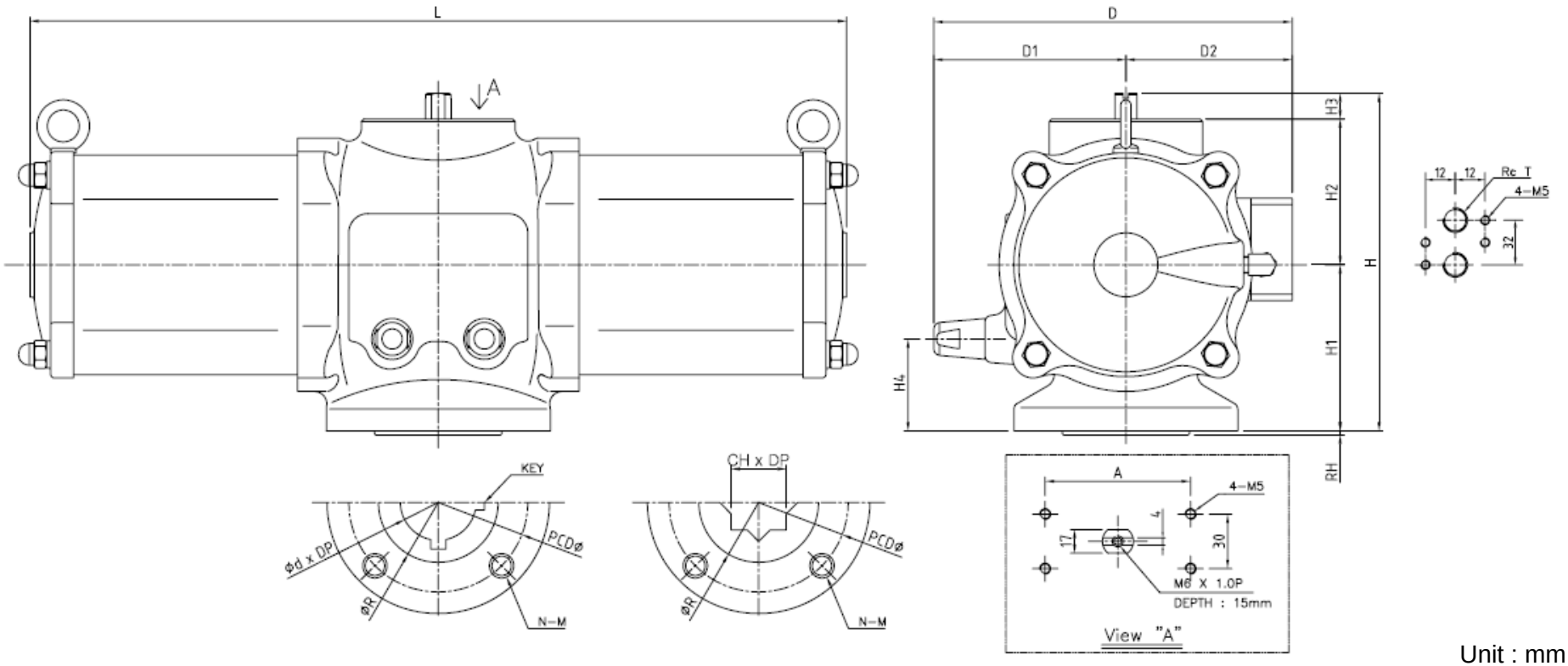
DIMENSION TABLE



1. DOUBLE ACTING

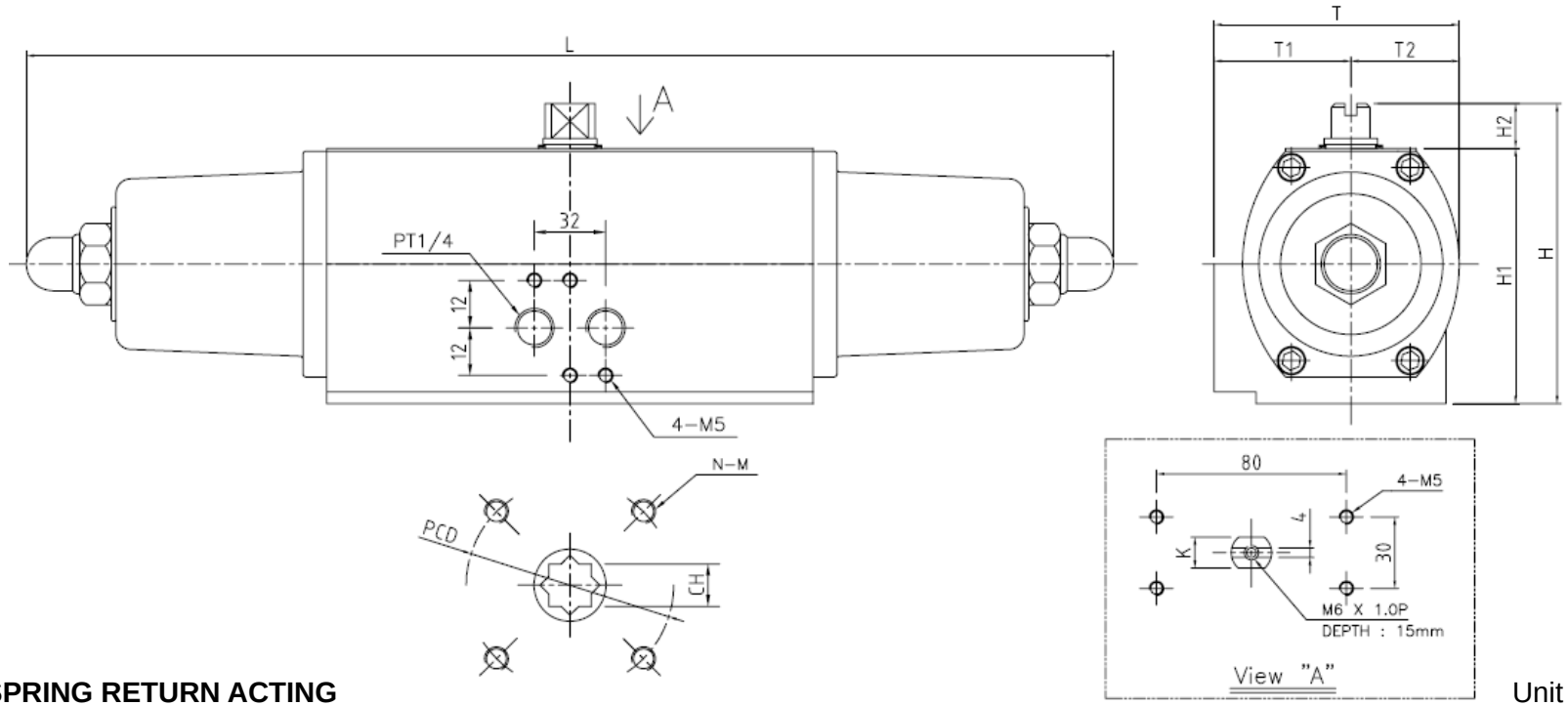
Unit : mm

SIZE	ISO. BASE	L	T	T1	T2	H	H1	H2	K	PCDØ	CH	Dp	N-M
AC05D	F05	188	69	40	29	87	67	20	11	Ø50	□11x11	13	4-M6
AC06D	F05/F07	234	83	46	37	108	86	22	13	Ø50 / Ø70	□14x14	17	4-M6, M8
AC08D	F07	286	98	56	42	123	103	20	17	Ø70	□17x17	19	4-M8
AC10D	F07/F10	344	114	62	52	143	123	20	22	Ø70 / Ø102	□22x22	26	4-M8, M10
AC12D	F07/F10	443	136	68	68	164	144	20	22	Ø70 / Ø102	□22x22	26	4-M8, M10
AC14D	F10/F12	486	158	79	79	180	160	20	22	Ø102/ Ø125	□27x27	30	4-M10/M12
AC16D	F10/F12	560	178	86	92	210	190	20	26	Ø102/ Ø125	□27x27	30	4-M10/M12
	F14									Ø140	□36x36		4-M16



Unit : mm

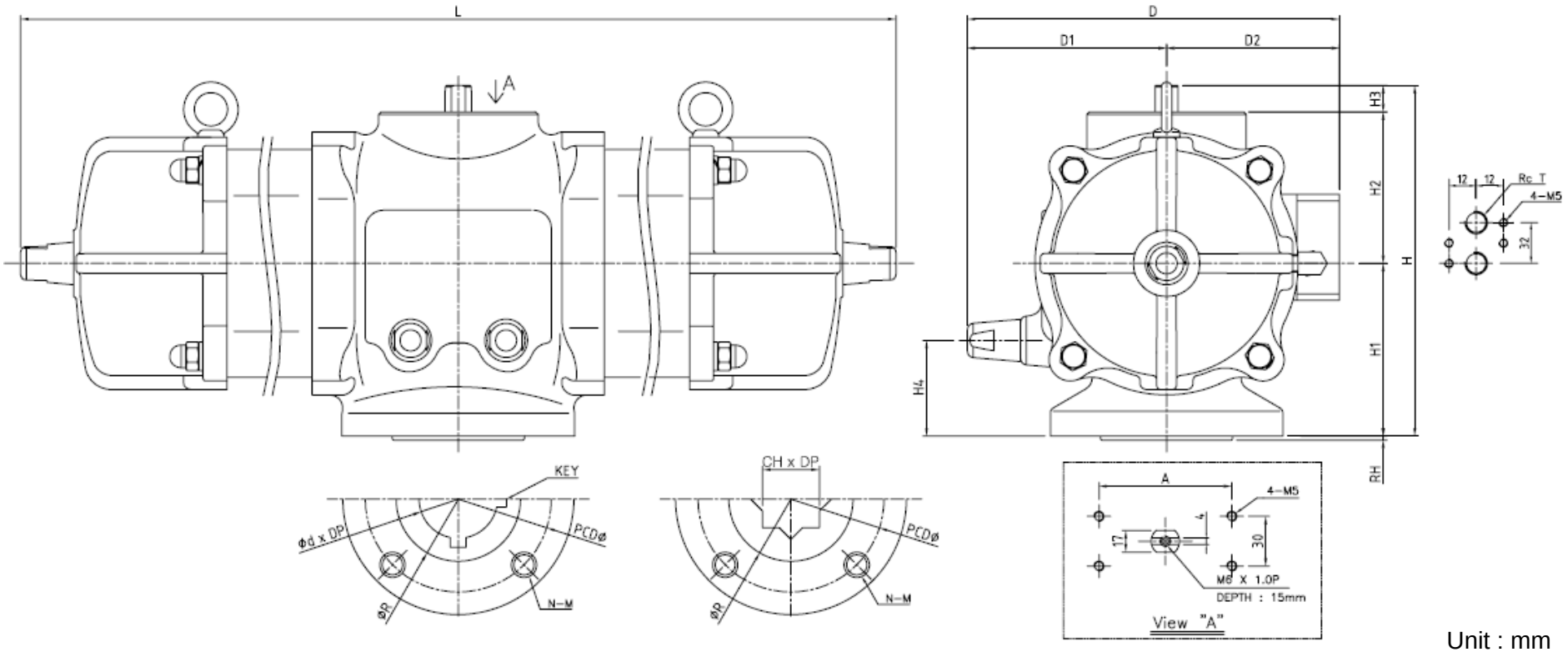
SIZE	ISO. BASE	L	D	D1	D2	H	H1	H2	H3	H4	ØR	RH	PCDØ	N-M	ØdxDp	Key	CHxDp	A	RCT
AC14D	F12	562	247	125	122	238	118	100	20	70	Ø85	2	Ø125	4-M12	-	-	□27x45	80	1/4
AC17D	F14	638	280	150	130	264	130	114	20	72	Ø100	3	Ø140	4-M16	-	-	□36x50	80	1/4
AC20D	F16	793	334	180	154	308	150	138	20	81	Ø130	3	Ø165	4-M20	-	-	□46x65	80	1/4
AC25D	F25	928	411	225	186	373	188	165	20	100	Ø200	4	Ø254	8-M16	Ø75x85	20x12	-	130	3/8
AC30D	F25	1098	472	260	212	422	212	190	20	110	Ø200	4	Ø254	8-M16	Ø90x85	25x14	-	130	3/8



2. SPRING RETURN ACTING

Unit : mm

SIZE	ISO. BASE	L	T	T1	T2	H	H1	H2	K	PCDØ	CH	Dp	N-M
AC05S	F05	258	69	40	29	87	67	20	11	Ø50	□11x11	13	4-M6
AC06S	FF05/F07	320	83	46	37	108	86	22	13	Ø50 / Ø70	□14x14	17	4-M6, M8
AC08S	F07	418	98	56	42	123	103	20	17	Ø70	□17x17	19	4-M8
AC10S	F07/F10	506	114	62	52	143	123	20	22	Ø70 / Ø102	□22x22	26	4-M8, M10
AC12S	F07/F10	640	136	68	68	164	144	20	22	Ø70 / Ø102	□22x22	26	4-M8, M10
AC14S	F10/F12	716	158	79	79	180	160	20	22	Ø102/ Ø125	□27x27	30	4-M10,M12
AC16S	F10/F12	750	178	86	92	210	190	20	26	Ø102/ Ø125	□27x27	30	4-M10,M12
	F14										□36x36		4-M16



Unit : mm

SIZE	ISO. BASE	L	D	D1	D2	H	H1	H2	H3	H4	ØR	RH	PCDØ	N-M	ØdxDp	Key	CHxDp	A	Rc T
AC14S	F12	844	247	125	122	238	118	100	20	70	Ø85	2	Ø125	4-M12	-	-	□27x45	80	1/4
AC17S	F14	934	280	150	130	264	130	114	20	72	Ø100	3	Ø140	4-M16	-	-	□36x50	80	1/4
AC20S	F16	1172	334	180	154	308	150	138	20	81	Ø130	3	Ø165	4-M20	-	-	□46x65	80	1/4
AC25S	F25	1424	411	225	186	373	188	165	20	100	Ø200	4	Ø254	8-M16	Ø75x85	20x12	-	130	3/8
AC30S	F25	1664	472	260	212	422	212	190	20	110	Ø200	4	Ø254	8-M16	Ø90x85	25x14	-	130	3/8