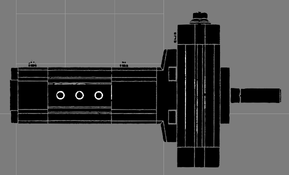
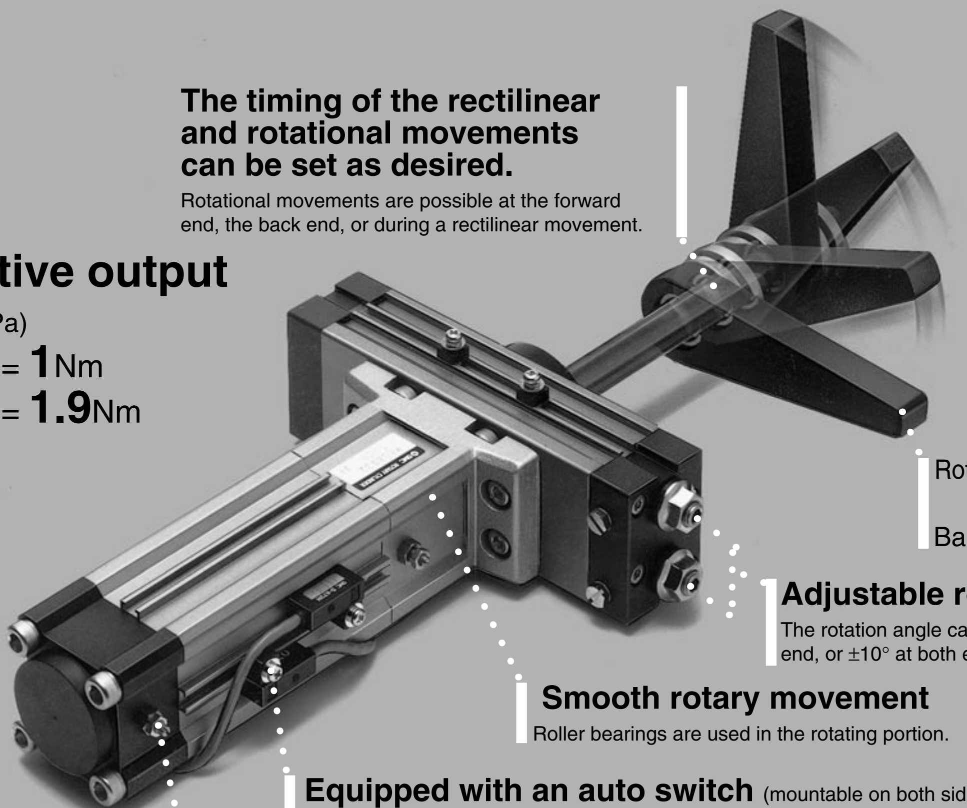


Rotary Cylinder

Series MRQ

Size: 32, 40

A rectilinear rotation unit that compactly integrates a slim cylinder and a rotary actuator.



The timing of the rectilinear and rotational movements can be set as desired.

Rotational movements are possible at the forward end, the back end, or during a rectilinear movement.

Effective output

(At 0.5MPa)

Size 32 = **1**Nm

Size 40 = **1.9**Nm

Rotation angle: **80° to 100°**
170° to 190°
Backlash: Within 2°

Adjustable rotation angle

The rotation angle can be adjusted ±5° at each end, or ±10° at both ends.

Smooth rotary movement

Roller bearings are used in the rotating portion.

Equipped with an auto switch (mountable on both sides)

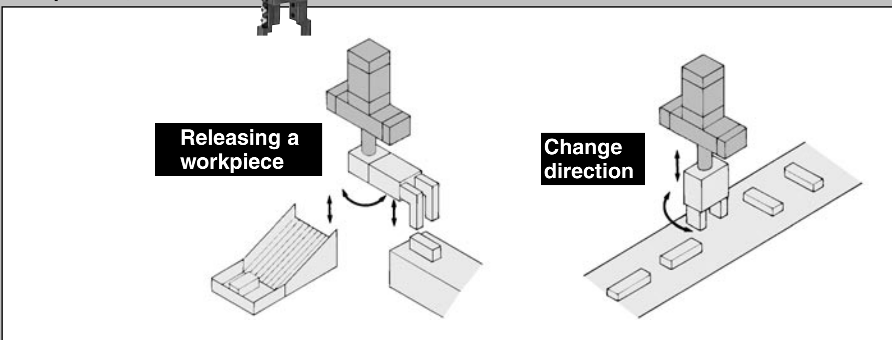
Magnet included as standard.
(Reed switch: D-A7/A8,
Solid state switch: D-F7/J7)

An air cushion is also available.

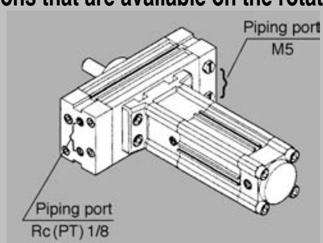
Series MRQ

Linear motion part size	Output of rotating part (at 0.5MPa)	Rotation angle	Linear motion stroke (mm)									
			5	10	15	20	25	30	40	50	75	100
32	1.02N/m	80° to 100°	●	●	●	●	●	●	●	●	●	●
		170° to 190°	●	●	●	●	●	●	●	●	●	●
40	1.91N/m	80° to 100°	●	●	●	●	●	●	●	●	●	●
		170° to 190°	●	●	●	●	●	●	●	●	●	●

Application examples



A connecting port can be selected from two positions that are available on the rotation unit.



Connecting ports are provided "IN" two positions as standard specifications.

Data❶
How to Set Rotation Time

Unit Conversions

SI units are used in this catalog. The unit conversion between SI and conventional units are as follows:

Pressure	1MPa	= 10.1972kgf/cm²	Oscillation acceleration 100m/s² = 10.1972G
Cylinder thrust/load	100N	= 10.1972kgf	Standard air: Symbol (ANR)
Torque	1Nm	= 10.1972kgfcm	Temperature 20°C {293K}, Air with
Moment of inertia	1kgm²	= 10.1972kgcm/s²	an absolute pressure of 760 mmHg
Kinetic energy	1J	= 10.1972kgcm	{101.3kPa}, and a relative humidity of 65%

Allowable Kinetic Energy

Even if the torque that is required by the load in the rotation movement is small, the internal parts could become damaged depending on the inertia of the load. Therefore, select an appropriate model for your application by taking the load's moment of inertia, kinetic energy, and rotation time into consideration. (A chart that depicts the moments of inertia and the rotation time is provided to facilitate the selection process.)

1 Setting of Rotation Time

Set the rotation time within the adjustable rotation time range that ensures stable operation, based on the table on the right. Setting the speed higher than the upper limit could cause the actuator to stick or slip.

Size	Allowable kinetic energy (J)	Adjustable rotation time range that ensures stable operation
32	0.023	0.2 to 1
40	0.028	0.2 to 1

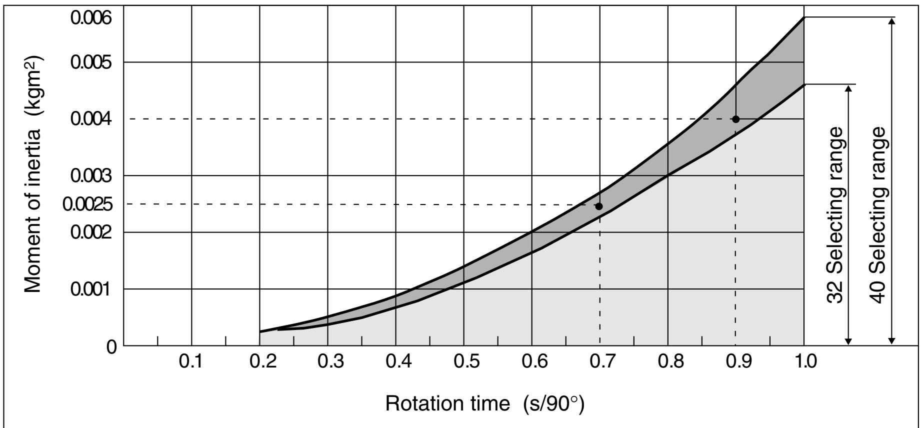
2 How to Calculate Moment of Inertia

Formula of moment of inertia is subject to load shape. Refer to the moment of inertia formula on p.4-247

3 Selection of a Model

Select a model by applying the calculated moment of inertia to the chart below.

Moment of inertia and rotation time



How to calculate the load energy

$$E = \frac{1}{2} I\omega^2,\ \omega = \frac{2\theta}{t}$$

E: Kinetic energy·········(J)
I: Moment of inertia···(kgm²)
ω*: Angular velocity·····(rad/s)
θ: Rotation angle·······(rad)
180° = 3.14rad
t: Rotation time·········(s)

*The ω that is obtained here is the terminal angular velocity of an isometric acceleration movement.

⟨How to read graph⟩

● Moment of inertia·······0.0025kgm²   ● Rotation time·······0.7S/90°, size 40 will be selected.

⟨Calculation example⟩

Load shape: Column with a radius of 0.2m and a weight of 0.2kg   Rotation time: 0.7s/90°

$$I = 0.2 \times \frac{0.2^2}{2} = 0.004\text{kgm}^2$$

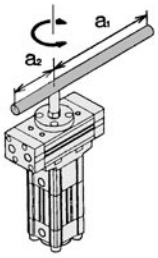
In the chart that depicts the moment of inertia and the rotation time, find the intersecting point of the lines that extend from the locations corresponding to 0.004kg/m² on the vertical axis (moment of inertia) and to 0.9s/90° on the horizontal axis (rotation time). Select size 40 because the intersecting point is found within the selection range for size 40.

Data ❷
Moment of Inertia

4 Calculation of moment of inertia I (I: Moment of Inertia (kgm2) m: Load weight (kg))

①Thin rod

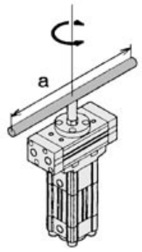
Position of rotation axis: Perpendicular to the piston rod and passes through centre line.



$I = m_1 \frac{a_1^2}{3} + m_2 \frac{a_2^2}{3}$

②Thin rod

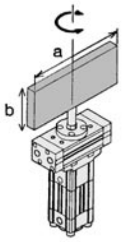
Position of rotation axis: Perpendicular to the rod and passes through the centre of gravity.



$I = m \frac{a^2}{12}$

③Thin rectangle board (Parallelogram)

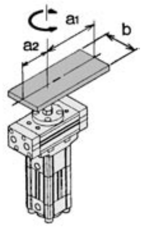
Position of rotation axis: Parallel to side b and passes a centre of gravity.



$I = m \frac{a^2}{12}$

④Thin rectangle board (Parallelogram)

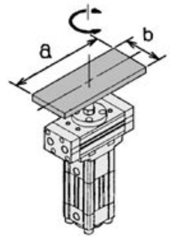
Position of rotation axis: Perpendicular to the board and passes through centre line.



$I = m_1 \frac{4a_1^2+b^2}{12} + m_2 \frac{4a_2^2+b^2}{12}$

⑤Thin rectangle board (Parallelogram)

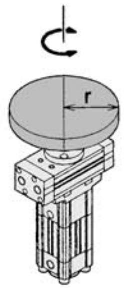
Position of rotation axis: Passes through centre of gravity and perpendicular to the board. (Same formula regardless of board thickness.)



$I = m \frac{a^2+b^2}{12}$

⑥Column (Including discs)

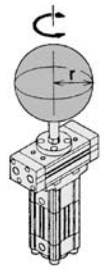
Position of rotation axis: Centre axis.



$I = m \frac{r^2}{2}$

⑦Sphere

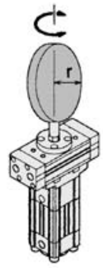
Position of rotation axis: Sphere centred about axis of rotation.



$I = m \frac{2r^2}{5}$

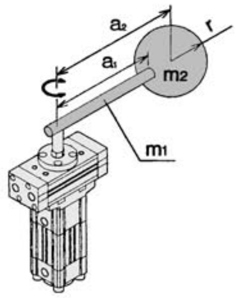
⑧Disc

Position of rotation axis: Disc centred about axis of rotation.



$I = m \frac{r^2}{4}$

⑨With a load at the lever end

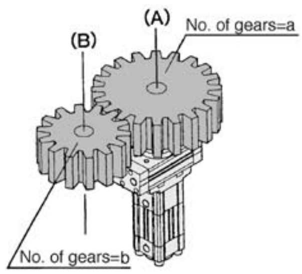


$I = m_1 \frac{a_1^2}{3} + m_2 a_2^2 + K$

Ex.) Referring to case ⑦ where "W_2" is a sphere,

$K = m_2 \frac{2r^2}{5}$

⑩Gear transmission



1. Find moment of inertia I_B around the rod (B).
2. Replace moment of inertia I_B around the rod (A) with I_A,

$I_A = \left(\frac{a}{b}\right)^2 I_B$

Data ❸
Theoretical Output

5 Linear Motion Part Theoretical Output

Linear motion Part theoretical output table

Unit: N

Size	Rod diameter (mm)	Operating direction	Piston area (mm^2)	Operating pressure (MPa)						
				0.15	0.2	0.3	0.4	0.5	0.6	0.7
32	12.2	OUT	804	121	161	241	322	402	482	563
		IN	675	101	135	202	270	337	405	472
40	14.2	OUT	1256	183	251	377	502	628	754	879
		IN	1081	162	216	324	433	541	649	757

(Formula) Thrust (N) = Piston area (mm^2) x Operating pressure (MPa)

Generation power from the linear motion part

Calculation formula

$F_1 = \eta \times A_1 \times P$ .... (1)

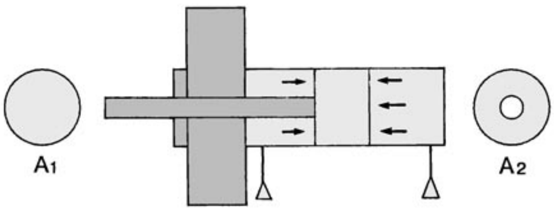
$F_2 = \eta \times A_2 \times P$ .... (2)

$A_1 = \frac{\pi}{4} D^2$ .... (3)

$A_2 = \frac{\pi}{4} (D^2 - d^2)$ .... (4)

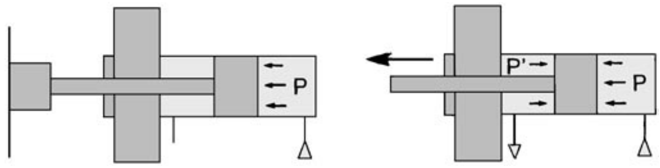
F_1 = Cylinder force generated on the extending side (N)
F_2 = Cylinder force generated on the retracting side (N)
η = Load rate
A_1 = Piston area on the extending side (mm^2)
A_2 = Piston area on the retracting side (mm^2)
D = Tube bore size (mm)
d = Piston rod diameter (mm)
P = Operating pressure (MPa)

Note) As shown in the diagram below, the retracting side pressure surface area of the double acting single rod cylinder is reduced by the area that corresponds to the piston rod's cross sectional area.



Load rate η

In the process of selecting an appropriate cylinder, remember that there are sources of resistance other than the load that apply in the output direction. Even at a standstill as shown in the diagram below, the resistance that is incurred by the seals or bearings in the cylinder must be subtracted. Furthermore, during operation, the reactive force that is created by the exhaust pressure also acts as resistance.



While not operated While operated

Because resistance that counters the cylinder output vary with conditions such as the cylinder size, pressure, and speed, it is necessary to select an air cylinder of a greater capacity. For this purpose, the load ratio is used; make sure that the load ratio values listed below are obtained when selecting an air cylinder.
1) Using the cylinder for stationary operation: load ratio η = 0.7 (Fig. 1)
2) Using the cylinder for dynamic operation: load ratio η = 0.5 (Fig. 2)
3) Using a guide type for horizontal operation: load ratio η = 1 (Fig. 3)

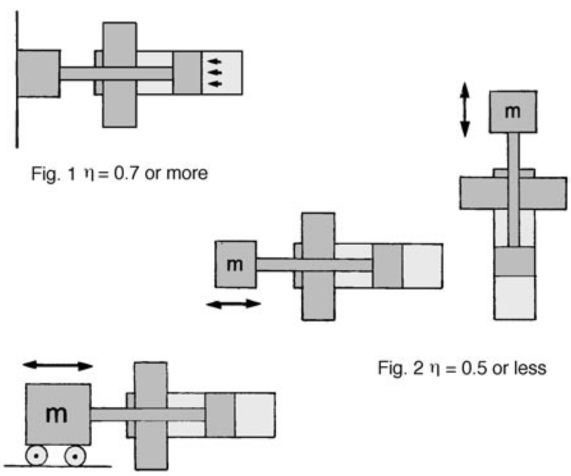


Fig. 1 η = 0.7 or more

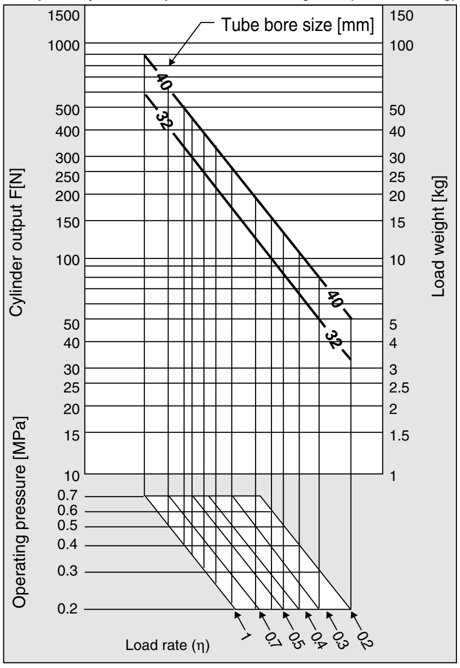
Fig. 2 η = 0.5 or less

Fig. 3 η = 1 or less

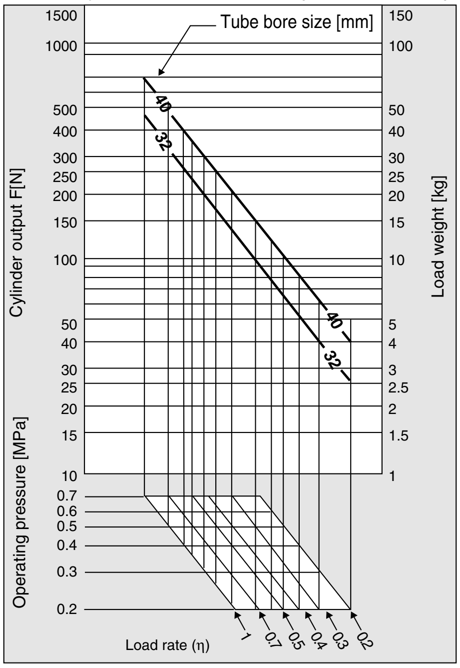
Note) For dynamic operation, the load ratio may be set even lower if it is particularly necessary to operate the cylinder at high speeds. Setting it lower provides a greater margin in the cylinder output, thus enabling the cylinder to accelerate more quickly.

Data❸
Theoretical Output/Side Load/Allowable Moment

⟨Graph 1⟩ Cylinder output on the extending side (Double acting)



⟨Graph 2⟩ Cylinder output on the retracting side (Double acting)



How to read graph

① Decide on the direction in which the cylinder output will be used (the extension or the retraction side). (See graph 1 for the extension side, and graph 2 for the retraction side.)
② Find the point at which the load ratio (diagonal line) and the operating pressure (horizontal line) intersect. Then, extend a vertical line from that point. (Determine the load ratio η in accordance with the load ratio η that has been determined on p.4-248)
③ Extend a horizontal line from the necessary cylinder output (left diagram), and find the point at which it intersects with the vertical line of ②. The diagonal line above that intersecting point represents the inner diameter of the tube that can be used.

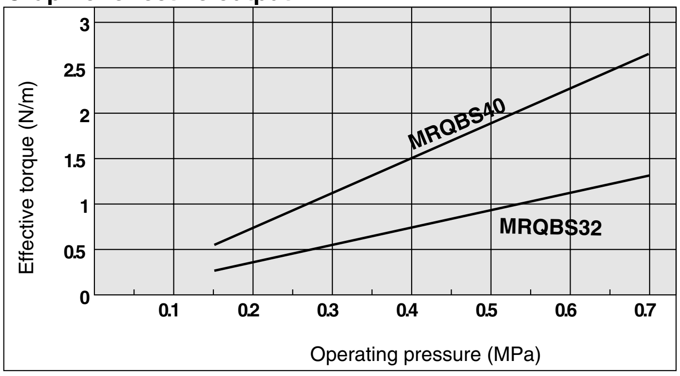
6 Theoretical Output of the Rotating Part

Table of Theoretical Output of the Rotating Part

Unit: Nm

Size	Operating pressure (MPa)						
	0.15	0.3	0.3	0.4	0.5	0.6	0.7
32	0.34	0.45	0.68	0.9	1.13	1.36	1.58
40	0.64	0.85	1.27	1.7	2.12	2.54	2.97

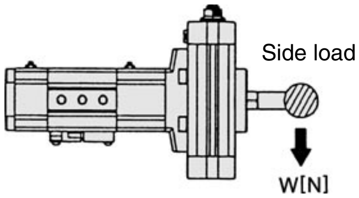
Graph of effective output

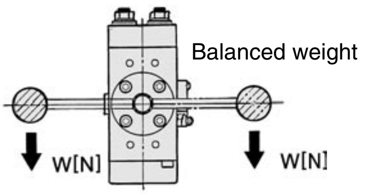


7 The allowable lateral load and the moment at the tip of the piston rod

An excessive amount of lateral load or moment applied to the piston rod could cause a malfunction or internal damage. The allowable load range varies by conditions such as the installed orientation of the cylinder body or whether an arm lever is attached to the tip of the piston rod. Find the allowable value from the diagram shown below and operate the rotary cylinder within that value.

1) Using the cylinder body installed horizontally:
To operate the rotary cylinder with the cylinder body installed horizontally, make sure that the total load that is applied to the tip of the piston rod will be within the value indicated in the table below. If the centre of gravity of the total load is not in the centre of the shaft, provide a balance weight as illustrated below so that moment in the rotational direction would not be applied to the tip of the piston rod.





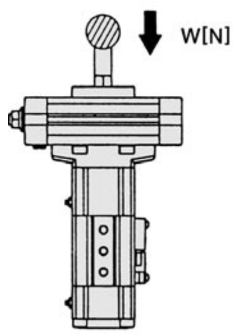
Allowable side load on the piston end

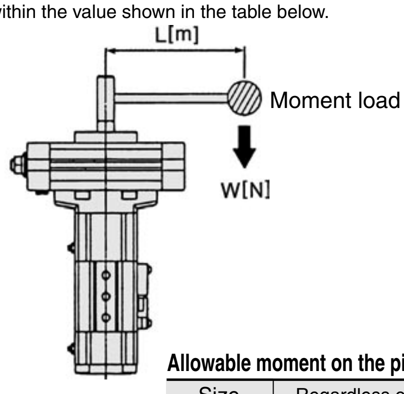
Unit: N

Size	Stroke of linear part									
	5	10	15	20	25	30	40	50	75	100
32	14	14	13	13	13	12	12	11	10	9
40	23	23	22	21	21	20	19	18	16	15

2) Using the cylinder body installed vertically:
To operate the rotary cylinder with the cylinder body installed vertically, the total load that is applied to the tip of the piston rod must be within the thrust of the rectilinear portion in which the load ratio is taken into consideration. (Refer to p.4-248 for further information on load rate.)

If the centre of gravity of the total load is not in the centre of the shaft, it is necessary to calculate the moment. Make sure that the moment is within the value shown in the table below.





Affecting moment to the piston rod end
Moment = W X L [Nm]

Allowable moment on the piston rod end

Size	Regardless of the stroke
32	2.128 [Nm]
40	3.844 [Nm]

Data ❹
Air Consumption

8 Air Consumption

Results are determined by measuring the factors through 1 complete cycle over one minute.

Rotatary Motion Part Angle of rotation: 90°, 180° Unit: ℓ/min (ANR)

Size	Angle of rotation (Degree)	Inner volume (cm^3)	Operating pressure (MPa)						
			0.15	0.2	0.3	0.4	0.5	0.6	0.7
32	80° to 100°	4.88	0.024	0.029	0.039	0.048	0.058	0.068	0.077
	170° to 190°	8.46	0.042	0.05	0.067	0.084	0.1	0.117	0.134
40	80° to 100°	9.22	0.046	0.055	0.073	0.091	0.109	0.128	0.146
	170° to 190°	15.90	0.079	0.095	0.126	0.157	0.189	0.22	0.251

Linear Motion Part Unit: ℓ/min (ANR)

Size	Stroke (mm)	Inner volume (cm^3)		Operating pressure (MPa)						
		Head side	Rod side	0.15	0.2	0.3	0.4	0.5	0.6	0.7
32	5	4	3.4	0.018	0.022	0.029	0.037	0.044	0.051	0.059
	10	8	6.7	0.036	0.044	0.058	0.073	0.087	0.102	0.116
	15	12.1	10.1	0.055	0.066	0.088	0.11	0.132	0.154	0.176
	20	16.1	13.5	0.073	0.088	0.117	0.146	0.176	0.205	0.234
	25	20.1	16.9	0.092	0.11	0.147	0.183	0.22	0.256	0.293
	30	24.1	20.2	0.11	0.132	0.175	0.219	0.263	0.307	0.35
	40	32.2	27	0.147	0.176	0.235	0.293	0.351	0.41	0.468
	50	40.2	33.7	0.183	0.22	0.293	0.366	0.439	0.512	0.585
	75	60.3	50.6	0.275	0.33	0.439	0.549	0.658	0.768	0.877
	100	80.4	67.5	0.367	0.44	0.586	0.732	0.878	1.02	1.17
40	5	6.3	5.4	0.029	0.035	0.046	0.058	0.069	0.081	0.093
	10	13	11	0.058	0.07	0.093	0.116	0.139	0.162	0.185
	15	19	16	0.087	0.104	0.139	0.174	0.208	0.243	0.277
	20	25	22	0.116	0.139	0.185	0.231	0.277	0.324	0.37
	25	31	27	0.145	0.174	0.231	0.289	0.347	0.405	0.462
	30	38	32	0.174	0.209	0.278	0.347	0.416	0.485	0.555
	40	50	43	0.232	0.278	0.37	0.463	0.555	0.647	0.74
	50	63	54	0.29	0.348	0.463	0.578	0.694	0.809	0.924
	75	94	81	0.435	0.521	0.694	0.868	1.04	1.21	1.39
	100	126	108	0.58	0.695	0.926	1.16	1.39	1.62	1.85

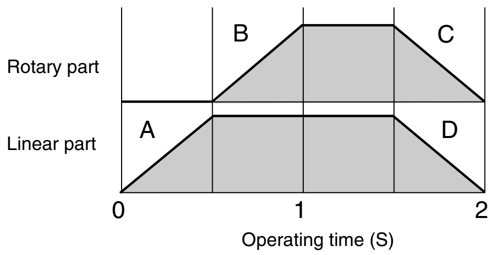
Data❺
Air Requirements

9 Air Requirements

The required air volume, which is the amount of air that is required for operating the rotary cylinder at the prescribed speed, is necessary for selecting the F.R.L. equipment or the pipe size.
The amount of air requirement of rotary actuator = 0.06 x V x (P/0.1013)/t ℓ/min(ANR)
V: Inner volume = cm^3
P: Absolute pressure = {Operating pressure (MPa) + 0.1013}
t: Operating time = s

Calculate the required air volume separately for the linear motion part and the rotary motion part. The required air volume for operating the linear motion and rotary motion parts simultaneously is the total of the individually obtained values.
Calculation example: Obtain the required air volume to be used from the operation chart shown below.

Model: MRQBS32-50CA-A73 Operating pressure: 0.5MPa



Calculate the amount of air requirement for A, B, C and D respectively.
A = 0.06 X 40.2 X {(0.5 + 0.1013)/0.1013}/0.5 = 28.6 ℓ/min
B = 0.06 X 4.88 X {(0.5 + 0.1013)/0.1013}/0.5 = 3.5 ℓ/min
C = B = 3.5 ℓ/min
D = 0.06 X 33.7 X {(0.5 + 0.1013)/0.1013}/0.5 = 24 ℓ/min
Since operation is simultaneous at C and D, total the respective amounts of air requirement.
C + D = 3.5 + 24 = 27.5 ℓ/min

Rotary Cylinder

Series MRQ

Size: 32, 40

How to Order

E MRQ B S 32 — 50 C A — A73 SO

Thread

—	Rc(PT)
E	G(PF)

Mounting style

B: Basic style

F: Flange on the rod side

Size/Standard stroke (mm)

32	5, 10, 15, 20, 25, 30, 40, 50, 75, 100
40	

∗ Refer to p.4-262 and 4-263 for middle and long strokes other than standard stroke.

Min. stroke with auto switch in the linear motion

No. of auto switches	1	2
Min. stroke (mm)	5	10

No. of auto switches mounted

Linear motion \ Rotation	0	1	2
0	—	OS	O2
1	SO	SS	S2
2	2O	2S	—

Auto switch/Rail mounting

—	Without auto switch

∗Refer to the table below for the part number for the applicable auto switch.

Angle of rotation

A	80° to 100°
B	170° to 190°

Additional symbol

C	With air cushion on the linear motion part
N	Without air cushion on the linear motion part

Auto Switch Specifications

●Standard ○Made to order

Type	Special ability	Electrical entry	Indication	Wiring (Output)	Load voltage DC		Load voltage AC	Auto switch part no. (Direction of electrical entry) Perpendicular	Auto switch part no. (Direction of electrical entry) In-line	Lead wire length* (m) 0.5 (—)	3 (L)	5 (Z)	— (N)	Applicable loading	
Reed switch	—	Grommet	Yes	3 wire	—	4 to 8V	—	—	A76H	●	●	—	—	—	IC
				2 wire		—	200V	A72	A72H	●	●	—	—	Relay, PLC	Relay, PLC
						24V	100V	A73	A73H	●	●	●	—		
			No			100V or less	100V or less	A80	A80H	●	●	—	—	Relay, PLC, IC	Relay, PLC, IC
		Connector	Yes			24V	—	A73C	——	●	●	●	●	Relay, PLC	—
			No				24V or less	A80C	——	●	●	●	●	Relay, PLC, IC	—
		Grommet	Yes				—	A79W	——	●	●	●	—	Relay, PLC	—
Solid state switch	—	Grommet	Yes	3 wire (NPN)	24V	5V	—	F7NV	F79	●	●	○	—	Relay, PLC, IC	Relay, PLC, IC
				3 wire (PNP)		12V		F7PV	F7P	●	●	○	—		
				2 wire		12V		F7BV	J79	●	●	○	—	Relay, PLC, IC	PLC
		Connector						J79C	——	●	●	○	●	Relay, PLC	—
	Diagnosis indicator (2 colour)	Grommet		3 wire (PNP)		5V		—	F7PW	●	●	○	—	—	Relay, PLC, IC
				3 wire (NPN)		12V		—	F79W	●	●	○	—	—	
				2 wire		12V		—	J79W	●	●	○	—	—	Relay, PLC
	Water resistant ability* (2 colour)							—	F7BA★*	—	●	○	—	—	
	With timer			3 wire (NPN)		5V		—	F7NT★	—	●	○	—	—	Relay, PLC, IC
	Diagnosis output (2 colour)			4 wires (NPN)		12V		—	F79F	●	●	○	—	—	
	Latch type with diagnosis output (2 colour)					12V		—	F7LF	●	●	○	—	—	Relay, PLC

∗ 1) Lead wire symbols
0.5m: — Ex.) A73H
3m: L Ex.) A73HL
5m: Z Ex.) A73HZ
—: N Ex.) A80CN

∗ 2) This rotary cylinder is not an improved product in water resistant ability. Consult SMC when using F7BA★.

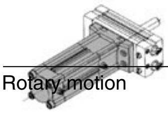
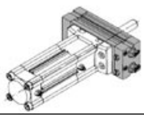
SMC

Order Made P.4-262 to 4-263

Standard Specifications

Fluid	Air (Non-lube)
Max. operating pressure	0.7 MPa
Min. operating pressure	0.15 MPa
Ambient and fluid temperature	0° to 60°C (No condensation)
Mounting	Basic style, Rod side flange style

Linear motion, Rotary motion/Specifications

Linear motion 	Bore size (mm)	32	40
	Piston speed	50 to 500mm/s	
	Cushion	With air cushion, Without air cushion	
	Port size	1/8	
Rotary motion 	Output torque (At 0.5 MPa)	1Nm	1.9Nm
	Stable rotation time regulation range	0.2 to 1S/90°	
	Cushion	—	
	Allowable kinetic energy	0.023J	0.028J
	Port size	Rc (PT)1/8, M5 X 0.8 (The port is plugged for delivery.)	
	Backlash	2° or less	

* For detailed explanation of effective output, refer to the description on p.4-249

Applicable Auto switch

Function	Auto switch with contact point	Auto switch without contact point
Linear motion part/ Rotary motion part	Grommet (Vertical cable access) D-A7□, A80, A79W Grommet (Horizontal cable access) D-A7□H, A80H Connector D-A73C, A80C	Grommet (Vertical cable access) D-F7□V Grommet (Horizontal cable access) D-F7□, J79, J79W, F-7□W F7□F, F7BAL, F7NTL Connector D-J79C

* For further explanation, refer to the description on p.6-15

Linear Motion/Standard Motion

Size	Standard stroke (mm)
32/40	5, 10, 15, 20, 25, 30, 40, 50, 75, 100

* Refer to p.4-262 for other intermediate strokes.

Weight

Size	Rotation angle	Basic weight (kg)	Add'l stroke weight (kg/mm)	Flange (kg)
32	80° to 100°	1.4	0.004	0.5
	170° to 190°	1.5		
40	80° to 100°	2.1	0.005	0.5
	170° to 190°	2.3		

Calculation method: (Ex) MRQBS32-50CA
- Basic weight··························1.4 kg
- Stroke additional weight············0.004 X 50 = 0.2 kg

Total 1.6 kg

Weight of a single auto switch

Unit: g

Applicable auto switch	Auto switch model		Length of lead wire 0.5m	Length of lead wire 3m*
Reed switch	D-A7□, A80, D-A7□H, A80H		10	52
	D-A73C, A80C		12	54
	D-A79W		11	53
Solid state switch	D-J79, J79W	2 wire	11	49
	D-F7	3 wire	12	56
		4 wire	14	56

* Write "L" at the end of the part number for 3 meters of lead wire. (Available for all the types. 3 metre type is standard for "D-F7BAL", "F79LF" and "F7NTL".)

Possible to exchange basic style with flange style

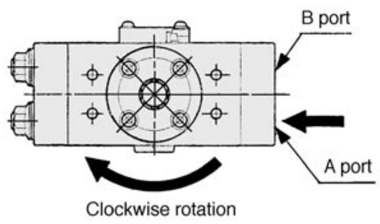
Specify with the part numbers shown below when ordering flange parts.

Size	Part No.
32	P317010-7
40	P317020-7

Attached parts: Flange 1 piece
Hexagon socket head cap screw 4 pieces

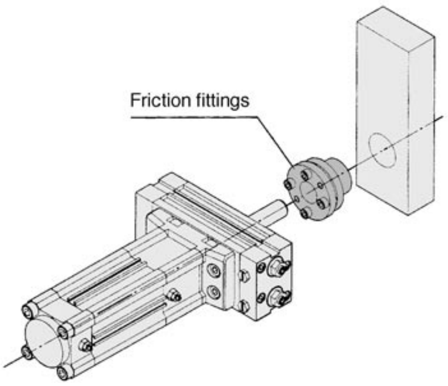
Rotating direction

When pressure is applied from the arrow-marked side, the rod rotates clockwise.

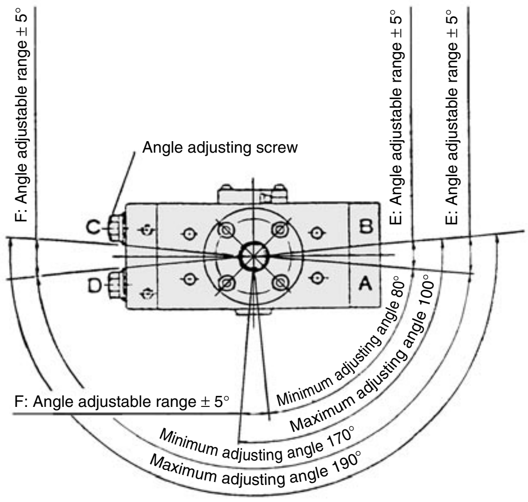


Allowable lateral load to the piston rod end

Using friction fittings makes it easier to mount the load to the piston rod end.



Rotation angle adjustable range/Rotation angle



Note) • The diagram shows the rotation angle with a reference position set at random. Each rotation angle end can be adjusted 5°.
• When the cylinder is pressurized from port B, range E can be adjusted by regulating angle adjustment screw C. When the cylinder is pressurized from port A, range F can be adjusted by regulating angle adjustment screw D.

Manufacturers of friction fittings/Models

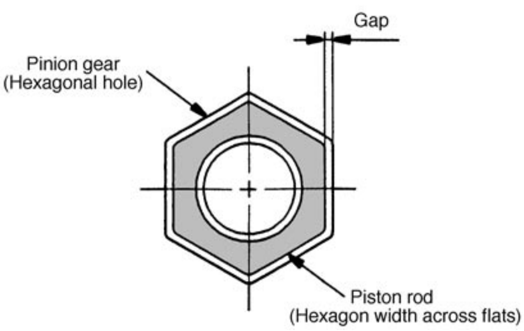
Size	Miki Pully (ETP bushing)	Eyesell (Mechanical lock)	Nabeya Industry (Clamp lock)
32	ETP-K-12	MA12 X 26	CLH-12 X 18
40	ETP-K-14	MA14 X 28	CLH-14 X 23

∗Consult the manufacturers concerning further information like on specifications.

Size	Adjusting angle per 1 rotation of angle adjusting screw
32	5.7°
40	4.8°

Backlash

The rotary motion part has a double-rack construction. The pinion gear has a hexagonal hole, and a slight clearance exists between this hole and the hexagonal flats of the piston rod. This clearance generates a backlash in the rotational direction of the piston rod.

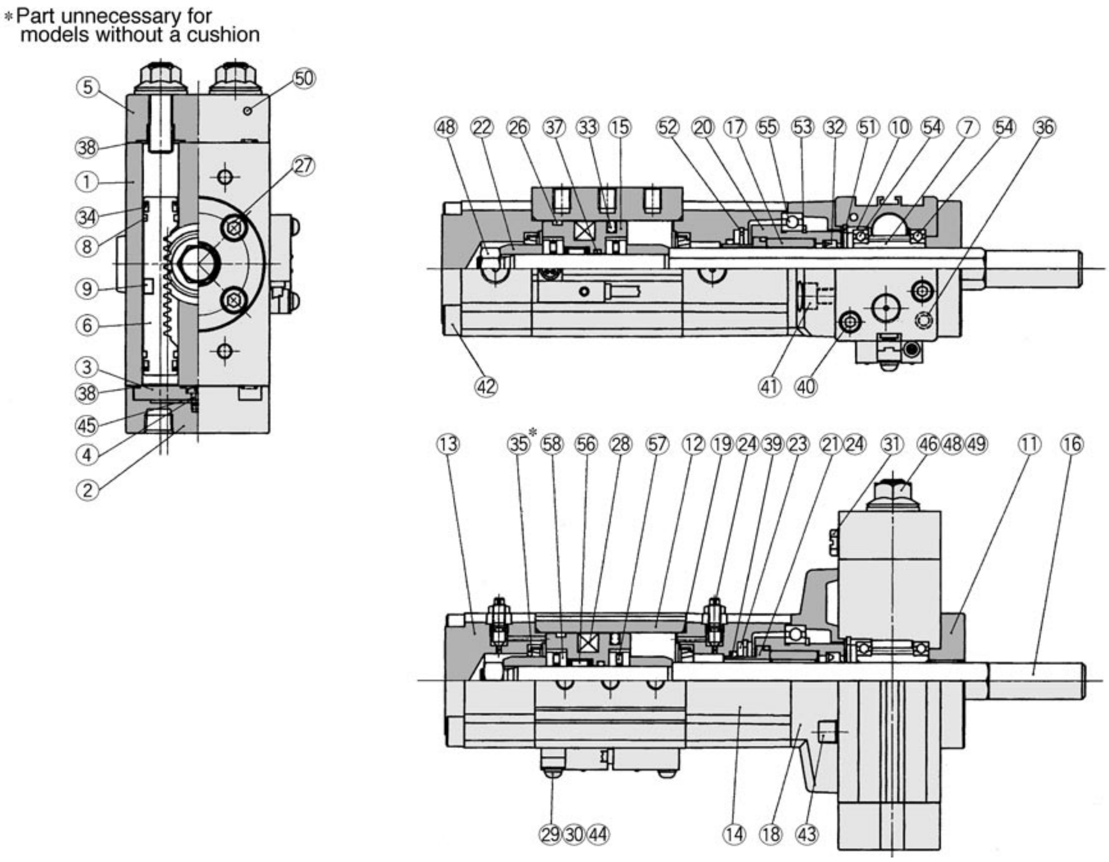


⚠Precaution

⚠ Caution

The angle adjustment bolt is adjusted to a random position within the adjustable rotating range. Therefore, it must be readjusted to obtain the angle that suits your application.

Construction/Parts List



Component Parts

No.	Description	Material	Note
①	Body	Aluminium alloy	Anodized
②	Cover	Aluminium alloy	Anodized
③	Plate	Aluminium alloy	Chromated
④	Packing	NBR	
⑤	End cover	Aluminium alloy	Anodized
⑥	Piston	Stainless steel	Soft nitriding
⑦	Pinion gear	Chrome molybdnum steel	Soft nitriding
⑧	Wearing	Resin	
⑨	Magnet	Magnet	
⑩	Bearing color	Aluminium alloy	Anodized
⑪	Steady brace cover	Aluminium alloy	Anodized
⑫	Tube	Aluminium alloy	Anodized
⑬	Head cover	Aluminium alloy	Anodized
⑭	Rod cover	Aluminium alloy	Platinum silver
⑮	Piston	Aluminium alloy	Chromated
⑯	Piston rod	Stainless steel	Soft nitriding
⑰	Non-rotating guide	Sintered metallic	Soft nitriding
⑱	Flange	Aluminium alloy	Platinum silver
⑲	O ring	NBR	
⑳	Rod packing guide	Aluminium alloy	Anodized
㉑	Color	Aluminium alloy	Anodized
㉒	Cushion ring	Rolled steel	Electroless nickel plated
㉓	O ring retainer	Aluminium alloy	Chromated
㉔	O ring	NBR	
㉕	Cushion valve Ass'y	Steel wire	
㉖	Wearing	Resin	
㉗	Hexagon socket head cap screw	Chrome molybdnum steel	Nickel plated
㉘	Plastic magnet	Magnet	
㉙	Switch mounting nut	Rolled steel	
㉚	Switch spacer	Resin	
㉛	Plug	Brass	Electroless nickel plated
㉜	Rod packing	NBR	
㉝	Piston packing	NBR	

Component Parts

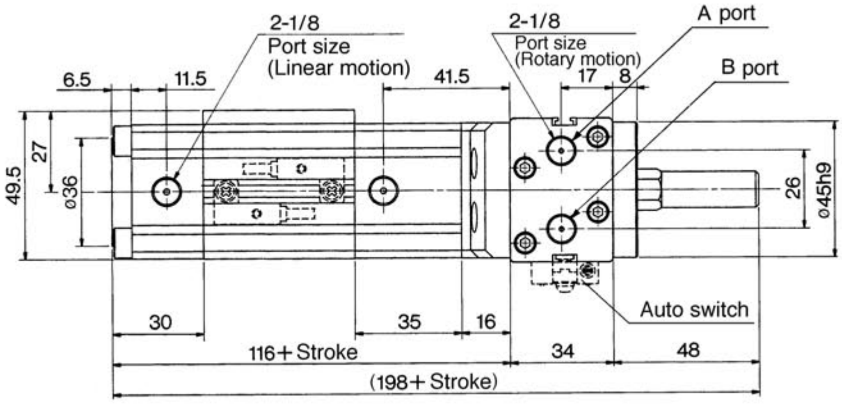
No.	Description	Material	Note
㉞	Piston packing	NBR	
㉟	Cushion packing	NBR	
㊱	O ring	NBR	
㊲	O ring	NBR	
㊳	O ring	NBR	
㊴	O ring	NBR	
㊵	Hexagon socket head cap screw	Stainless steel	
㊶	Hexagon socket head cap screw	Stainless steel	
㊷	Hexagon socket head cap screw	Stainless steel	
㊸	Hexagon socket head cap screw	Stainless steel	
㊹	Cross-recessed pan head small screw	Steel wire	Nickel plated
㊺	Cross-recessed pan head small screw	Steel wire	Zinc chromate
㊻	Hexagonal socket head retaining ring	Steel wire	Electroless nickel plated
㊼	Compact hexagon nut	Stainless steel	
㊽	Hexagon nut with flange	Steel wire	Electroless nickel plated
㊾	Seal washer	Steel wire	
㊿	Steel ball	Steel wire	
51	R-shape snap ring	Steel wire	Zinc chromated
52	R-shape snap ring	Steel wire	Zinc chromated
53	R-shape snap ring	Steel wire	Zinc chromated
54	Bearing	Bearing steel	
55	Bearing	Bearing steel	
56	Shell type needle roller bearing	Bearing steel	
57	Thrust needle roller bearing	Bearing steel	
58	Bearing ring	Bearing steel	

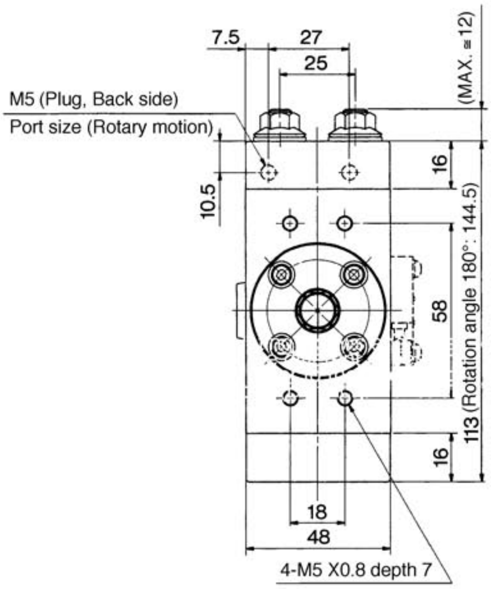
Spare Parts List

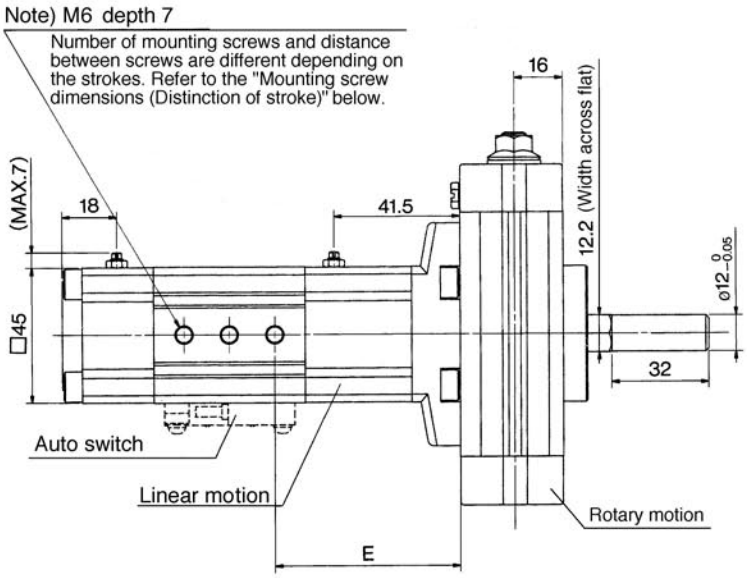
Description	Size	
	32	40
Spare parts Ass'y	P31701-1	P31702-1
	The parts of the above-mentioned number ④ ⑧ ⑲ ㉖ ㉜ ㉝ ㉞ ㊱ ㊲ ㊳ ㊴ ㊾	

Size**32**  Basic Style/**MRQBS32**

The dimensions below shows an actuator with a rotation angle of 80° to 100° style.

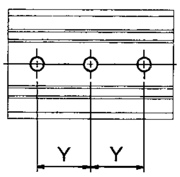
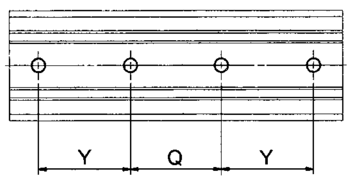






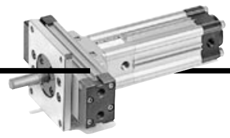
The dimension above left shows an actuator with a rotation angle of 80° to 100° style with a stroke of 15mm.

Mounting screw dimensions (Distinction of stroke)

Mounting screw 3 pcs.	Mounting screw 4 pcs.
	

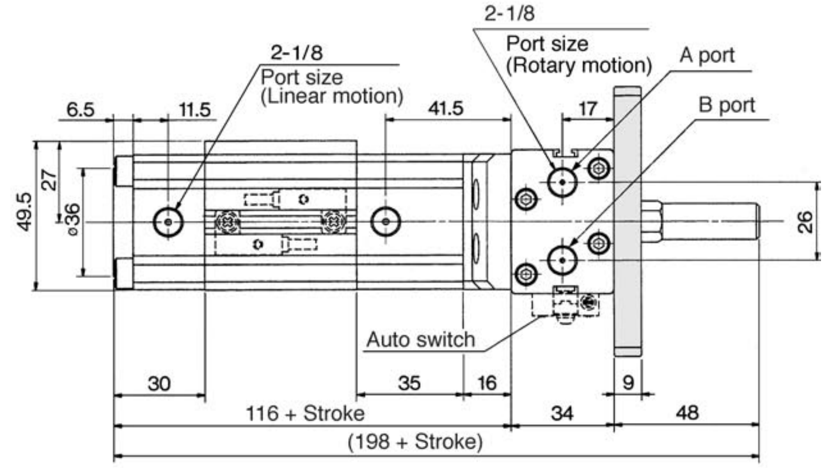
(mm)

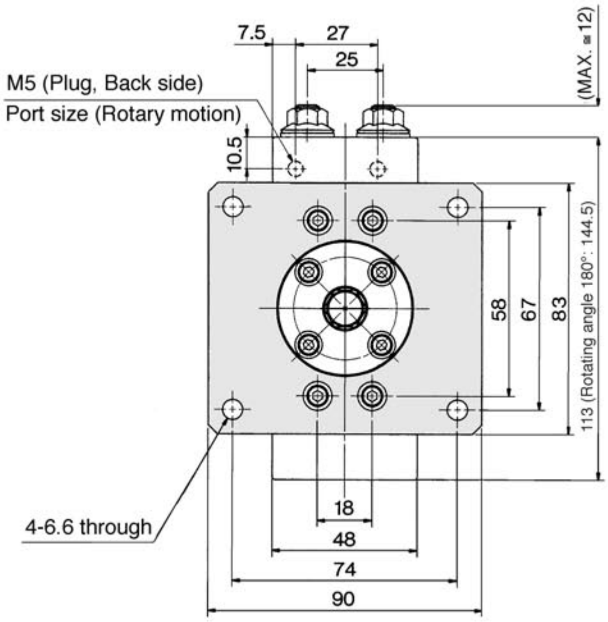
Stroke	5	10	15	20	25	30	40	50	75	100
Y	12.5	12.5	15	15	20	20	15	17.5	25	30
Q	—	—	—	—	—	—	20	20	20	30
E	58.5	61	61	63.5	61	63.5	63.5	66	71	73.5

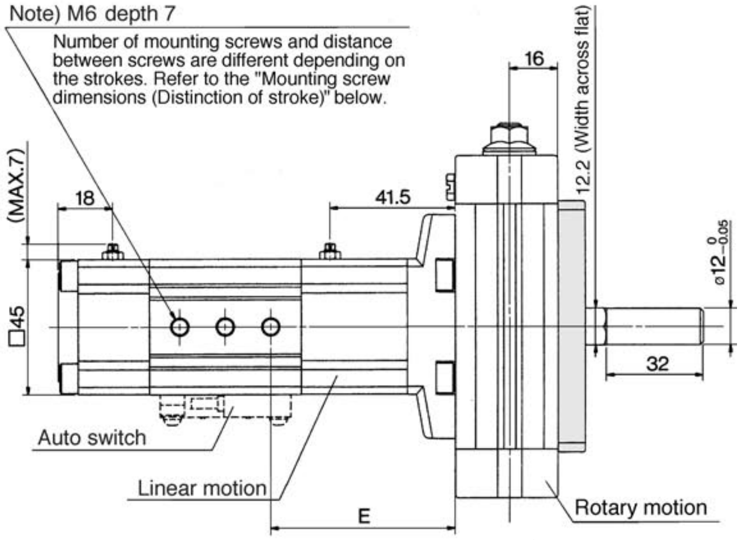


Flange Style/**MRQFS32**

The dimensions below shows an actuator with a rotation angle of 80° to 100° style.

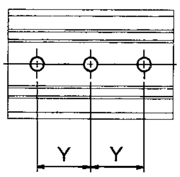
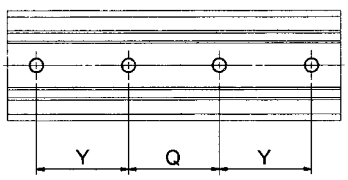






The dimension above left shows an actuator with a rotation angle of 80° to 100° style with a stroke of 15mm.

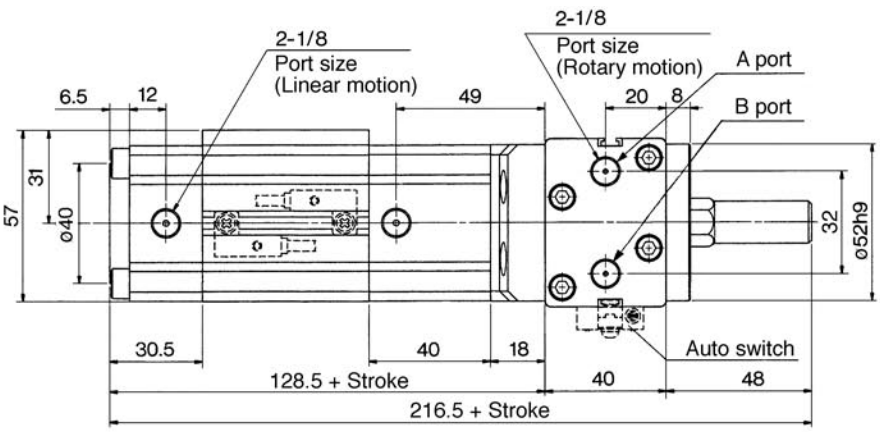
Mounting screw dimensions (Distinction of stroke)

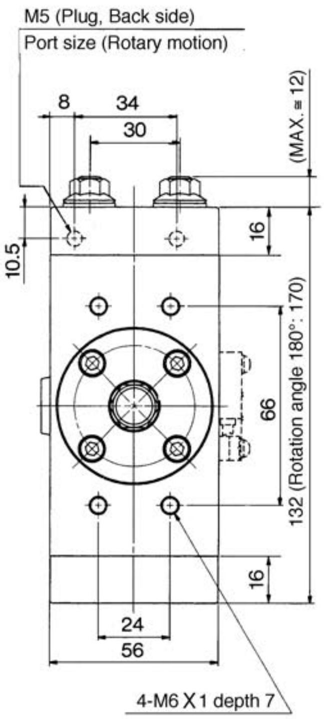
Mounting screw 3 pcs.	Mounting screw 4 pcs.
 (mm)	 (mm)

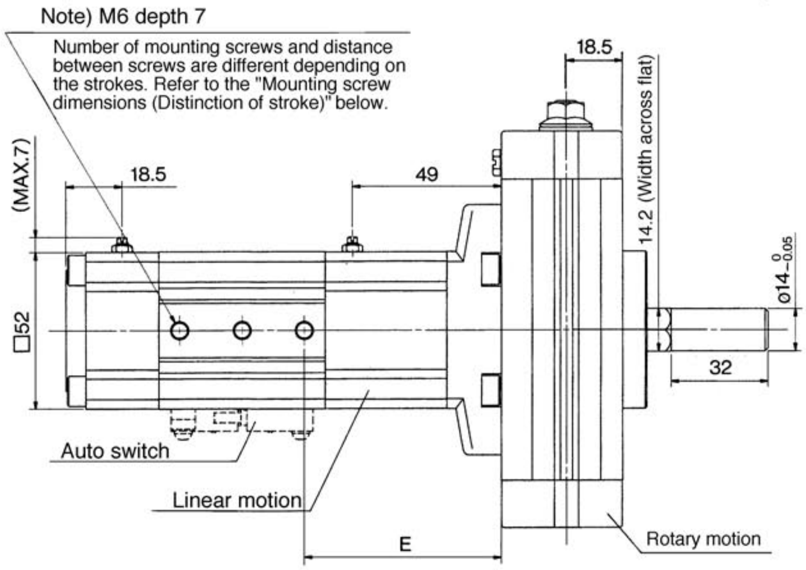
Stroke	5	10	15	20	25	30	40	50	75	100
Y	12.5	12.5	15	15	20	20	15	17.5	25	30
Q	—	—	—	—	—	—	20	20	20	30
E	58.5	61	61	63.5	61	63.5	63.5	66	71	73.5

Size 40 Basic Style/**MRQBS40**

The dimensions below shows an actuator with a rotation angle of 80° to 100° style.

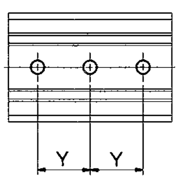
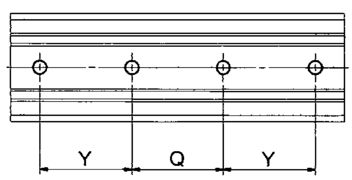






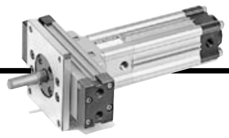
The dimension above left shows an actuator with a rotation angle of 80° to 100° style with a stroke of 15mm.

Mounting screw dimensions (Distinctions of stroke)

Mounting screw 3 pcs.	Mounting screw 4 pcs.
	

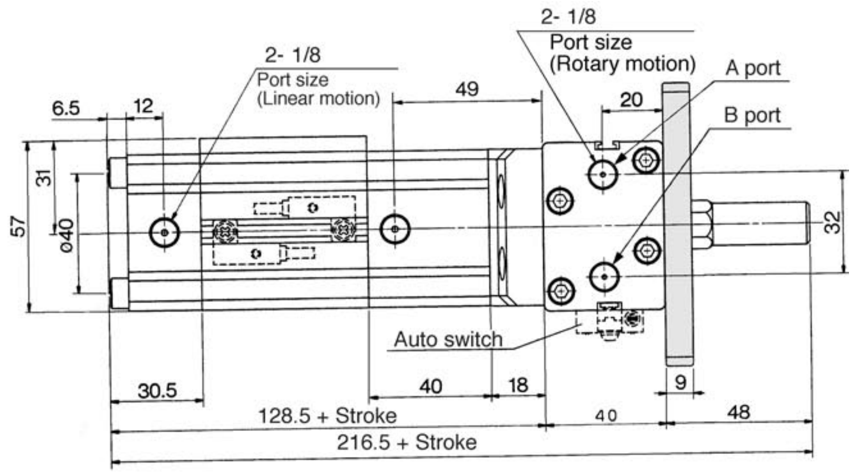
(mm)

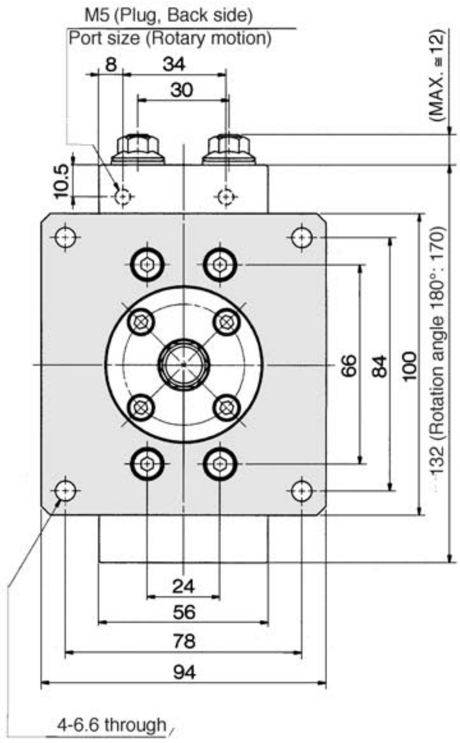
Stroke	5	10	15	20	25	30	40	50	75	100
Y	12.5	15	15	20	20	15	17.5	17.5	25	30
Q	—	—	—	—	—	20	20	20	20	30
E	68	68	70.5	68	70.5	68	70.5	75.5	80.5	83

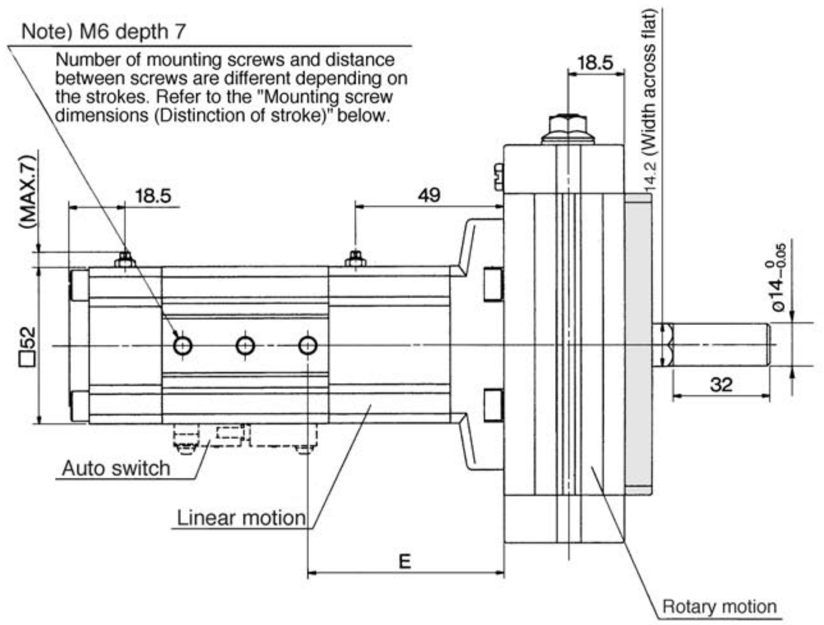


Flange Style/**MRQFS40**

The dimensions below shows an actuator with a rotation angle of 80° to 100° style.

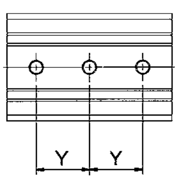
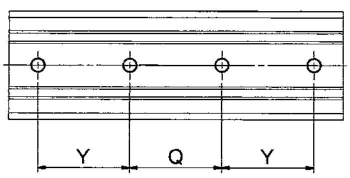






The dimension above left shows an actuator with a rotation angle of 80° to 100° style with a stroke of 15mm.

Mounting screw dimensions (Distinctions of stroke)

Mounting screw 3 pcs.	Mounting screw 4 pcs.
 (mm)	 (mm)

Stroke	5	10	15	20	25	30	40	50	75	100
Y	12.5	15	15	20	20	15	17.5	17.5	25	30
Q	—	—	—	—	—	20	20	20	20	30
E	68	68	70.5	68	70.5	68	70.5	75.5	80.5	83

Series MRQ
Auto Switch Specifications

Refer to p.6-15 concerning further information on specifications of the auto switch single body.

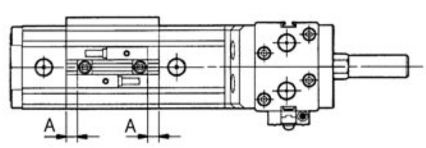
Models of applicable auto switches

Mounting	Auto switch model		Lead wire, Ability, Electrical entry
Linear part Rotary part	Reed switch	D-A7□, A80	Grommet (Vertical)
		D-A7□H, A80H	Grommet (Horizontal)
		D-A73C□, A80C	Connector
		D-A79W	Grommet (2 colour indication, Vertical)
	Solid state switch	D-F7□V	Grommet (Vertical)
		D-F7□, J79	Grommet (Horizontal)
		D-J79C	Connector
		D-F7□W, J79W	Grommet (2 colour indication, Horizontal)
		D-F7BAL*	Grommet (2 colour Water resistant, Horizontal)
		D-F7□F	Grommet (2 colour, With diagnosis output, Horizontal)
		D-F7NTL	Grommet (With timer, Horizontal)

*This product (rotary cylinder) is not water resistant. Consult SMC when using D-F7BAL.

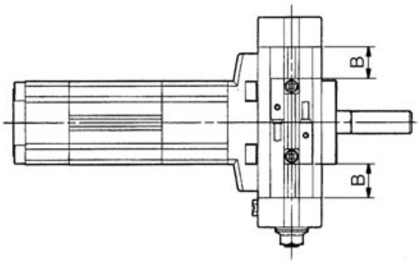
Operating Range/Hysteresis/Proper Mounting Positions of Auto Switch

Linear part



Linear part		Size	D-A7/A8	D-F7□, J79	D-F7□W, J79W
Linear part	Operating range (mm)	32	12	6	8
		40	11		7
	Hysteresis (mm)	32	2	1	1
		40			
	Proper mounting position A (mm)	32	8.5 (9)	9	13
		40	11 (11.5)	11.5	15.5

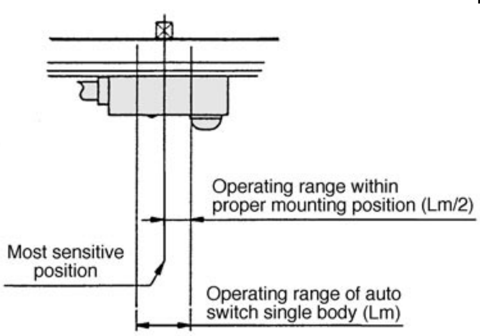
Rotary part



Rotary part		Size	Rotating angle	D-A7/A8	D-F7□, J79	D-F7□W, J79W
Rotary part	Operating range (θ m)	32	—	55	28	28
		40		46	27	27
	Angle of hysteresis (Degree)	32		10	4	4
		40		7	3	3
	Proper mounting position B (mm)	32	80° to 100°	24.5 (25)	25	25
			170° to 190°	32 (32.5)	32.5	32.5
		40	80° to 100°	31.5 (32)	32	32
			170° to 190°	41 (41.5)	41.5	41.5

The values in (parentheses) are of D-A72, A7□H, A80H

Hysteresis



Operating angle θ m: The value of the individual auto switch's movement range Lm converted into the shaft's rotation angle

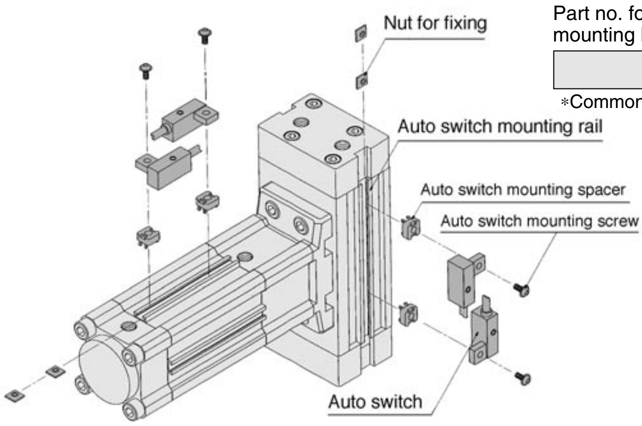
Angle of hysteresis: The value of the auto switch's hysteresis as represented by an angle

Mounting and moving method of auto switch

Part no. for auto switch mounting bracket

BQ-2

*Common for MRQ32 and 40

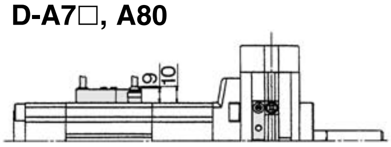


① Slide the auto switch mounting spacer and place it on the auto switch mounting position of the body. (At this time, verify that the auto switch mounting nut that is inserted in the auto switch mounting rail is placed simultaneously in the auto switch mounting position.)
② Engage the tongue portion of the auto switch mounting arm into the groove portion of the auto switch mounting spacer.
③ Lightly screw the auto switch mounting screw into the auto switch mounting nut, via the hole in the auto switch mounting arm.
④ After verifying the detection position, tighten the mounting screw to secure the auto switch in place. (The tightening torque of the M3 screw is approximately 0.5Nm.)
⑤ The detection position can be changed under the conditions described in step ③ .

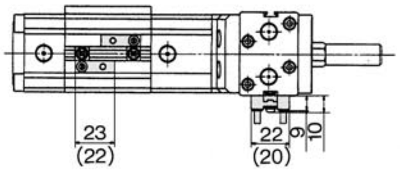
Auto Switch Mounting Dimensions

Read Switch

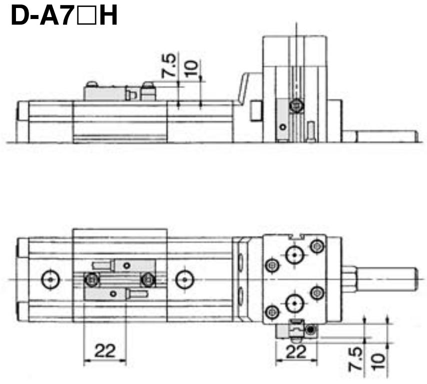
D-A7□, A80



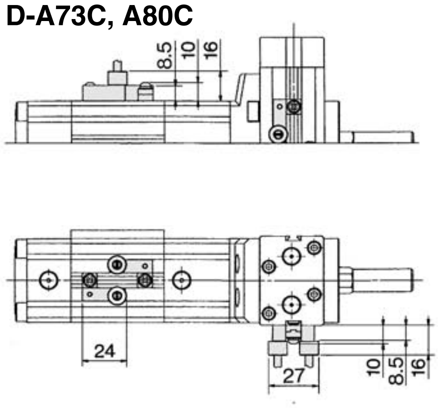
(In parentheses) are the
dimensions of "A72".



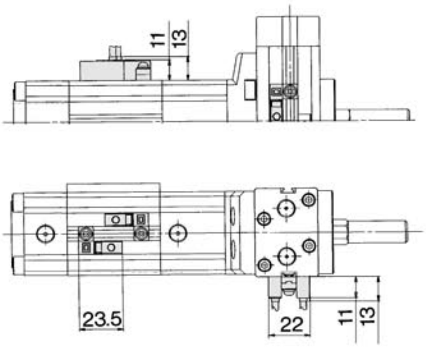
D-A7□H



D-A73C, A80C

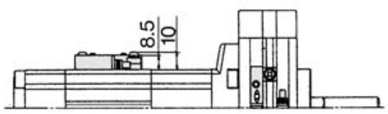


D-A79W

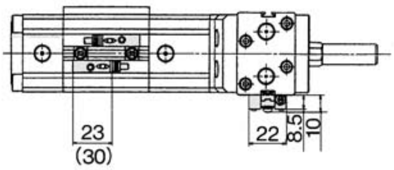


Solid State Switch

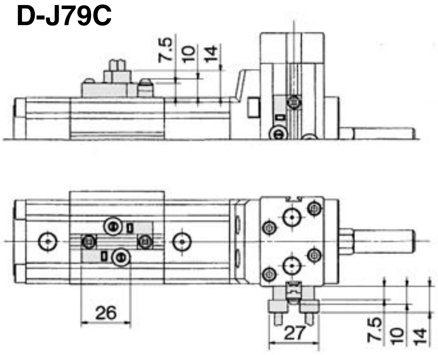
D-F7□, F7□F, F7BAL, F7NTL, J79



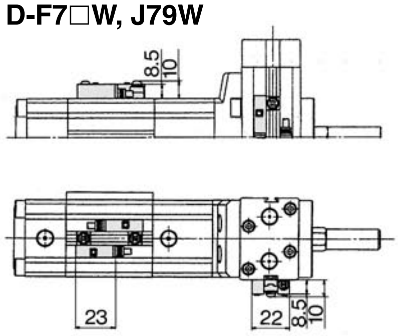
(In parentheses) are the
dimensions of "F7LF".



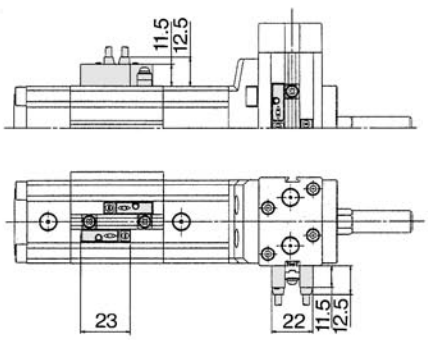
D-J79C



D-F7□W, J79W



D-F7□V



Series MRQ
Made to Order Specifications
-X1 to X5

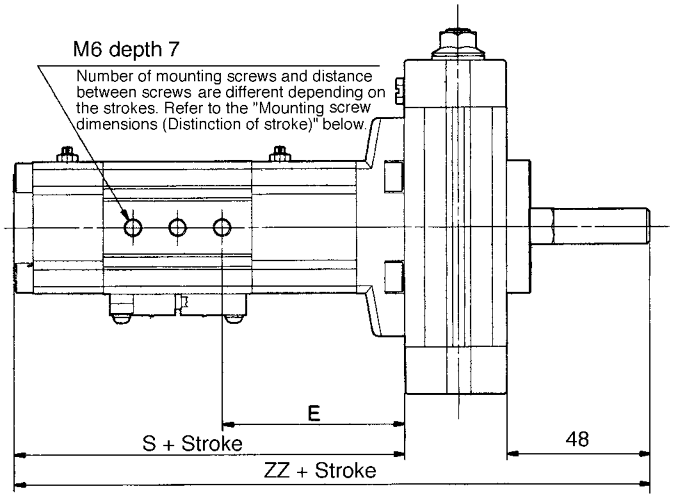
Consult SMC for the detailed specifications, dimensions and delivery.

1 Intermediate stroke — Symbol -X1

MRQ [Mounting Style] S 32/40 – [Stroke] [Cushion] [Rotation angle] X– [Auto switch] –X1

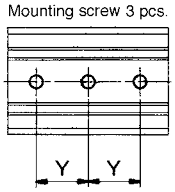
Operating stroke · Intermediate stroke

For the intermediate strokes other than standard ones, the full length is shortened by cutting the linear motion side according to the stroke.

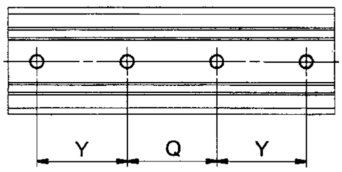


Mounting screw dimensions (Distinction of stroke)

Mounting screw 3 pcs.



Mounting screw 4 pcs.



(mm)

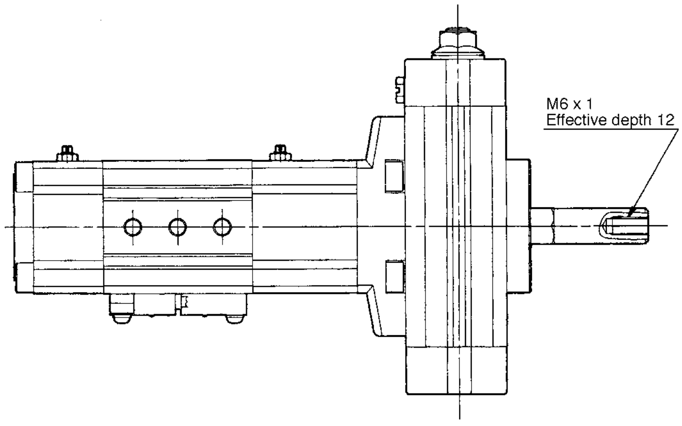
Size	Stroke	Y	Q	E	Mounting screw
32	1 to 4	12.5	—	58.5 - (5 stroke) /2	3
	6 to 9			61 - (10 stroke) /2	
	11 to 14	15		61 - (15 stroke) /2	
	16 to 19			63.5 - (20 stroke) /2	
	21 to 24	20		61 - (25 stroke) /2	
	26 to 29			63.5 - (30 stroke) /2	
	31 to 39	15	20	63.5 - (40 stroke) /2	4
	41 to 49	17.5		66 - (50 stroke) /2	
	51 to 65	25		66 - (65 stroke) /2	
	66 to 74			71 - (75 stroke) /2	
	76 to 90	30	30	68.5 - (90 stroke) /2	
	91 to 99			73.5 - (100 stroke) /2	
40	1 to 4	12.5	—	68 - (5 stroke) /2	3
	6 to 9	15		68 - (10 stroke) /2	
	11 to 14			70.5 - (15 stroke) /2	
	16 to 19	20		68 - (20 stroke) /2	
	21 to 24			70.5 - (25 stroke) /2	
	26 to 29	15	20	68 - (30 stroke) /2	4
	31 to 39	17.5		70.5 - (40 stroke) /2	
	41 to 49			75.5 - (50 stroke) /2	
	51 to 65	25		75.5 - (65 stroke) /2	
	66 to 74			80.5 - (75 stroke) /2	
	76 to 90	30	30	78 - (90 stroke) /2	
	91 to 99			83 - (100 stroke) /2	

Size	S	ZZ
32	116	198
40	128.5	216.5

2 Rod end female thread — Symbol -X2

MRQ [Mounting style] S 32/40 – [Stroke] [Cushion] [Rotation angle] X– [Auto switch] –X2

Rod end female thread

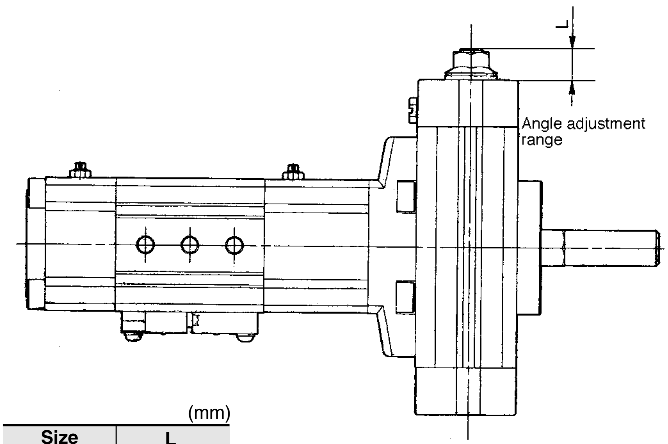


3 Non-standard angle adjustment range — Symbol -X5

MRQ [Mounting style] S 32/40 – [Stroke] [Cushion] [Rotation angle] X– [Auto switch] –X5

Non-standard angle adjustment range

The standard angle adjustment range of ±5°(one side) is changed to $^{+5°}_{-95°}$ in this type.



(mm)

Size	L
32	Max. 32
40	Max. 31.5

Possible to change the specification from standard to"-X5"

Specify the part number for hexagon socket head cap screw for angle adjustment referring to the list below.

Size	Part no.
32	P317010-13
40	

Attached parts: Hexagon socket head cap screw 1 pc.
Hexagon nut with flange 1 pc.
Seal washer 1 pc.

∗One set of the actuator requires two sets of the hexagon socket head cap screws.

Made to Order Specifications -X10

Consult SMC for further information on specifications, dimensions and delivery.

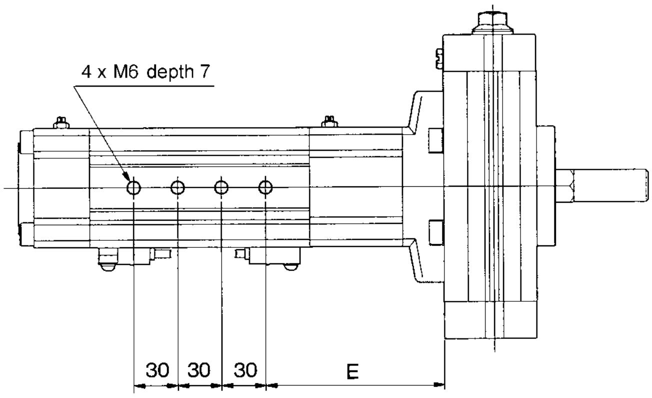
Symbol

4 Long Stroke (101 to 200 mm) -X10

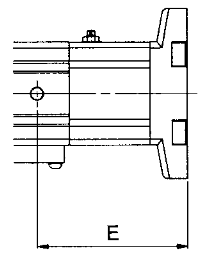
✻Refer to the table of number of the auto switches mounted below.

MRQ [Mounting style] S 32/40 – [Stroke] [Cushion] [Rotation angle] X – [Auto switch] – X10

Stroke: Operating stroke
X10: Long stroke



Equation for "E" dimensions



Size 32
(Stroke-100) /2 + 73.5

Size 40
(Stroke-100) /2 + 83

Acceptable side loading to the tip of piston rod F

	Size 32	Size 40
Stroke	F(N)	F(N)
105	9	15
110		14
115	8	
120		
125		
130		13
140		
150	7	12
175		
200	5	11

Set at the closer factors to those indicated in the table for the acceptable side loading of strokes not indicated in the table.

Number of auto switches mounted

Linear motion \ Rotation	0	1	2
0	—	0S	02
1	S0	SS	S2
2	20	2S	—
n	n0	nS	n2

Combinations of made to order products No.1 to 4 are available. Consult SMC for further information.