

Slit Type Rodless Cylinders with Cam-follower Guides

ORK SERIES

The ORK series with cam-follower guides adds a rolling bearing function to the slit type rodless cylinders with guides. A heavy load and a large bending moment can be applied directly to achieve smooth operation.

1 SMOOTH OPERATION WITHOUT INSTALLING A GUIDE

Because the slider and the cylinder body act as the guide, the rolling angle of the slider (rolling angle of the slider at applying the maximum rolling moment) becomes 1/2 of that of the ORGA series. Moreover, the rolling bearing of the cam-follower guide makes for smooth operation.

2 LONG STROKE AND COMPACT PIPING

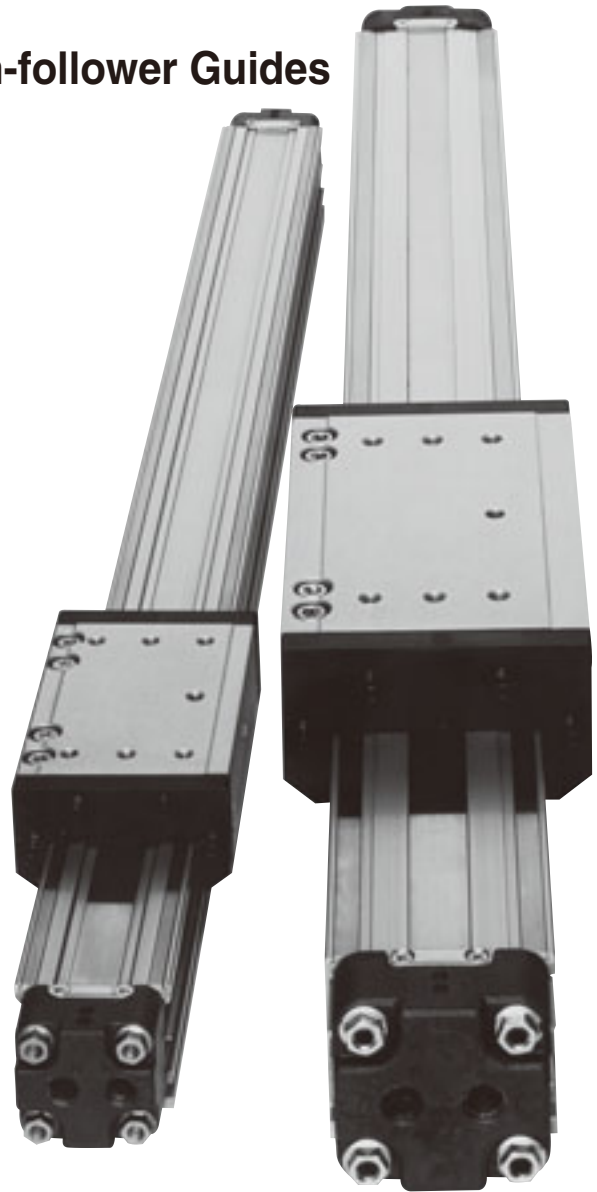
As for the maximum stroke, $\phi 16$ [0.630in.] can be made up to 3000mm [118.1in.], and $\phi 20$ [0.787in.]~ $\phi 50$ [1.969in.] up to 5000mm [196.8in.]. Moreover, one-direction piping and both-side piping can be selected according to the installation, and with these cylinders, it is possible to make equipment and machine designs compact.

3 STROKE ADJUSTMENT AND HIGH SPEED

By installing a stroke adjusting bolt or shock absorber, the stroke can be finely adjusted, and can be used at high speeds. Also because a magnet is installed as standard equipment on the piston, by simply mounting a sensor switch, it becomes a rodless cylinder with sensors.

4 EASY ADJUSTMENT AND ACCURATE

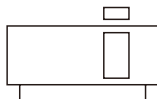
The shaft of the cam-follower is mounted directly onto the block making adjustment easy. The wide rail width maintains long-term precision.



ORK SERIES



Symbol



Specifications

Bore size mm [in.]		16 [0.630]	20 [0.787]	25 [0.984]	32 [1.260]	40 [1.575]	50 [1.969]
Item							
Operation type		Double acting type					
Media		Air					
Operating pressure range	MPa [psi.]	0.15~0.8 [22~116]			0.1~0.8 [15~116]		
Proof pressure	MPa [psi.]	1.2 [174]					
Operating temperature range	°C [°F]	0~60 [32~140]					
Operating speed range	mm/s [in./sec.]	100~2000 [3.9~78.7] ^{Note1}					
Cushion		Variable cushions on both sides					
Cushioning stroke (one side)	mm [in.]	15 [0.591]	18 [0.709]	21 [0.827]	26 [1.024]	40 [1.575]	
Lubrication		Not required ^{Note2}					
Stroke adjusting range mm [in.] (One side to the specification stroke)	With shock absorber (optional)	Up to the full stroke and fine adjustment 0~-15 [0~-0.591]	Up to the full stroke and fine adjustment 0~-20 [0~-0.787]		Up to the full stroke and fine adjustment 0~-30 [0~-1.181]		
	With stroke adjusting bolt (optional)	0~-4 [0~-0.157]	0~-5 [0~-0.197]	0~-6 [0~-0.236]	0~-8 [0~-0.315]	0~-10 [0~-0.394]	
		(Fine adjustment at the end of the stroke only)					
Stroke tolerance	1000 or less	+1.5 ₀ [+0.059] ₀			+1.5 ₀ [+0.059] ₀		
	1001~3000	+2.0 ₀ [+0.079] ₀			+2.0 ₀ [+0.079] ₀		
	3001~5000	-			+2.5 ₀ [+0.098] ₀		
Port size		M5×0.8	Rc1/8		Rc1/4		Rc3/8

Notes 1: Select the piston speed according to the "Cushioning capacity" graph on p.1117, and the "Impact speed and mass of impact object" graph on p.1120.

2: The product can be used without lubrication, if lubrication is required, use Turbine Oil Class 1 (ISO VG32) or equivalent.

3: For details, see p.1120.

Specifications of Shock Absorber

Item	Model	KSHJ10×10		KSHJ12×10		KSHJ14×12		KSHJ18×16		KSHJ20×16		KSHJ22×25	
		-01	-02	-01	-02	-01	-02	-01	-02	-01	-02	-01	-02
Applicable cylinder		ORK16		ORK20		ORK25		ORK32		ORK40		ORK50	
Maximum absorption	J [ft.-lbf]	3 [2.21]		6 [4.43]		10 [7.4]		20 [14.8]		30 [22.1]		50 [36.9]	
Absorbing stroke	mm [in.]	10 [0.394]				12 [0.472]		16 [0.630]				25 [0.984]	
Maximum impact speed	mm/s [in./sec.]	1000 [39.4]	2000 [78.7]	1000 [39.4]	2000 [78.7]	1000 [39.4]	2000 [78.7]	1000 [39.4]	2000 [78.7]	1000 [39.4]	2000 [78.7]	1000 [39.4]	2000 [78.7]
Maximum operating frequency	cycle/min	60				40				30			
Maximum absorption per minute	J/min [ft.-lbf/min.]	120 [88.5]		220 [162]		240 [177]		320 [236]		450 [332]		500 [369]	
Spring return force ^{Note}	N [lbf.]	8.0 [1.80]		7.6 [1.71]		9.2 [2.07]		22.0 [4.95]		22.0 [4.95]		28.5 [6.41]	
Angle variation		1° or less						3° or less					
Operating temperature range	°C [°F]	0~60 [32~140]											

Note: Values at retracted position.

Caution: The life of the shock absorber may vary from the Slit Type Rodless Cylinder, depending on its operating conditions.

Cylinder Thrust

Bore size mm [in.]	Pressure area mm ² [in ²]	Pressure MPa [psi.]							
		0.1 [15]	0.2 [29]	0.3 [44]	0.4 [58]	0.5 [73]	0.6 [87]	0.7 [102]	0.8 [116]
16 [0.630]	201 [0.312]	20 [4.5]	40 [9.0]	60 [13.5]	80 [18.0]	101 [22.7]	121 [27.2]	141 [31.7]	161 [36.2]
20 [0.787]	314 [0.487]	31 [7.0]	63 [14.2]	94 [21.1]	126 [28.3]	157 [35.3]	188 [42.3]	220 [49.5]	251 [56.4]
25 [0.984]	490 [0.760]	49 [11.0]	98 [22.0]	147 [33.0]	196 [44.1]	245 [55.1]	294 [66.1]	343 [77.1]	392 [88.1]
32 [1.260]	804 [1.246]	80 [18.0]	161 [36.2]	241 [54.2]	322 [72.4]	402 [90.4]	482 [108.4]	563 [126.6]	643 [144.5]
40 [1.575]	1256 [1.947]	126 [28.3]	251 [56.4]	377 [84.7]	502 [112.8]	628 [141.2]	754 [169.5]	879 [197.6]	1005 [225.9]
50 [1.969]	1963 [3.043]	196 [44.1]	393 [88.3]	589 [132.4]	785 [176.5]	982 [220.8]	1178 [264.8]	1374 [308.9]	1570 [352.9]

Bore Size and Stroke

mm		
Bore size	Standard strokes	Available strokes
16	100,200,300,400,500,600,700,800	0~3000
20	200,300,400,500,600,700,800,1000,1200,1400,1600,2000	0~5000
25	200,300,400,500,600,700,800,1000,1200,1400,1600,2000	
32	200,300,400,500,600,700,800,1000,1200,1400,1600,2000	
40	300,400,500,600,700,800,900,1000,1100,1200,1300,1400,1600,1800,2000	
50	300,400,500,600,700,800,900,1000,1100,1200,1300,1400,1600,1800,2000	

Remark : Non-standard strokes are available at 1mm pitch intervals. Consult us for delivery.
Also consult us for strokes over 3000mm.

Mass

kg [lb.]							
Bore size mm [in.]	Zero stroke mass	Additional mass of each 1mm [0.0394in.] stroke	Additional mass				Additional mass of 1 sensor switch (with sensor holder)
			L-type bracket	F-type support	Shock absorber (with holder)	Stroke adjusting bolt (with holder)	
16 [0.630]	0.42 [0.93]	0.0015 [0.0033]	0.014 [0.031]	0.008 [0.018]	0.042 [0.093]	0.034 [0.075]	A: 0.02 [0.04] B: 0.05 [0.11]
20 [0.787]	0.79 [1.74]	0.0025 [0.0055]	0.03 [0.066]	0.015 [0.033]	0.07 [0.15]	0.056 [0.123]	A: 0.05 [0.11] B: 0.09 [0.20]
25 [0.984]	1.24 [2.73]	0.0030 [0.0066]	0.05 [0.11]	0.06 [0.13]	0.12 [0.26]	0.10 [0.22]	
32 [1.260]	2.67 [5.89]	0.0050 [0.0110]	0.10 [0.22]	0.08 [0.18]	0.22 [0.49]	0.17 [0.37]	
40 [1.575]	4.13 [9.11]	0.0060 [0.0132]	0.08 [0.18]	0.12 [0.26]	0.40 [0.88]	0.35 [0.77]	
50 [1.969]	6.40 [14.11]	0.0092 [0.0203]	0.22 [0.49]	0.12 [0.26]	0.62 [1.37]	0.52 [1.15]	

Air Flow Rate and Air Consumption

While the cylinder's air flow rate and air consumption can be found through the following calculations, the quick reference table below provides the answers more conveniently.

$$\text{Air flow rate: } Q_1 = \frac{\pi D^2}{4} \times L \times \frac{60}{t} \times \frac{P+0.101}{0.101} \times 10^{-6}$$

$$\text{Air consumption: } Q_2 = \frac{\pi D^2}{4} \times L \times 2 \times n \times \frac{P+0.101}{0.101} \times 10^{-6}$$

Q₁: Required air flow rate for cylinder ℓ /min (ANR)
Q₂: Air consumption of cylinder ℓ /min (ANR)
D: Bore size of cylinder barrel mm
L: Cylinder stroke mm
t: Time required for cylinder to travel 1 stroke s
n: Number of cylinder reciprocations per minute times/min
P: Pressure MPa

$$\text{Air flow rate: } Q_1' = \frac{\pi D'^2}{4} \times L' \times \frac{60}{t} \times \frac{P'+14.7}{14.7} \times \frac{1}{1728}$$

$$\text{Air consumption: } Q_2' = \frac{\pi D'^2}{4} \times L' \times 2 \times n \times \frac{P'+14.7}{14.7} \times \frac{1}{1728}$$

Q₁': Required air flow rate for cylinder ft³/min. (ANR)*
Q₂': Air consumption of cylinder ft³/min. (ANR)*
D': Bore size of cylinder barrel in.
L': Cylinder stroke in.
t: Time required for cylinder to travel 1 stroke sec.
n: Number of cylinder reciprocations per minute times/min
P': Pressure psi.

* Refer to p.54 for an explanation of ANR.

Bore size mm [in.]	Air pressure MPa [psi.]								
	0.1 [15]	0.2 [29]	0.3 [44]	0.4 [58]	0.5 [73]	0.6 [87]	0.7 [102]	0.8 [116]	0.9 [131]
16 [0.630]	0.792 [0.0483]	1.182 [0.0721]	1.573 [0.0960]	1.963 [0.1198]	2.352 [0.1435]	2.743 [0.1674]	3.133 [0.1912]	—	—
20 [0.787]	1.24 [0.0757]	1.86 [0.1135]	2.45 [0.1495]	3.07 [0.1873]	3.68 [0.2246]	4.29 [0.2618]	4.90 [0.2990]	5.51 [0.3362]	6.13 [0.3741]
25 [0.984]	1.94 [0.1184]	2.89 [0.1764]	3.83 [0.2337]	4.79 [0.2923]	5.75 [0.3509]	6.71 [0.4095]	7.67 [0.4681]	8.61 [0.5254]	9.57 [0.5840]
32 [1.260]	3.18 [0.1941]	4.73 [0.2886]	6.28 [0.3832]	7.85 [0.4790]	9.41 [0.5742]	10.98 [0.6700]	12.55 [0.7659]	14.10 [0.8604]	15.66 [0.9556]
40 [1.575]	4.95 [0.3021]	7.40 [0.4516]	9.83 [0.5999]	12.26 [0.7482]	14.69 [0.8964]	17.16 [1.0472]	19.60 [1.1961]	22.04 [1.3450]	24.47 [1.4933]
50 [1.969]	7.73 [0.4717]	11.55 [0.7049]	15.35 [0.9367]	19.15 [1.1686]	22.95 [1.4005]	26.80 [1.6354]	30.63 [1.8692]	—	—

The figures in the table show the air flow rate and air consumption when a cylinder makes 1 reciprocation with stroke of 1mm [0.0394in.]. The air flow rate and air consumption actually required is found by the following calculations.

- Finding the air flow rate (for selecting F.R.L., valves, etc.)

Example: When operating an air cylinder with bore size of 40mm [1.575in.] at speed of 300mm/s [11.8in./sec.] and under air pressure of 0.5MPa [73psi.]

$$14.69 \times \frac{1}{2} \times 300 \times 10^{-3} = 2.21 \text{ ℓ/s [0.0780ft}^3\text{/sec.]} \text{ (ANR)}$$

$$\text{(At this time, the air flow rate per minute is } 14.69 \times \frac{1}{2} \times 300 \times 60 \times 10^{-3} = 132.21 \text{ ℓ/min [4.667ft}^3\text{/min.]} \text{ (ANR).)}$$

- Finding the air consumption

Example 1. When operating an air cylinder with bore size of 40mm [1.575in.] and stroke of 100mm [3.94in.], under air pressure of 0.5MPa [73psi.] for 1 reciprocation

$$14.69 \times 100 \times 10^{-3} = 1.469 \text{ ℓ [0.0519ft}^3\text{/Reciprocation]} \text{ (ANR)}$$

Example 2. When operating the air cylinder with bore size of 40mm [1.575in.] and stroke of 100mm [3.94in.], under air pressure of 0.5MPa [73psi.],

$$\text{for 10 reciprocations per minute } 14.69 \times 100 \times 10 \times 10^{-3} = 14.69 \text{ ℓ/min [0.519ft}^3\text{/min.]} \text{ (ANR)}$$

Note: To find the actual air consumption required when using the rodless cylinder, add the air consumption of the piping to the air consumption obtained from the above calculation.

Moreover, for the slit type rodless cylinder ORK series, add 1 ℓ/min [0.0353ft³/min.] (ANR) as additional air leakage from the slit.

Order Codes

ORK 40×1000 - - - - - -

Slit type rodless cylinder with cam-follower guide
Bore size × Stroke

Mounting brackets
Blank : No mounting bracket
L : L-type bracket (1 set with 2 brackets)

Supporting brackets Note1
Blank : No supporting bracket
F : F-type support (1 set with 2 brackets)

Number of supporting bracket sets Note1
1 : With 1 set (with 2 supporting brackets)
2 : With 2 sets (with 4 supporting brackets)
 ⋮

Shock absorber
Blank : No shock absorber
K : With -01 shock absorber (Maximum impact speed 1000mm/s, with holder)
KM : With -02 shock absorber (Maximum impact speed 2000mm/s, with holder)

Number of shock absorbers (with holder)
1 : With 1 shock absorber
2 : With 2 shock absorbers

Stroke adjusting bolt
Blank : No stroke adjusting bolt
S : With stroke adjusting bolt (with holder)

Number of sensor switches
1 : With 1 sensor switch
2 : With 2 sensor switches
 ⋮

Lead wire length
 (with sensor switch)
A : 1000mm [39in.]
B : 3000mm [118in.]


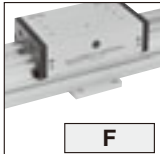
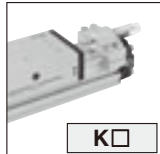
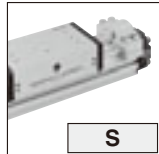


Sensor switch Note2
For φ16
Blank : No sensor switch
ZC130 : Solid state type with indicator lamp
 DC10~28V
ZC153 : Solid state type with indicator lamp
 DC4.5~28V
CS5T : Reed switch type without indicator lamp
 DC5~28V AC85~115V
CS11T : Reed switch type with indicator lamp
 DC10~28V
For φ20~φ50
Blank : No sensor switch
ZG530 : Solid state type with indicator lamp
 DC10~28V
ZG553 : Solid state type with indicator lamp
 DC4.5~28V
CS3M : Reed switch type with indicator lamp
 DC10~30V AC85~230V
CS4M : Reed switch type with indicator lamp
 DC10~30V AC85~115V
CS5M : Reed switch type without indicator lamp
 DC3~30V AC85~115V

● For details of the specifications, see p.1544.

Number of stroke adjusting bolts (with holder)
1 : With 1 stroke adjusting bolt
2 : With 2 stroke adjusting bolts

Notes: 1. The supporting brackets are not the brackets used to mount the body.
 Select after referring to p.1118.
 2. For the order code of the sensor switch and the sensor holder only, see p.1115.

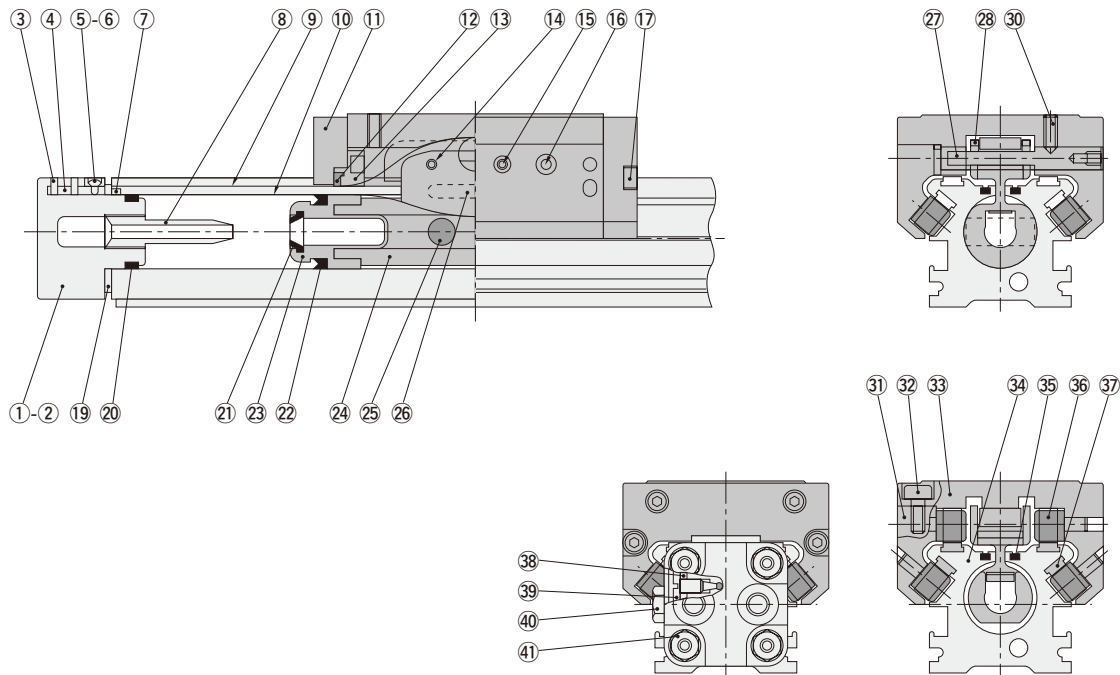
Options

With L-type bracket  L	With F-type support  F	With shock absorber  K □	With stroke adjusting bolt  S	φ 16 with sensor switch 	φ 20~φ 50 with sensor switch 
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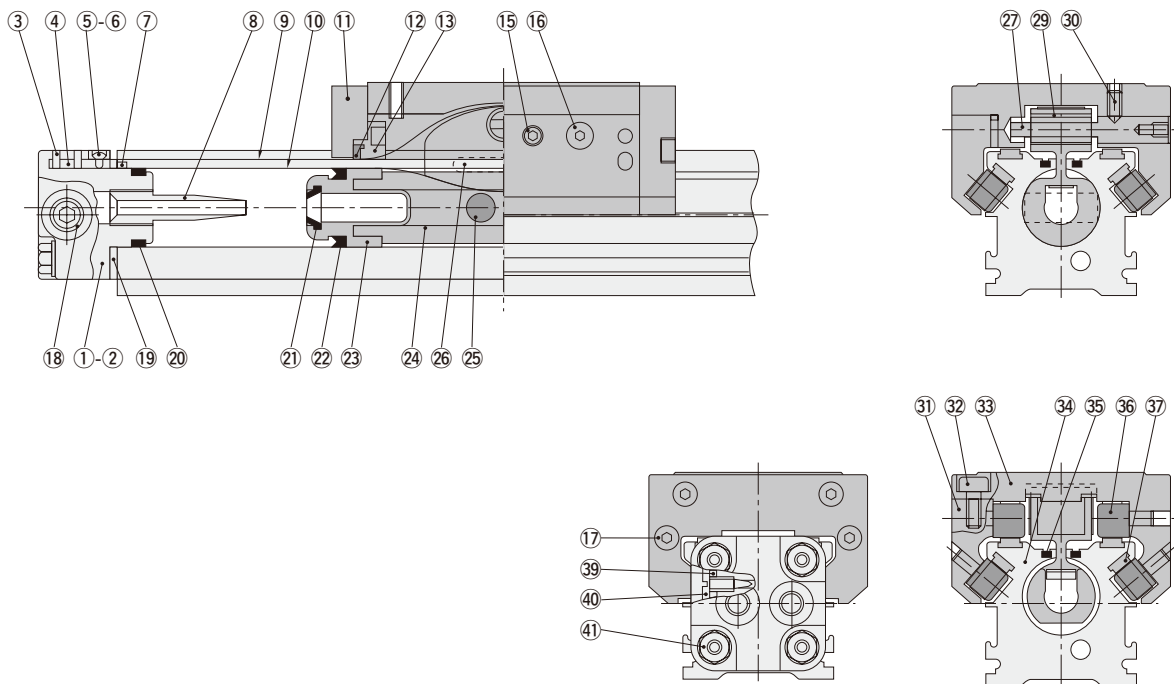
Additional Parts

<p>● Order codes for L-type bracket and supporting bracket only</p> <p>□ - ORK □</p> <p>16 : For φ 16 [0.630in.] 20 : For φ 20 [0.787in.] 25 : For φ 25 [0.984in.] 32 : For φ 32 [1.260in.] 40 : For φ 40 [1.575in.] 50 : For φ 50 [1.969in.]</p> <p>Basic cylinder type</p> <p>L : L-type bracket F : F-type support</p>	<p>● Order codes for shock absorber only</p> <p>KSHJ10×10-01, KSHJ10×10-02 : For ORK16 KSHJ12×10-01, KSHJ12×10-02 : For ORK20 KSHJ14×12-01, KSHJ14×12-02 : For ORK25 KSHJ18×16-01, KSHJ18×16-02 : For ORK32 KSHJ20×16-01, KSHJ20×16-02 : For ORK40 KSHJ22×25-01, KSHJ22×25-02 : For ORK50</p> <p>● Order codes for stroke adjusting bolt only</p> <p>S16 : For ORK16 S20 : For ORK20 S25 : For ORK25 S32 : For ORK32 S40 : For ORK40 S50 : For ORK50</p>	<p>● Order codes for shock absorber and stroke adjusting bolt holder only</p> <p>CL16 : For ORK16 CL20 : For ORK20 CL25 : For ORK25 CL32 : For ORK32 CL40 : For ORK40 CL50 : For ORK50</p>
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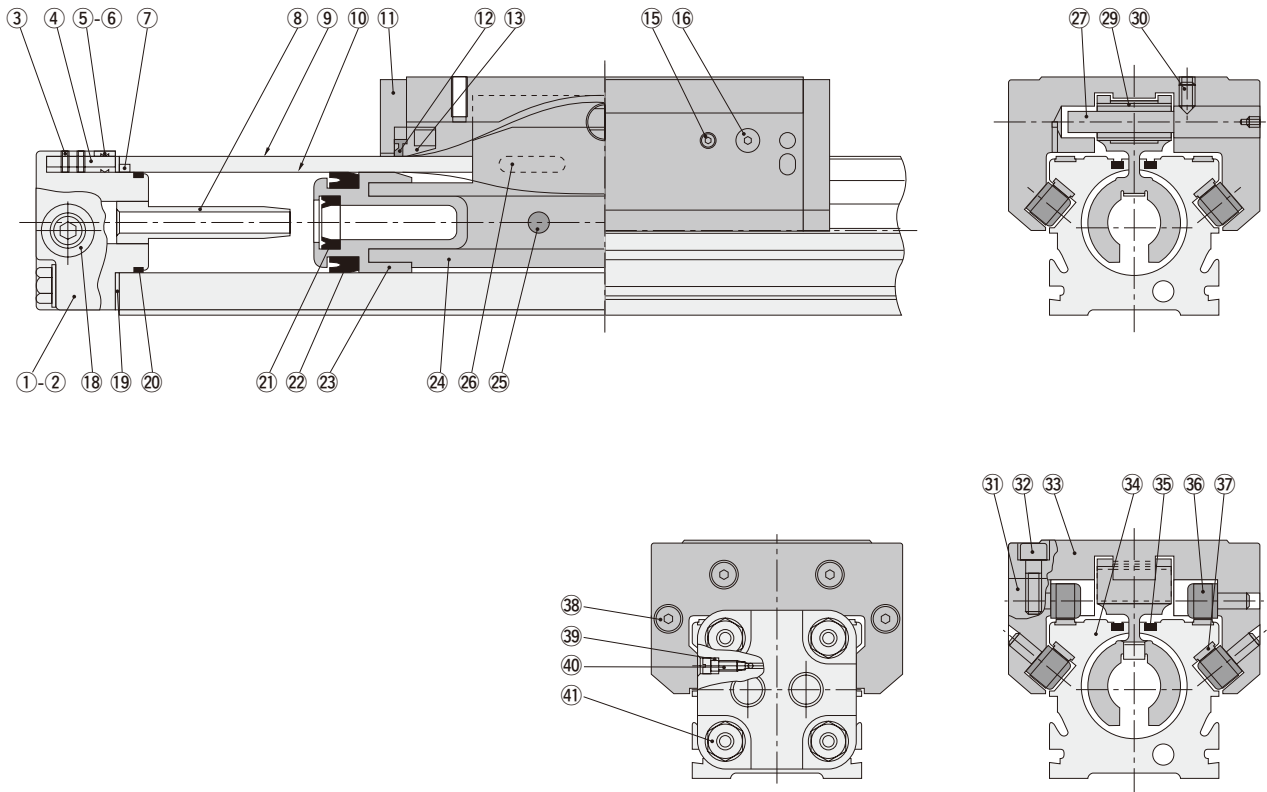
ORK16, 20



ORK25



ORK32, 40, 50



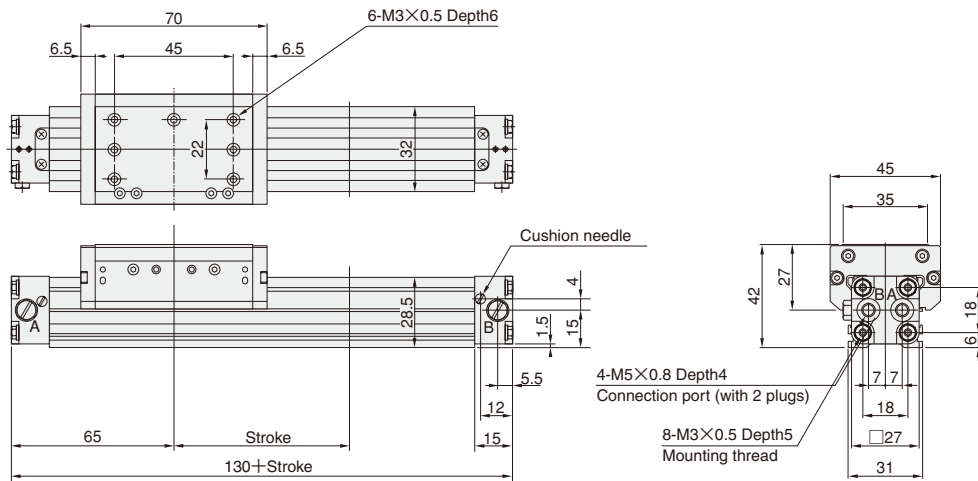
Major parts and Materials

No.	Parts	Materials	Q'ty	Remarks
①	End cap R	Aluminum alloy	1	Anodized
②	End cap L	Aluminum alloy	1	Anodized
③	Inner seal band setscrew	Alloy steel	4	Hexagon socket setscrew
④	Inner seal band lock	Steel	2	Nickel plated
⑤	Outer seal band lock	Steel	2	Nickel plated
⑥	Outer seal band setscrew	Steel	4	Cross recessed countersunk head screw
⑦	Rivet	Polyacetal	2	
⑧	Cushion pipe	Polyacetal	2	
⑨	Outer seal band	Stainless chrome steel	1	
⑩	Inner seal band	Stainless chrome steel	1	
⑪	End plate	Alloy steel	2	Phosphate coating
⑫★	Scraper	Synthetic rubber (NBR)	2	
⑬	Scraper holder	Special plastic	2	
⑭	Spring pin	Alloy steel	2	ϕ 16 [0.630in.] and ϕ 20 [0.787in.] only
⑮	Side slider lock setscrew	Alloy steel	2	Hexagon socket setscrew
⑯	Side slider adjusting bolt	Alloy steel	2	Hexagon socket setscrew
⑰	End plate mounting bolt	Alloy steel	8	For ϕ 16, hexagon socket head bolt For ϕ 20~ ϕ 50, hexagon socket button bolts
⑱	Hexagon socket plug	Alloy steel	2	For ϕ 32 [1.260in.], ϕ 40 [1.575in.], and ϕ 50 [1.969in.], 4 pcs.
⑲★	Cylinder gasket	Aluminium alloy sheet	2	Synthetic rubber (NBR) baked

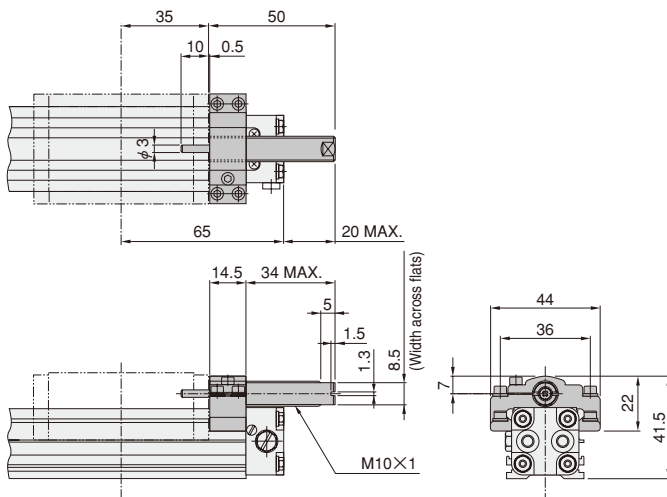
No.	Parts	Materials	Q'ty	Remarks
⑳★	Cap gasket	Synthetic rubber (NBR)	2	
㉑★	Cushion seal	Synthetic rubber (NBR)	2	
㉒★	Piston seal	Synthetic rubber (NBR)	2	
㉓	Piston	Polyacetal	2	
㉔	Piston yoke	Aluminum alloy	1	
㉕	Magnet	Alnico magnet	2	
㉖★	Bearing strip	Polyethylene	2	For ϕ 32 [1.260in.], ϕ 40 [1.575in.] and ϕ 50 [1.969in.], 4 pcs.
㉗	Carrier pin	Alloy steel	1	Black oxide
㉘	Yoke mount	Steel	1	Soft nitriding for ϕ 16 [0.630in.] and ϕ 20 [0.787in.] only
㉙	Bushing	Steel	1	Soft nitriding
㉚	Carrier pin setscrew	Alloy steel	1	Hexagon socket setscrew
㉛	Side slider	Aluminum alloy	1	Anodized
㉜	Side slider mounting bolt	Alloy steel	4	Hexagon socket head bolt
㉝	Slider	Aluminum alloy	1	Anodized
㉞	Cylinder barrel	Aluminum alloy	1	Anodized
㉟	Magnet strip	Rubber magnet	2	
㊱	Cam-follower	—	8	
㊲	Rail	Steel, drawn rod	4	
㊳★	Cushion gasket	Synthetic rubber (NBR)	2	
㊴	Cushion needle	Brass	2	
㊵	Plug	Brass for ϕ 16, alloy steel for ϕ 20	2	ϕ 16 [0.630in.] and ϕ 20 [0.787in.] only
㊶	End cap screw	Alloy steel	8	Zinc plated

★: Available as a seal repair kit.

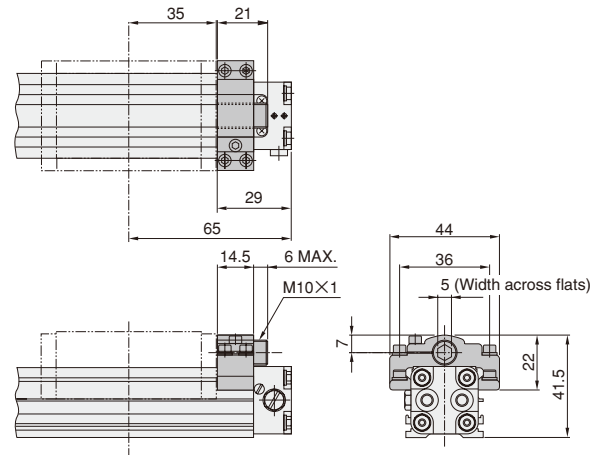
Dimensions of ORK16 (mm)



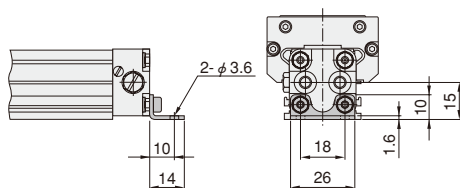
● Shock absorber: -K



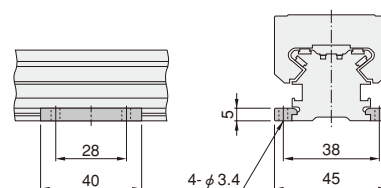
● Stroke adjusting bolt: -S



● L-type bracket: -L

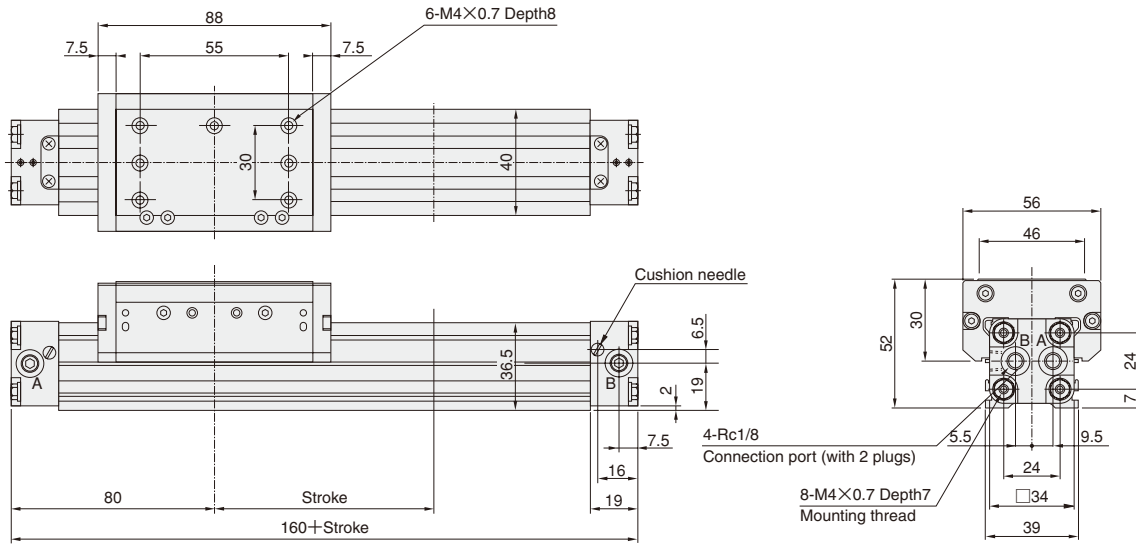


● F-type support: -F



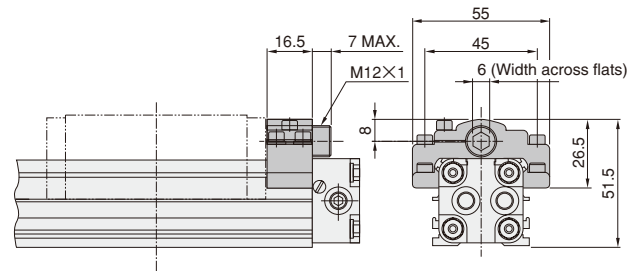
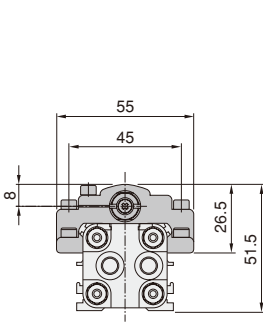
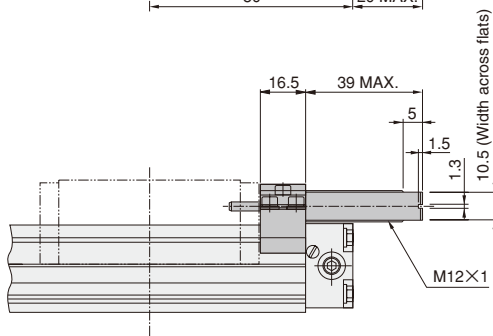
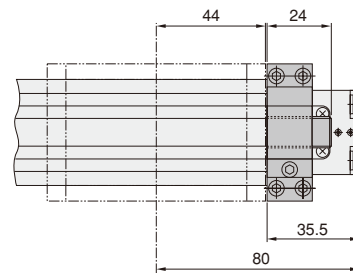
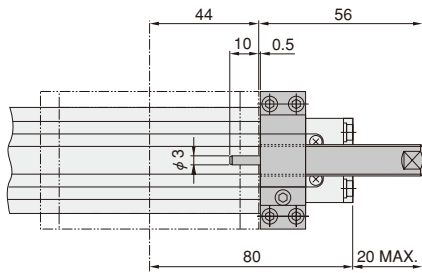
Note: Do not install sensor switches in place on the cylinder that will interfere with the F-type support.

Dimensions of ORK20 (mm)



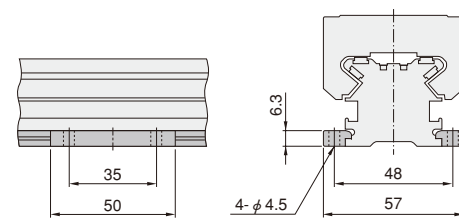
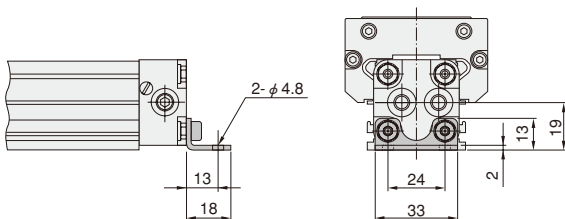
● Shock absorber: -K

● Stroke adjusting bolt: -S



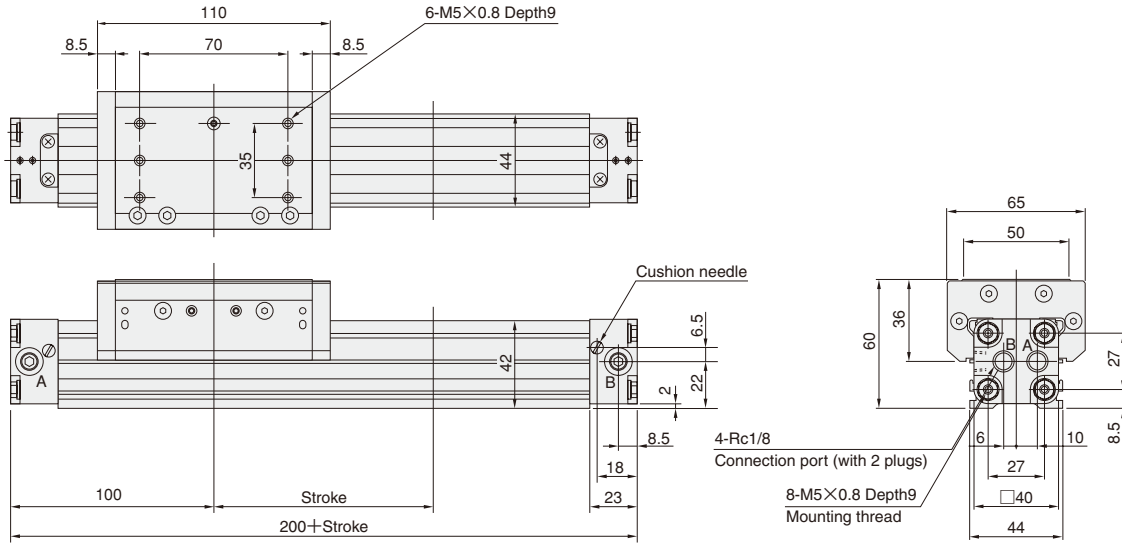
● L-type bracket: -L

● F-type support: -F

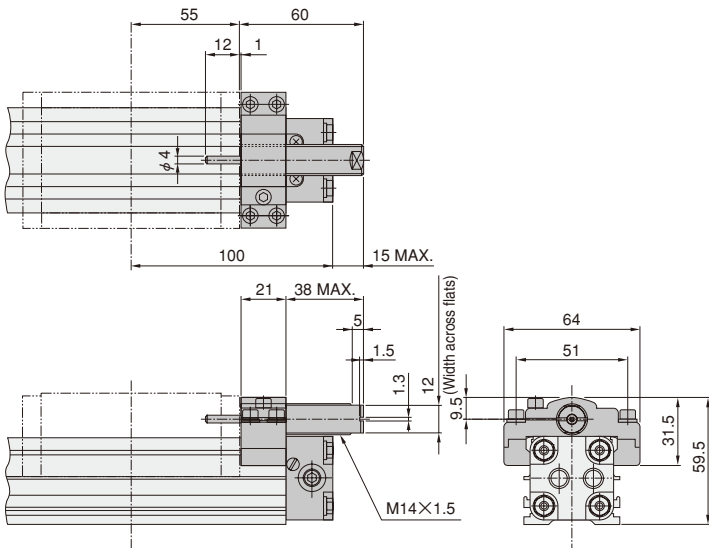


Note: Do not install sensor switches in place on the cylinder that will interfere with the F-type support.

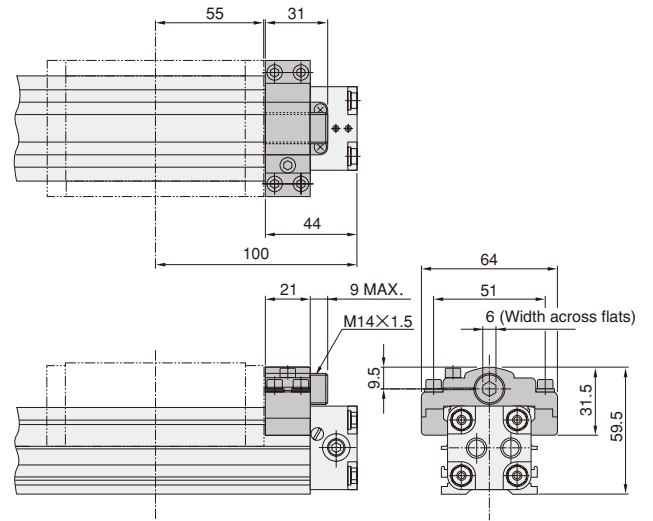
Dimensions of ORK25 (mm)



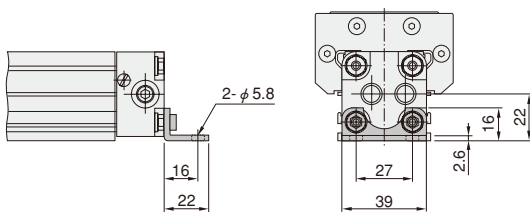
● Shock absorber: -K



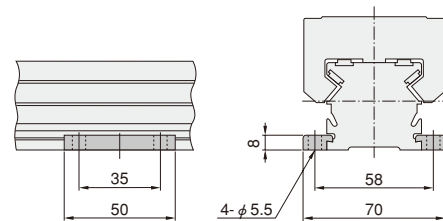
● Stroke adjusting bolt: -S



● L-type bracket: -L

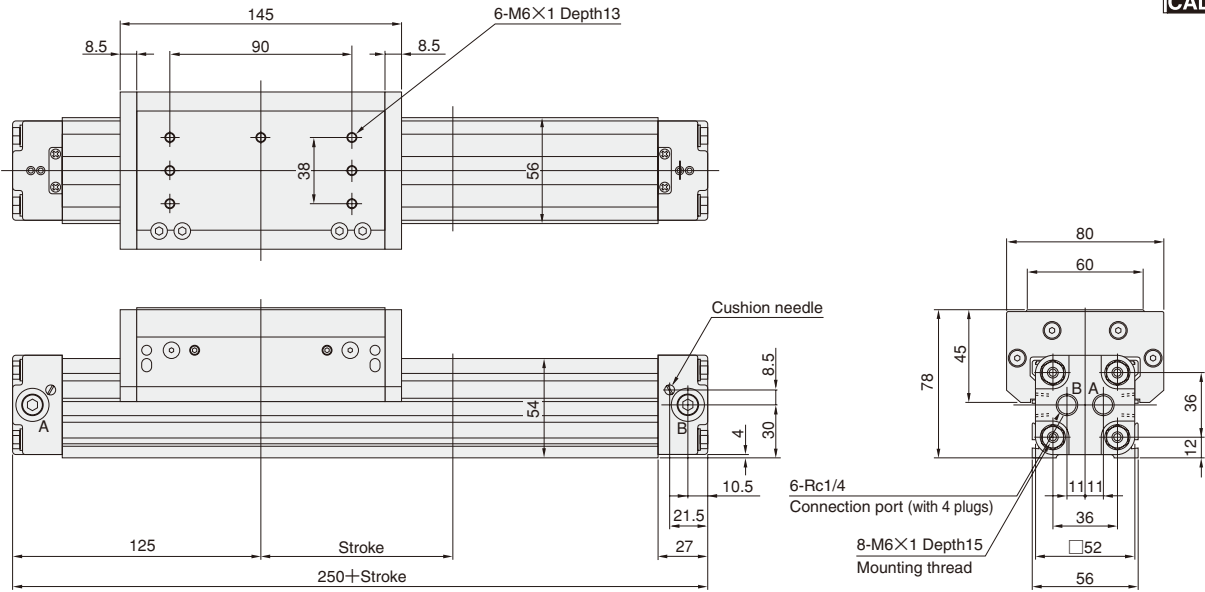


● F-type support: -F

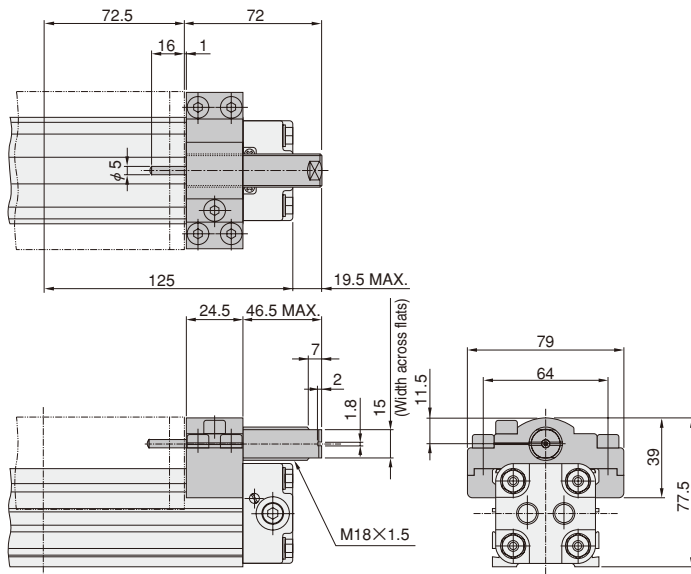


Note: Do not install sensor switches in place on the cylinder that will interfere with the F-type support.

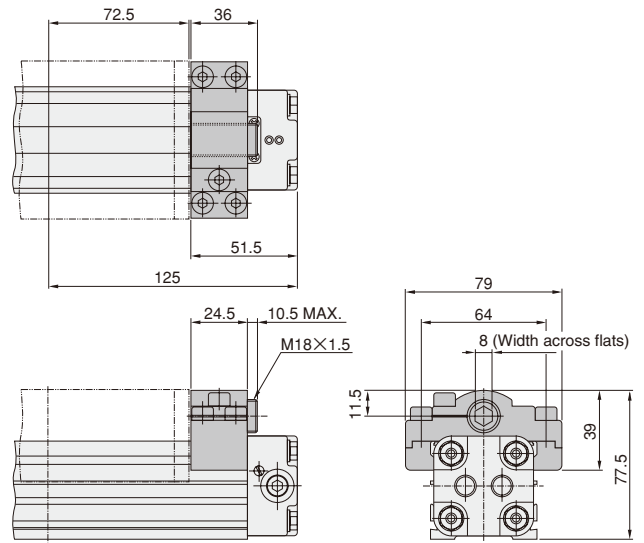
Dimensions of ORK32 (mm)



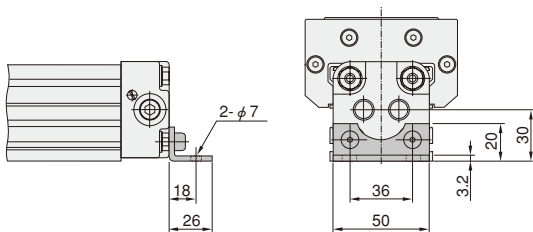
● Shock absorber: -K



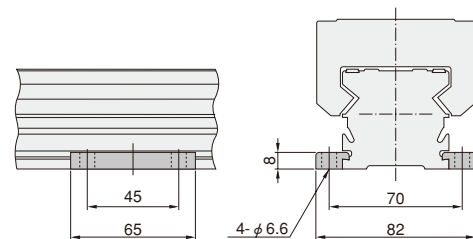
● Stroke adjusting bolt: -S



● L-type bracket: -L

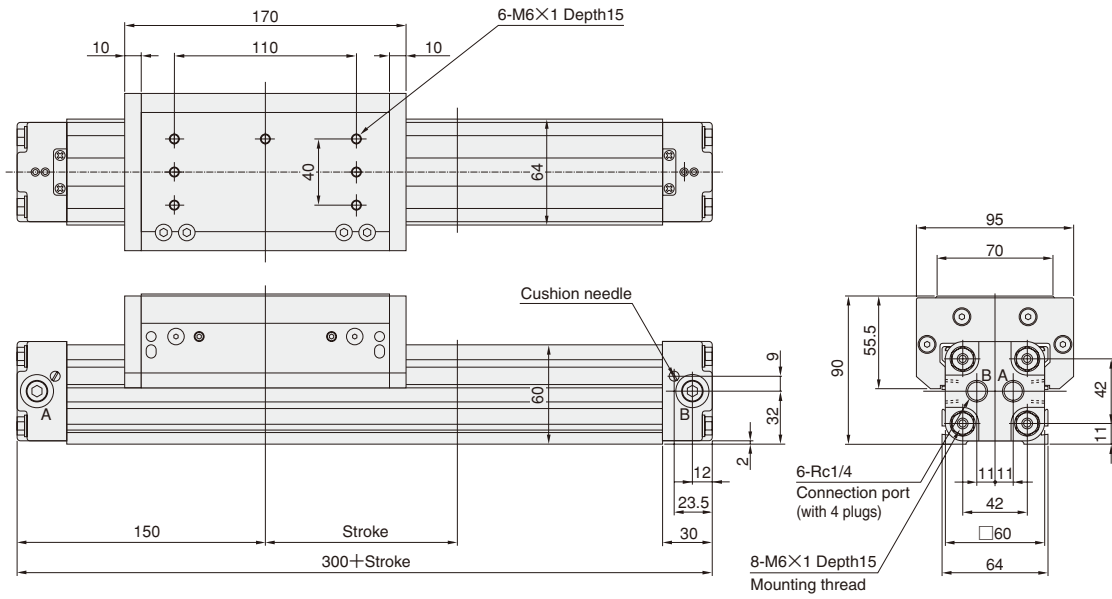


● F-type support: -F

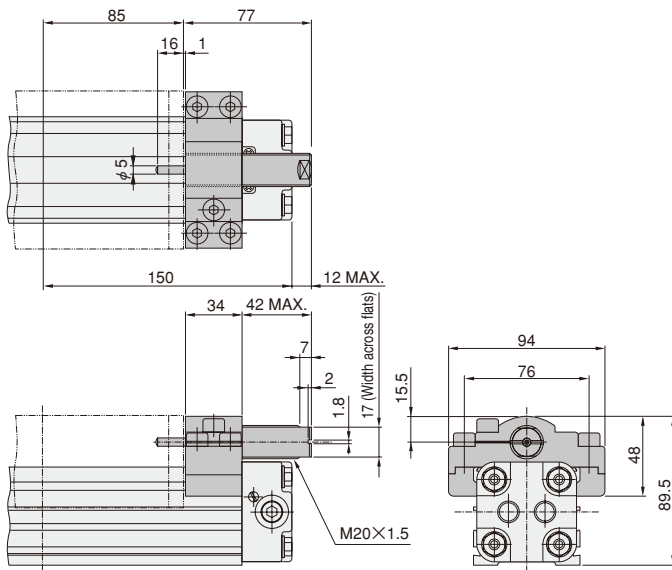


Note: Do not install sensor switches in place on the cylinder that will interfere with the F-type support.

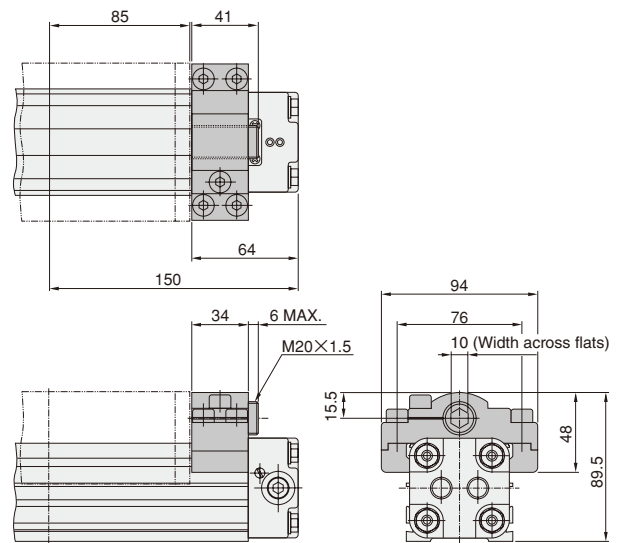
Dimensions of ORK40 (mm)



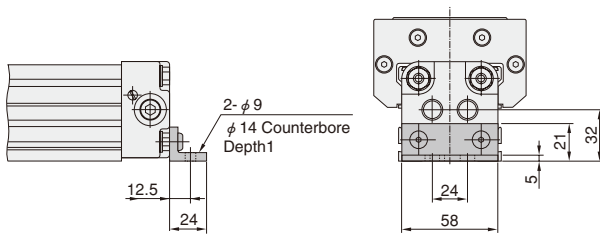
● Shock absorber: -K



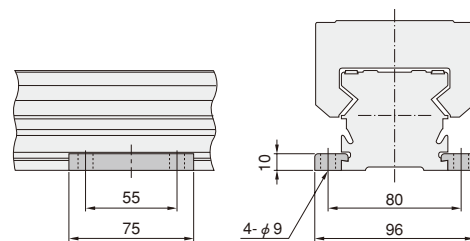
● Stroke adjusting bolt: -S



● L-type bracket: -L

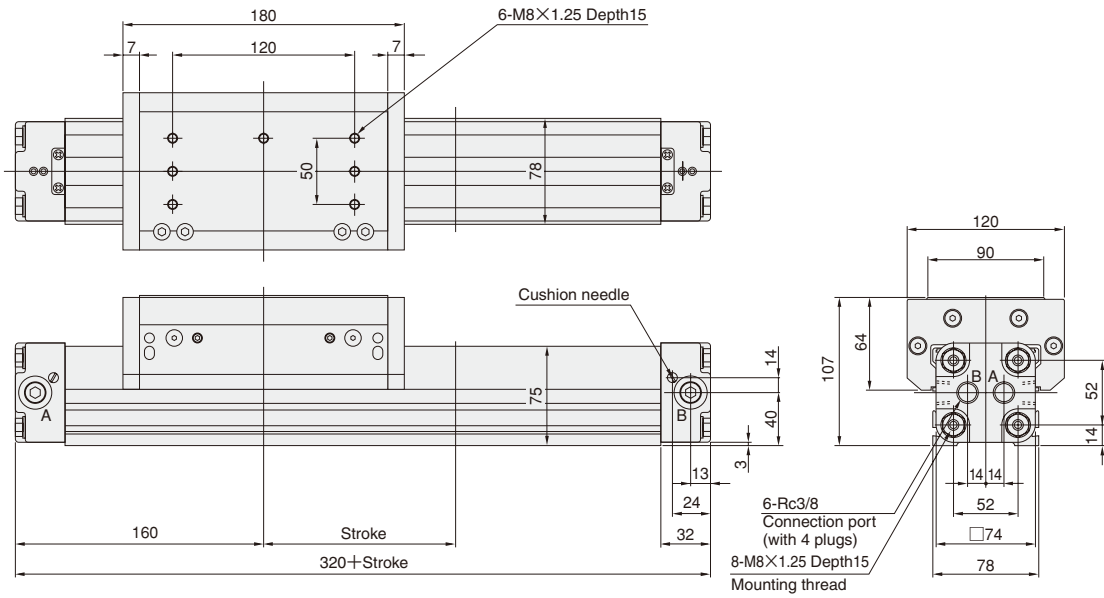


● F-type support: -F

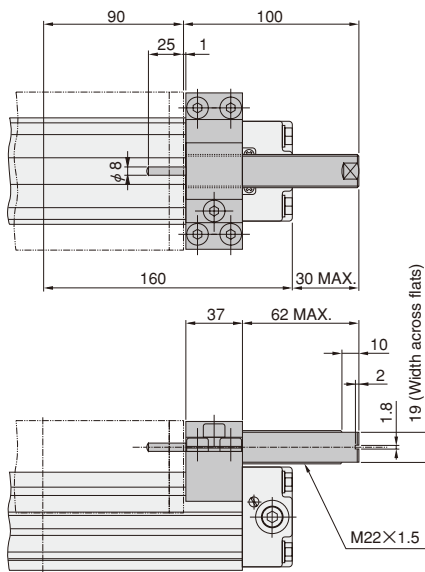


Note: Do not install sensor switches in place on the cylinder that will interfere with the F-type support.

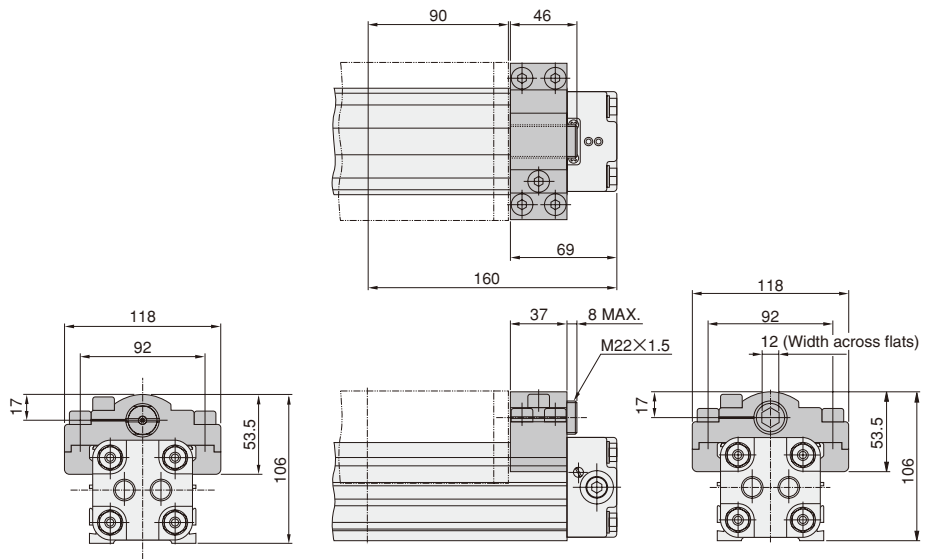
Dimensions of ORK50 (mm)



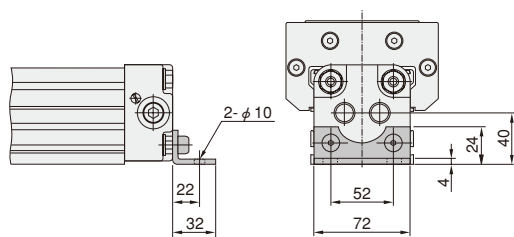
● Shock absorber: -K



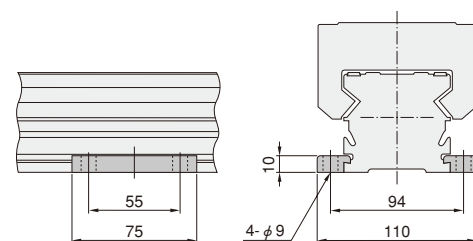
● Stroke adjusting bolt: -S



● L-type bracket : -L



● F-type support: -F



Note: Do not install sensor switches in place on the cylinder that will interfere with the F-type support.

SENSOR SWITCHES

Solid State Type, Reed Switch Type

Order Codes for Sensor Switch

● Sensor switch (with sensor holder)

				Sensor switch model	Lead wire length	Basic cylinder type	Bore size	
For $\phi 16$	Solid state type	2-lead wire	with indicator lamp	DC10~28V	ZC130	A B	16	
	Solid state type	3-lead wire	with indicator lamp	DC4.5~28V	ZC153			
	Reed switch type	2-lead wire	without indicator lamp	DC5~28V AC85~115V	CS5T			
	Reed switch type	2-lead wire	with indicator lamp	DC10~28V	CS11T			
For $\phi 20$ } For $\phi 50$	Solid state type	2-lead wire	with indicator lamp	DC10~28V	ZG530		-ORK	20 25 32 40 50
	Solid state type	3-lead wire	with indicator lamp	DC4.5~28V	ZG553			
	Reed switch type	2-lead wire	with indicator lamp	DC10~30V AC85~230V	CS3M			
	Reed switch type	2-lead wire	with indicator lamp	DC10~30V AC85~115V	CS4M			
	Reed switch type	2-lead wire	without indicator lamp	DC3~30V AC85~115V	CS5M			

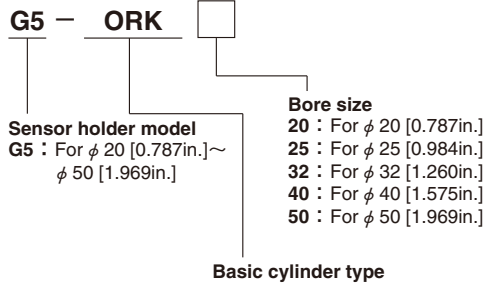
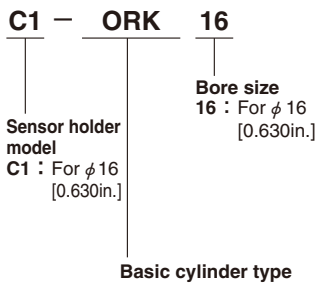
● For details of sensor switches, see p.1544.

● A : 1000mm [39in.]
B : 3000mm [118in.]

● Order codes for sensor holder only

● For $\phi 16$ [0.630in.]

● For $\phi 20$ [0.787in.]~ $\phi 50$ [1.969in.]



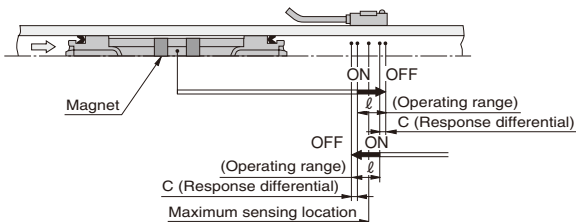
Sensor Switch Operating Range, Response Differential, and Maximum Sensing Location

● Operating range : ℓ

The distance the piston travels in one direction, while the switch is in the ON position.

● Response differential : C

The distance between the point where the piston turns the switch ON and the point where the switch is turned OFF as the piston travels in the opposite direction.



● For $\phi 16$ [0.630in.]

Bore size mm [in.]	ZC130□, ZC153□			CS5T□, CS11T□		
	Operating range	Response differential	Maximum sensing location*	Operating range	Response differential	Maximum sensing location*
16 [0.630]	3.6~5.9 [0.142~0.232]	0.5 [0.020] or less	8.5 [0.335]	8~10.5 [0.315~0.413]	1.6 [0.063] or less	CS5T□ CS11T□ 7 [0.276] 10.5 [0.413]

● For $\phi 20$ [0.787in.]~ $\phi 50$ [1.969in.]

Bore size mm [in.]	ZG530□, ZG553□			CS□M□		
	Operating range	Response differential	Maximum sensing location*	Operating range	Response differential	Maximum sensing location*
20 [0.787]	4.1~6.8 [0.161~0.268]	0.6 [0.024] or less	11 [0.433]	10.4~14.2 [0.409~0.559]	1.5 [0.059] or less	11 [0.433]
25 [0.984]	4.4~7.4 [0.173~0.291]	0.7 [0.028] or less		11.8~15.2 [0.465~0.598]	1.5 [0.059] or less	
32 [1.260]	5.7~9.5 [0.224~0.374]	0.8 [0.031] or less		17.0~20.3 [0.669~0.799]	1.5 [0.059] or less	
40 [1.575]	6.6~11.0 [0.260~0.433]	0.9 [0.035] or less		19.0~23.5 [0.748~0.925]	1.8 [0.071] or less	
50 [1.969]	7.5~12.5 [0.295~0.492]	1.0 [0.039] or less		21.3~26.0 [0.839~1.024]	1.8 [0.071] or less	

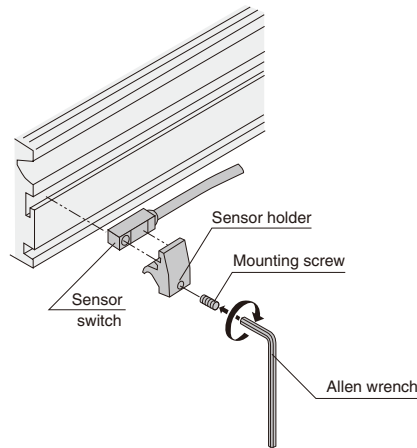
Remark: The values in the above table are reference values.

※ : This is the length measured from the switch's opposite end side to the lead wire.

Moving Sensor Switch

● Loosening the sensor holder mounting screw allows the sensor switch to be moved along the switch mounting groove on the cylinder body.

● Tighten the mounting screw with a tightening torque of 0.2N·m [1.8in·lbf].

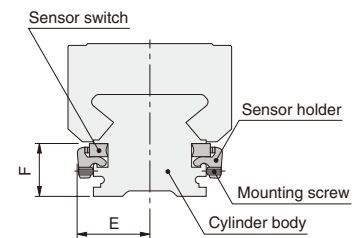
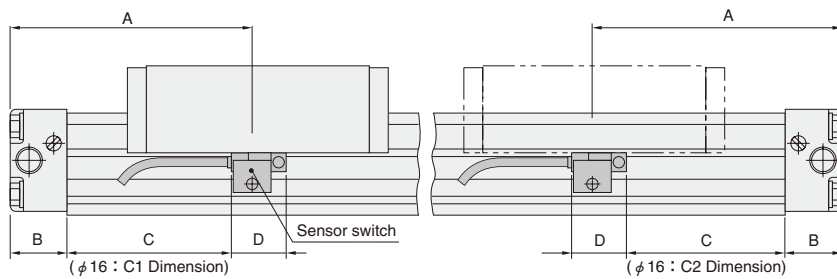


Dimensions and Mounting Location of Sensor Switch

When the sensor switch is mounted in the locations shown below, the magnet comes to the maximum sensing location of the sensor switch at the end of the stroke.

		mm [in.]						
Bore size	Sensor switch	A	B	C1	C2	D	E	F
16 [0.630]	ZC130 □	65 [2.559]	15 [0.591]	33.5 [1.319]	41.5 [1.634]	25 [0.984]	19.5 [0.768]	14.5 [0.571]
	ZC153 □			35 [1.378]	43 [1.693]	22 [0.866]		
	CS5T □			34.5 [1.358]	39.5 [1.555]	26 [1.024]		
	CS11T □							

		mm [in.]						
Bore size	Sensor switch	A	B	C	D	E	F	
20 [0.787]	ZG530 □	80 [3.150]	19 [0.748]	50 [1.969]	22 [0.866]	26.5 [1.043]	21.3 [0.839]	
25 [0.984]	ZG553 □	100 [3.937]	23 [0.906]	66 [2.598]		29 [1.142]	23.5 [0.925]	
32 [1.260]	CS3M □	125 [4.921]	27 [1.063]	87 [3.425]		35 [1.378]	33 [1.299]	
40 [1.575]	CS4M □	150 [5.906]	30 [1.181]	109 [4.291]		39 [1.535]	34 [1.339]	
50 [1.969]	CS5M □	160 [6.299]	32 [1.260]	107 [4.213]		45 [1.772]	42 [1.654]	



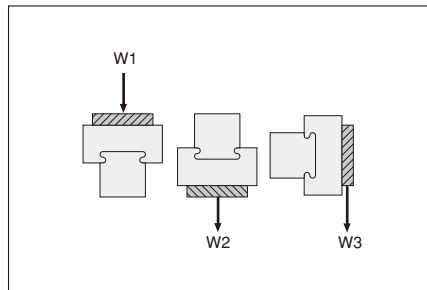
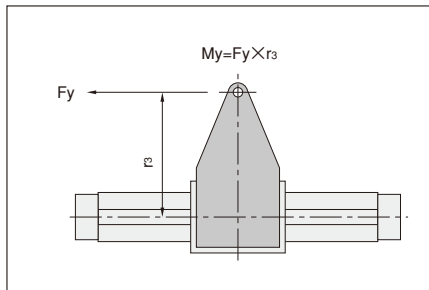
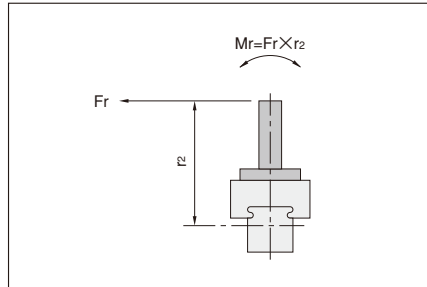
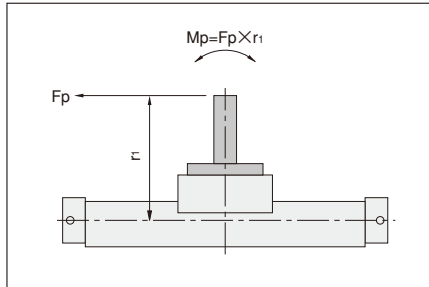
Handling Instructions and Precautions



Selection and Mounting

Allowable load and moment

Although the rodless cylinders ORK series with cam-follower guides can be used with directly applying loads, make sure that the load and moment do not exceed the values in the table below.



Pitching moment : $M_p = F_p \times r_1$ {N·m}
 Rolling moment : $M_r = F_r \times r_2$ {N·m}
 Yawing moment : $M_y = F_y \times r_3$ {N·m}
 Maximum load capacity : W_1, W_2, W_3 {N}

Bore size mm [in.]	M_p N·m [ft·lbf]	M_r N·m [ft·lbf]	M_y N·m [ft·lbf]	W_1 N [lbf.]	W_2 N [lbf.]	W_3 N [lbf.]
16 [0.630]	4 [3.0]	1.5 [1.1]	1.5 [1.1]	77.5 [17.4]	49.0 [11.0]	14.7 [3.3]
20 [0.787]	8 [5.9]	3 [2.2]	3 [2.2]	137 [30.8]	98.1 [22.1]	24.5 [5.5]
25 [0.984]	15 [11.1]	5 [3.7]	5 [3.7]	196 [44.1]	137 [30.8]	39.2 [8.8]
32 [1.260]	30 [22.1]	10 [7.4]	10 [7.4]	314 [70.6]	216 [48.6]	58.8 [13.2]
40 [1.575]	60 [44.3]	20 [14.8]	20 [14.8]	490 [110.2]	343 [77.1]	98.1 [22.1]
50 [1.969]	115 [84.8]	35 [25.8]	35 [25.8]	785 [176.5]	539 [121.2]	157 [35.3]

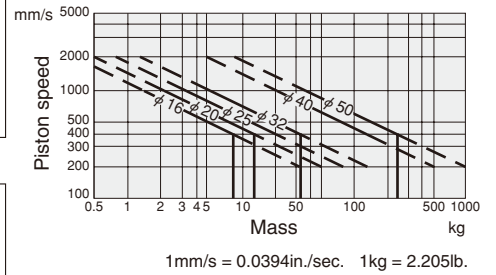
Remark : The rolling angle (inclined angle) of the slider, when the allowable rolling moment is applied, is as follows for both sides together.

Bore size mm [in.]	Rolling angle
16 [0.630]	Within about 1.5°
20 [0.787]	
25 [0.984]	Within about 0.8°
32 [1.260]	
40 [1.575]	Within about 0.5°
50 [1.969]	

- Cautions:**
1. The moment including the inertial force generated when the load is moved or stopped must not exceed the values in the above table.
 2. For the mass and the piston speed, see the [Cushioning capacity](#).
 3. Rolling moment: M_r should not be applied, as much as possible.

Cushioning capacity

While variable cushions are standard equipment on the rodless cylinder with cam-follower guides, keep the maximum mass and speed within the ranges shown in the graph below. If load and speed exceed the ranges, install an external shock absorber, etc., to absorb the shock.



Cushion stroke		mm [in.]
Bore size	Cushion stroke	
16 [0.630]	15 [0.591]	
20 [0.787]	18 [0.709]	
25 [0.984]	21 [0.827]	
32 [1.260]	26 [1.024]	
40 [1.575]	40 [1.575]	
50 [1.969]	40 [1.575]	

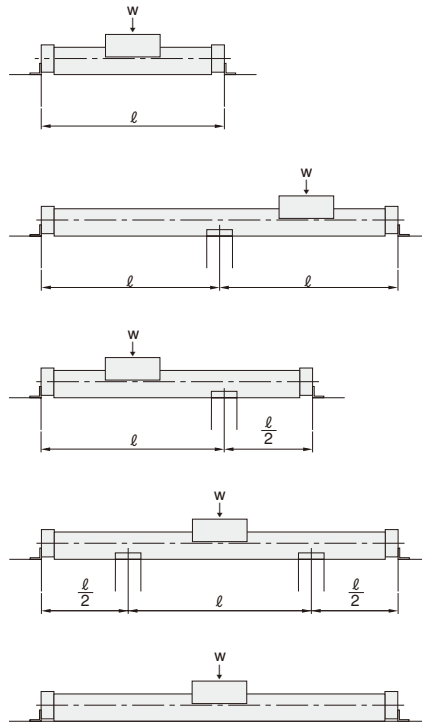
- Cautions:**
1. The mass shown in the graph is the total mass carried by the rodless cylinder with cam-follower guides.
 2. Adjust cushions according to the piston speed and the mass, and absorb the impacts effectively.

Support

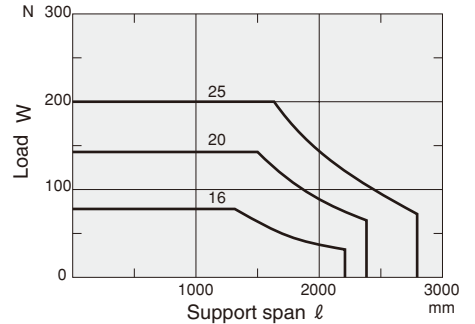
A long stroke and large load may cause deflection in the cylinder body. In this case, it is also necessary to support the intermediate position so that the support span: l is below the graph, as shown in the diagrams to the right. The intermediate portion can be easily supported by installing the necessary number of F-type supports to the cylinder body.

Bore size	Support span: l
16 [0.630]	Stroke + 130 [5.12]
20 [0.787]	Stroke + 160 [6.30]
25 [0.984]	Stroke + 200 [7.87]
32 [1.260]	Stroke + 250 [9.84]
40 [1.575]	Stroke + 300 [11.81]
50 [1.969]	Stroke + 320 [12.60]

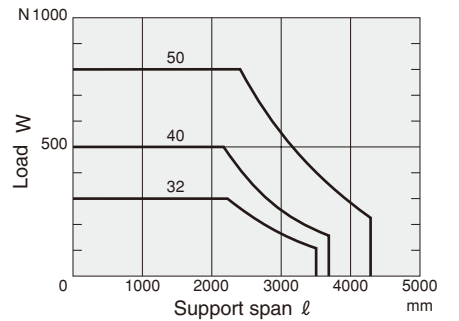
Note: Do not install sensor switches in place on the cylinder that will interfere with the F-type support.



●ORK16, 20, 25



●ORK32, 40, 50



1N = 0.2248lbf. 1mm = 0.0394in.

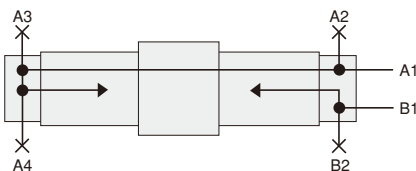
Piping position and operating direction

According to where the slit type rodless cylinder ORK series is mounted, piping for one side or both sides can be selected.

●ORK16, 20, 25

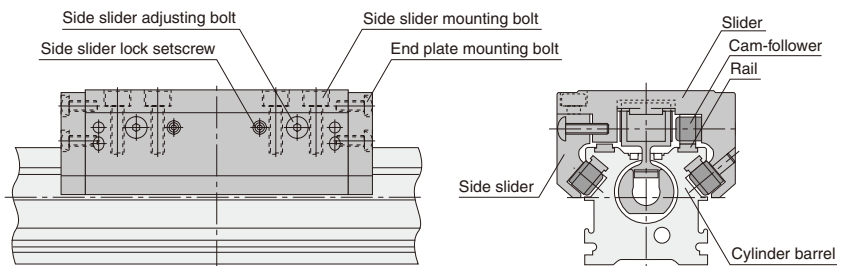


●ORK32, 40, 50



- Cautions:**
1. A1, A2, A3 and A4 are common ports.
 2. B1 and B2 are common ports.
 3. A2, A3, A4 and B2 are plugged.
 4. Use a convenient port for your piping.

Adjusting the slider portion



The slider portion has been adjusted, but when readjusting, follow the instructions below.

1. Loosen the end plate mounting bolts at both sides of the slider a little.
2. Next loosen the side slider mounting bolts a little.
3. Loosen the side slider lock setscrews.
4. Adjust the side slider position with the side slider adjusting bolts to adjust the vertical clearance of the slider.
5. Tighten the side slider mounting bolts.
6. Tighten the side slider lock setscrews to secure the side slider adjusting bolts.
7. Tighten the end plate mounting bolts at both sides of the slider.

Handling Instructions and Precautions

Mounting

1. While any mounting direction is allowed, mount the slider so that it faces downward, or protect the seal band with a cover, etc., when installing in locations subject to dripping water or oil, etc., or to large amounts of dust.
2. Avoid any electric welding either during or after mounting the slit type rodless cylinders ORK series. Flows of welding current to the cylinder could generate arcs that result in damage or depositions.

Caution: Avoid applying strong shocks to the cylinder body's slit portion.

Intermediate stop control

Since for structural reasons external air leakage is inevitable for the slit type rodless cylinders ORK series, use of all port block (closed centers) 3-position valves, etc., for intermediate stop control could result in failure to maintain the stopping position, and the piston speed could not be controlled when restarting. We recommend, therefore, double-sided pressure control circuits that use PAB-connection (pressure centers) 3-position valves, etc. For intermediate stopping control under constant loads, such as vertical mountings, consult us.

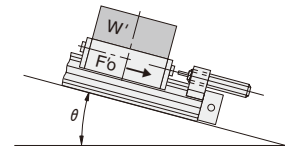
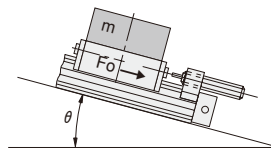
Calculation of impact energy

Horizontal impact	
$E = E_1 + E_2$ $= \frac{m \cdot v^2}{2} + F_0 \cdot L$	$E' = E'_1 + E'_2$ $= \frac{W' \cdot v'^2}{2g'} + F'_0 \cdot L'$

Vertical impact ^{Note 1}			
When descending ^{Note 2}		When ascending	
$E = E_1 + E_2 + E_3$ $= \frac{m \cdot v^2}{2} + F_0 \cdot L + m \cdot g \cdot L$	$E' = E'_1 + E'_2 + E'_3$ $= \frac{W' \cdot v'^2}{2g'} + F'_0 \cdot L' + W' \cdot L'$	$E = E_1 + E_2 - E_3$ $= \frac{m \cdot v^2}{2} + F_0 \cdot L - m \cdot g \cdot L$	$E' = E'_1 + E'_2 - E'_3$ $= \frac{W' \cdot v'^2}{2g'} + F'_0 \cdot L' - W' \cdot L'$

Note 1: For impact on incline, E_3 becomes $E'_3 = m \cdot g \cdot L \cdot \sin \theta$.

Note 1: For impact on incline, E'_3 becomes $E''_3 = W' \cdot L' \cdot \sin \theta$.



Note 2: When descending, the operating air pressure: P, should be lower than when ascending, because heavier loads can be carried.

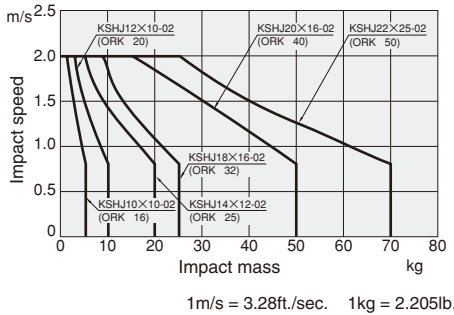
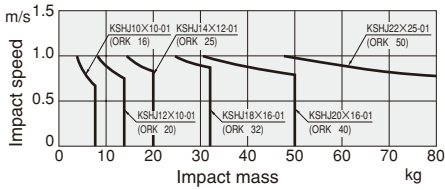
- E : Total impact energy ... [J]
- E_1 : Kinetic energy ... $\frac{m \cdot v^2}{2}$ [J]
- E_2 : Additional energy by cylinder thrust ... $F_0 \cdot L$ [J]
- E_3 : Additional energy by load mass ... $m \cdot g \cdot L$ [J]
- m : Load mass [kg]
- v : Impact speed [m/s]
- g : Gravity acceleration 9.8 [m/s²]
- F_0 : Cylinder thrust ... $= \frac{\pi}{4} \cdot D^2 \cdot P$ [N]
- [D: Cylinder bore (mm) P: Operating air pressure (MPa)]
- L : Absorbing stroke of shock absorber [m]

Note 2: When descending, the operating air pressure: P', should be lower than when ascending, because heavier loads can be carried.

- E' : Total impact energy ... [ft.lbf]
- E'_1 : Kinetic energy ... $\frac{W' \cdot v'^2}{2g'}$ [ft.lbf]
- E'_2 : Additional energy by cylinder thrust ... $F'_0 \cdot L'$ [ft.lbf]
- E'_3 : Additional energy by load weight ... $W' \cdot L'$ [ft.lbf]
- W' : Load weight [lbf]
- v' : Impact speed [ft./sec.]
- g' : Gravity acceleration 32.2 [ft./sec.]
- F'_0 : Cylinder thrust ... $= \frac{\pi}{4} \cdot D'^2 \cdot P'$ [lbf]
- [D': Cylinder bore [in.] P': Operating air pressure [psi.]]
- L' : Absorbing stroke of shock absorber [ft.]

Impact speed and mass of impact object

Graphs of the impact speed and mass of impact object



Remark: Horizontal impact

The air pressure is 0.5MPa [73psi.], and a shock absorber is used in the above case.

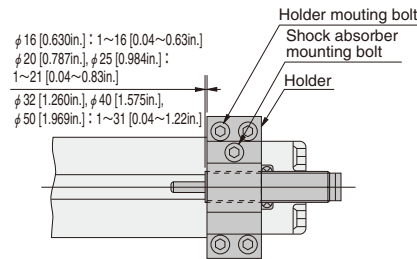
Cautions: 1. Tighten the 4 holder mounting bolts equally so that the striker evenly hits the front surface of the shock absorber.

2. Use the shock absorber within the range of the specifications.
3. Set the load so that the impact energy does not exceed the maximum absorption of the shock absorber.
4. The maximum impact speed to the optional shock absorber is 1000mm/s [39.4in./sec.] or 2000mm/s [78.7in./sec.].
5. The speed at the moment of impact with the shock absorber should not exceed 1000mm/s [39.4in./sec.] or 2000mm/s [78.7in./sec.] provided in each specifications. Care should be taken that this is likely to greatly differ from the average speed of the cylinder.
6. If using in locations subject to dripping water, dripping oil, etc., or to large amounts of dust, use a cover to protect the unit. Oil, water or dust on the shock absorber rod can reduce the life of the shock absorber.
7. Do not loosen or remove the screw on the rear end of the shock absorber. Oil sealed inside will leak, damaging the shock absorber function.

Stroke adjustment

● When using with a shock absorber

When using with a shock absorber, the stroke can be easily adjusted over entire cylinder strokes. First, all 4 holder mounting bolts should be loosened and move the holder so that the stroke should be roughly determined. Then tighten the holder mounting bolts to secure the holder. Next, loosen the shock absorber mounting bolt, then finely adjust the shock absorber body by rotating the shock absorber body by hand or with a wrench. After adjustment, tighten the shock absorber mounting bolt and secure the shock absorber. The stroke can be adjusted in the range of $\phi 16$ [0.630in.]: 15mm [0.59in.] on one side, $\phi 20$ [0.787in.], $\phi 25$ [0.984in.]: 20mm [0.79in.] on one side, $\phi 32$ [1.260in.], $\phi 40$ [1.575in.], $\phi 50$ [1.969in.]: 30mm [1.18in.] on one side. When adjustments are required for over this range, the holder should be moved. If a shock absorber is used with an variable cushion cylinder, it might rebound. When it is required to stop at the end of the stroke using a shock absorber, the adjusting cushion needle should be fully opened.

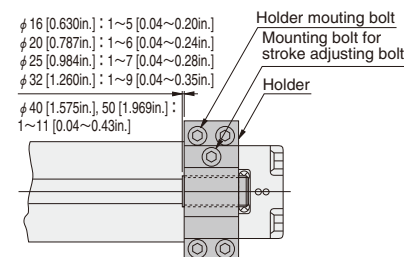


● When using with a stroke adjusting bolt

When using with a stroke adjusting bolt, fine adjustment of the stroke can be made at the end of the stroke. Loosen the mounting bolt for stroke adjusting bolt, then finely adjust the stroke by rotating the stroke adjusting bolt, and after adjustment, tighten the mounting bolt for stroke adjusting bolt and secure the stroke adjusting bolt.

Stroke adjusting range of stroke adjusting bolt

Bore size	Stroke adjusting range (one side)
16 [0.630]	4 [0.157]
20 [0.787]	5 [0.197]
25 [0.984]	6 [0.236]
32 [1.260]	8 [0.315]
40, 50 [1.575, 1.969]	10 [0.394]



Tightening torque of the holder mounting bolt

Bore size mm [in.]	Tightening torque N·cm [in·lbf]	Allen wrench mm [in.]
16 [0.630]	117.7 [10.4]	2.5 [0.098]
20 [0.787]	274.6 [24.3]	3 [0.118]
25 [0.984]	588.4 [52.1]	4 [0.157]
32 [1.260]	980.7 [86.8]	5 [0.197]
40 [1.575]	1961.3 [173.6]	6 [0.236]
50 [1.969]	3922.7 [347.2]	8 [0.315]

Cautions: 1. Stroke adjustment should not be done by moving the holder. Use the holder with a shock absorber when over a wide range stroke adjustment is required.

2. The cushion stroke is shortened when finely adjust the stroke, and the shock absorption of the variable cushion decreases. The cushion capacity decreases by about 30% when the stroke adjustment is maximized.



General precautions

Piping

Always thoroughly blow off (use compressed air) the tubing before connecting it to the slit type rodless cylinders ORK series. Entering chips, sealing tape, rust, etc., generated during piping work could result in air leaks or other defective operation.

Atmosphere

1. If using in locations subject to dripping water, dripping oil, etc., or to large amounts of dust, use a cover to protect the unit or mount with the slider facing downward.
2. Do not engage in electric welding close to the slit type rodless cylinders ORK series. The welding spatters could damage the outer seal band.
3. The product cannot be used when the media or ambient atmosphere contains any of the substances listed below.
Organic solvents, phosphate ester type hydraulic oil, sulphur dioxide, chlorine gas, or acids, etc.

Lubrication

The product can be used without lubrication, if lubrication is required, use Turbine Oil Class 1 (ISO VG32) or equivalent.

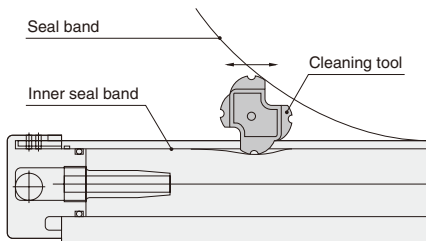
Media

1. Use air for the media. For the use of any other media, consult us.
2. Air used for the slit type rodless cylinders ORK series should be clean air that contains no deteriorated compressor oil, etc. Install an air filter (filtration of a minimum 40 μm) near the slit type rodless cylinder ORK series or valve to remove collected liquid or dust. In addition, drain the air filter periodically.

Handling Instructions and Precautions

Maintenance

The slit type rodless cylinders ORK series is structurally incapable of completely preventing air leakage to the outside. Nevertheless, particles adhering to the inner seal band are the most common cause of initial-staged air leakages, and this type of failure is easily remedied. First, loosen the outer seal band setscrews, detach the outer seal band only at both the end cap portions, and supply about 0.1MPa [15psi.] of air into the rodless cylinders ORK series. Next, peel off the outer seal band, and insert a cleaning tool inside the cylinder barrel slit and then, while pressing down the inner seal band and moving it along the slit, use air to blow off the particles.



- Cautions:**
1. Always use protective glasses during working.
 2. When performing maintenance, use the special cleaning tool. Use of a screwdriver or other tool could damage the inner seal band or cylinder barrel.
 3. If the above maintenance fails to stop the air leakage, follow instructions in the user's manual to perform a cylinder overhaul.