KOGANEI

Air Cylinder

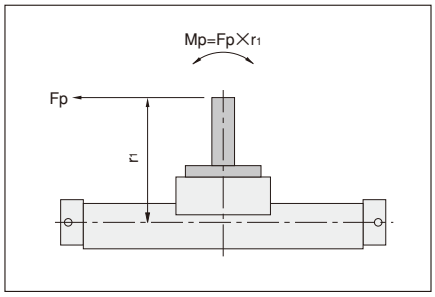
SLIT TYPE RODLESS CYLINDER ORK Series

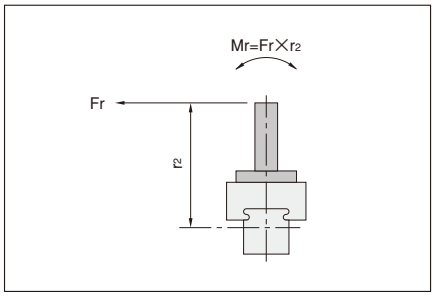
INSTRUCTION MANUAL Ver.1.0

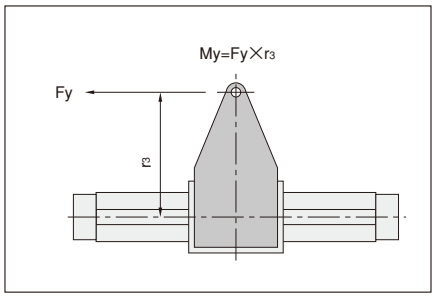
Selection and Mounting

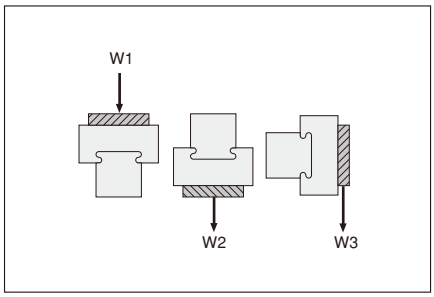
Allowable load and moment

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 : Mp = Fp × r1 {N·m}
Rolling moment : Mr = Fr × r2 {N·m}
Yawing moment : My = Fy × r3 {N·m}
Maximum load capacity : W1, W2, W3 {N}

Bore size mm [in.]	Mp N·m [ft·lbf]	Mr N·m [ft·lbf]	My N·m [ft·lbf]	W1 N [lbf.]	W2 N [lbf.]	W3 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]

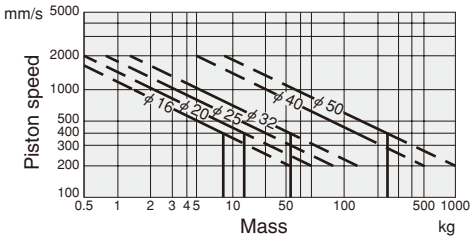
Remark : The rolling angle (inclined angle) of the slider, when the allowable rolling moment is applied, is as follows for both sides together.

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: Mr 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.



1mm/s = 0.0394in./sec. 1kg = 2.205lb.

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.

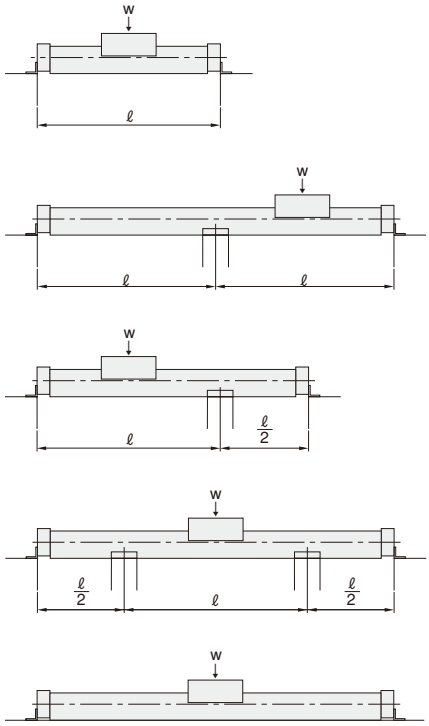
Support

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.

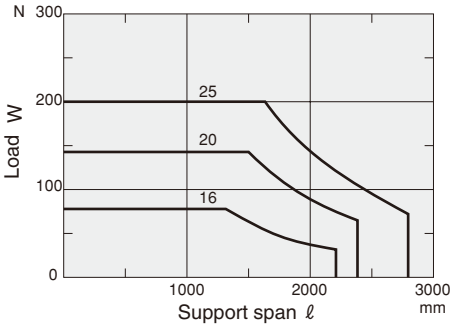
mm [in.]

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]

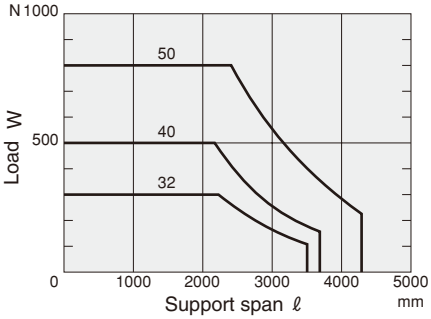
Note: Do not install sensor switches in place on the cylinder that will interfere with the **F**-type support.



●**ORK16, 20, 25**



●**ORK32, 40, 50**

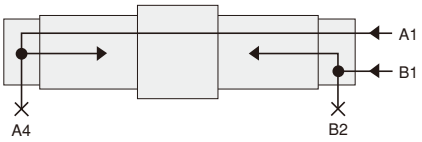


1N = 0.2248lbf. 1mm = 0.0394in.

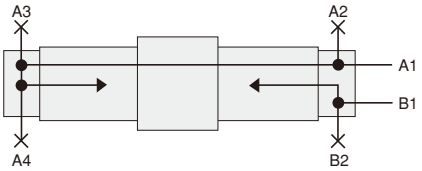
Piping position and operating direction

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**

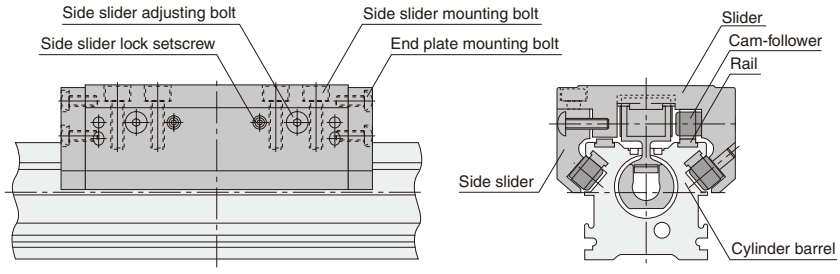


●**ORK32, 40, 50**



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.

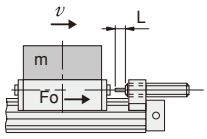
Caution: Avoid applying strong shocks to the cylinder body's slit portion.

Intermediate stop control

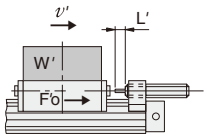
Since for structural reasons external air leakage is inevitable for the slit type rodless cylinders ORK series, use of all port block (closed centers) 3-position valves, etc., for intermediate stop control could result in failure to maintain the stopping position, and the piston speed could not be controlled 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



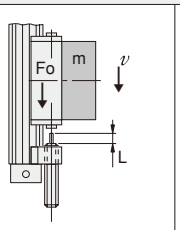
$$E = E_1 + E_2 = \frac{m \cdot v^2}{2} + Fo \cdot L$$



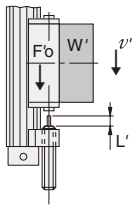
$$E' = E'_1 + E'_2 = \frac{W' \cdot v'^2}{2g'} + F'o \cdot L'$$

Vertical impact Note 1

When descending Note 2

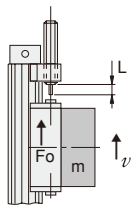


$$E = E_1 + E_2 + E_3 = \frac{m \cdot v^2}{2} + Fo \cdot L + m \cdot g \cdot L$$

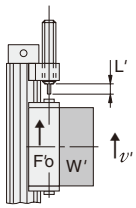


$$E' = E'_1 + E'_2 + E'_3 = \frac{W' \cdot v'^2}{2g'} + F'o \cdot L' + W' \cdot L'$$

When ascending



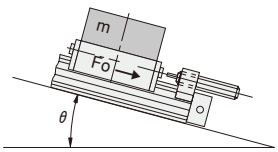
$$E = E_1 + E_2 - E_3 = \frac{m \cdot v^2}{2} + Fo \cdot L - m \cdot g \cdot L$$

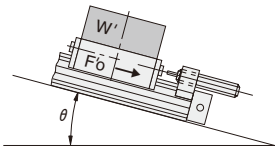


$$E' = E'_1 + E'_2 - E'_3 = \frac{W' \cdot v'^2}{2g'} + F'o \cdot L - W' \cdot L'$$

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 … Fo·L [J]

E_3 : Additional energy by load mass … m·g·L [J]

m : Load mass [kg]

v : Impact speed [m/s]

g : Gravity acceleration 9.8 [m/s²]

Fo : 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′o·L′ [ft·lbf]

E'_3 : Additional energy by load weight … W′·L′ [ft·lbf]

W′ : Load weight [lbf]

v' : Impact speed [ft./sec.]

g′ : Gravity acceleration 32.2 [ft./sec.]

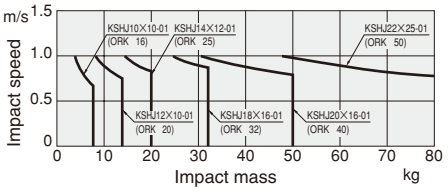
F′o : Cylinder thrust … $= \frac{\pi}{4} \cdot D'^2 \cdot P'$ [lbf]

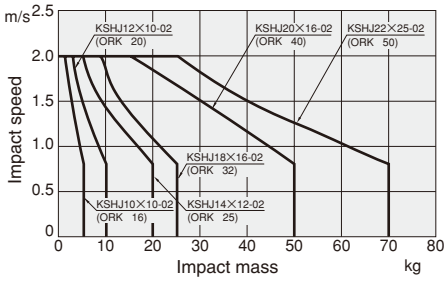
[D′: Cylinder bore [in.] P′: Operating air pressure [psi.]]

L′ : Absorbing stroke of shock absorber [ft.]

Impact speed and mass of impact object

Graphs of the impact speed and mass of impact object





1m/s = 3.28ft./sec. 1kg = 2.205lb.

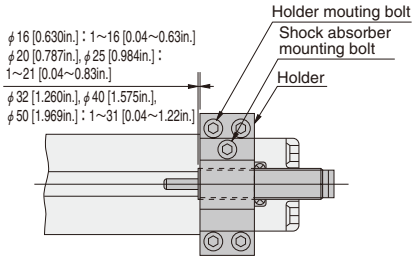
Remark: Horizontal impact
The air pressure is 0.5MPa [73psi.], and a shock absorber is used in the above case.

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 mounting location 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 ϕ16 [0.630in.]: 15mm [0.59in.] on one side, ϕ20 [0.787in.], ϕ25 [0.984in.]: 20mm [0.79in.] on one side, ϕ32 [1.260in.], ϕ40 [1.575in.], ϕ50 [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.



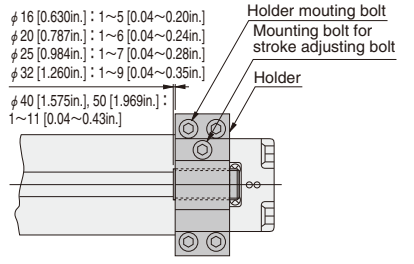
●When using with a stroke adjusting bolt

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

mm [in.]

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

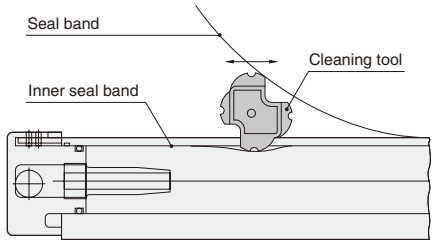
The product can be used without lubrication, if lubrication is required, use Turbine Oil Class 1 **(ISO VG32)** or equivalent.

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.

Maintenance

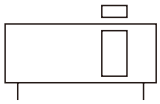
The slit type rodless cylinders ORK series is structurally incapable of completely preventing air leakage to the outside. Nevertheless, particles adhering to the inner seal band are the most common cause of initial-staged air leakages, and this type of failure is easily remedied. First, loosen the outer 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.

ORK **SERIES**

Symbol



Specifications

Item \ Bore size mm [in.]		16 [0.630]	20 [0.787]	25 [0.984]	32 [1.260]	40 [1.575]	50 [1.969]
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 [Note3] 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

N [lbf.]

Bore size mm [in.]	Pressure area mm² [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.

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

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

Q_1	Required air flow rate for cylinder	ℓ/min (ANR)
Q_2	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

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

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

Q_1'	Required air flow rate for cylinder	ft³/min. (ANR)※
Q_2'	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.

cm³ [in.³]/Reciprocation (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.]

$14.69 \times \frac{1}{2} \times 300 \times 10^{-3} = 2.21$ ℓ/s [0.0780ft³/sec.] (ANR)

(At this time, the air flow rate per minute is $14.69 \times \frac{1}{2} \times 300 \times 60 \times 10^{-3} = 132.21$ ℓ/min [4.667ft³/min.] (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
$14.69 \times 100 \times 10^{-3} = 1.469$ ℓ [0.0519ft³]/Reciprocation (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.], for 10 reciprocations per minute
$14.69 \times 100 \times 10 \times 10^{-3} = 14.69$ ℓ/min [0.519ft³/min.] (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)

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.

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

Sensor switch Note2

For φ16

Blank	No sensor switch	
ZC130	Solid state type DC10～28V	with indicator lamp
ZC153	Solid state type DC4.5～28V	with indicator lamp
CS5T	Reed switch type DC5～28V AC85～115V	without indicator lamp
CS11T	Reed switch type DC10～28V	with indicator lamp

For φ20～φ50

Blank	No sensor switch	
ZG530	Solid state type DC10～28V	with indicator lamp
ZG553	Solid state type DC4.5～28V	with indicator lamp
CS3M	Reed switch type DC10～30V AC85～230V	with indicator lamp
CS4M	Reed switch type DC10～30V AC85～115V	with indicator lamp
CS5M	Reed switch type DC3～30V AC85～115V	without indicator lamp

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

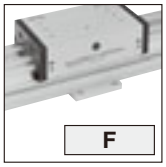
Lead wire length
(with sensor switch)
A：1000mm [39in.]
B：3000mm [118in.]

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

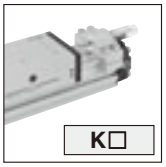
Options

With L-type bracket

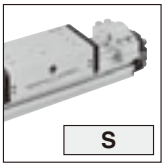
With F-type support



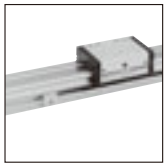
With shock absorber



With stroke adjusting bolt



φ16 with sensor switch



φ20～φ50 with sensor switch

Additional Parts

● Order codes for L-type bracket and supporting bracket only

□ – **ORK** □

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.]

Basic cylinder type

L：L-type bracket
F：F-type support

● Order codes for shock absorber only

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

● Order codes for stroke adjusting bolt only

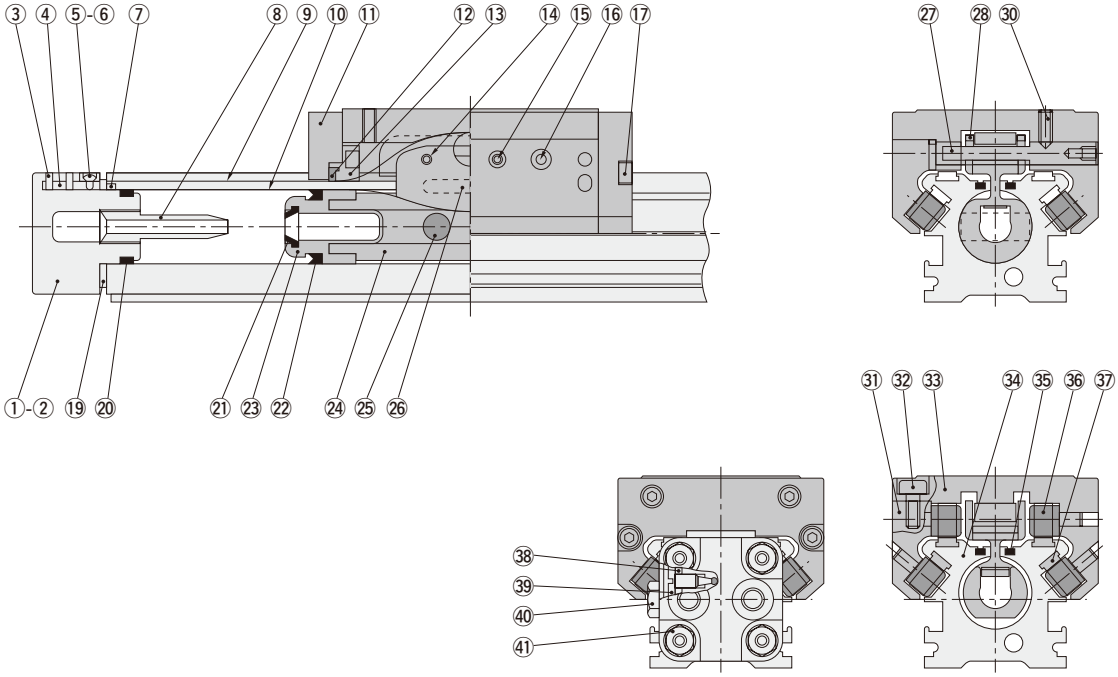
S16：For ORK16
S20：For ORK20
S25：For ORK25
S32：For ORK32
S40：For ORK40
S50：For ORK50

● Order codes for shock absorber and stroke adjusting bolt holder only

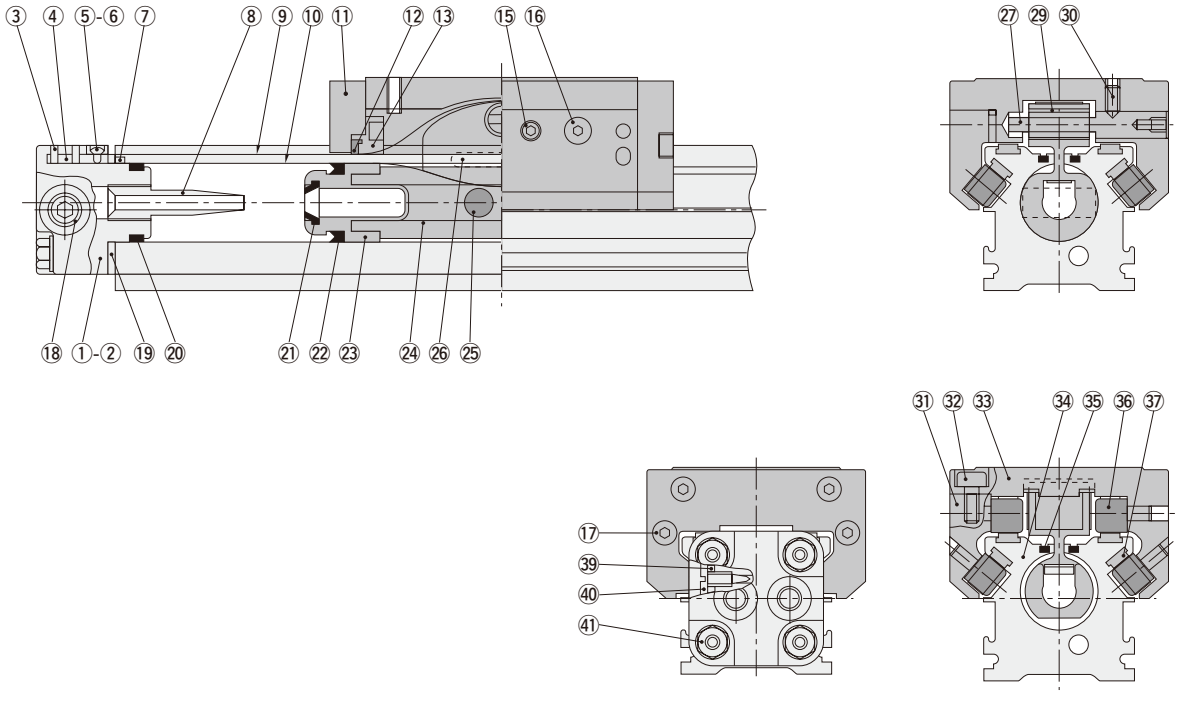
CL16：For ORK16
CL20：For ORK20
CL25：For ORK25
CL32：For ORK32
CL40：For ORK40
CL50：For ORK50

Inner Construction

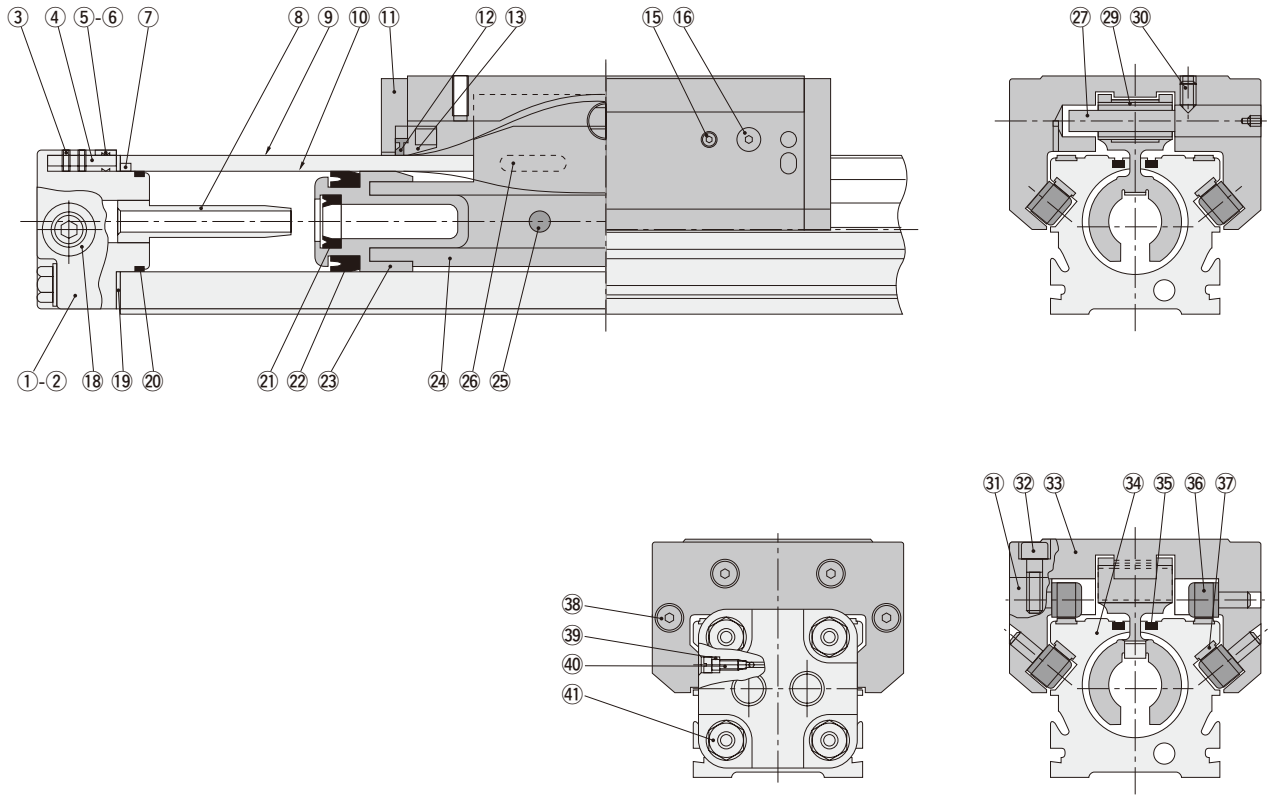
ORK16, 20



ORK25



ORK32, 40, 50



Major parts and Materials

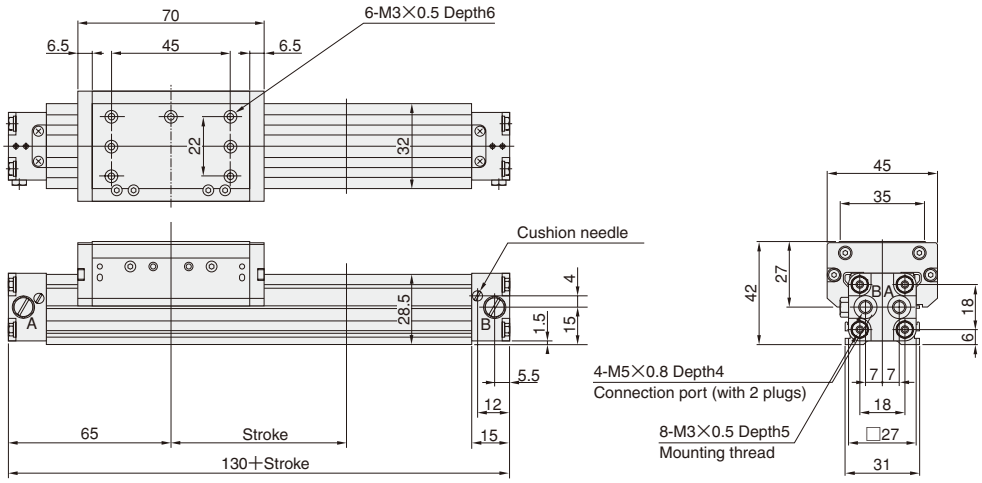
No.	Parts	Materials	Q'ty	Remarks
①	End cap R	Aluminum alloy	1	Anodized
②	End cap L	Aluminum alloy	1	Anodized
③	Inner seal band setscrew	Alloy steel	4	Hexagon socket setscrew
④	Inner seal band lock	Steel	2	Nickel plated
⑤	Outer seal band lock	Steel	2	Nickel plated
⑥	Outer seal band setscrew	Steel	4	Cross reccessed 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	ϕ16 [0.630in.] and ϕ20 [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 ϕ16, hexagon socket head bolt For ϕ20～ϕ50, hexagon socket button bolts
⑱	Hexagon socket plug	Alloy steel	2	For ϕ32 [1.260in.], ϕ40 [1.575in.], and ϕ50 [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 ϕ32 [1.260in.], ϕ40 [1.575in.] and ϕ50 [1.969in.], 4 pcs.
㉗	Carrier pin	Alloy steel	1	Black oxide
㉘	Yoke mount	Steel	1	Soft nitriding for ϕ16 [0.630in.] and ϕ20 [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 ϕ16, alloy steel for ϕ20	2	ϕ16 [0.630in.] and ϕ20 [0.787in.] only
㊶	End cap screw	Alloy steel	8	Zinc plated

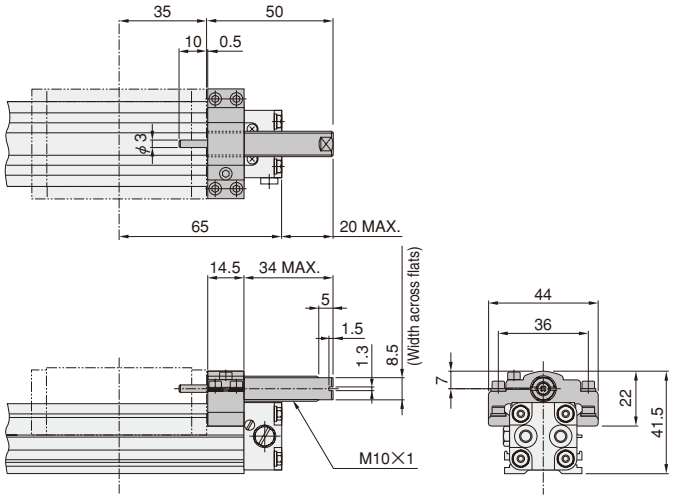
★: Available as a seal repair kit.

Dimensions of ORK16 (mm)

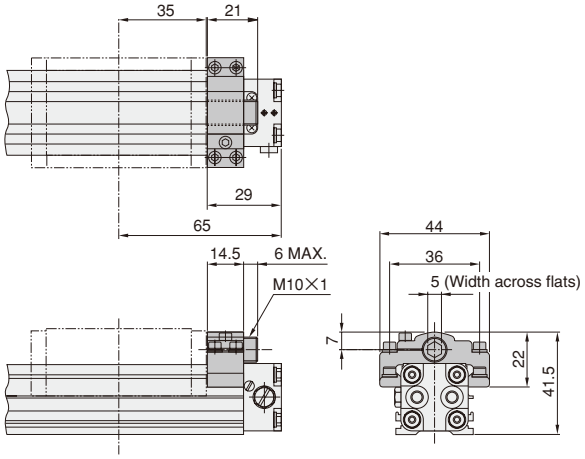
ORK16



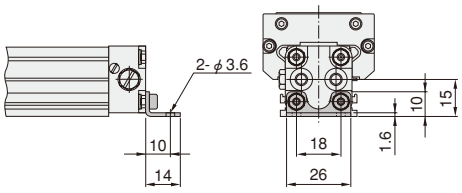
●Shock absorber: -K



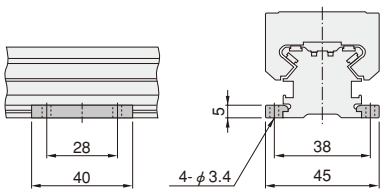
●Stroke adjusting bolt: -S



●L-type bracket: -L



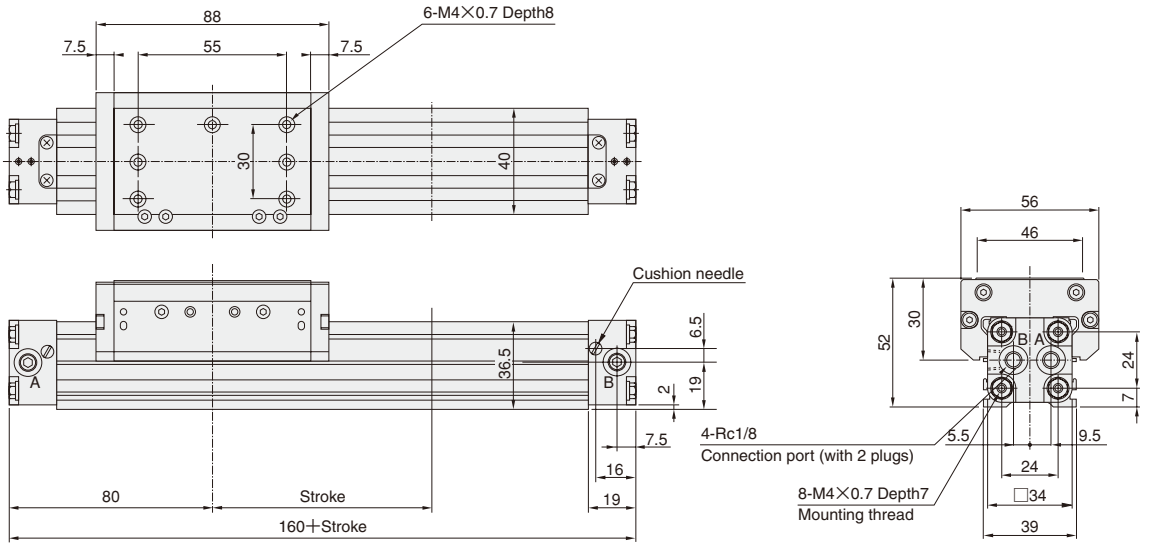
●F-type support: -F



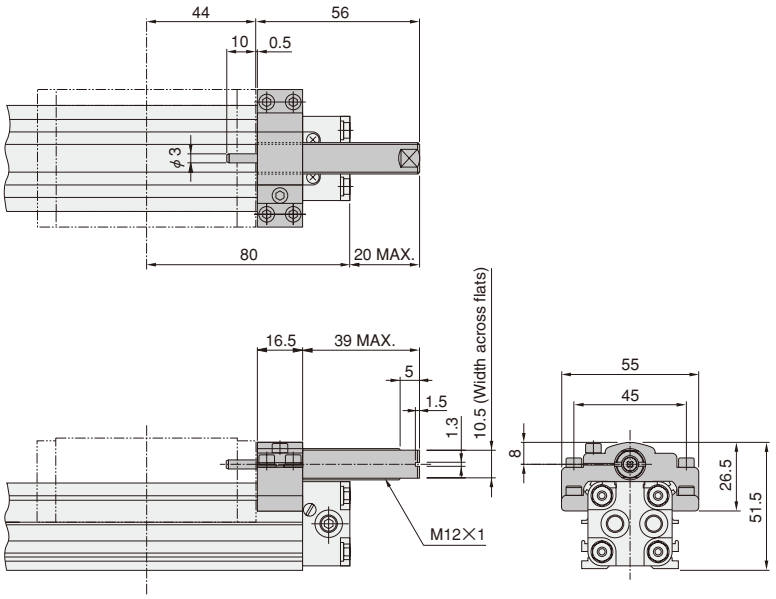
Note: Do not install sensor switches in place on the cylinder that will interfere with the **F**-type support.

Dimensions of ORK20 (mm)

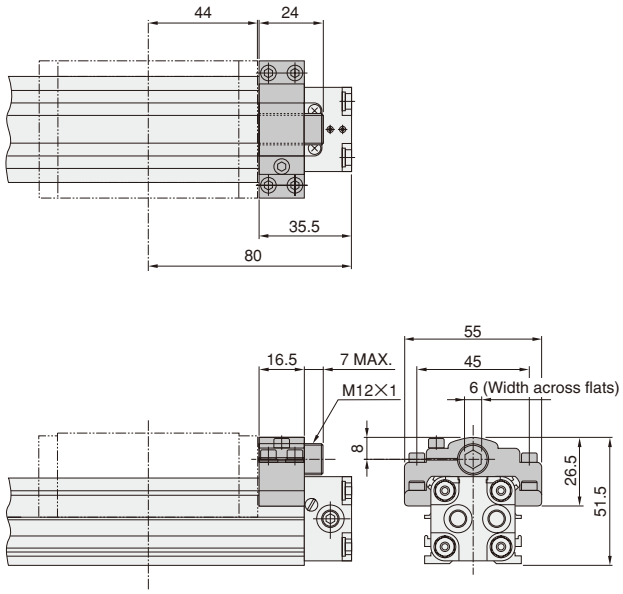
ORK20



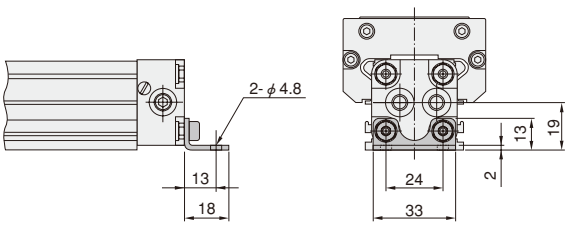
●Shock absorber: -K



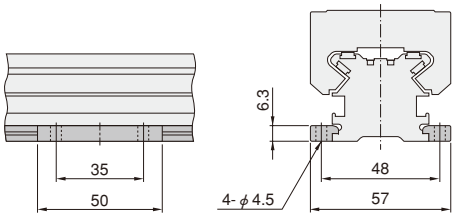
●Stroke adjusting bolt: -S



●L-type bracket: -L



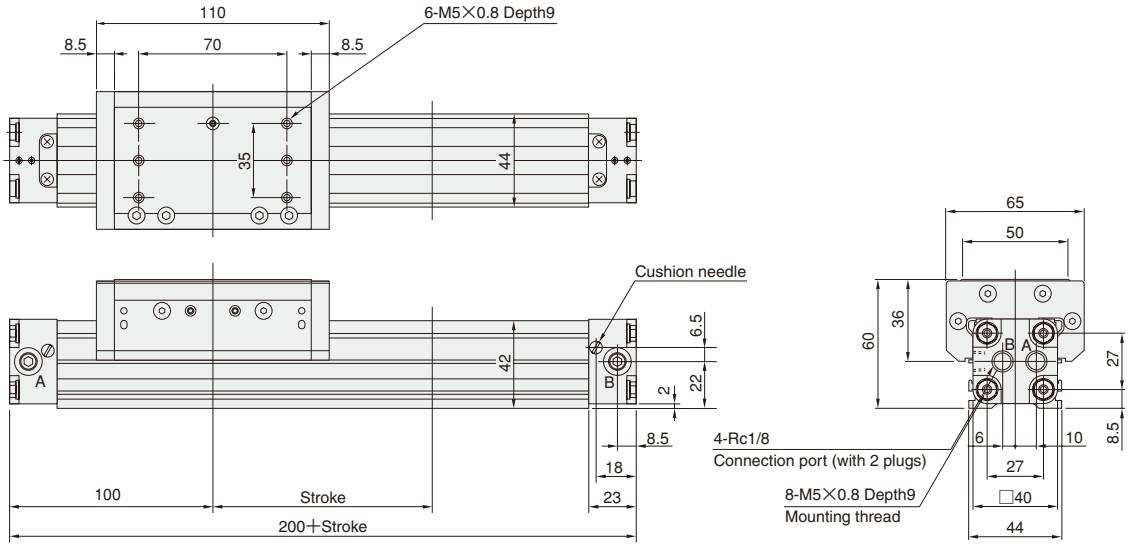
●F-type support: -F



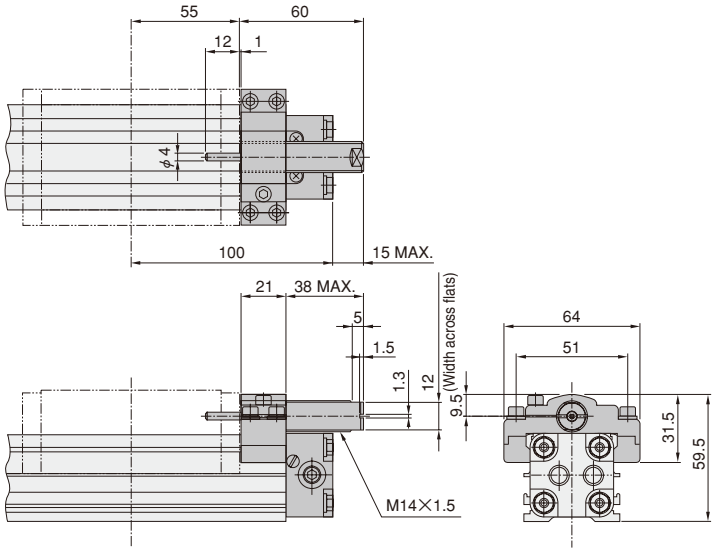
Note: Do not install sensor switches in place on the cylinder that will interfere with the **F**-type support.

Dimensions of ORK25 (mm)

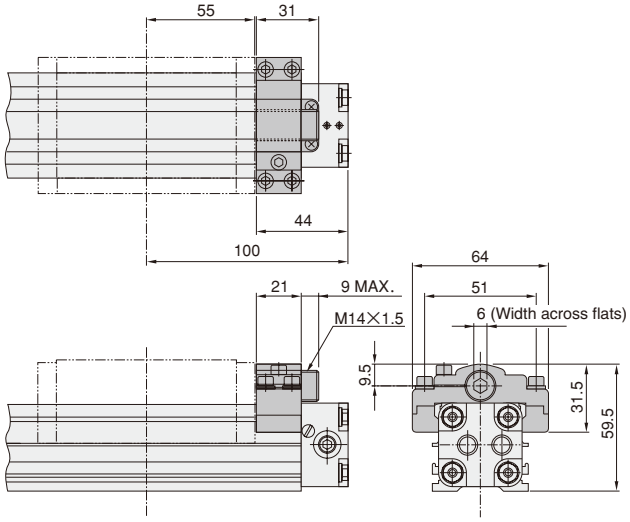
ORK25



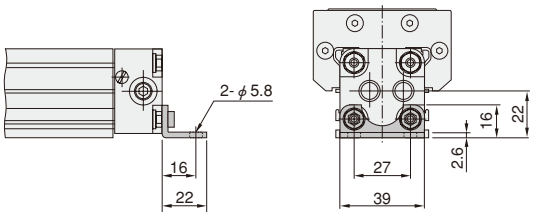
●Shock absorber: -K



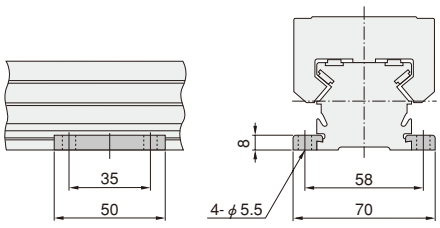
●Stroke adjusting bolt: -S



●L-type bracket: -L



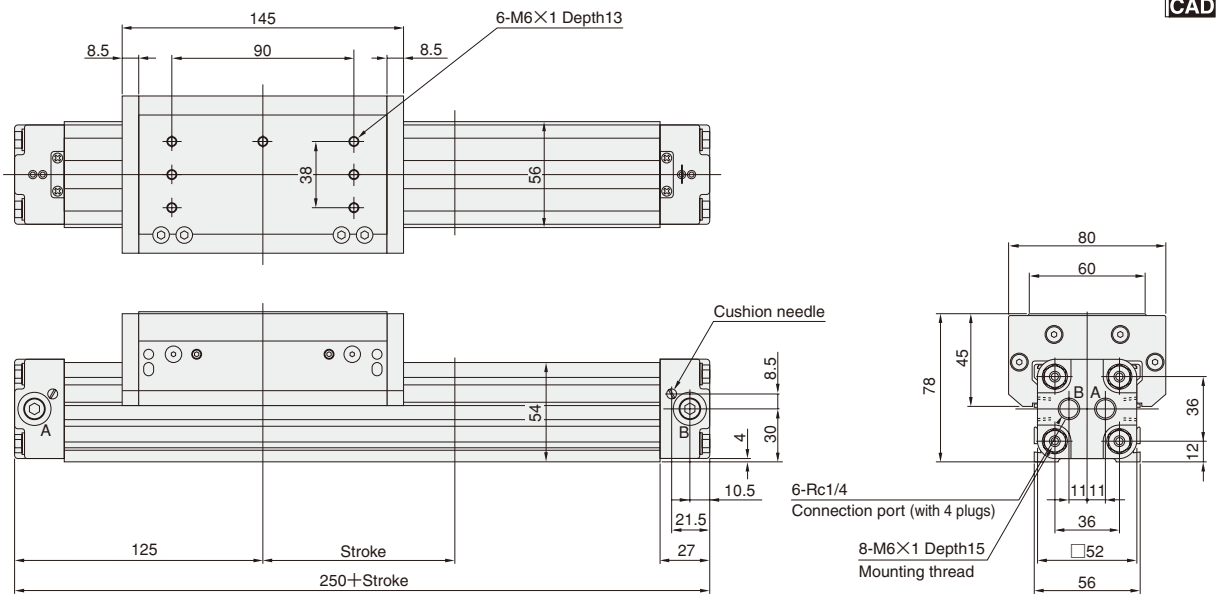
●F-type support: -F



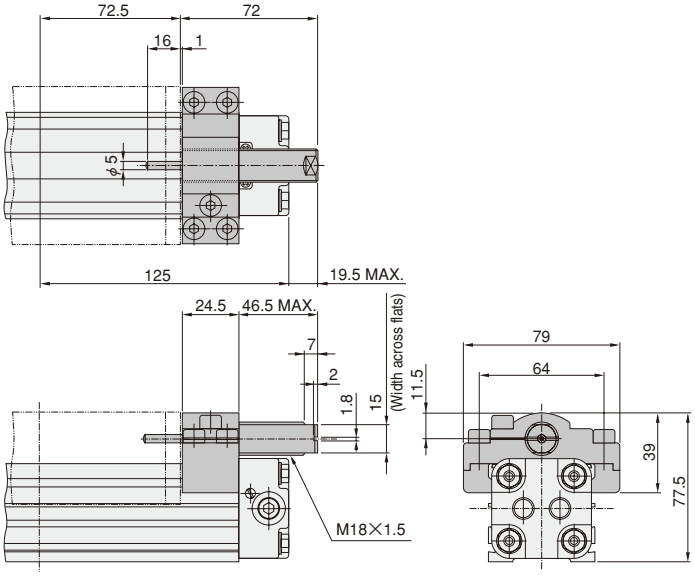
Note: Do not install sensor switches in place on the cylinder that will interfere with the **F**-type support.

Dimensions of ORK32 (mm)

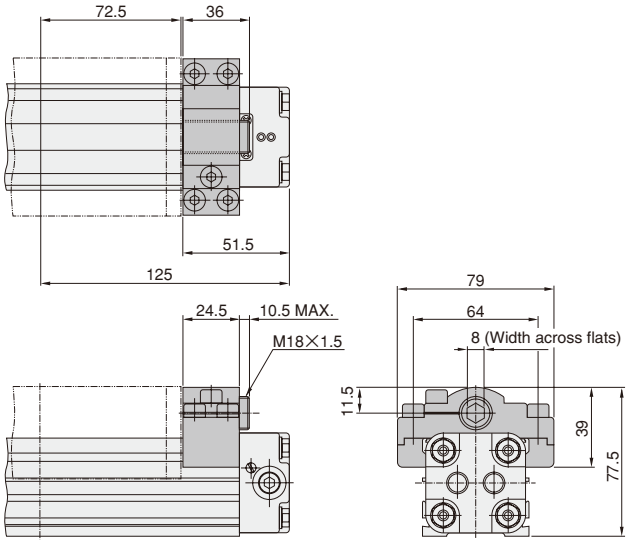
ORK32



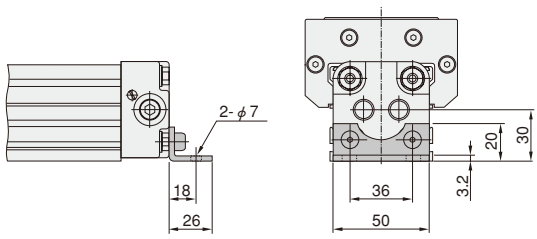
●Shock absorber: -K



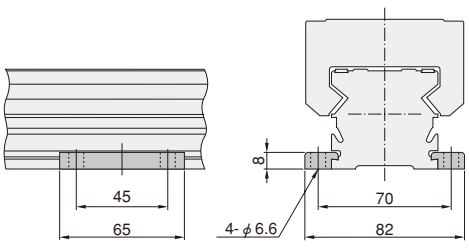
●Stroke adjusting bolt: -S



●L-type bracket: -L



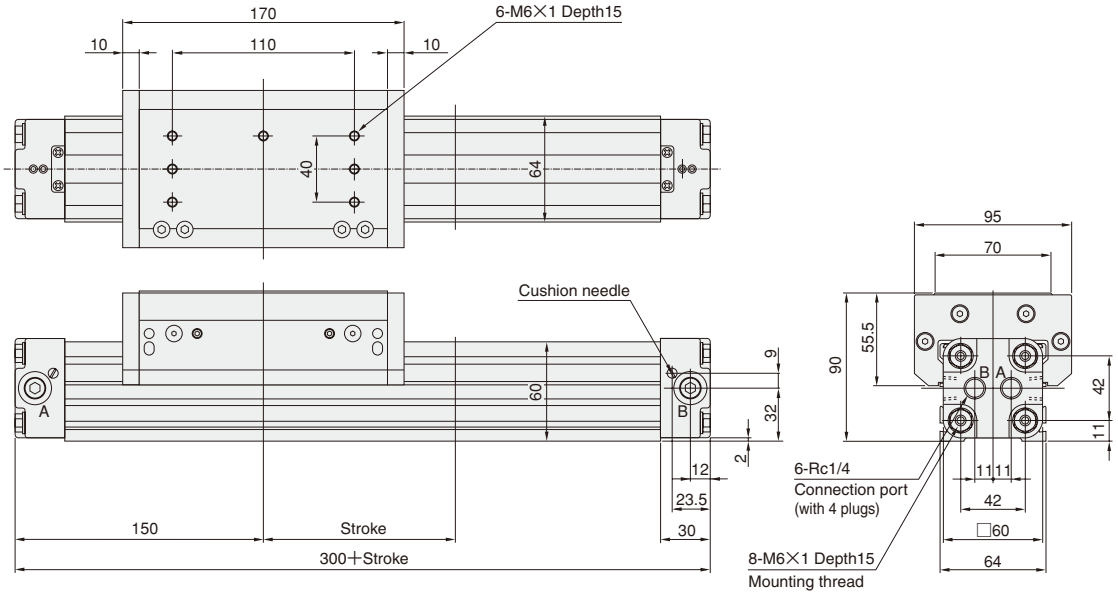
●F-type support: -F



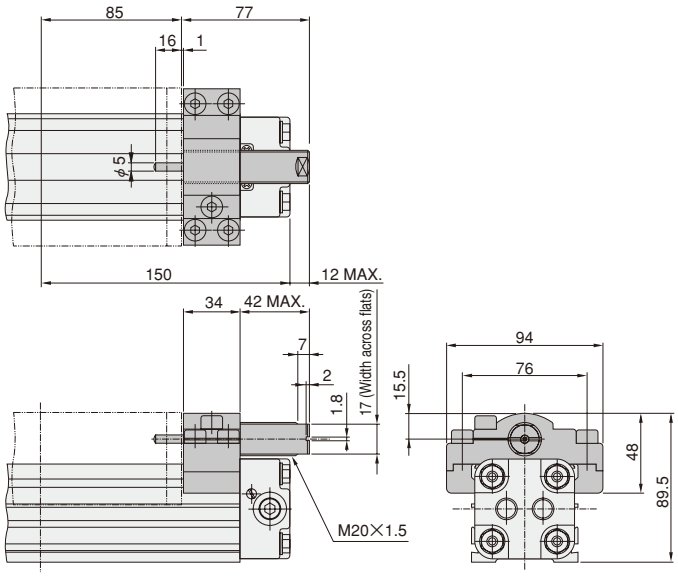
Note: Do not install sensor switches in place on the cylinder that will interfere with the **F**-type support.

Dimensions of ORK40 (mm)

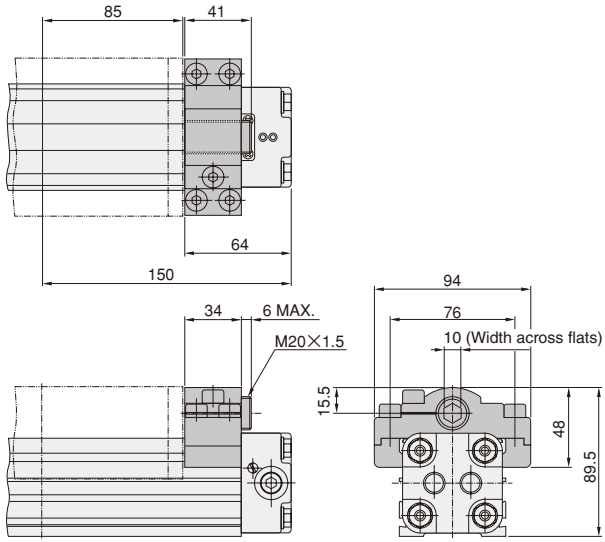
ORK40



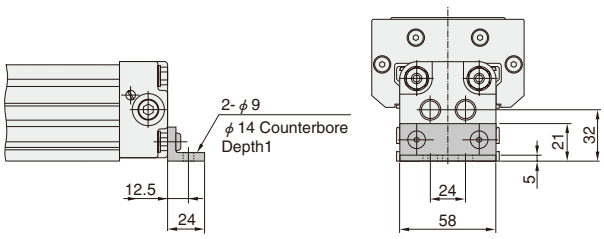
●Shock absorber: -K



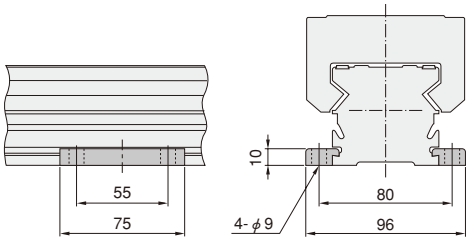
●Stroke adjusting bolt: -S



●L-type bracket: -L



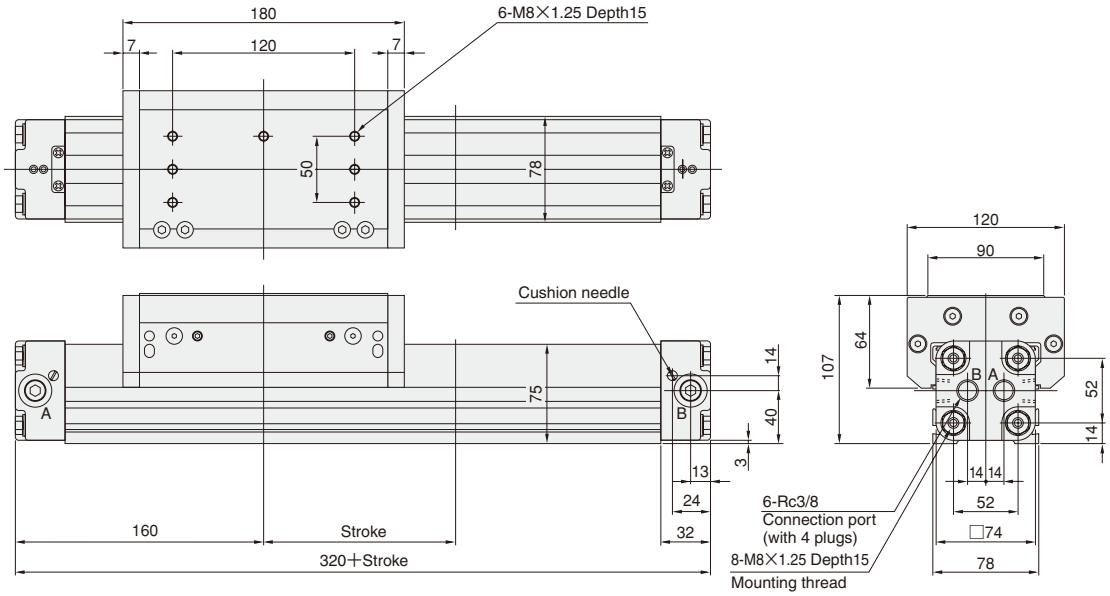
●F-type support: -F



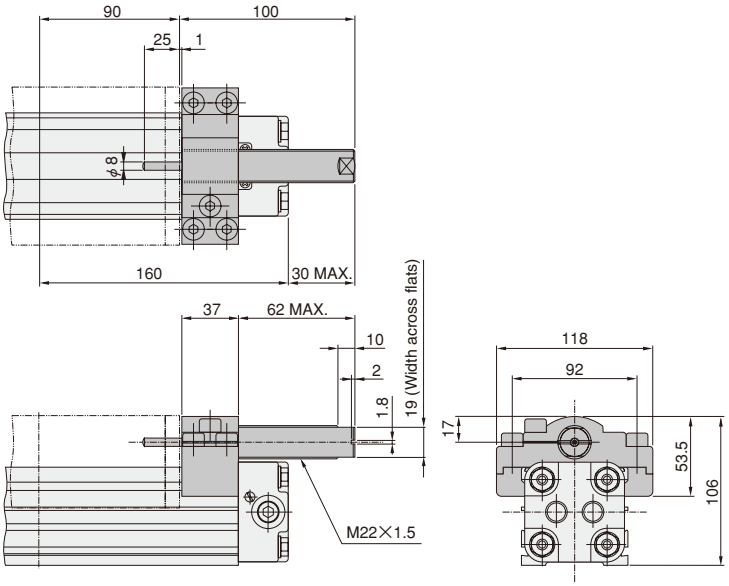
Note: Do not install sensor switches in place on the cylinder that will interfere with the **F**-type support.

Dimensions of ORK50 (mm)

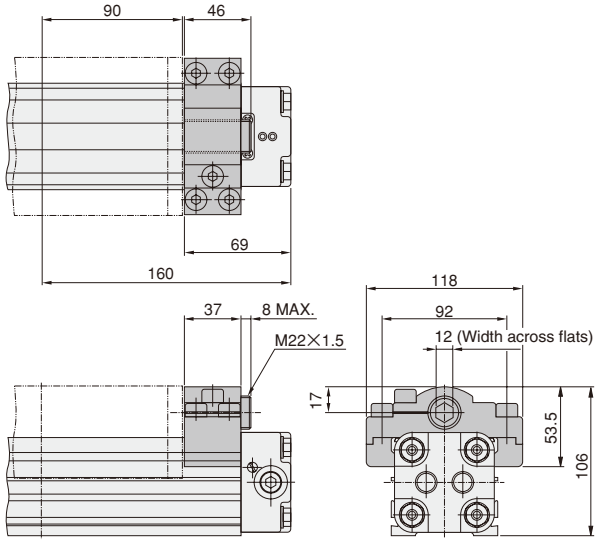
ORK50



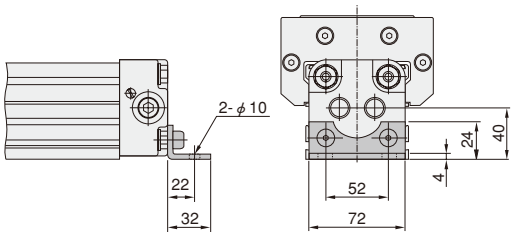
●Shock absorber: -K



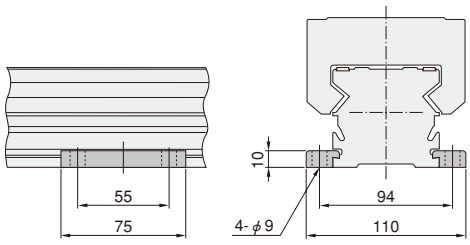
●Stroke adjusting bolt: -S



●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 ϕ16	Solid state type	2-lead wire	with indicator lamp	DC10～28V	ZC130	A B	-ORK	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 ϕ20 ～ For ϕ50	Solid state type	2-lead wire	with indicator lamp	DC10～28V	ZG530			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 ϕ16 [0.630in.]

C1 － **ORK** **16**

Sensor holder model
C1：For ϕ16 [0.630in.]

Bore size
16：For ϕ16 [0.630in.]

Basic cylinder type

● For ϕ20 [0.787in.]～ϕ50 [1.969in.]

G5 － **ORK** □

Sensor holder model
G5：For ϕ20 [0.787in.]～ϕ50 [1.969in.]

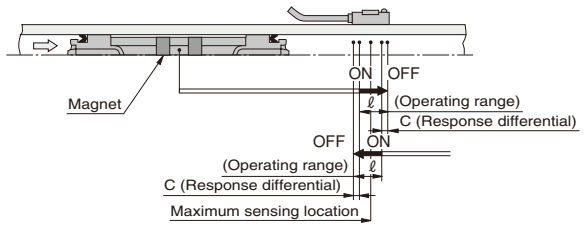
Bore size
20：For ϕ20 [0.787in.]
25：For ϕ25 [0.984in.]
32：For ϕ32 [1.260in.]
40：For ϕ40 [1.575in.]
50：For ϕ50 [1.969in.]

Basic cylinder type

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 ϕ16 [0.630in.]

mm [in.]

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 ϕ20 [0.787in.]～ϕ50 [1.969in.]

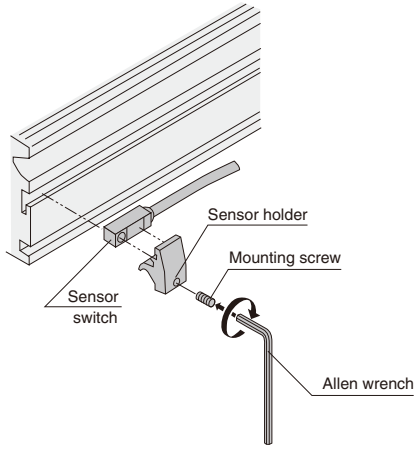
mm [in.]

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□							
	CS5T□			35 [1.378]	43 [1.693]	22 [0.866]		
	CS11T□			34.5 [1.358]	39.5 [1.555]	26 [1.024]		

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]