

KOGANEI

Air Cylinder

SLIT TYPE RODLESS CYLINDER ORV Series

INSTRUCTION MANUAL Ver.1.0

Handling Instructions and Precautions



General precautions

Piping

1. Always thoroughly blow off (use compressed air) the tubing before connecting it to the rodless cylinder. Entering chips, sealing tape, rust, etc., generated during piping work could result in air leaks or other defective operation.
2. When screwing piping or fittings to rodless cylinders, tighten them using the following tightening torques.

| Connecting thread | Tightening torque N·m [ft·lbf] |
|-------------------|--------------------------------|
| M5×0.8 | 1.57 [1.16] |
| Rc1/8 | 6.77~8.63 [4.99~6.37] |
| Rc1/4 | 11.57~13.44 [8.53~9.91] |
| Rc3/8 | 21.18~23.05 [15.62~17.00] |

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 piston yoke facing downward.
2. Do not engage in electric welding close to the slit type rodless cylinders **ORV** 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

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

Media

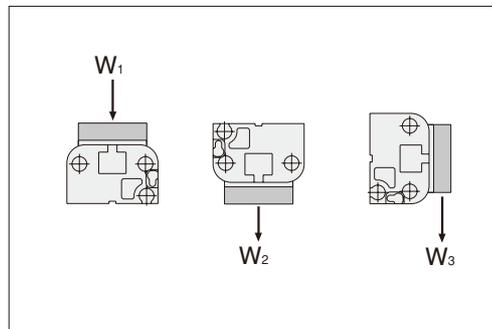
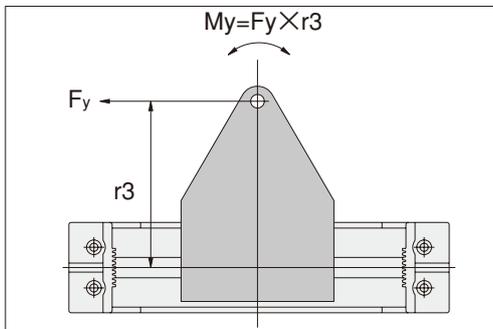
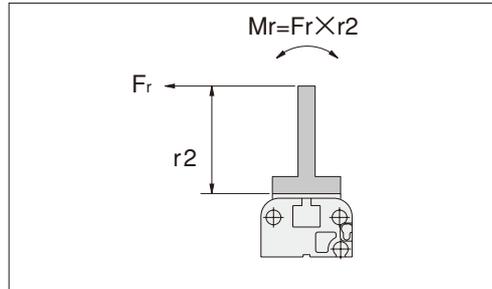
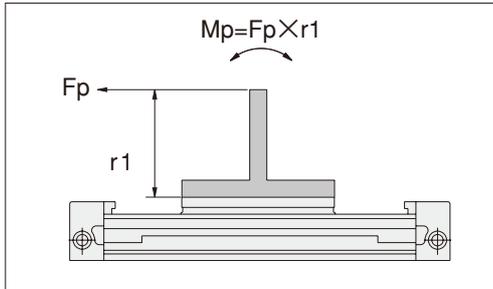
1. Use air for the media. For the use of any other media, consult us.
2. Air used for the slit type rodless cylinders **ORV** series should be clean air that contains no moisture, dust, and oxidized oil, etc. Install an air filter (filtration of a minimum 40 µm) near the slit type rodless cylinders **ORV**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



Selection

Allowable load and moment

Although the slit type rodless cylinders **ORV** series can be used with directly applying loads, make sure that the load and moment do not exceed the values in the table below. In addition, since load capacity may vary depending on the speed, confirm the rubber bumper and shock absorber absorption capacity on p.1055 before use.



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)

| Direction of moment Model | M _p N·m [ft·lbf] | M _r N·m [ft·lbf] | M _y N·m [ft·lbf] | No shock absorber | | | With shock absorber | | |
|------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| | | | | W ₁ N [lbf] | W ₂ N [lbf] | W ₃ N [lbf] | W ₁ N [lbf] | W ₂ N [lbf] | W ₃ N [lbf] |
| ORV16 | 3.2 [2.4] | 0.5 [0.4] | 0.5 [0.4] | 20 [4.5] | 20 [4.5] | 20 [4.5] | 40 [9.0] | 40 [9.0] | 20 [4.5] |
| ORV20 | 6.3 [4.6] | 1.2 [0.9] | 1.2 [0.9] | 32 [7.2] | 32 [7.2] | 32 [7.2] | 70 [15.7] | 70 [15.7] | 35 [7.9] |
| ORV25 | 12 [8.9] | 1.6 [1.2] | 1.6 [1.2] | 50 [11.2] | 50 [11.2] | 50 [11.2] | 120 [27.0] | 120 [27.0] | 60 [13.5] |
| ORV32 | 30 [22] | 3.2 [2.4] | 3.2 [2.4] | 80 [18.0] | 80 [18.0] | 80 [18.0] | 200 [45.0] | 200 [45.0] | 100 [22.5] |
| ORV40 | 60 [44] | 6.3 [4.6] | 6.3 [4.6] | 120 [27.0] | 120 [27.0] | 120 [27.0] | 300 [67.4] | 300 [67.4] | 150 [33.7] |
| ORV50 | 100 [74] | 10 [7.4] | 10 [7.4] | 200 [45.0] | 200 [45.0] | 200 [45.0] | 480 [107.9] | 480 [107.9] | 240 [54.0] |

Caution: The moment including the inertial force generated when the load is moved or stopped must not exceed the values in the above table.

Keep the mass and speed within the range of the rubber bumper and shock absorber capacity graphs.

Handling Instructions and Precautions

Cushioning capacity

■ Rubber bumper capacity

The slit type rodless cylinders **ORV** series comes with rubber bumpers as standard equipment. The absorbable mass and impact speed, however, lie within the “no shock absorber” range shown in the “rubber bumper and shock absorber capacity graph” below. Do not use it when the maximum impact speed exceeds 500mm/s [19.7in./sec.].

■ Shock absorber absorption capacity

The slit type rodless cylinders **ORV** series uses shock absorbers as optional equipment. The absorbable mass and impact speed, however, lie within the “with shock absorber” range shown in the “rubber bumper and shock absorber capacity graph” to the right. Do not use it when the maximum impact speed exceeds 800mm/s [31.5in./sec.].

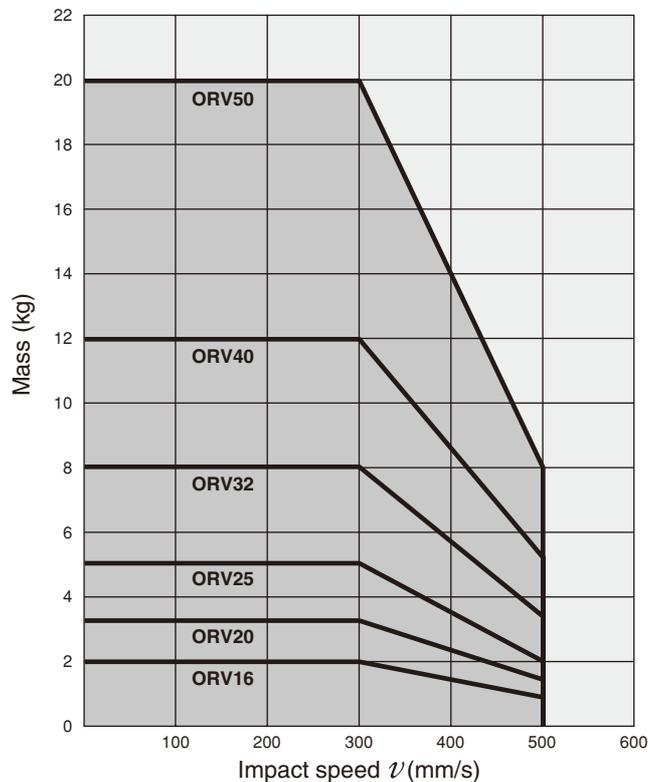
■ Rubber bumper and shock absorber capacity graph

(Horizontal use, at air pressure of 0.5MPa)

The “mass” in the graph refers to the total mass carried by the **ORV** series. “Impact speed” refers to the speed immediately before striking the rubber bumper or shock absorber. Note that this is not the same as “average speed (cylinder stroke/time required).”

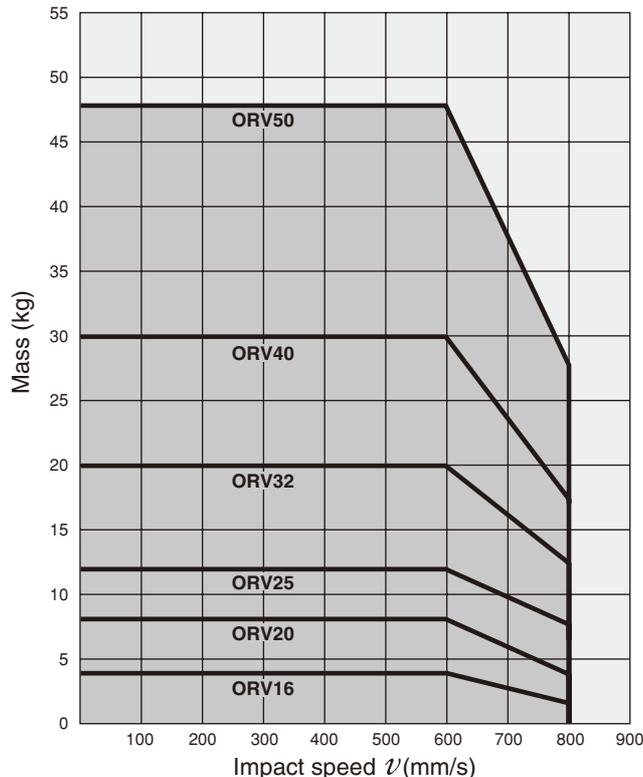
(See “Impact speed graph” to the lower right.)

● No shock absorber



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

● With shock absorber

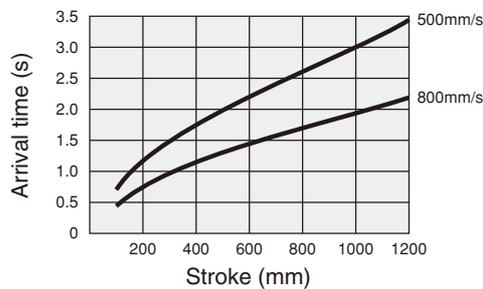


1kg = 2.205lb.
1mm/s = 0.0394in./sec.

■ Impact speed graph (Horizontal use, at air pressure of 0.5MPa)

The graph below shows the impact time at 800mm/s [31.5in./sec.] and 500mm/s [19.7in./sec.] for each stroke of the table at the end of the stroke.

For use, set the times on the upper side of the curve.

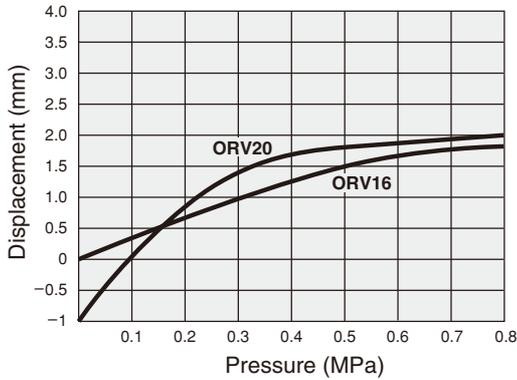


1mm = 0.0394in.

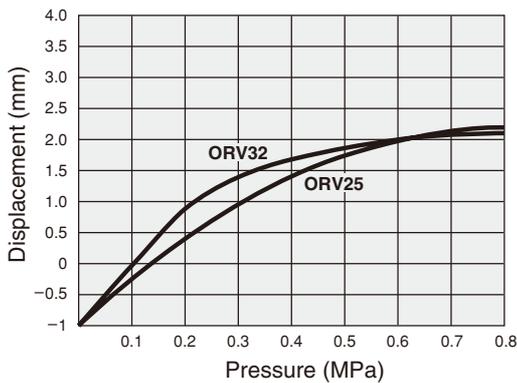
Amount of stroke change due to the rubber bumper

In the slit type rodless cylinders ORV series, note that use of the rubber bumper results in the stroke varying according to pressure as shown in the graphs below. (The graphs below show the displacement of the rubber bumper on one side.)

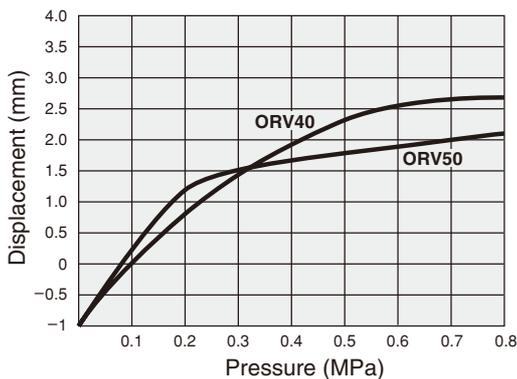
● ORV16, 20



● ORV25, 32



● ORV40, 50



1mm = 0.0394in. 1MPa = 145psi.

Caution: When using a rodless cylinder, select a suitable cushion and/or shock absorber to prevent rebounding. Rebound could result in such problems as breakage of the seal band.

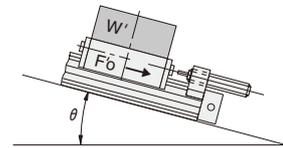
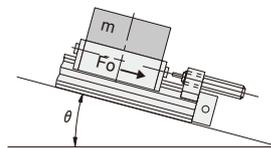
Calculation of impact energy

| 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]

E₁ : Kinetic energy ... $\frac{m \cdot v'^2}{2}$ [J]

E₂ : Additional energy by cylinder thrust ... $F_0 \cdot L$ [J]

E₃ : 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]

F₀ : 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.]

F₀ : 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.]

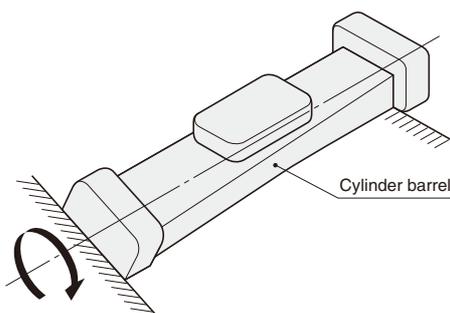
Handling Instructions and Precautions



Mounting

Mounting

1. While any mounting direction in the slit type rodless cylinders **ORV** series is allowed, mount the piston yoke so that it faces downward or protect it with a cover, etc., when mounting 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 **ORV** series. Flows of welding current to the cylinder could generate arcs that result in damage or depositions of the seal band.
3. Be careful to avoid making scratches or dents, etc., on the cylinder barrel.
4. If using in locations where the cylinder can easily become smeared, clean the cylinder periodically. After cleaning, always apply grease to the sliding portion of the cylinder barrel and outer seal band surface.
5. Mount the cylinder barrel so that it cannot be twisted. Insufficient flatness of the mounting surface could result in cylinder barrel twisting, damaged bands, air leaks, and operating malfunctions.

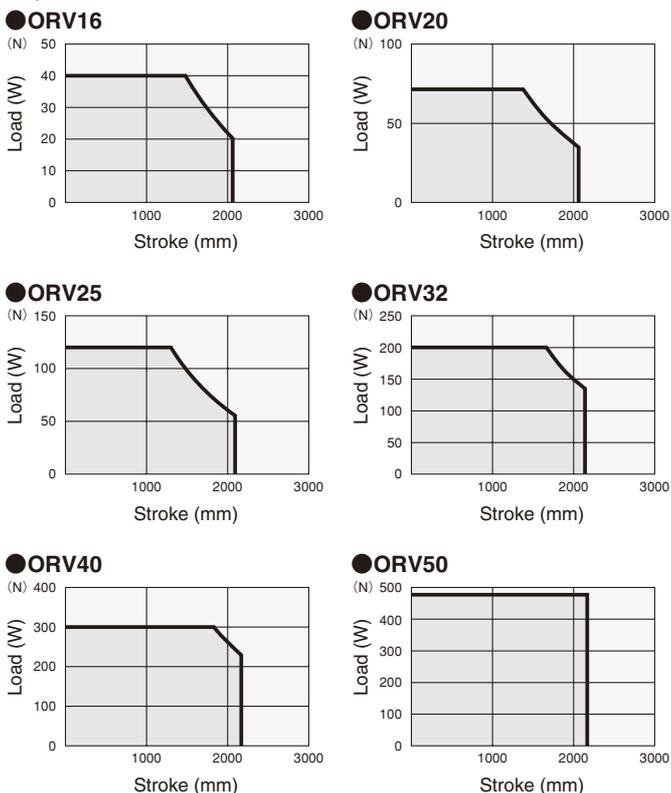


6. Precautions for the supporting types

| Two-point support at both ends | Three-point support |
|---|---------------------|
| | |
| <p>※ For 2-point support at both ends, and 3-point support, always mount so that the cylinder barrel is supported underneath both ends by at least 10mm [0.394in.] of contact area.</p> | |

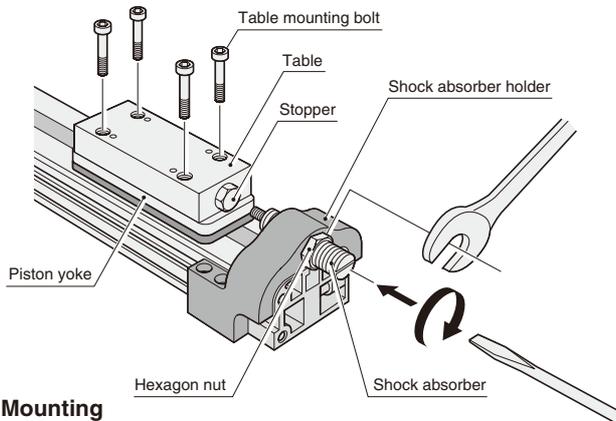
| Support on bottom surface of barrel |
|--|
| |
| <p>When supported directly on the bottom surface of the barrel, as shown above, the load can be applied without mounting other supports.</p> |

7. When the total cylinder length is long, the load could give a large deflection that could result in defective operation. If the relationship between the load on a 2-point support at both ends and the stroke exceeds the range shown in the graphs below, always use an F-type support at an intermediate position.



1N = 0.22481bf.
1mm = 0.0394in.

Mounting the shock absorber, and stroke adjustment



Mounting

1. There are no particular restrictions on mounting position so long as the end surface of the shock absorber holder does not protrude beyond the cylinder end surface. (Can also be used at an intermediate position.)
2. Mount so that the shock absorber and the stopper on the table are completely in contact with the entire surface.
3. Use the shock absorber within the range of the shock absorber absorption capacity (the range of its capacity graph).
4. Maximum impact speed of the shock absorber is 800mm/s [31.5in./sec.]. Note that this is not the same as the average speed. The speed at the time of impact should not exceed 800mm/s [31.5in./sec.].
5. Do not use the shock absorber in a place subject to dripping water or oil, or large amounts of dust. If using it in these places, install a cover, etc., so that the drops do not drip on it directly and it is not covered in dust. Otherwise it could lead to improper operation and may decrease the absorption energy.
6. Do not loosen the setscrew on the center of the shock absorber's back end surface. The oil inside will leak out which fail the function of the shock absorber.
7. Do not install other shock absorbers in this product without permission. Because product characteristics vary between shock absorbers, if other shock absorbers are used, damage to the cylinder etc., may occur.
8. Use the supplied table mounting bolts to secure the table to the piston yoke.

Tightening torques of the mounting bolts

| Model | Tightening torque N·m [ft·lbf] | Mounting bolt |
|-------|-----------------------------------|---------------|
| ORV16 | 2.0 [1.5] | M4×0.7 |
| ORV20 | 2.0 [1.5] | M4×0.7 |
| ORV25 | 4.0 [3.0] | M5×0.8 |
| ORV32 | 7.0 [5.2] | M6×1 |
| ORV40 | 7.0 [5.2] | M6×1 |
| ORV50 | 15.0 [11.1] | M8×1.25 |

Remark: Tighten the table mounting bolt in accordance with the above values.

Shock absorber position adjustment

- ① Loosen the hexagon nut holding the shock absorber.
- ② Use a flat blade screwdriver to rotate the shock absorber and adjust its position.
- ③ When the desired position has been attained, tighten the hexagon nut to secure it in place.

Hexagon nut tightening torques

| Model | Tightening torque N·m [ft·lbf] | Width across flats mm [in.] |
|-------|-----------------------------------|--------------------------------|
| ORV16 | 8.0 [5.9] | 13 [0.512] |
| ORV20 | 8.0 [5.9] | 14 [0.551] |
| ORV25 | 10.0 [7.4] | 17 [0.669] |
| ORV32 | 24.0 [17.7] | 21 [0.827] |
| ORV40 | 30.0 [22.1] | 24 [0.945] |
| ORV50 | 78.0 [57.5] | 27 [1.063] |

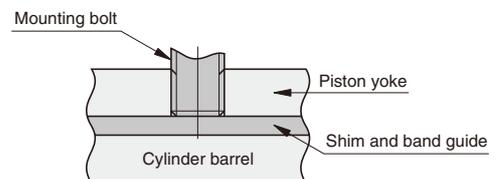
Mounting a workpiece

1. When using the piston yoke to mount a workpiece, fasten within the tightening torques shown in the table below.

Mounting bolt tightening torques

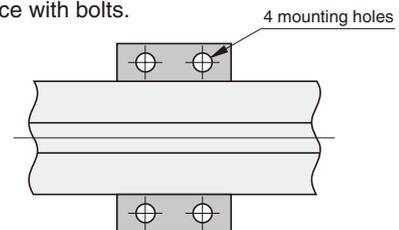
| Model | Tightening torque N·m [ft·lbf] | Mounting bolt |
|-------|-----------------------------------|---------------|
| ORV16 | 2.0 [1.5] | M4×0.7 |
| ORV20 | 2.0 [1.5] | M4×0.7 |
| ORV25 | 4.0 [3.0] | M5×0.8 |
| ORV32 | 7.0 [5.2] | M6×1 |
| ORV40 | 7.0 [5.2] | M6×1 |
| ORV50 | 15.0 [11.1] | M8×1.25 |

2. Pay attention to the screw length of the mounting bolt. Screwing a bolt deeper than the tapped hole depth could result in its bumping against the shim and band guide, causing defective operation.



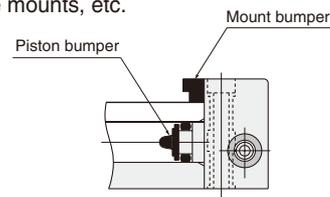
Mounting the F-type support

For the F-type support, use mounting holes in four places to secure it in place with bolts.



The bumpers

The cylinder is equipped with two types of bumpers, a mount bumper and a piston bumper. Piston stopping shocks are designed to be absorbed by the piston bumpers, while the mount bumpers are auxiliary. The mount bumpers can be removed when using M-type mounts, etc.



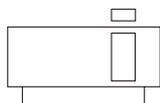
M-type mounts

Be sure to remove the mount bumper when using M-type mounts. If the mount bumper is left in place, the piston bumper will not function, which could drastically shorten the cylinder's operating life.

SLIT TYPE RODLESS CYLINDERS ORV SERIES



Symbol



Specifications

| Item | Model | ORV16 | ORV20 | ORV25 | ORV32 | ORV40 | ORV50 | |
|-----------------------------|-----------------|--|---|---|---|---|---|---|
| Equivalent bore size | mm [in.] | 16 [0.630] | 20 [0.787] | 25 [0.984] | 32 [1.260] | 40 [1.575] | 50 [1.969] | |
| Media | | Air ^{Note1} | | | | | | |
| Operation type | | Double acting type | | | | | | |
| Operating pressure range | MPa [psi.] | 0.15~0.8 [22~116] | | | | | | |
| Proof pressure | MPa [psi.] | 1.2 [174] | | | | | | |
| Operating temperature range | °C [°F] | 0~60 [32~140] | | | | | | |
| Operating speed range | mm/s [in./sec.] | Rubber bumper 80~500 [3.1~19.7], with shock absorber 80~800 [3.1~31.5] ^{Note2} | | | | | | |
| Cushion | Standard | With rubber bumper | | | | | | |
| | Option | Shock absorber | | | | | | |
| Lubrication | | Not required (If lubrication is required, use Turbine Oil Class 1 [ISO VG32] or equivalent.) | | | | | | |
| Stroke adjusting range | mm [in.] | With shock absorber One side 0~20 [0~0.787] | | | | One side 0~30 [0~1.181] | | |
| Maximum stroke | mm | 2000 | | | | | | |
| Stroke tolerance | mm [in.] | Strokes 2000mm or less | +5 [+0.197] ^{Note3} +1 [+0.039] | +6 [+0.236] ^{Note3} +1 [+0.039] | +6 [+0.236] ^{Note3} 0 [0] | +6 [+0.236] ^{Note3} +1 [+0.039] | +7 [+0.276] ^{Note3} +1 [+0.039] | +6 [+0.236] ^{Note3} +2 [+0.078] |
| Port size | | M5×0.8 | Rc1/8 | Rc1/8 | Rc1/4 | Rc1/4 | Rc3/8 | |

Notes: 1. Use clean air that contains no moisture, dust, and oxidized oil.

2. Use the cushioning capacity, etc., on p.1055 to select the operating speed.

3. Since the stroke will vary depending on the air pressure, see the graphs on p.1056 showing the "Amount of stroke change due to the rubber bumper."

Specifications of Shock Absorber

| Item | Model | KSHJV 10×10 | KSHJV 12×10 | KSHJV 14×12 | KSHJV 18×16 | KSHJV 20×16 | KSHJV 22×25 |
|-------------------------------------|-----------------------|---------------|-------------|-------------|-------------|-------------|-------------|
| Applicable cylinder | | ORV16 | ORV20 | ORV25 | ORV32 | ORV40 | ORV50 |
| Maximum absorption | J [ft.-lbf] | 3 [2.2] | 6 [4.4] | 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.] | 800 [31.5] | | | | | |
| 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.

Theoretical Thrust

| Model | Pressure area mm ² [in. ²] | Air pressure MPa [psi.] | | | | | | |
|-------|--|-------------------------|-------------|-------------|-------------|--------------|--------------|--------------|
| | | 0.2 [29] | 0.3 [44] | 0.4 [58] | 0.5 [73] | 0.6 [87] | 0.7 [102] | 0.8 [116] |
| ORV16 | 201 [0.312] | 40 [9.0] | 60 [13.5] | 80 [18.0] | 101 [22.7] | 121 [27.2] | 141 [31.7] | 161 [36.2] |
| ORV20 | 314 [0.487] | 63 [14.2] | 94 [21.1] | 126 [28.3] | 157 [35.3] | 188 [42.3] | 220 [49.5] | 251 [56.4] |
| ORV25 | 490 [0.760] | 98 [22.0] | 147 [33.0] | 197 [44.3] | 245 [55.1] | 294 [66.1] | 343 [77.1] | 392 [88.1] |
| ORV32 | 804 [1.246] | 161 [36.2] | 241 [54.2] | 322 [72.4] | 402 [90.4] | 482 [108.4] | 563 [126.6] | 643 [144.5] |
| ORV40 | 1256 [1.947] | 251 [56.4] | 377 [84.7] | 502 [112.8] | 628 [141.2] | 754 [169.5] | 879 [197.6] | 1005 [225.9] |
| ORV50 | 1963 [3.043] | 393 [88.3] | 589 [132.4] | 785 [176.5] | 982 [220.8] | 1178 [264.8] | 1374 [308.9] | 1570 [352.9] |

N [lbf.]

Equivalent Bore Size and Stroke

| mm | | |
|----------------------|---|--------------------------|
| Equivalent bore size | Standard strokes | Maximum available stroke |
| 16 | 25, 50, 75, 100, 125, 150, 175, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800 | 2000 |
| 20, 25 | 50, 100, 150, 200, 250, 300, 350, 400, 450, 500, 550, 600, 650, 700, 750, 800, 850, 900, 1000 | |
| 32, 40, 50 | 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200 | |

Remark: Non-standard strokes are available at 1mm pitch intervals. For strokes beyond the maximum available stroke, or for non-standard strokes, ask the nearest Koganei office. Consult us for delivery.

Mass

| kg [lb.] | | | | | | | | | |
|----------|------------------|---|----------------|---------------|---------------------|---------------|---------------|--|---------------|
| Model | Zero stroke mass | Additional mass for each 25mm [0.984in.] stroke | F-type support | M-type mount | Shock absorber unit | | | Additional mass of 1 sensor switch ^{Note} | |
| | | | | | Table | One side | Both sides | ZE□□□A | ZE□□□B |
| ORV16 | 0.20 [0.44] | 0.03 [0.066] | 0.008 [0.018] | 0.019 [0.042] | 0.077 [0.17] | 0.062 [0.137] | 0.124 [0.273] | 0.015 [0.033] | 0.035 [0.077] |
| ORV20 | 0.34 [0.75] | 0.04 [0.088] | 0.016 [0.035] | 0.03 [0.066] | 0.14 [0.31] | 0.105 [0.232] | 0.21 [0.46] | | |
| ORV25 | 0.51 [1.12] | 0.05 [0.110] | 0.028 [0.062] | 0.038 [0.084] | 0.20 [0.44] | 0.18 [0.40] | 0.36 [0.79] | | |
| ORV32 | 1.15 [2.54] | 0.085 [0.187] | 0.036 [0.079] | 0.095 [0.209] | 0.47 [1.04] | 0.31 [0.68] | 0.62 [1.37] | | |
| ORV40 | 1.90 [4.19] | 0.125 [0.276] | 0.062 [0.137] | 0.13 [0.287] | 0.68 [1.50] | 0.46 [1.01] | 0.92 [2.03] | | |
| ORV50 | 3.48 [7.67] | 0.19 [0.419] | 0.062 [0.137] | 0.23 [0.507] | 1.07 [2.36] | 0.74 [1.63] | 1.48 [3.26] | | |

Note: Sensor switch types A and B show the lead wire lengths.
A: 1000mm [39in.] B: 3000mm [118in.]

Air Flow Rate and Air Consumption

While the slit type rodless cylinders **ORV** series' 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: Equivalent bore size mm
L: Cylinder stroke mm
t: Time required for cylinder to travel one 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': Equivalent bore size in.
L': Cylinder stroke in.
t: Time required for cylinder to travel one stroke sec.
n: Number of cylinder reciprocations per minute times/min
P': Pressure psi.

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

| Equivalent bore size mm [in.] | Air pressure MPa [psi.] | | | | | | |
|-------------------------------|-------------------------|-----------------|----------------|----------------|----------------|----------------|----------------|
| | 0.2 [29] | 0.3 [44] | 0.4 [58] | 0.5 [73] | 0.6 [87] | 0.7 [102] | 0.8 [116] |
| 16 [0.630] | 1.198 [0.07311] | 1.596 [0.09739] | 1.993 [0.1216] | 2.391 [0.1459] | 2.789 [0.1702] | 3.187 [0.1945] | 3.585 [0.2188] |
| 20 [0.787] | 1.871 [0.1142] | 2.493 [0.1521] | 3.115 [0.1901] | 3.737 [0.2280] | 4.358 [0.2659] | 4.980 [0.3039] | 5.602 [0.3419] |
| 25 [0.984] | 2.924 [0.1784] | 3.896 [0.2377] | 4.867 [0.2970] | 5.838 [0.3563] | 6.810 [0.4156] | 7.781 [0.4748] | 8.753 [0.5341] |
| 32 [1.260] | 4.791 [0.2924] | 6.382 [0.3895] | 7.974 [0.4866] | 9.566 [0.5838] | 11.16 [0.6810] | 12.75 [0.7781] | 14.34 [0.8751] |
| 40 [1.575] | 7.486 [0.4568] | 9.973 [0.6086] | 12.46 [0.7604] | 14.95 [0.9123] | 17.43 [1.064] | 19.92 [1.216] | 22.41 [1.368] |
| 50 [1.969] | 11.70 [0.7140] | 15.58 [0.9508] | 19.47 [1.188] | 23.35 [1.425] | 27.24 [1.662] | 31.13 [1.900] | 35.01 [2.136] |

The figures in the table show the air flow rate and air consumption when a rodless 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 a slit type rodless cylinder **ORV** series with an equivalent bore size of 40mm [1.575in.] at a speed of 300mm/s [118in./sec.] and under air pressure of 0.5MPa [73psi.]

$$14.95 \times \frac{1}{2} \times 300 \times 10^{-3} = 2.24 \text{ } \ell/\text{s} [0.0791\text{ft}^3/\text{sec.}] \text{ (ANR)}$$

$$\text{(At this time, the flow rate per minute is } 14.95 \times \frac{1}{2} \times 300 \times 60 \times 10^{-3} = 134.55 \text{ } \ell/\text{min} [4.75\text{ft}^3/\text{min.}] \text{ (ANR))}$$

● Finding the air consumption

Example 1. When operating a slit type rodless cylinder **ORV** series with an equivalent bore size of 40mm [1.575in.] and a stroke of 100mm [3.94in.], and under air pressure of 0.5MPa [73psi.], for 1 reciprocation

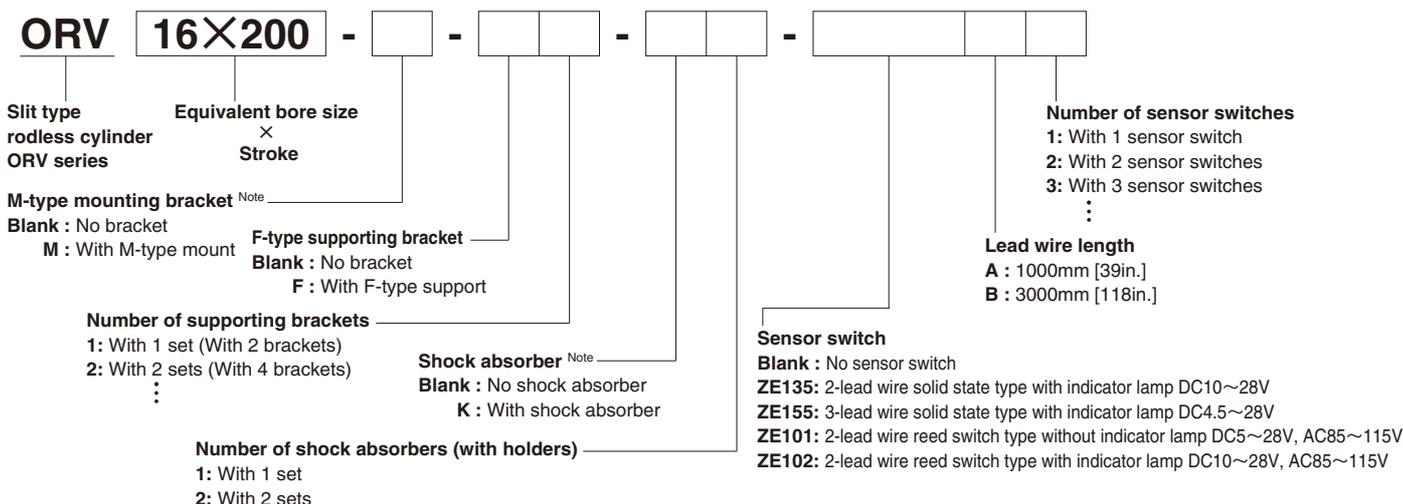
$$14.95 \times 100 \times 10^{-3} = 1.495 \text{ } \ell [0.0528\text{ft}^3]/\text{Reciprocation} \text{ (ANR)}$$

Example 2. When operating a slit type rodless cylinder **ORV** series with an equivalent bore size of 40mm [1.575in.] and a stroke of 100mm [3.94in.], and under air pressure of 0.5MPa [73psi.], for 10 reciprocations per minute

$$14.95 \times 100 \times 10 \times 10^{-3} = 14.95 \text{ } \ell/\text{min} [0.528\text{ft}^3/\text{min.}] \text{ (ANR)}$$

Note: To find the actual air consumption required when using the slit type rodless cylinders **ORV** series, add the air consumption of the piping to the air consumption obtained from the above calculation.

Order Codes



Note: The combination of M-type mount and shock absorber not allowed.

Additional Parts

● Shock absorber unit

(with shock absorber, table, and holder)

K-ORV



Equivalent bore size

16 : For ORV16, 20 : For ORV20
25 : For ORV25, 32 : For ORV32
40 : For ORV40, 50 : For ORV50

● M-type mounting brackets

M-ORV



Equivalent bore size

16 : For ORV16, 20 : For ORV20
25 : For ORV25, 32 : For ORV32
40 : For ORV40, 50 : For ORV50

● F-type supporting brackets (with 2 units)

F-ORV



Equivalent bore size

16 : For ORV16, 20 : For ORV20
25 : For ORV25, 32 : For ORV32
40 : For ORV40, 50 : For ORV50

● Shock absorber

KSHJV



Mounting thread size × Stroke

10×10 — For ORV16
12×10 — For ORV20
14×12 — For ORV25
18×16 — For ORV32
20×16 — For ORV40
22×25 — For ORV50

Linear orifice type shock absorber

● Shock absorber holder

C-ORV



Equivalent bore size

16 : For ORV16, 20 : For ORV20
25 : For ORV25, 32 : For ORV32
40 : For ORV40, 50 : For ORV50

● Table for shock absorber (with bolt)

T-ORV



Equivalent bore size

16 : For ORV16, 20 : For ORV20
25 : For ORV25, 32 : For ORV32
40 : For ORV40, 50 : For ORV50

● For the sensor switches, see p.1065.

Repair Kit

● Seal kit Note

MK1-ORV



Equivalent bore size

16 : For ORV16, 20 : For ORV20
25 : For ORV25, 32 : For ORV32
40 : For ORV40, 50 : For ORV50

● Seal band kit

MK2-ORV



Equivalent bore size × Stroke

● End cap assembly, R side

MK3-ORV



Equivalent bore size

16 : For ORV16, 20 : For ORV20
25 : For ORV25, 32 : For ORV32
40 : For ORV40, 50 : For ORV50

Note: The fewest order unit of the seal kit is every 5 sets.

● End cap assembly, L side

MK4-ORV



Equivalent bore size

16 : For ORV16, 20 : For ORV20
25 : For ORV25, 32 : For ORV32
40 : For ORV40, 50 : For ORV50

● Piston assembly

MK5-ORV

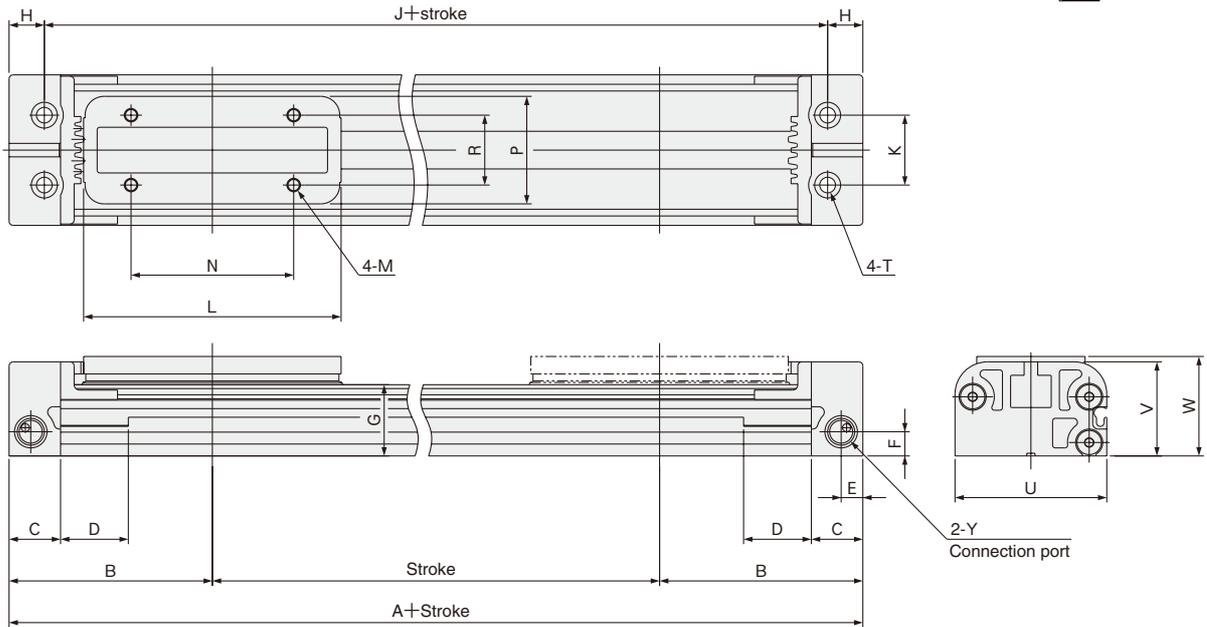


Equivalent bore size

16 : For ORV16, 20 : For ORV20
25 : For ORV25, 32 : For ORV32
40 : For ORV40, 50 : For ORV50

Dimensions (mm)

●ORV Equivalent bore size × Stroke



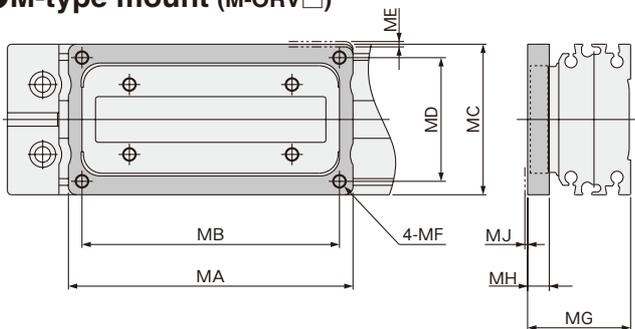
Note: For M-type mounts and F-type supports, see "Optional Parts Dimensions" below.

| Model | Code | A | B | C | D | E | F | G | H | J | K | L |
|-------|------|-----|-----|----|----|------|-----|------|----|-----|----|-----|
| ORV16 | | 112 | 56 | 15 | 25 | 5.5 | 9 | 20.5 | 11 | 90 | 18 | 67 |
| ORV20 | | 136 | 68 | 17 | 25 | 8 | 8.5 | 23 | 12 | 112 | 22 | 85 |
| ORV25 | | 152 | 76 | 19 | 25 | 8 | 9 | 26.5 | 13 | 126 | 26 | 95 |
| ORV32 | | 206 | 103 | 24 | 25 | 11.5 | 13 | 35 | 17 | 172 | 32 | 136 |
| ORV40 | | 242 | 121 | 26 | 25 | 11.5 | 18 | 43 | 19 | 204 | 36 | 165 |
| ORV50 | | 276 | 138 | 31 | 25 | 14 | 23 | 53 | 22 | 232 | 44 | 184 |

| Model | Code | N | M | P | R | T | U | V | W | Y |
|-------|------|-----|------------------|----|----|----------------------------------|-----|----|----|--------|
| ORV16 | | 40 | M4×0.7 Depth 6 | 30 | 20 | φ3.6 φ6.5 Counterbore, Depth 3.3 | 40 | 26 | 28 | M5×0.8 |
| ORV20 | | 50 | M4×0.7 Depth 7 | 35 | 24 | φ4.8 φ8 Counterbore, Depth 4.5 | 48 | 30 | 32 | Rc1/8 |
| ORV25 | | 60 | M5×0.8 Depth 9 | 40 | 26 | φ5.8 φ9.5 Counterbore, Depth 5.5 | 56 | 35 | 37 | Rc1/8 |
| ORV32 | | 80 | M6×1 Depth 11 | 50 | 32 | φ7 φ11 Counterbore, Depth 6.5 | 70 | 46 | 48 | Rc1/4 |
| ORV40 | | 100 | M6×1 Depth 12 | 60 | 40 | φ7 φ11 Counterbore, Depth 6.5 | 84 | 54 | 58 | Rc1/4 |
| ORV50 | | 120 | M8×1.25 Depth 16 | 70 | 48 | φ9 φ14 Counterbore, Depth 8.5 | 102 | 68 | 72 | Rc3/8 |

Optional Parts Dimensions (mm)

●M-type mount (M-ORV□)

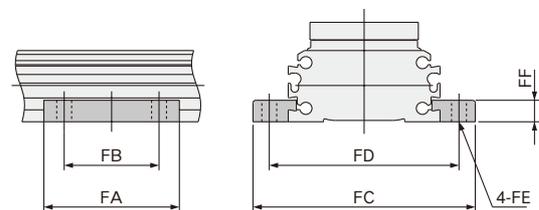


Note: Always remove the mount bumpers when using M-type mounts.

M-type mount

| Model | Code | MA | MB | MC | MD | ME | MF | MG | MH | MJ |
|-------|------|-----|-----|----|----|----|------------------|----|----|----|
| ORV16 | | 75 | 66 | 46 | 38 | 2 | M4×0.7 Depth 6 | 29 | 6 | 1 |
| ORV20 | | 94 | 85 | 51 | 42 | 2 | M4×0.7 Depth 7 | 33 | 7 | 1 |
| ORV25 | | 105 | 95 | 56 | 46 | 2 | M5×0.8 Depth 8 | 38 | 8 | 1 |
| ORV32 | | 150 | 138 | 70 | 58 | 3 | M6×1 Depth 11 | 49 | 11 | 1 |
| ORV40 | | 181 | 166 | 80 | 68 | 3 | M6×1 Depth 12 | 59 | 12 | 2 |
| ORV50 | | 205 | 188 | 94 | 78 | 3 | M8×1.25 Depth 15 | 73 | 15 | 2 |

●F-type support (F-ORV□)

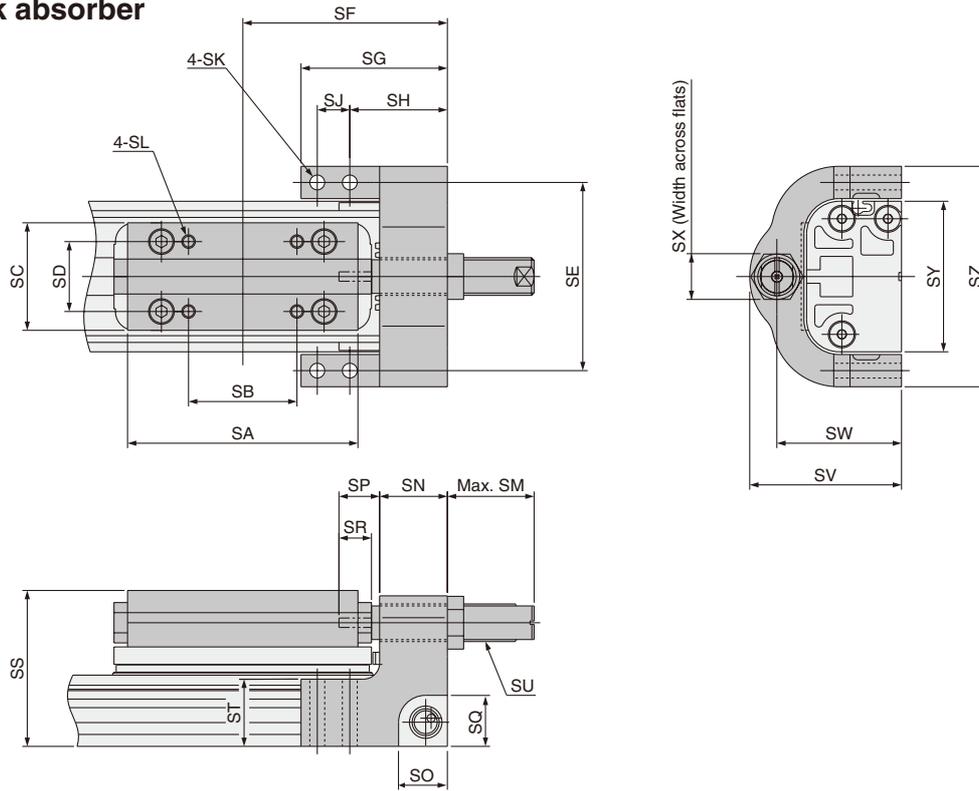


F-type support

| Model | Code | FA | FB | FC | FD | FE | FF |
|-------|------|----|----|-----|-----|------|-----|
| ORV16 | | 40 | 28 | 54 | 47 | φ3.4 | 5 |
| ORV20 | | 50 | 35 | 66 | 57 | φ4.5 | 6.3 |
| ORV25 | | 50 | 35 | 82 | 70 | φ5.5 | 8 |
| ORV32 | | 65 | 45 | 96 | 84 | φ6.6 | 8 |
| ORV40 | | 75 | 55 | 116 | 100 | φ9 | 10 |
| ORV50 | | 75 | 55 | 134 | 118 | φ9 | 10 |

Optional Dimensions (mm)

● With shock absorber



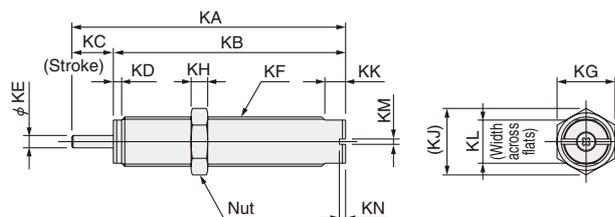
Note: For M-type mounts and F-type supports, see p.1063.

| Model | Code | SA | SB | SC | SD | SE | SF | SG | SH | SJ | SK | SL |
|-------|------|-----|----|----|----|-----|-----|----|----|----|------------------------------------|------------------|
| ORV16 | | 60 | 25 | 30 | 20 | 48 | 56 | 42 | 30 | 8 | φ 3.4 | M4×0.7 Depth 12 |
| ORV20 | | 78 | 30 | 35 | 24 | 57 | 68 | 48 | 35 | 8 | φ 4.5 | M4×0.7 Depth 12 |
| ORV25 | | 85 | 40 | 40 | 26 | 70 | 76 | 54 | 36 | 12 | φ 5.5 φ 9.5 Counterbore, Depth 5.5 | M5×0.8 Depth 14 |
| ORV32 | | 123 | 55 | 50 | 32 | 84 | 103 | 68 | 46 | 14 | φ 6.6 | M6×1 Depth 16 |
| ORV40 | | 150 | 75 | 60 | 40 | 100 | 121 | 74 | 48 | 18 | φ 6.6 φ 11 Counterbore, Depth 6.5 | M6×1 Depth 16 |
| ORV50 | | 167 | 88 | 70 | 48 | 118 | 138 | 90 | 62 | 17 | φ 9 | M8×1.25 Depth 18 |

| Model | Code | SM | SN | SO | SP | SQ | SR | SS | ST | SU | SV | SW | SX | SY | SZ |
|-------|------|------|------|----|------|------|----|-----|------|---------|-----|------|----|-----|-----|
| ORV16 | | 27.5 | 20 | 14 | 12.5 | 16.5 | 10 | 44 | 16 | M10×1 | 42 | 34.5 | 12 | 40 | 54 |
| ORV20 | | 30.5 | 22.5 | 17 | 13 | 17 | 10 | 50 | 18.5 | M12×1 | 48 | 39.5 | 14 | 48 | 66 |
| ORV25 | | 31.5 | 25 | 19 | 15.5 | 19 | 12 | 58 | 25 | M14×1.5 | 56 | 46 | 17 | 56 | 82 |
| ORV32 | | 37 | 31.5 | 24 | 19.5 | 25 | 16 | 74 | 28 | M18×1.5 | 72 | 59.5 | 21 | 70 | 96 |
| ORV40 | | 38.5 | 35 | 27 | 19.5 | 32 | 16 | 85 | 40 | M20×1.5 | 83 | 69 | 24 | 84 | 116 |
| ORV50 | | 54 | 42.5 | 31 | 28.5 | 39 | 25 | 103 | 44 | M22×1.5 | 101 | 85 | 27 | 102 | 134 |

Dimensions of Shock Absorber (mm)

● KSHJV Mounting thread size × Stroke

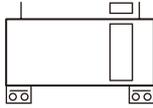


| Model | Code | KA | KB | KC | KD | KE | KF | KG | KH | KJ | KK | KL | KM | KN |
|------------------------|------|-----|-----|----|----|----|---------|----|----|------|----|------|-----|-----|
| KSHJV10×10 (For ORV16) | | 60 | 50 | 10 | 2 | 3 | M10×1 | 12 | 3 | 13.9 | 5 | 8.5 | 1.3 | 1.5 |
| KSHJV12×10 (For ORV20) | | 66 | 56 | 10 | 2 | 3 | M12×1 | 14 | 4 | 16.2 | 5 | 10.5 | 1.3 | 1.5 |
| KSHJV14×12 (For ORV25) | | 72 | 60 | 12 | 2 | 4 | M14×1.5 | 17 | 5 | 19.6 | 5 | 12 | 1.3 | 1.5 |
| KSHJV18×16 (For ORV32) | | 88 | 72 | 16 | 3 | 5 | M18×1.5 | 21 | 8 | 24.2 | 7 | 15 | 1.8 | 2 |
| KSHJV20×16 (For ORV40) | | 93 | 77 | 16 | 3 | 5 | M20×1.5 | 24 | 8 | 27.7 | 7 | 17 | 1.8 | 2 |
| KSHJV22×25 (For ORV50) | | 125 | 100 | 25 | 3 | 6 | M22×1.5 | 27 | 9 | 31.2 | 10 | 19 | 1.8 | 2 |

SENSOR SWITCHES

Solid State Type, Reed Switch Type

Symbol



Order Codes



-ORV

Lead wire length

A : 1000mm [39in.]

B : 3000mm [118in.]

Sensor switch model

ZE135 : Solid state type with indicator lamp DC10V~28V Horizontal lead wire

ZE101 : Reed switch type without indicator lamp DC5V~28V Horizontal lead wire
AC85~115V

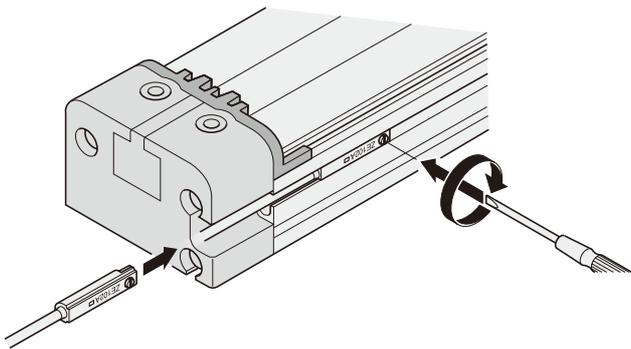
ZE155 : Solid state type with indicator lamp DC4.5V~28V Horizontal lead wire

ZE102 : Reed switch type with indicator lamp DC10V~28V Horizontal lead wire
AC85~115V

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

Moving Sensor Switch

Loosening the mounting screw allows the sensor switch to be moved along the switch mounting groove on the barrel. In addition, the lead wires can be inserted into the groove of the end cap.

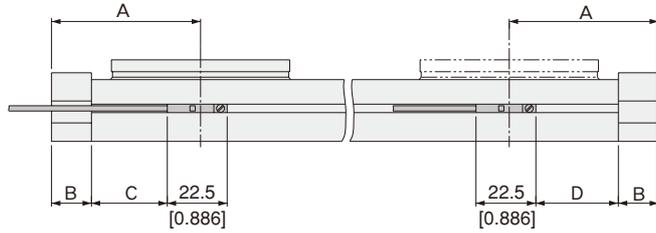


● Tighten the mounting screw with a tightening torque of 20~30N·cm [1.8~2.7in·lbf].

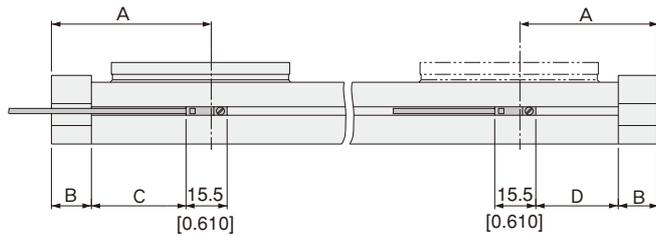
Mounting Location of End of Stroke Detection Sensor Switch

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.

● Reed switch type (ZE101, ZE102)



● Solid state type (ZE135, ZE155)



● Reed switch type (ZE101, ZE102)

mm [in.]

| Model | A | B | C | D |
|-------|------------|-----------|--------------|-----------|
| ORV16 | 56 [2.20] | 15 [0.59] | 28.5 [1.122] | 31 [1.22] |
| ORV20 | 68 [2.68] | 17 [0.67] | 38.5 [1.516] | 41 [1.61] |
| ORV25 | 76 [2.99] | 19 [0.75] | 44.5 [1.752] | 47 [1.85] |
| ORV32 | 103 [4.06] | 24 [0.94] | 66.5 [2.618] | 69 [2.72] |
| ORV40 | 121 [4.76] | 26 [1.02] | 82.5 [3.248] | 85 [3.35] |
| ORV50 | 138 [5.43] | 31 [1.22] | 94.5 [3.720] | 97 [3.82] |

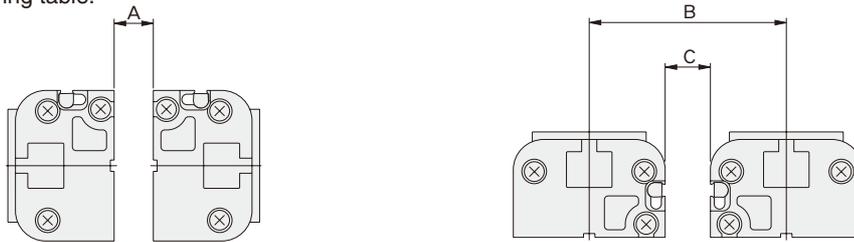
● Solid state type (ZE135, ZE155)

mm [in.]

| Model | A | B | C | D |
|-------|------------|-----------|--------------|------------|
| ORV16 | 56 [2.20] | 15 [0.59] | 31.5 [1.240] | 35 [1.38] |
| ORV20 | 68 [2.68] | 17 [0.67] | 41.5 [1.634] | 45 [1.77] |
| ORV25 | 76 [2.99] | 19 [0.75] | 47.5 [1.870] | 51 [2.01] |
| ORV32 | 103 [4.06] | 24 [0.94] | 69.5 [2.736] | 73 [2.87] |
| ORV40 | 121 [4.76] | 26 [1.02] | 85.5 [3.366] | 89 [3.50] |
| ORV50 | 138 [5.43] | 31 [1.22] | 97.5 [3.839] | 101 [3.98] |

When Mounting ORV Series with Sensor Switches in Close Proximity

When mounting the ORV series with sensor switches in close proximity, install the cylinders so that they should not be below the values shown in the following table.



mm [in.]

| Code | type | Model | ORV16 | ORV20 | ORV25 | ORV32 | ORV40 | ORV50 |
|------|------------------|-------|-----------|-----------|-----------|-----------|------------|------------|
| A | Solid state type | | 0 | 0 | 0 | 0 | 0 | 0 |
| | Reed switch type | | 0 | 0 | 0 | 0 | 0 | 0 |
| B | Solid state type | | 44 [1.73] | 52 [2.05] | 61 [2.40] | 77 [3.03] | 91 [3.58] | 111 [4.37] |
| | Reed switch type | | 49 [1.93] | 58 [2.28] | 69 [2.72] | 86 [3.39] | 102 [4.02] | 119 [4.69] |
| C | Solid state type | | 4 [0.16] | 4 [0.16] | 5 [0.20] | 7 [0.28] | 7 [0.28] | 9 [0.35] |
| | Reed switch type | | 9 [0.35] | 10 [0.39] | 13 [0.51] | 16 [0.63] | 16 [0.63] | 17 [0.67] |