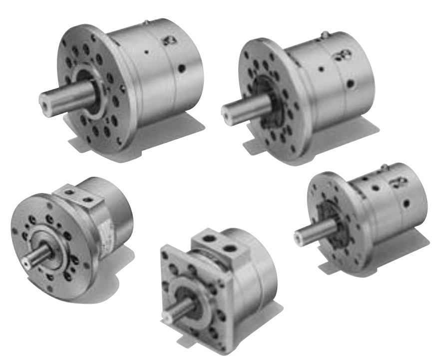
# Vane type actuators with max. working pressure of 7 MPa

- Single vane and double vane type rotary actuators are standardized.
- Available the cushion model.
- The shaft parallel key (single key) .



## Specifications: Standard type

| Model \ Item | Vane type | Rotating angle | Port size | Internal volume cm³ | nternal leakage rate cm³ /min (at 40℃) | Allowable inertia energy J | Allowable load: Radial load | Allowable load: Thrust load | Weight kg | Rema-rks |
|---|---|---|---|---|---|---|---|---|---|---|
| 70RV 10 | Single | $270^{\circ}\,{}^{+3}_{0}$ | Rc1/8 | 10 | 10 | 0.013 | 9.81 | 4.90 | 1 | Standard |
| | Double | $90^{\circ}\,{}^{+3}_{0}$ | | 6.5 | 20 | | | | | |
| 70RV 15 | Single | $270^{\circ}\,{}^{+3}_{0}$ | Rc1/8 | 17 | 15 | 0.025 | 19.6 | 9.81 | 2 | |
| | Double | $90^{\circ}\,{}^{+3}_{0}$ | | 11 | 30 | | | | | |
| 70RV 20 | Single | $270^{\circ}\,{}^{+3}_{0}$ | Rc1/8 | 24 | 20 | 0.046 | 49.0 | 24.5 | 3 | |
| | Double | $90^{\circ}\,{}^{+3}_{0}$ | | 16 | 40 | | | | | |
| 70RV 30 | Single | $270^{\circ}\,{}^{+3}_{0}$ | Rc1/8 | 51 | 30 | 0.088 | 78.5 | 39.2 | 4.3 | |
| | Double | $90^{\circ}\,{}^{+3}_{0}$ | | 34 | 60 | | | | 4.5 | |
| 70RV 100 | Single | $270^{\circ}\,{}^{+3}_{0}$ | Rc1/4 | 111 | 50 | 0.255 | 147 | 68.6 | 10.2 | |
| | Double | $90^{\circ}\,{}^{+3}_{0}$ | | 74 | 100 | | | | 10.4 | |
| 70RV 200 | Single | $270^{\circ}\,{}^{+3}_{0}$ | Rc3/8 | 221 | 100 | 0.510 | 294 | 137 | 20.0 | Order made |
| | Double | $90^{\circ}\,{}^{+3}_{0}$ | | 147 | 200 | | | | 20.5 | |
| 70RV 400 | Single | $270^{\circ}\,{}^{+3}_{0}$ | Rc3/8 | 435 | 100 | 0.755 | 343 | 167 | 32 | |
| | Double | $90^{\circ}\,{}^{+3}_{0}$ | | 290 | 200 | | | | 33 | |
| 70RV 700 | Single | $270^{\circ}\,{}^{+3}_{0}$ | Rc1/2 | 780 | 100 | 0.912 | 343 | 167 | 41 | |
| | Double | $90^{\circ}\,{}^{+3}_{0}$ | | 520 | 200 | | | | 43 | |

## Common conditions

- Adaptable fluids: Petroleum-based fluid (When using another fluid, specify the fluid.) Recommended fluid: ISO VG32 to 56 (ISO viscosity grade)
- Nominal pressure: 7 MPa
- Minimum operating pressure: 1 MPa
- Proof test pressure: 10.5 MPa
- Hydraulic fluid temperature: 0 to +60℃ (No freezing)
- Use the actuators indoors.
- Do not use them in a place where they are exposed to considerable dust or vibration.

Notes) ● For the internal structure, refer to the sectional drawings at the end of this catalog.
● The hydraulic pressure generated in an actuator due to the inertia of load must be lower than the proof test pressure.

## Adaptability of Fluid

| Adaptable fluid | | | | |
|---|---|---|---|---|
| Petroleum-based fluid | Water-glycol fluid | Phosphate ester fluid | Water in oil fluid | Oil in water fluid |
| ○ | ○ | × | × | × |





## Specifications: With cushion

| Model \ Item | Vane type | Rotating angle | Port size | Internal volume cm³ | nternal leakage rate cm³ /min (at 40℃) | Allowable load: Radial load | Allowable load: Thrust load | Weight kg |
|---|---|---|---|---|---|---|---|---|
| 70RV 10 | Single | $180^{\circ}\,{}^{+3}_{0}$ | Rc1/8 | 6.5 | 10 | 9.81 | 4.90 | 1.2 |
| | | $90^{\circ}\,{}^{+3}_{0}$ | | 3.3 | | | | |
| 70RV 15 | Single | $180^{\circ}\,{}^{+3}_{0}$ | Rc1/8 | 11 | 15 | 19.6 | 9.81 | 2.4 |
| | | $90^{\circ}\,{}^{+3}_{0}$ | | 5.5 | | | | |
| 70RV 20 | Single | $180^{\circ}\,{}^{+3}_{0}$ | Rc1/8 | 16 | 20 | 49.0 | 24.5 | 3.3 |
| | | $90^{\circ}\,{}^{+3}_{0}$ | | 8 | | | | |
| 70RV 30 | Single | $180^{\circ}\,{}^{+3}_{0}$ | Rc1/8 | 34 | 30 | 78.5 | 39.2 | 4.7 |
| | | $90^{\circ}\,{}^{+3}_{0}$ | | 17 | | | | 4.8 |
| 70RV 100 | Single | $180^{\circ}\,{}^{+3}_{0}$ | Rc1/4 | 74 | 50 | 147 | 68.6 | 13.5 |
| | | $90^{\circ}\,{}^{+3}_{0}$ | | 37 | | | | 13.8 |
| 70RV 200 | Single | $180^{\circ}\,{}^{+3}_{0}$ | Rc3/8 | 147 | 100 | 294 | 137 | 25.7 |
| | | $90^{\circ}\,{}^{+3}_{0}$ | | 73.5 | | | | 26.4 |
| 70RV 400 | Single | $180^{\circ}\,{}^{+3}_{0}$ | Rc3/8 | 290 | 100 | 343 | 167 | 34 |
| | | $90^{\circ}\,{}^{+3}_{0}$ | | 145 | | | | 35 |
| 70RV 700 | Single | $180^{\circ}\,{}^{+3}_{0}$ | Rc1/2 | 520 | 100 | 343 | 167 | 44 |
| | | $90^{\circ}\,{}^{+3}_{0}$ | | 260 | | | | 46 |

## Cushion Specifications

| Model \ Item | Max. inertia moment kg·m² | Max. inrush angular speed rad/s | Cushion angle rad | Max. absorbed energy (Working pressure MPa) 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|
| 70RV 10 | 0.098 | 10.4 | 0.349(20°) | 2.06 | 1.77 | 1.47 | 1.18 | 0.883 | 0.588 |
| 70RV 15 | 0.196 | 10.4 | 0.436(25°) | 4.81 | 4.12 | 3.43 | 2.75 | 2.06 | 1.37 |
| 70RV 20 | 0.294 | 10.4 | 0.436(25°) | 7.55 | 6.47 | 5.39 | 4.31 | 3.24 | 2.16 |
| 70RV 30 | 0.588 | 10.4 | 0.436(25°) | 15.1 | 12.9 | 10.8 | 8.63 | 6.47 | 4.31 |
| 70RV 100 | 1.47 | 8.7 | 0.436(25°) | 30.9 | 26.5 | 22.1 | 17.7 | 13.2 | 8.83 |
| 70RV 200 | 3.92 | 6.9 | 0.436(25°) | 78.9 | 67.7 | 56.4 | 45.1 | 33.8 | 22.6 |
| 70RV 400 | 6.86 | 5.2 | 0.436(25°) | 137 | 118 | 98.1 | 78.5 | 58.8 | 39.2 |
| 70RV 700 | 13.7 | 4.3 | 0.436(25°) | 251 | 215 | 179 | 143 | 107 | 71.6 |

Note) From the viewpoint of the torque efficiency, the working pressure should be 2 MPa or more. If the actuator is used at a pressure of less than 2 MPa for unavoidable reasons, the max. absorbed energy is the same as that at a working pressure of 2 MPa.

## ● How to order

### General Purpose Type

❶ Model ❷ Type ❸ Vane type ❹ Cushion ❺ Rotating angle

- ● Standard type: 70RV 10 S — 270
- ● With cushion: 70RV 10 S C — 180

**❷ Type**

Standard type
10·15·20·30·100·200·400·700

**❸ Vane type**

| | |
|---|---|
| S | Single vane |
| D | Double vane |

**❺ Rotating angle**

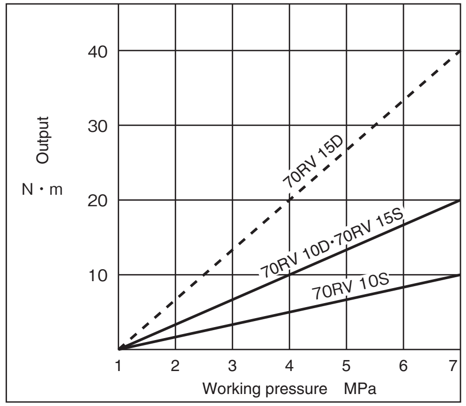
| | |
|---|---|
| Standard type | |
| 270 | 270° (only single vane type) |
| 90 | 90° (only double vane type) |
| With cushion | |
| 90 | 90° |
| 180 | 180° |



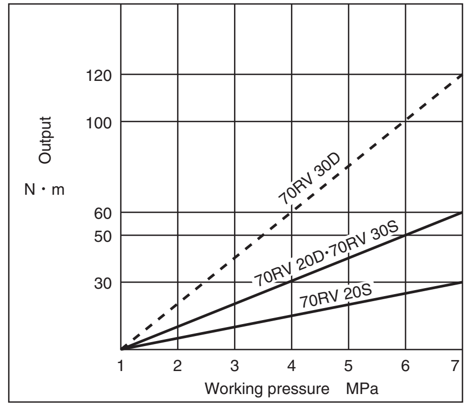
### Output Characteristic Charts (Theoretical torque)

1MPa=10.2kgf/cm2
10N·m=1.02kgf·m

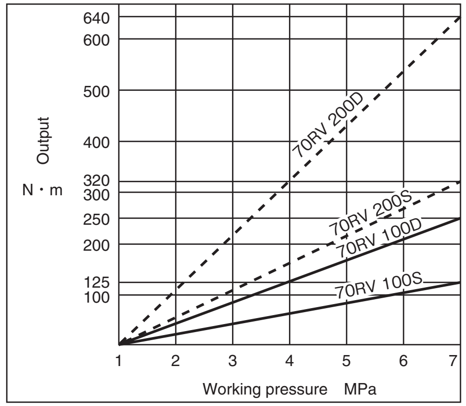
70RV 10·15



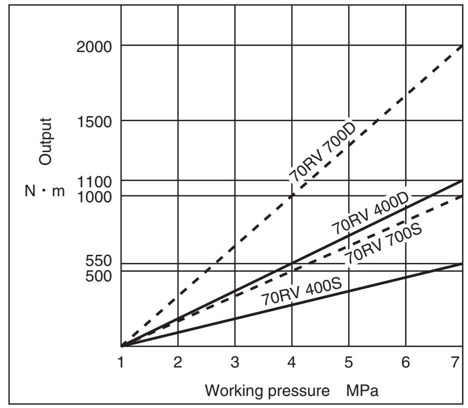

70RV 20·30




70RV 100·200




70RV 400·700




● These charts are common to the standard type and the type with cushion.

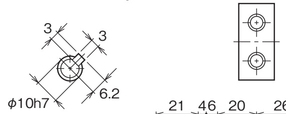
Unit: mm

CAD/DATA 70RV/T70RV Bore is available.

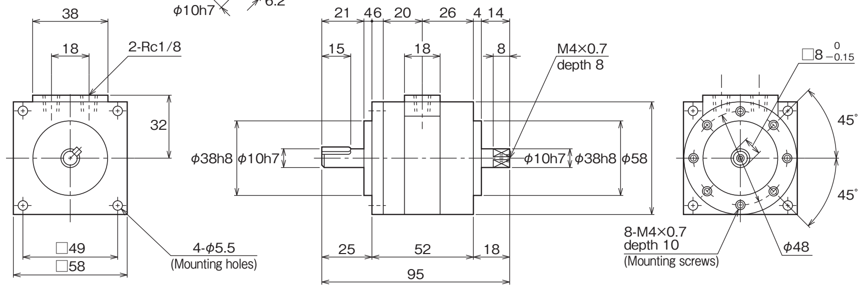
## 70RV 10 ＊－＊

Vane type
S: Single
D: Double
Rotating angle
270° (only single vane type)
90° (only double vane type)

Dimensions of key



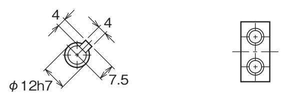

- The tolerances of the dimensions of the key conform to JIS B1301.



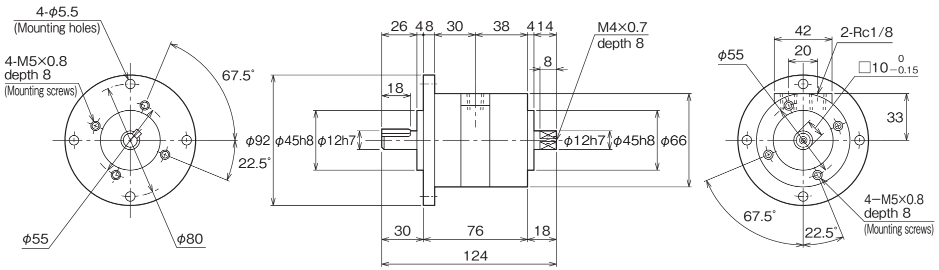

## 70RV 15 ＊－＊

Vane type
S: Single
D: Double
Rotating angle
270° (only single vane type)
90° (only double vane type)

Dimensions of key



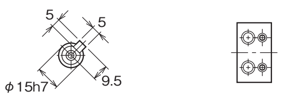

- The tolerances of the dimensions of the key conform to JIS B1301.



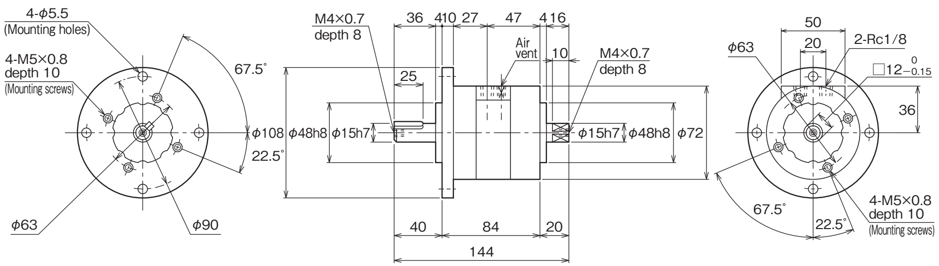

## 70RV 20 ＊－＊

Vane type
S: Single
D: Double
Rotating angle
270° (only single vane type)
90° (only double vane type)

Dimensions of key




- The tolerances of the dimensions of the key conform to JIS B1301.





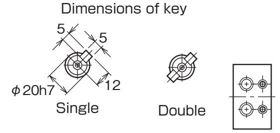
Unit: mm


CAD/DATA 70RV/T70RV Bore is available.

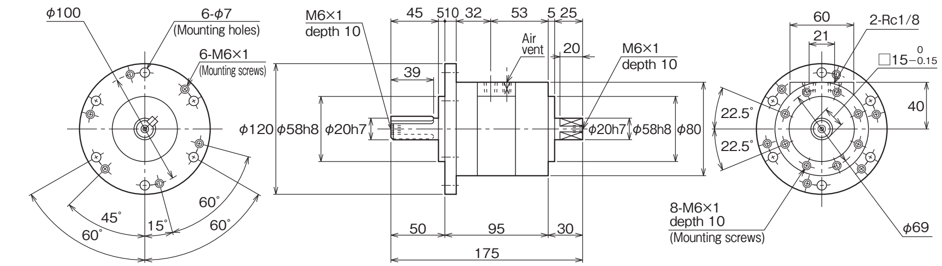
## 70RV 30 ＊－＊

Vane type
S: Single
D: Double
Rotating angle
270° (only single vane type)
90° (only double vane type)

Dimensions of key



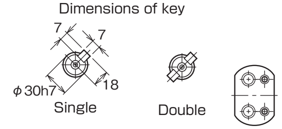

- The tolerances of the dimensions of the key conform to JIS B1301.
- The double vane type rotary actuator is provided with two parallel keys.



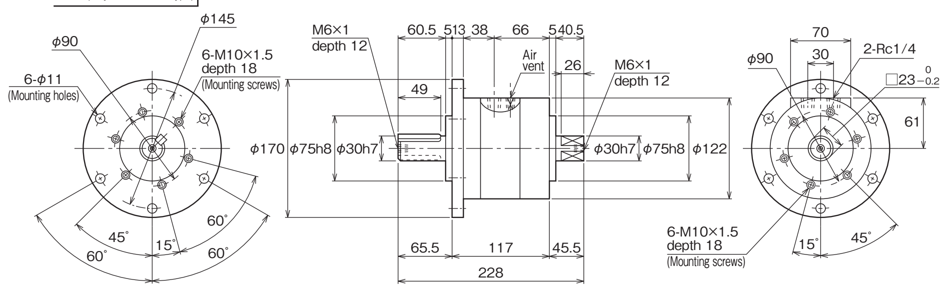

## 70RV 100 ＊－＊

Vane type
S: Single
D: Double
Rotating angle
270° (only single vane type)
90° (only double vane type)

Dimensions of key



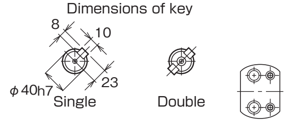

- The tolerances of the dimensions of the key conform to JIS B1301.
- The double vane type rotary actuator is provided with two parallel keys.



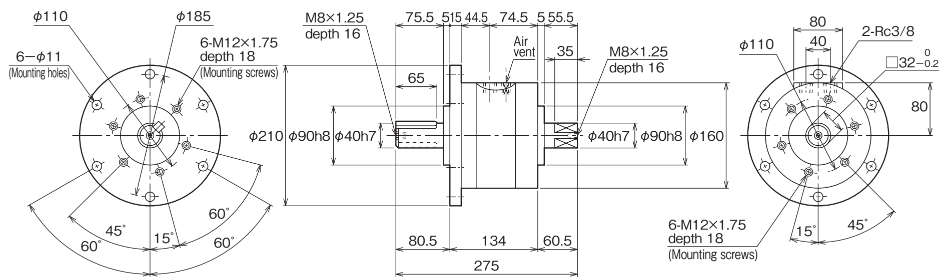

## 70RV 200 ＊－＊

Vane type
S: Single
D: Double
Rotating angle
270° (only single vane type)
90° (only double vane type)

Dimensions of key




- The tolerances of the dimensions of the key conform to JIS B1301.
- The double vane type rotary actuator is provided with two parallel keys.



# 7 MPa Vane Type Rotary Actuator Standard Type

Unit: mm

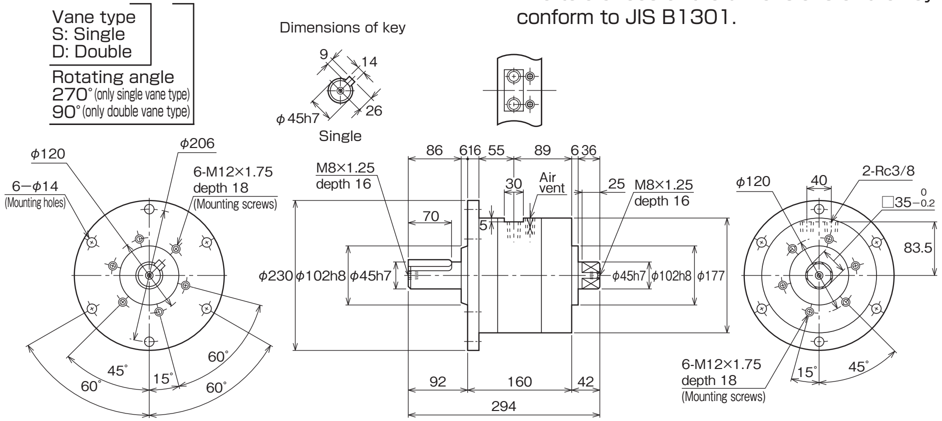
CAD/DATA 70RV/T70RV Bore is available.

## 70RV 400 *–*

Vane type
S: Single
D: Double

Rotating angle
270° (only single vane type)
90° (only double vane type)

● The tolerances of the dimensions of the key conform to JIS B1301.

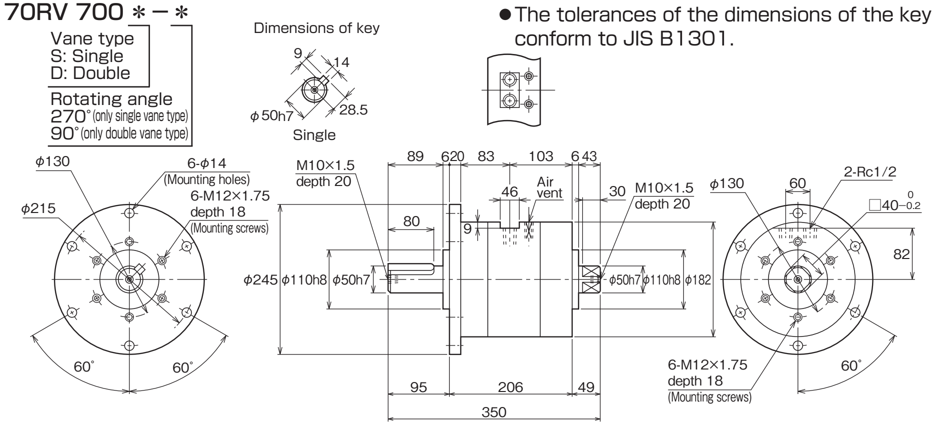



## 70RV 700 *–*

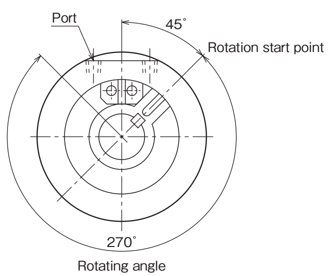
Vane type
S: Single
D: Double

Rotating angle
270° (only single vane type)
90° (only double vane type)

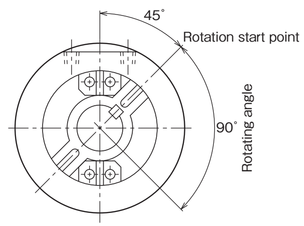
● The tolerances of the dimensions of the key conform to JIS B1301.




## Rotation start point and rotating angle viewed from the front: Standard type




When the rotating angle is 270°




When the rotating angle is 90°

● The position at 45° from the port (position of the parallel key) is the rotation start point.





# 7 MPa Vane Type Rotary Actuator With Cushion

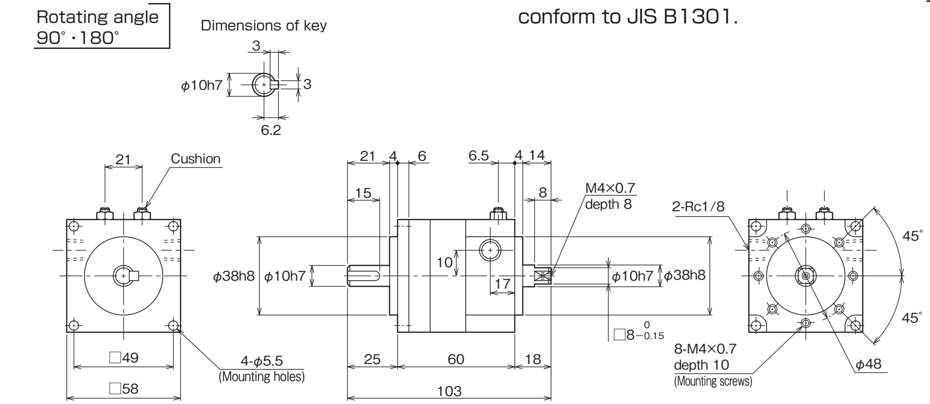
Unit: mm

CAD/DATA 70RV/T70RV Bore is available.

## 70RV 10SC *

Rotating angle
90°・180°

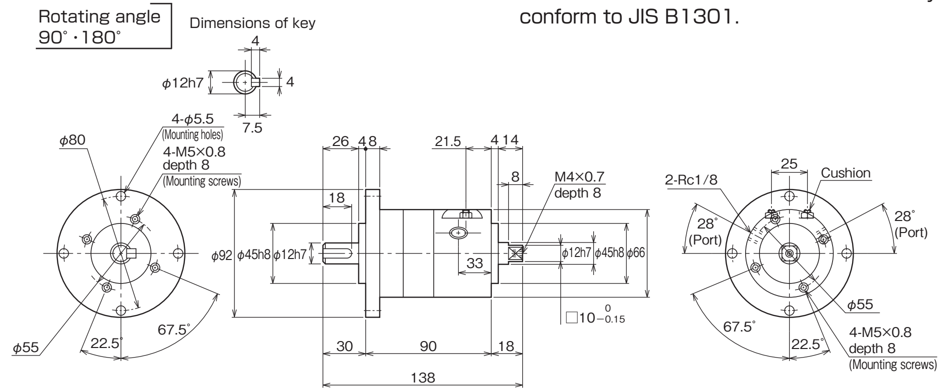
● The tolerances of the dimensions of the key conform to JIS B1301.




## 70RV 15SC *

Rotating angle
90°・180°

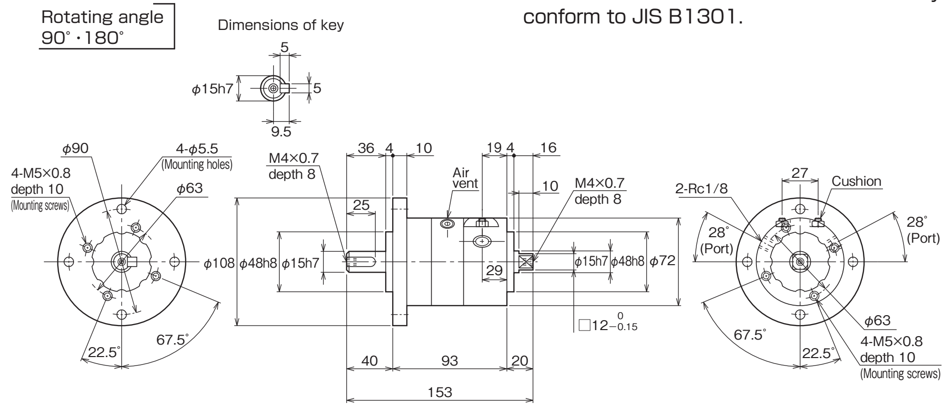
● The tolerances of the dimensions of the key conform to JIS B1301.




## 70RV 20SC *

Rotating angle
90°・180°

● The tolerances of the dimensions of the key conform to JIS B1301.



# 7 MPa Vane Type Rotary Actuator With Cushion

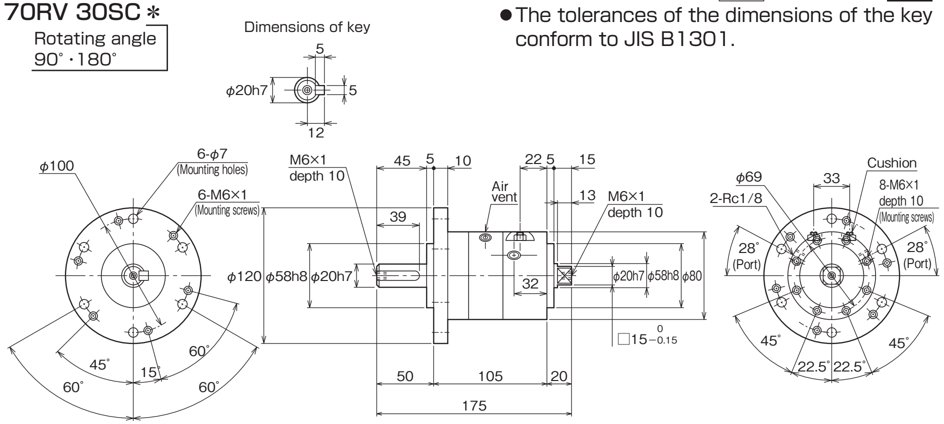
Unit: mm

CAD/DATA 70RV/T70RVC Bore is available.

## 70RV 30SC＊

Rotating angle
90°・180°

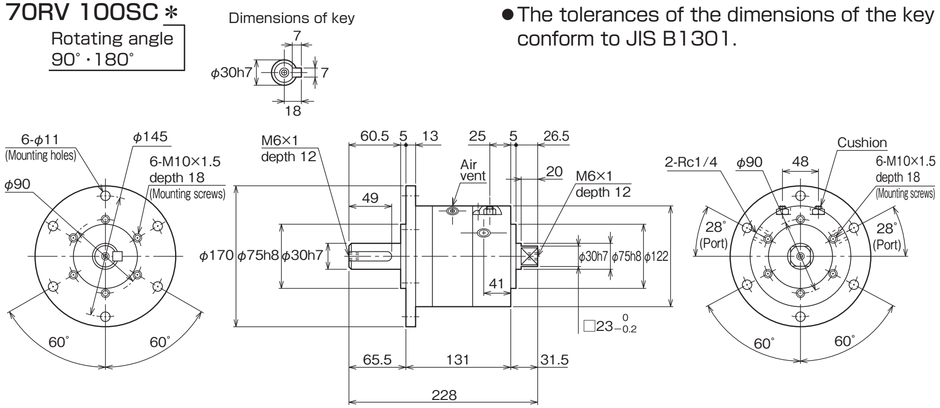
● The tolerances of the dimensions of the key conform to JIS B1301.




## 70RV 100SC＊

Rotating angle
90°・180°

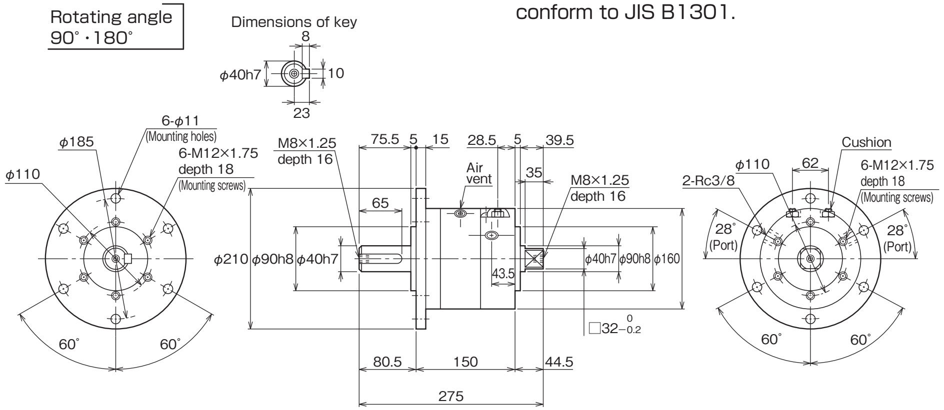
● The tolerances of the dimensions of the key conform to JIS B1301.




## 70RV 200SC＊

Rotating angle
90°・180°

● The tolerances of the dimensions of the key conform to JIS B1301.



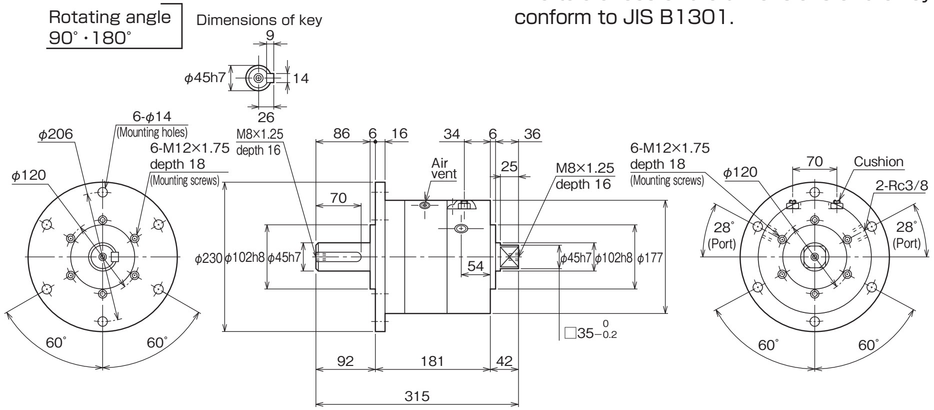



CAD/DATA 70RV/T70RVC Bore is available.

## 70RV 400SC＊

Rotating angle
90°・180°

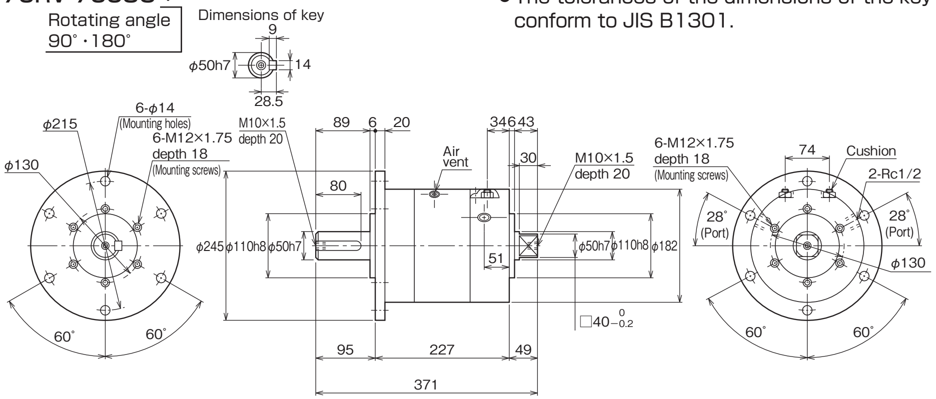
● The tolerances of the dimensions of the key conform to JIS B1301.



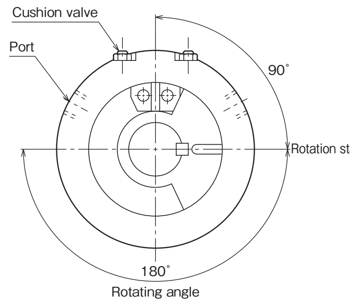

## 70RV 700SC＊

Rotating angle
90°・180°

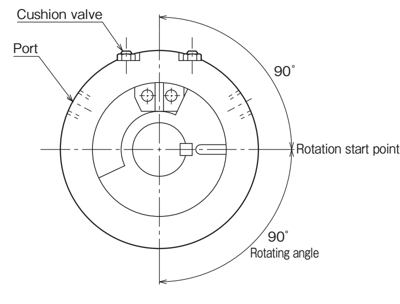
● The tolerances of the dimensions of the key conform to JIS B1301.




## Rotation start point and rotating angle viewed from the front: With cushion




When the rotating angle is 180°




When the rotating angle is 90°

● The position at 90° from the cushion valve (position of the parallel key) is the rotation start point.


70RV Rotary Actuators

## 1. Selection of size

**To obtain simple static force for clamping, etc.**

①Determine the working pressure. P(MPa)
②Determine the required force. F(N)
③Determine the arm length from the rotary actuator. L(m)

→ Calculation of required torque
$T_S$=F×L(N·m)

→ Determine the rotary actuator size which ensures $T_S \leq T_H$ from the output characteristic charts.
$T_H$: effective torque of rotary actuator

**To move a load**

Resistance load

When frictional force, gravity or other external force (resistance force) is applied
①Determine the working pressure. P(MPa)
②Determine the required force. $F_R$(N)
③Determine the arm length from the rotary actuator. L(m)

→ Calculation of resistance torque
$T_R$=K×$F_R$×L(N·m)
K: allowance coefficient
When the load does not fluctuate: K=2
When the load fluctuates: K=3
(When the resistant moment caused by gravity acts)
If K is less than 3 when the load fluctuates, the angular speed will significantly change.

↓

Inertia load

To rotate an article
①Determine the rotating angle, rotating time and working pressure.
Rotating angle θ(rad)
Rotating time t(s)
Working pressure P(MPa)
90°=1.5708 rad
180°=3.1416 rad
270°=4.7124 rad
②Calculate the inertia moment of the load from the shape and weight of the load. For the calculation formula, see the Inertia Moment Calculation Table.
I(kg·m²)
③Calculate the average angular acceleration.

$\alpha=\frac{\theta}{t^2}$ (rad/s²)

θ: rotating angle (rad)
t: rotating time (s)

Note) In the case that the cushion is equipped, use the angle (θc) before entry to the cushion stroke as the rotating angle θ, and use the time (tc) before entry to the cushion stroke as the rotating time t.
θc=rotating angle (θ)−cushion angle (θt)

$\alpha=\frac{\theta c}{tc^2}$ (rad/s²)

→ Calculation of accelerating torque
$T_A$=5×I×α(N·m)
$T_A$ is the torque required to accelerate the inertia load to a certain speed.

↑

Required torque T=$T_R$+$T_A$

→ Determine the size of the rotary actuator which ensures $T \leq T_H$ from the output characteristic charts.
$T_H$: effective torque of rotary actuator





## 2. Check of allowable inertia energy

In the case of inertia load, keep the load inertia energy lower than the allowable inertia energy of the rotary actuator.
①Calculation of average angular speed $\omega=\frac{\theta}{t}$ (rad/s)
θ: rotating angle (rad) t=rotating time (s)
②Calculate the impact angular speed $\omega_0$
$\omega_0$=1.2ω(rad/s)
③Calculation of load inertia energy
E=1/2I$\omega_0^2$(J)
I: load inertia moment (kg·m²)
④Make sure that the load inertia energy E is less than the allowable inertia energy of the rotary actuator.
If E exceeds the allowable inertia energy, select a larger rotary actuator or a rotary actuator with cushion.

## 3. Confirmation of cushion performance (in the case of rotary actuator with cushion)

Determine the inertia moment I from the shape and weight of the load, and make sure that the inertia moment is within the load range. I≦Imax I(kg·m²)

↓

Make sure that the impact angular speed for rushing into the cushion is less than the max. impact angular speed.

$\omega=\frac{\theta c}{tc}$ (rad/s)

$\omega_0$≒1.2ω(rad/s) $\omega_0$≦ωmax

θc: angle before entry to cushion stroke (rad)
tc: time before entry to cushion stroke (s)
ω : average angular speed (rad/s)
$\omega_0$: impact angular speed (rad/s)

↓

Determine the impact energy from the load inertia moment and impact angular speed.
$E_1$=½I$\omega_0^2$(J) I=inertia moment (kg·m²) $\omega_0$=impact angular speed (rad/s)

↓

Determine the energy of external force applied during cushion stroke.
$E_2$=(Mg+Mf)θt(J) $E_2$: energy of external force
Mg: gravity moment caused by unbalanced load (N·m)
Mg=L×Fg Fg: force caused by load gravity (N)
In the case of a balanced load or motion on a horizontal surface, Mg=0.
Mf: moment generated by other thrust forces (for example, when the cylinder force acts) (N·m)
Mf=L×Ff Ff: thrust force (N)
When there are no other thrust forces, Mf=0.
θt: cushion angle (rad)

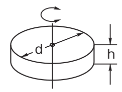
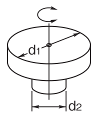
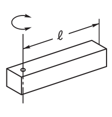
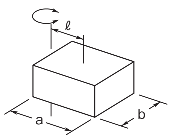
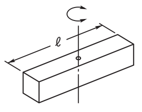
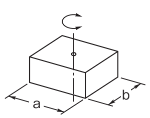
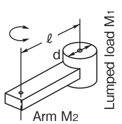
↓

Make sure that $E_1$+$E_2$ is less than the max. absorbed energy.

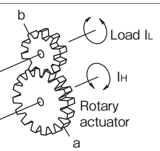
↓

When all requirements stated above are met, the rotary actuator is acceptable. If any of them is not met, the rotary actuator cannot be used.
A shock absorber with higher absorbing performance is necessary.
See "TAIYO General Catalog of Shock Absorbers".

## Inertia Moment Calculation Table

| Shape | Sketch | Requirements | Inertia moment I(kg·m²) | Radius of rotation $K_1^2$ | Remarks |
|---|---|---|---|---|---|
| Disc |  | Diameter d(m)<br>Weight M(kg) | $I=M\cdot\frac{d^2}{8}$ | $\frac{d^2}{8}$ | |
| Stepped disc |  | Diameter $d_1$(m)<br>$d_2$(m)<br>Weight Part $d_1$ $M_1$(kg)<br>Part $d_2$ $M_2$(kg) | $I=M_1\cdot\frac{d_1^2}{8}+M_2\cdot\frac{d_2^2}{8}$ | | When part $d_2$ is significantly small as compared to part $d_1$, it is allowed to ignore $d_2$. |
| Bar (rotation center at end) |  | Length of bar ℓ(m)<br>Weight M(kg) | $I=M\cdot\frac{\ell^2}{3}$ | $\frac{\ell^2}{3}$ | When the width of the bar is 30% or more of the length (ℓ), regard the bar as a rectangular solid. |
| Rectangular solid |  | Length of side a(m)<br>b(m)<br>Distance to center of gravity ℓ(m)<br>Weight M(kg) | $I=M(\ell^2+\frac{a^2+b^2}{12})$ | $\ell^2+\frac{a^2+b^2}{12}$ | |
| Bar (rotation center at center) |  | Length of bar ℓ(m)<br>Weight M(kg) | $I=M\cdot\frac{\ell^2}{12}$ | $\frac{\ell^2}{12}$ | When the width of the bar is 30% or more of the length (ℓ), regard the bar as a rectangular solid. |
| Rectangular solid |  | Length of side a(m)<br>b(m)<br>Weight M(kg) | $I=M\cdot\frac{a^2+b^2}{12}$ | $\frac{a^2+b^2}{12}$ | |
| Lumped load |  | Shape of lumped load: Disc<br>Diameter of disc d(m)<br>Length of arm ℓ(m)<br>Weight of lumped load $M_1$(kg)<br>Weight of arm $M_2$(kg) | $I=M_1\cdot\ell^2+M_1\cdot K_1^2+M_2\cdot\frac{\ell^2}{3}$<br>In case of disc $K_1^2=\frac{d^2}{8}$ | For other shapes, see $K_1^2$ shown above. | When $M_2$ is significantly small as compared to $M_1$, it is allowed to consider $M_2$ to be 0. |

### Method of converting load $J_L$ to the load around the rotary actuator axis when a gear is used

| | | | | | |
|---|---|---|---|---|---|
| Gear |  | No. of teeth<br>Rotary actuator side a<br>Load side b<br>Inertia moment of load $I_L$(kg·m²) | Inertia moment of load around rotary actuator axis<br>$I_H=(\frac{a}{b})^2 I_L$ | | When the gear is larger, the inertia moment of the gear must be taken into consideration. |

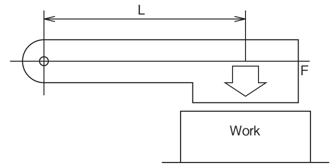




### Example of selection of vane type rotary actuator

**1. To use for a clamp**

- Length of arm L=0.2m
- Clamp force F=500N
- Working pressure P=7MPa




To use for a clamp

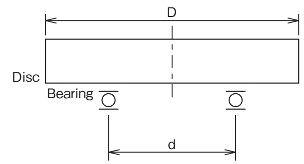
<Selection of size>

Static torque $T_S$=

According to the Output Characteristic Charts (Theoretical torque), the rotary actuator 70RV-30D or larger model can be used.

**2. To rotate a circular table**

- Weight of table M=50kg
- Diameter of table D=1m
- Center diameter of plain bearing d =0.3m
- Friction coefficient of plain bearing $\mu$ =0.05
- Rotating angle $\theta$ =180°
- Rotating time t =3s
- Working pressure t =7MPa




To rotate a circular table

<Selection of size>

①Determine the resistance torque $T_R$.

$T_R=K\times F_R\times L$

Consider that the allowance coefficient K is 2.

Resistance force $F_R=\mu\times M=0.05\times 50\times 9.8=24.5$(N)

Therefore, $T_R=2\times 24.5\times 0.3/2=7.35$(N·m)

②Determine the accelerating torque $T_A$.

$T_A=5\times I\times\alpha$(N·m)

Inertia moment I(kg·m²)

Since the load has the shape of a disc,

$I=M\cdot D^2/8=50\times 1^2/8=6.25$(kg·m²)

Calculation of angular acceleration $\alpha$(rad/s²)

$\alpha=\theta/t^2=3.1416/3^2=0.35$(rad/s²)

$T_A=5\times 6.25\times 0.35=10.94$(N·m)

③Determine the required torque T.

$T=T_R+T_A=7.35+10.94=18.29$(N·m)

According to the Output Characteristic Charts (Theoretical torque), the rotary actuator 70RV-15S or larger model can be used.

<Check of allowable inertia energy>

①To stop with the stopper in the rotary actuator

Calculation of average angular speed

$\omega=\theta/t=3.141/3=1.05$(rad/s)

Calculation of impact angular speed $\omega_0$

$\omega_0=1.2\omega=1.2\times 1.05=1.26$(rad/s)

Calculation of load inertia energy E

$E=1/2I\omega_0^2=1/2\times 6.25\times 1.26^2=4.96$(J)

Judging from the allowable inertia energy, there is no usable rotary actuator.

②To use a cushion

Judging from the max. absorbed energy and max. inertia moment, the rotary actuator 70RV-200SC or larger model can be used.

<Selection of size based on torque and allowable inertia energy>

Use 70RV-100SC, and rotate the load only by the rotary actuator.

<Check of rotating time, radial load and thrust load>

Rotating time: 3 sec

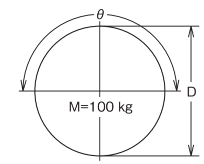
Radial load: 0 kg

Thrust load: 0 kg (because of use of a bearing)

Therefore, the rotary actuator 70RV-200SC or larger model can be used.

**3. To rotate a disc**

- Weight of disc M=100kg
- Diameter of disc D=0.5m
- Rotating angle $\theta$ =180°
- Rotating time t =5s
- Working pressure P =7MPa




To rotate a disc

<Selection of size>

①Determine the resistance torque $T_R$.

Since no external force acts on the disc, the resistance torque $T_R$ is 0.

②Determine the accelerating torque $T_A$.
$T_A=5\times I\times\alpha$ (N·m)
Calculation of inertia moment I(kg·m²)
Since the load has the shape of a disc,
$I=M\cdot D^2/8=100\times0.5^2/8=3.13$ (kg·m²)
Calculation of angular acceleration $\alpha$ (rad/s²)
$\alpha=\theta/t^2=3.1416/5^2=0.13$ (rad/s²)
$T_A=5\times3.13\times0.13=2.03$ (N·m)
③Determine the required torque T.
$T=T_R+T_A=0+2.03=2.03$ (N·m)
According to the Output Characteristic Charts (Theoretical torque),
the rotary actuator 70RV-10S or larger model can be used.

<Check of allowable energy>
①To stop with the stopper in the rotary actuator
Calculation of average angular speed
$\omega=\theta/t=3.1416/5=0.63$ (rad/s)
Calculation of impact angular speed $\omega_0$
$\omega_0=1.2\omega=1.2\times0.63=0.76$ (rad/s)
Calculation of load inertia energy E
$E=1/2I\omega_0^2=1/2\times3.13\times0.76^2=0.90$ (J)
Judging from the allowable inertia energy, the rotary actuator 70RV-700S or larger model can be used.
②To use a cushion
Judging from the max. absorbed energy and max. inertia moment, the rotary actuator 70RV-200SC or larger model can be used.

<Selection of size based on torque and allowable inertia energy>
Use 70RV-400SC, and rotate the load only by the rotary actuator.
<Check of rotating time, radial load and thrust load>
Rotating time 5 sec
Radial load 100 kg
Thrust load 0 kg
Therefore, 70RV-200SC or larger model can be used.

## Working Rotating Time

Standard type — Unit: s

| | 90˚ | 270˚ |
|---|---|---|
| 70RV 10 | 0.22 to 6 | 0.54 to 18 |
| 70RV 15 | 0.22 to 6 | 0.54 to 18 |
| 70RV 20 | 0.23 to 6 | 0.54 to 18 |
| 70RV 30 | 0.5 to 9 | 0.54 to 27 |
| 70RV 100 | 0.6 to 9 | 0.67 to 27 |
| 70RV 200 | 0.75 to 9 | 0.81 to 27 |
| 70RV 400 | 1 to 18 | 1.08 to 54 |
| 70RV 700 | 1.8 to 18 | 1.35 to 54 |

With cushion (not incl. cushioning zone) — Unit: s

| | 90˚ | 180˚ |
|---|---|---|
| 70RV 10 | 0.18 to 6 | 0.36 to 12 |
| 70RV 15 | 0.18 to 6 | 0.36 to 12 |
| 70RV 20 | 0.18 to 6 | 0.36 to 12 |
| 70RV 30 | 0.18 to 9 | 0.36 to 18 |
| 70RV 100 | 0.22 to 9 | 0.45 to 18 |
| 70RV 200 | 0.27 to 9 | 0.54 to 18 |
| 70RV 400 | 0.36 to 18 | 0.72 to 36 |
| 70RV 700 | 0.45 to 18 | 0.9 to 36 |

## Setting of Rotating Time

⚠CAUTION

Use the actuator within the range of rotating time shown in the above table. If the rotary actuator is used longer than the above rotating time, smooth operation or cushioning effect cannot be obtained due to stick-slip, etc. If the rotating time is shorter than the above time, the rotary actuator may be damaged.



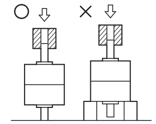


## Precautions for use

⚠CAUTION

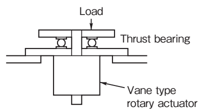
- To install the body, use bolts of strength class 8.8 or over in the specified size. When installing, observe the following instructions.
1) Secure the actuator using all mounting holes.
2) Take care not to tighten the bolts unevenly. Tighten them to the tightening torque specified for the bolts used.
3) Take care not to apply any external load other than the main body load to the bolts. (Use durable mounting materials.)

Fig. 1



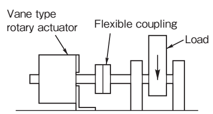

- When attaching a load or a joint to the shaft of the vane type rotary actuator, attach it in such a way that its force is not applied to the body as shown in Fig. 1.

Fig. 2 <Thrust load>




- A load in the axial direction (thrust load) on the shaft of the vane type rotary actuator can cause operation failure. Avoid applying such a load to the actuator. Use a thrust bearing as shown in Fig. 2 so that the thrust load is not applied to the rotary actuator.
- Application of a bending load (radial load) to the shaft end of the vane type rotary actuator can cause operation failure. Avoid applying such a load to the actuator. If this cannot be avoided, provide the rotary actuator with a mechanism as shown in Fig. 3 to convey only the rotating force to the actuator.

Fig. 3 <Radial load>




- When the weight of the load is large and the operating speed is high, shock may be caused by the inertia force, and it may not be absorbed only by the internal shock receiver, thereby resulting in damage to the equipment. In this case, provide a shock absorber to absorb the inertia energy.
- When installing the vane type rotary actuator or starting it after a long-term suspension, discharge air from it. Insufficient discharge of air may cause operation failure.

⚠CAUTION

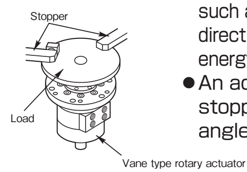
If you have any questions about repair or maintenance, consult us. Never disassemble the actuator.

## Notes on piping work

- Take care that dirt and pipe cuttings do not enter the piping.
- Take care that air does not accumulate in the piping.
- When connecting the actuator with a rubber hose, do not bend the hose in a radius lower than the specified radius.
- Be sure to flush the piping. After flushing, connect the piping to the rotary actuator. If the piping is not flushed, contaminants in the piping may cause operation failure of the rotary actuator or fluid leak.
- The vane type rotary actuators cause internal leak. Also, the solenoid valves used on the control circuits cause internal leak. Therefore, they cannot be stopped in the middle of operation under load torque. To suspend any of the actuators in the middle for a long time, provide it with an external mechanical stopper.

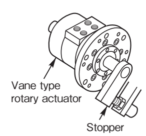
## External stopper

Fig. 4



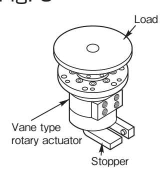

- Attach an external stopper in such a way that the stopper directly receives the inertia energy of the load. (Fig. 4)
- An adjustable external stopper is convenient for angle adjustment.

Fig. 5




- When the actuator must be stopped more accurately, provide an external stopper.
- An adjustable external stopper is convenient for angle adjustment. To ensure the stopping accuracy, it is recommended to attach the stopper to a position with as large radius as possible. (Fig. 5)

Fig. 6

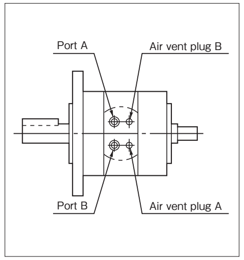



- When the load is driven on the key groove side and an external stopper is provided on the square shaft side, make sure that the load is less than the allowable energy. If the load exceeds the allowable energy, the shaft may be broken. (Fig. 6)

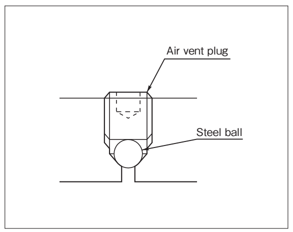
## How to discharge air

⚠CAUTION

If the air vent plug is loosened excessively, the plug may fly out or the fluid may spout out.




- Feed the fluid at a low pressure to the rotary actuator, and, when the pressure is applied to the port A, loosen the air vent plug A one or two turns (turn counterclockwise) to discharge air.
  When the pressure is applied to the port B, loosen the air vent plug B to discharge air.
- If air has accumulated in the rotary actuator, white turbid hydraulic fluid flows out of the air vent plug. Discharge air repeatedly until the white turbidity of the fluid is lost.
- After discharging air, tighten the air vent plug to the specified tightening torque (turn clockwise), and make sure that the fluid does not leak. [Torque: 8 N·m]
- Discharge air not only from the rotary actuator, but also from the piping. If air remains in the piping, operation failure may be caused.
- After discharging air, start the rotary actuator at a reduced pressure, and gradually increase the pressure to the working pressure.
  Note) 70RV-10 and 15 do not have air vents.




## How to adjust cushion

⚠CAUTION

If the rotating speed is increased at the start of adjustment of the cushion, abnormal surge pressure will occur, and the rotary actuator or the machine may be damaged.

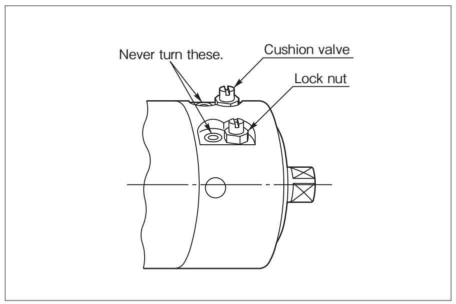
The cushion has been adjusted before shipment. However, since the cushion attenuation effect changes depending on the rotating speed and load inertia, adjust the cushion valve as stated below.

- Loosen the lock nut.
- Turn the cushion valve to the right or left to adjust the speed at the rotating end to reduce the shock and smoothen the operation. Turn the cushion valve to the right, and it will close. Turn it to the left, and it will open.

⚠CAUTION

If the cushion plug is loosened excessively, the cushion valve may fly out or the fluid may spout out.

- After the completion of adjustment, secure the lock nut.
  The energy which can be absorbed by the cushion is limited.
  Adjust the cushion while gradually increasing the rotary actuator rotating speed from the state where the flow control valve is fully closed.
- The set screw beside the cushion valve is not designed to discharge air. Never turn it.

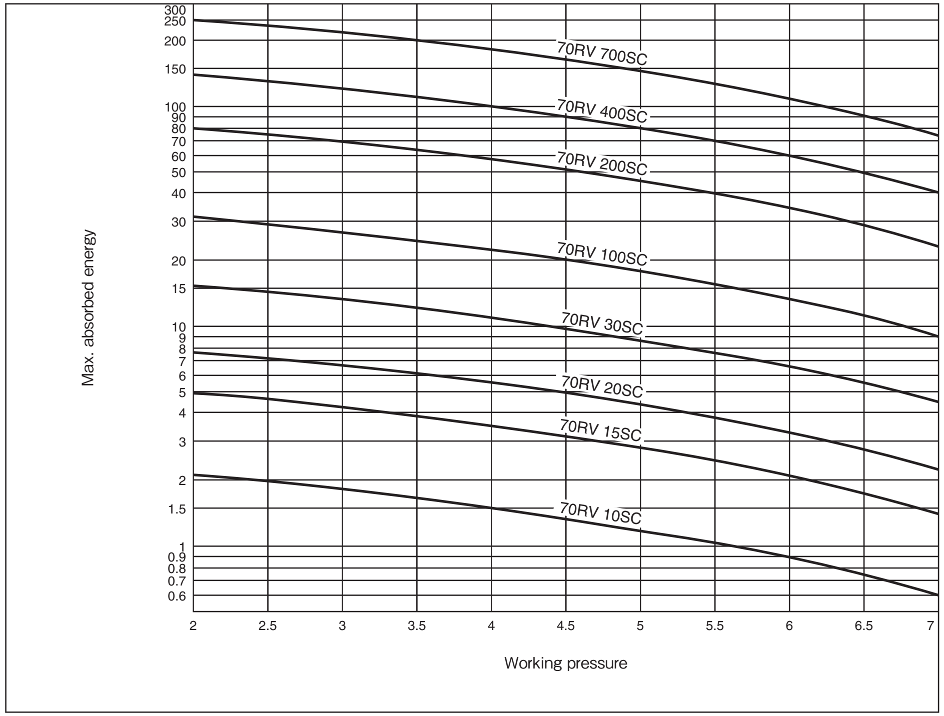







■Dependence of max. energy absorbed by cushion on working pressure on vane type rotary actuator with cushion

1 MPa=10.2 kgf/cm²
1 J=10.2 kgf·cm



■Control circuit

When using any vane type rotary actuator under light loading conditions, control the actuator with the basic circuit shown in Fig. 1. When using any vane type rotary actuator under heavy loading conditions, use a circuit as shown in Fig. 2, 3 or 4 to prevent application of shock and damage to the equipment due to surge pressure.
As aggressive measures to prevent shock and surge pressure, use a 2-stage deceleration control method as shown in Fig. 2, and adjust the deceleration time according to the loading conditions, reduction ratio, etc. As a control device for this purpose, use a pilot type switching valve or a proportional electromagnetic control valve.

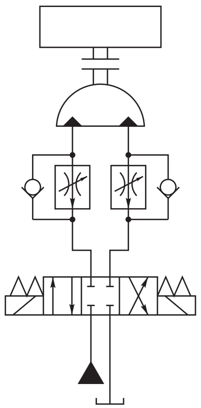


Fig. 1 (Basic circuit)

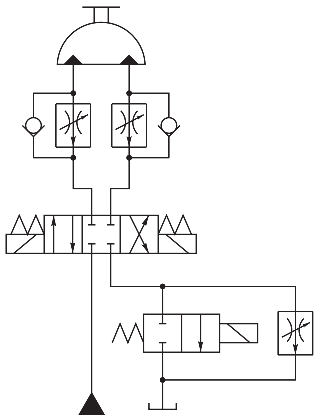


Fig. 2 (2-stage deceleration)

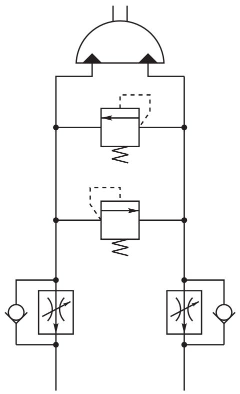


Fig. 3 (Brake valve)

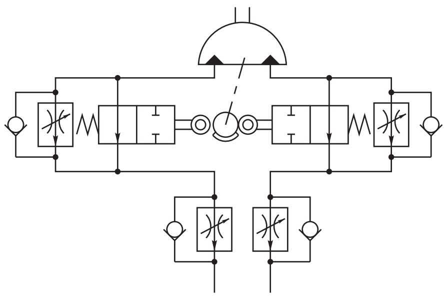


Fig. 4 (Deceleration valve)