High load and accurate positioning

Realizing high load direct installation and high position accuracy with table type rotary actuator GRC series due to bearing guide.

1. **Flexible design**
   - New compact type GRC-5 (Torq 5, 0.5N·m) first one in the industries.
   - Small torque never achieved
   - 6 types of 5, 10, 20, 30, 50 and 80.
   - Standard type and high accuracy type are available in same dimension
   - Products changes in manufacturing lines (basic type and high accuracy type) are conducted speedy.

2. **Easy installation**
   - Outlet direction of piping port can be selected from 3 sides.
   - Simple piping / wiring due to large hollow.
   - Hollow diameter φ 4 to φ 17 is available.
   - Socket and spigot for positioning is available on table top (4 points) or main body bottom (1 point).

3. **Easy operation**
   - Reliable operation due to external stopper
   - Due to external stopper and shock absorber (option), smooth stop is achieved without backlash.
   - Low speed operation of 1.5 seconds/90°

**Applications**
- Low speed operation realized due to large pinion diameter and long piston stroke length.
<table>
<thead>
<tr>
<th>Variation</th>
<th>Model no.</th>
<th>JIS symbol</th>
<th>Size</th>
<th>Maximum oscillating angle (degrees)</th>
<th>Option</th>
<th>Sketch</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic type</td>
<td>GRC</td>
<td></td>
<td></td>
<td>5  10  20  30  50  80  90  180</td>
<td>A1</td>
<td>A2</td>
<td>A3</td>
</tr>
<tr>
<td>High accuracy type</td>
<td>GRC-K</td>
<td></td>
<td></td>
<td>5  10  20  30  50  80  90  180</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Fine speed type</td>
<td>GRC-F</td>
<td></td>
<td></td>
<td>5  10  20  30  50  80  90  180</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>High accuracy/fine speed type</td>
<td>GRC-KF</td>
<td></td>
<td></td>
<td>5  10  20  30  50  80  90  180</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

Note: Refer to page 34 for outer mount shock absorber.
Pneumatic components

Safety precautions

Always read this section before starting use. Refer to Ending 69 for cylinders and to Ending 78 for cylinder switches.

Rotary actuator GRC Series

Design & Selection

1. Common

CAUTION

■ Select the model so output torque is double or over of torque required by the load.

The GRC Series uses a double piston, so if the oscillation angle is adjusted by the stopper bolt, torque at the oscillation end will be half the effective torque.

■ If torque required by the load is small even during oscillation, the actuator could be damaged by load inertia. Consider the load moment of inertia, kinetic energy, and oscillation time, and use at a level below tolerable energy.

■ If an external shock absorber is used, torque will drop at the oscillation end by the amount of the spring’s return force in the shock absorber.

2. Fine speed type GRC-F

CAUTION

■ Use with oil-free specifications. (Must be oil-free) Features may change if the device is lubricated.

■ Assemble the speed control valve near the rotary actuator.

If the speed control valve is assembled away from the rotary actuator, adjustments will become unstable.

Use the SC-M3/M5, SC3W, SCD-M3/M5 or SC3WU Series speed control valve.

■ Generally, the speed is stable with lower load factor or/and higher air pressure. Use a load at 50% or less.

■ Stable speed control is achieved with a meter-out circuit.

Avoid use with vibration.

The product will be adversely affected by vibration and operation will be unstable.

Return force is working in this angle.
1. Common

**CAUTION**

- Do not further machine the product. If so, strength will decrease and could lead to product damage. This may result in injury or damage to operator, component, or equipment.

- Do not increase the fixed orifice on the piping port by re-machining, etc., or actuator operation speed and impact will increase, damaging the actuator. Install a speed control valve on piping, etc.

- The piping port is selectable from 3 sides. Ports other than the side piping port are plugged when the product is shipped. When changing the piping port, interchange these plugs. When changing ports for the GRC-5 to 30, apply the recommended adhesive to plugs. When changing ports for GRC-50 or 80, apply recommended adhesive or wrap sealing tape around plugs. Failure to do so may lead to air leakage. (Recommended adhesive) LOCTITE 222 (LOCTITE JAPAN) THREE BOND1344 (THREE BOND)

- The relationship of piping ports and oscillation direction is shown below.

- An angle adjustment screw (stopper bolt or shock absorber) for adjustment of oscillation angle is provided as a standard. When the product is shipped, the angle adjustment screw is adjusted randomly within the oscillation adjustment range. Readjust this to the required angle before use.

- Adjust the angle to within the adjustment range specified for the product. If the angle is adjusted outside the adjustment range, the product could be damaged. Refer to product specifications (page 26) and oscillation angle adjustment (page 53).

---

<table>
<thead>
<tr>
<th>Size</th>
<th>Adjustment angle per stopper bolt 1 rotation</th>
<th>Adjustment angle per shock absorber 1 rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>8.7°</td>
<td>1.1°</td>
</tr>
<tr>
<td>10</td>
<td>4.9°</td>
<td>1.0°</td>
</tr>
<tr>
<td>20</td>
<td>5.7°</td>
<td>1.1°</td>
</tr>
<tr>
<td>30</td>
<td>3.8°</td>
<td>0.9°</td>
</tr>
<tr>
<td>50</td>
<td>3.5°</td>
<td>0.7°</td>
</tr>
<tr>
<td>80</td>
<td>3.5°</td>
<td>0.9°</td>
</tr>
</tbody>
</table>

R: Clockwise rotation
L: Counterclockwise rotation

---

Table 1
Observe steps (1) to (5) when adjusting the angle. If the angle is not adjusted this way, the seal washer may break after one or two adjustments.

Angle adjustment procedures:
1. First loosen the hexagon nut as shown in Fig. 1.
2. Separate the seal washer from the head cover as shown in Fig. 2.
3. Turn the stopper bolt, hexagon nut, and seal washer together as shown in Fig. 3, and adjust the angle. Check that the rubber section of the seal washer does not bite into the screw.
4. After adjusting the angle, move the seal washer near the head cover by hand as shown in Fig. 4.
5. Tighten as shown in Fig. 5 with the hexagon nut. Check that the rubber section of the seal washer does not bite into the screw section.

After adjusting the angle, securely tighten the hexagon nut with the tightening torque in Table 2. Otherwise, the hexagon nut may loosen and cause external leakage in prolonged use.

When replacing the seal washer sealing the angle adjustment stopper bolt (hexagon bolt when using external shock absorber), tighten the hexagon nut (hexagon bolt when using external shock absorber) with the tightening torque in Table 2. Otherwise, air may leak.

Table 2:

<table>
<thead>
<tr>
<th>Size</th>
<th>Basic type/high accuracy type</th>
<th>With external shock absorber</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>5.9 ± 10%</td>
<td>4 ± 10%</td>
</tr>
<tr>
<td>10</td>
<td>9.4 ± 10%</td>
<td>4.9 ± 10%</td>
</tr>
<tr>
<td>20</td>
<td>11.8 ± 10%</td>
<td>6.9 ± 10%</td>
</tr>
<tr>
<td>30</td>
<td>11.8 ± 10%</td>
<td>6.9 ± 10%</td>
</tr>
<tr>
<td>50</td>
<td>22.1 ± 10%</td>
<td>8.8 ± 10%</td>
</tr>
<tr>
<td>80</td>
<td>22.1 ± 10%</td>
<td>8.8 ± 10%</td>
</tr>
</tbody>
</table>

Tighten the shock absorber fixing nut with the tightening torque below. If force exceeds tightening torque below, the shock absorber could be damaged.

Table 3:

<table>
<thead>
<tr>
<th>Size</th>
<th>5</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>50</th>
<th>80</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.47</td>
<td>1.96</td>
<td>5.14</td>
<td>8.58</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4 gives the tightening torque for the hexagon socket bolt for installation and hexagon socket bolt for lever installation when using A3, and installing the shock absorber kit later.

Table 4:

<table>
<thead>
<tr>
<th>Size</th>
<th>Lever installation bolt</th>
<th>Outer mount shock absorber installation bolt</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tightening torque (N·m)</td>
<td>Tightening torque (N·m)</td>
</tr>
<tr>
<td>5</td>
<td>0.6 ± 20%</td>
<td>1.4 ± 20%</td>
</tr>
<tr>
<td>10</td>
<td>1.4 ± 20%</td>
<td>2.9 ± 20%</td>
</tr>
<tr>
<td>20</td>
<td>2.8 ± 20%</td>
<td>4.8 ± 20%</td>
</tr>
<tr>
<td>30</td>
<td>2.8 ± 20%</td>
<td>4.8 ± 20%</td>
</tr>
<tr>
<td>50</td>
<td>12.0 ± 20%</td>
<td>12.0 ± 20%</td>
</tr>
<tr>
<td>80</td>
<td>12.0 ± 20%</td>
<td>12.0 ± 20%</td>
</tr>
</tbody>
</table>
A rubber cushion is used in the GRC. (Basic, high precision type) When using at a pressure of 0.3MPa or less, the rubber cushion may not be pressed down completely. If accuracy is required at the oscillation end, use with a pressure of 0.3MPa or more.

Take care when placing cylinders near each other. When installing two or more rotary actuators with switches in parallel, or if there is a magnetic substance such as a steel plate nearby, provide the following distances from the cylinder body surface. (The dimensions are the same for all sizes.) Failure to do so may cause the switch to malfunction due to mutual magnetic force interference.

The CKD shock absorber is treated as a consumable. Replace the shock absorber if the energy absorption performance starts to drop or if the movement is no longer smooth.
## Table type rotary actuator

**Basic type/high accuracy type**

### GRC/GRC-K Series

- Size: 5, 10, 20, 30, 50, 80

### Specifications

<table>
<thead>
<tr>
<th>Descriptions</th>
<th>GRC-5</th>
<th>GRC-10</th>
<th>GRC-20</th>
<th>GRC-30</th>
<th>GRC-50</th>
<th>GRC-80</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Size</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Logical torque Note 1 N·m</td>
<td>0.5</td>
<td>1.0</td>
<td>2.0</td>
<td>3.0</td>
<td>5.2</td>
<td>8.1</td>
</tr>
<tr>
<td><strong>Actuation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working fluid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. working pressure</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Min. working pressure Note 2 MPa</strong></td>
<td></td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
</tr>
<tr>
<td>With shock absorber</td>
<td>0.25</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td><strong>Withstanding pressure MPa</strong></td>
<td>1.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature °C</td>
<td>0 to 60 (no freezing)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Port size</strong></td>
<td></td>
<td>M5</td>
<td>Rc1/8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cushion</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic type/high accuracy type</td>
<td></td>
<td>NCK-0.3</td>
<td>NCK-0.7</td>
<td>NCK-1.2</td>
<td>NCK-2.6</td>
<td></td>
</tr>
<tr>
<td>With shock absorber</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shock absorber model no.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Allowable energy absorption J</strong></td>
<td>0.005</td>
<td>0.005</td>
<td>0.005</td>
<td>0.005</td>
<td>0.005</td>
<td>0.005</td>
</tr>
<tr>
<td>With shock absorber</td>
<td>0.46</td>
<td>0.59</td>
<td>1.15</td>
<td>1.71</td>
<td>2.33</td>
<td>2.78</td>
</tr>
<tr>
<td>Shock absorber stroke mm</td>
<td>3.5</td>
<td>3.5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>6.5</td>
</tr>
<tr>
<td><strong>Lubrication</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not required (when lubricating, use turbine oil ISOVG32.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Volumetric capacity Note 3 cm³</strong></td>
<td>90°</td>
<td>1.3</td>
<td>3.5</td>
<td>7.0</td>
<td>10.5</td>
<td>18.1</td>
</tr>
<tr>
<td>180°</td>
<td>3.4</td>
<td>6.6</td>
<td>13.4</td>
<td>20.0</td>
<td>34.4</td>
<td>53.7</td>
</tr>
<tr>
<td><strong>Oscillating angle adjusting range Note 4</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic type/high accuracy type</td>
<td>0° to 100°</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>With shock absorber</td>
<td>90° to 190°</td>
<td>90°±6°</td>
<td>90°±6°</td>
<td>180°</td>
<td>180°±6°</td>
<td>0.2 to 1.5</td>
</tr>
<tr>
<td><strong>Oscillating time adjusting range Note 5</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic type</td>
<td>±0.17°</td>
<td>±0.23°</td>
<td>±0.26°</td>
<td>±0.32°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High accuracy type</td>
<td>±0.026°</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note 1:** Theoretical torque is value when working pressure 0.5 MPa.

**Note 2:** To push through the rubber cushion integrated in basic and high accuracy type, 0.3 MPa and over applicable pressure is required.

**Note 3:** Volumetric capacity is value within oscillating angle adjusting range when maximum oscillating angle.

**Note 4:** Oscillating angle adjusting range is value when adjusted by both side stopper bolts (shock absorber).

**Note 5:** Oscillating time adjusting range is value when working pressure 0.5 MPa.

**Note 6:** Displacement of table at 100mm away from the center of rotation is shown on technical data (page 51).
Switch specifications

1 color/2 color indicator

- Descriptions
  - Proximity 2 wire
    - T1H/T1V
    - T2H/T2V
    - T2YH/T2YV
  - Proximity 3 wire
    - T3H/T3V
    - T3PH/T3PV (Custom order)
    - T2YH/T2YV

- Applications
  - Programmable controller, relay
  - Programmable controller, relay

- Output method
  - Programmable controller
  - Programmable controller

- Power voltage
  - Programmable controller
  - Programmable controller

- Load voltage
  - 85 to 265 VAC
  - 10 to 30 VDC

- Load current
  - 5 to 100mA
  - 5 to 20mA (Note 1)

- Light
  - LED (ON lighting)
  - LED (ON lighting)

- Leakage current
  - 1mA or less with 100 VAC
  - 2mA or less with 200 VAC

With preventive maintenance output

- Descriptions
  - Proximity 3 wire
    - T2YH/V
  - Proximity 4 wire
    - T2YVH/V
  - Proximity 3 wire
    - T3YH/V
  - Proximity 4 wire
    - T3YVH/V

- Applications
  - Programmable controller
  - Programmable controller, relay

- Output method
  - Programmable controller

- Power voltage
  - Programmable controller

- Load voltage
  - 10 to 28 VDC

- Load current
  - 1mA or less

- Light
  - Red/green LED (ON lighting)

- Leakage current
  - 10μA or less

Minimum oscillating angle with switch

- Size
  - 5
  - 10
  - 20
  - 30
  - 50
  - 80

- T type proximity
  - 20°
  - 15°
  - 17.5°
  - 12.5°
  - 12.5°

Theoretical torque table

- Size
  - 5
  - 10
  - 20
  - 30
  - 50
  - 80

- Working pressure (MPa)
  - 0.1
  - 0.2
  - 0.3
  - 0.4
  - 0.5
  - 0.6
  - 0.7
  - 0.8
  - 0.9
  - 1.0

Product weight

- Oscillating angle
  - 90°
  - 180°

- Outer mount shock absorber weight

- Switch weight (per switch)
  - 0.02

Clean room specifications

- Dust preventive structure for inside the clean room

- Clean room specifications (Catalog No. CB-033SA)
**How to order**

- **Without switch**
  - GRC - 10 - 180 - T2H - A1

- **With switch**
  - GRC - 30 - 180 - T2H - R - A2

### Symbol

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Model no.</td>
<td>GRC Basic type</td>
</tr>
<tr>
<td></td>
<td>GRC-K High accuracy type</td>
</tr>
<tr>
<td>B Size (0.5MPa)</td>
<td></td>
</tr>
<tr>
<td>Model no.</td>
<td>Logical torque</td>
</tr>
<tr>
<td>5</td>
<td>0.5 (N·m)</td>
</tr>
<tr>
<td>10</td>
<td>1.0 (N·m)</td>
</tr>
<tr>
<td>20</td>
<td>2.0 (N·m)</td>
</tr>
<tr>
<td>30</td>
<td>3.0 (N·m)</td>
</tr>
<tr>
<td>50</td>
<td>5.2 (N·m)</td>
</tr>
<tr>
<td>80</td>
<td>8.1 (N·m)</td>
</tr>
<tr>
<td>C Port thread type</td>
<td></td>
</tr>
<tr>
<td>Blank</td>
<td>Rc thread</td>
</tr>
<tr>
<td>NN</td>
<td>NPT thread (size 50 and over) (custom order)</td>
</tr>
<tr>
<td>GN</td>
<td>G thread (size 50 and over) (custom order)</td>
</tr>
<tr>
<td>D Oscillating angle</td>
<td></td>
</tr>
<tr>
<td>90</td>
<td>90°</td>
</tr>
<tr>
<td>180</td>
<td>180°</td>
</tr>
<tr>
<td>E Switch model no.</td>
<td></td>
</tr>
</tbody>
</table>

**Note on model no. selection**

- Note 1: Port position of basic type/high accuracy type is provided on side surface.
- Note 2: Can not be attached outer mount shock absorber on basic type/high accuracy type later. If it will be installed later, select optional A3 type.
- Note 3: If an outer mount shock absorber is retrofit on the A3 type, the state will be the same as the A1 type. Consult with CKD on A2 type use.

**<Example of model number>**

GRC-10-180-T2V-D-A1

- **Double acting**
- **Model no.** : Basic type
- **Size** : 10
- **Port thread type** : Rc thread
- **Oscillating angle** : 180°
- **Switch model no.** : Proximity 2 wire
- **Switch quantity** : Two
- **Option** : With outer mount shock absorber installation position (1)

**Outer mount shock absorber installation drawing**

- GRC-.A1 (Installation position 1)
- GRC-.A2 (Installation position 2)
- GRC-.A3 (Installation position 3)

**Note on model no. selection**

- Note 1: Port position of basic type/high accuracy type is provided on side surface.
- Note 2: Can not be attached outer mount shock absorber on basic type/high accuracy type later. If it will be installed later, select optional A3 type.
- Note 3: If an outer mount shock absorber is retrofit on the A3 type, the state will be the same as the A1 type. Consult with CKD on A2 type use.

**Option**

- Blank
- Hexagon socket head set screw type stopper with urethane rubber
- A With outer mount shock absorber
- A1 Installation position (1)
- A2 Installation position (2)
- A3 Outer mount shock absorber later installation (installation groove machined)
How to order switch

- Only switch body

Switch model no.
(Item ① previous page)

How to order repair kits

- Sets of packing seal repair parts, etc.

Size
(Item ① previous page)

How to order outer mount shock absorber set

- Sets of plate, shock absorber and lever
- Used when installing external shock absorber onto A3 type later.

How to order stopper bolt set for adjustable angle

- Sets of hexagon head hole set screw with urethane hexagon nut and plain washer
- Used with no outer mount shock absorber

How to order seal washer set

- Used at seal washer replacement
- Seal washer 2 pcs.

How to order shock absorber set for adjustable angle

- Sets of shock absorber and stopper

Applicable shock absorber model No.

<table>
<thead>
<tr>
<th>Model</th>
<th>Shock absorber model no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRC-5</td>
<td>NCK-00-0.3</td>
</tr>
<tr>
<td>GRC-10</td>
<td>NCK-00-0.3</td>
</tr>
<tr>
<td>GRC-20</td>
<td>NCK-00-0.7</td>
</tr>
<tr>
<td>GRC-30</td>
<td>NCK-00-0.7</td>
</tr>
<tr>
<td>GRC-50</td>
<td>NCK-00-1.2</td>
</tr>
<tr>
<td>GRC-80</td>
<td>NCK-00-2.6</td>
</tr>
</tbody>
</table>
### Internal structure and parts list

- **GRC** (basic type)
- **GRC-K** (high accuracy type)

#### Part list

<table>
<thead>
<tr>
<th>No.</th>
<th>Parts name</th>
<th>Material</th>
<th>Remarks</th>
<th>No.</th>
<th>Parts name</th>
<th>Material</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hexagon socket head cap bolt</td>
<td>Stainless steel</td>
<td></td>
<td>13</td>
<td>Hexagon socket head set screw</td>
<td>Stainless steel</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Table</td>
<td>Aluminum alloy</td>
<td>Alumite</td>
<td>14</td>
<td>Steel ball</td>
<td>Stainless steel</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Bearing guard</td>
<td>Aluminum alloy</td>
<td>Alumite</td>
<td>15</td>
<td>Cylinder gasket</td>
<td>Nitrile rubber</td>
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</tr>
<tr>
<td>4</td>
<td>Ball bearing (1)</td>
<td>Alloy steel</td>
<td></td>
<td>16</td>
<td>Piston packing seal</td>
<td>Nitrile rubber</td>
<td></td>
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<tr>
<td>5</td>
<td>Shaft</td>
<td>Alloy steel</td>
<td></td>
<td>17</td>
<td>Wear ring</td>
<td>Acetar resin</td>
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</tr>
<tr>
<td>6</td>
<td>Cylinder body</td>
<td>Aluminum alloy</td>
<td>Hard alumite</td>
<td>18</td>
<td>Magnet</td>
<td>Plastic (5.10 is special alloy.)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Ball bearing (2)</td>
<td>Alloy steel</td>
<td></td>
<td>19</td>
<td>Piston</td>
<td>Stainless steel</td>
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<td>8</td>
<td>Hexagon socket head cap bolt</td>
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<td>20</td>
<td>Cushion rubber</td>
<td>Urethane rubber</td>
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<td>9</td>
<td>Head cover (1)</td>
<td>Aluminum alloy</td>
<td>Alumite</td>
<td>21</td>
<td>Seal washer</td>
<td>Steel /nitrile rubber</td>
<td>Galvanizing</td>
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<tr>
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<td>Nitrile rubber</td>
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<td>22</td>
<td>Hexagon nut</td>
<td>Steel</td>
<td>Nickeling</td>
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<tr>
<td>11</td>
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<td>23</td>
<td>Stopper bolt</td>
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<td>Nickeling</td>
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</table>

#### Sectional view of high accuracy type

- A cushion rubber position differs for GRC-*5.*
Internal structure and parts list

GRC-*A (with outer mount shock absorber)

Note: The figure shows 90° specifications. 180° specifications use same material etc.

Part list

<table>
<thead>
<tr>
<th>No.</th>
<th>Parts name</th>
<th>Material</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hexagon socket head cap bolt</td>
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</tr>
<tr>
<td>2</td>
<td>Lever</td>
<td>Carbon steel or alloy steel</td>
<td>Nickel/phosphorous plating</td>
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<tr>
<td>3</td>
<td>Connector</td>
<td>Steel</td>
<td>Nickeling</td>
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<td>4</td>
<td>Plate</td>
<td>Aluminum alloy</td>
<td>Alumite</td>
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<td>5</td>
<td>Hexagon socket head cap bolt</td>
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<td></td>
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<tr>
<td>6</td>
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<td>9</td>
<td>Shock absorber</td>
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<td>Hexagon nut</td>
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Repair kits

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<th>Kit No.</th>
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<tr>
<td>GRC-5K</td>
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<td>GRC-80K</td>
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</table>

Note 1: Specify the kit No. when ordering consumable parts.
Note 2: Avoid disassembling/repair, since high accuracy type uses highly controlled precision part.
When repairing high accuracy type, consult with CKD.
### Dimensions

- **GRC basic type**
- **GRC-K high accuracy type**

#### Piping port (set screw)

<table>
<thead>
<tr>
<th>Size</th>
<th>AA</th>
<th>AB</th>
<th>BA</th>
<th>BB</th>
<th>BC</th>
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<tbody>
<tr>
<td>5</td>
<td>M4</td>
<td>24</td>
<td>M4</td>
<td>26</td>
<td>48</td>
</tr>
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<td>36</td>
<td>M8</td>
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<td>62</td>
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<td>30</td>
<td>M8</td>
<td>44</td>
<td>M8</td>
<td>52</td>
<td>74</td>
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<td>50</td>
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<td>M8</td>
<td>54</td>
<td>M8</td>
<td>66</td>
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#### Piping port (set screw)

<table>
<thead>
<tr>
<th>Size</th>
<th>AA</th>
<th>AB</th>
<th>BA</th>
<th>BB</th>
<th>BC</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
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<td>24</td>
<td>M4</td>
<td>26</td>
<td>48</td>
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<td>M8</td>
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<td>94</td>
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</table>

#### Piping port (set screw)

<table>
<thead>
<tr>
<th>Size</th>
<th>AA</th>
<th>AB</th>
<th>BA</th>
<th>BB</th>
<th>BC</th>
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</thead>
<tbody>
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<td>5</td>
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<td>24</td>
<td>M4</td>
<td>26</td>
<td>48</td>
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<td>M8</td>
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<td>M8</td>
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<td>M8</td>
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<td>80</td>
<td>M8</td>
<td>54</td>
<td>M8</td>
<td>66</td>
<td>94</td>
</tr>
</tbody>
</table>
### GRC/GRC-K Series

**Basic type/high accuracy type**

- **RRC**
- **GRC**
- **RV3***

### Table type rotary actuator

Oscillation, rotation drive type

<table>
<thead>
<tr>
<th>HC</th>
<th>HD</th>
<th>HE</th>
<th>JA</th>
<th>JB</th>
<th>JC</th>
<th>JD</th>
<th>JE</th>
<th>JG</th>
<th>JH</th>
<th>K</th>
<th>MA</th>
<th>MB</th>
<th>NA</th>
<th>NB</th>
<th>NC</th>
<th>PA</th>
<th>PB</th>
<th>Q</th>
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<tbody>
<tr>
<td>30</td>
<td>7</td>
<td>6</td>
<td>15</td>
<td>18</td>
<td>16</td>
<td>21</td>
<td>11.5</td>
<td>65</td>
<td>82</td>
<td>5.6</td>
<td>29</td>
<td>42</td>
<td>17H9</td>
<td>2</td>
<td>4H9</td>
<td>5.5</td>
<td>2.4</td>
<td>12H9</td>
</tr>
<tr>
<td>33</td>
<td>7</td>
<td>6</td>
<td>15</td>
<td>19</td>
<td>20</td>
<td>21.5</td>
<td>12</td>
<td>75</td>
<td>99</td>
<td>5.6</td>
<td>37</td>
<td>48</td>
<td>22H9</td>
<td>2</td>
<td>8H9</td>
<td>5.5</td>
<td>2.4</td>
<td>18H9</td>
</tr>
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<td>37</td>
<td>9</td>
<td>7</td>
<td>14.5</td>
<td>20.5</td>
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<td>22</td>
<td>13</td>
<td>86</td>
<td>115</td>
<td>5.6</td>
<td>47</td>
<td>58</td>
<td>27H9</td>
<td>2</td>
<td>11H9</td>
<td>6.5</td>
<td>3.9</td>
<td>20H9</td>
</tr>
<tr>
<td>37</td>
<td>9</td>
<td>9</td>
<td>14.5</td>
<td>20.5</td>
<td>37</td>
<td>22</td>
<td>13</td>
<td>111</td>
<td>155</td>
<td>5.6</td>
<td>57</td>
<td>68</td>
<td>32H9</td>
<td>2</td>
<td>13H9</td>
<td>7.5</td>
<td>2.9</td>
<td>26H9</td>
</tr>
<tr>
<td>48</td>
<td>13</td>
<td>10</td>
<td>21.5</td>
<td>27.5</td>
<td>36</td>
<td>32.5</td>
<td>17.5</td>
<td>129</td>
<td>177</td>
<td>8.1</td>
<td>58</td>
<td>75</td>
<td>37H9</td>
<td>4</td>
<td>14H9</td>
<td>10.5</td>
<td>5.3</td>
<td>28H9</td>
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<td>35</td>
<td>19</td>
<td>135</td>
<td>183</td>
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<td>58</td>
<td>80</td>
<td>40H9</td>
<td>3</td>
<td>17H9</td>
<td>9.5</td>
<td>4.4</td>
<td>36H9</td>
</tr>
</tbody>
</table>

---

**Position of 4-BA and 2-CA differ for GRC-5 only.**

**A section details**

- **Switch installation positon**
Dimensions: with outer mount shock absorber size 5

- GRC-5- A1/A2

Note: The drawing is for A1 type (installation position 1).

Note: Dimensions of rotary actuator main body are as same as basic type, however the body can not be fixed with using 4 taps on main body top. Position for dowel hole differs depending on installation position of outer mount shock absorber on table top.
Dimensions: with outer mount shock absorber size 10, 20

GRC-10-*-A1/A2
Note: The drawing is for A1 type (installation position (1)).

GRC-20-*-A1/A2
Note: The drawing is for A1 type (installation position (1)).

Note: Dimensions of rotary actuator main body are as same as basic type, however the body can not be fixed with using 4 taps on main body top. Position for dowel hole differs depending on installation position of outer mount shock absorber on table top. (Refer to GRC-5-*-A1/A2.)
Dimensions: with outer mount shock absorber size 30, 50

- **GRC-30-*-A1/A2**
  
  Note: The drawing is for A1 type (installation position (1)).

- **GRC-50-*-A1/A2**
  
  Note: The drawing is for A1 type (installation position (1)).

---

Note: Dimensions of rotary actuator main body are as same as basic type, however the body can not be fixed with using 4 taps on main body top. Position for dowel hole differs depending on installation position of outer mount shock absorber on table top. (Refer to GRC-5-*-A1/A2.)
Dimensions: with outer mount shock absorber size 80

- GRC-80-*-A1/A2

Note: The drawing is for A1 type (installation position (1)).

<table>
<thead>
<tr>
<th>Oscillation direction</th>
<th>112.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjustment angle</td>
<td>0.9°/per rotation</td>
</tr>
</tbody>
</table>

Note: Dimensions of rotary actuator main body are as same as basic type, however the body can not be fixed with using 4 taps on main body top. Position for dowel hole differs depending on installation position of outer mount shock absorber on table top. (Refer to GRC-5-*-A1/A2.)
Dimensions: outer mount shock absorber later installation size 5 to 80

<table>
<thead>
<tr>
<th>Size</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>3.5</td>
<td>8.4</td>
<td>15</td>
<td>1</td>
<td>M3 depth 6.5</td>
</tr>
<tr>
<td>10</td>
<td>3.8</td>
<td>11</td>
<td>18</td>
<td>1</td>
<td>M4 depth 6</td>
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<tr>
<td>20</td>
<td>4.5</td>
<td>13.4</td>
<td>23</td>
<td>1</td>
<td>M5 depth 7.5</td>
</tr>
<tr>
<td>30</td>
<td>4.5</td>
<td>17</td>
<td>27</td>
<td>2</td>
<td>M6 depth 8.5</td>
</tr>
<tr>
<td>50</td>
<td>6.9</td>
<td>18.4</td>
<td>32</td>
<td>2</td>
<td>M8 depth 9</td>
</tr>
<tr>
<td>80</td>
<td>6.9</td>
<td>20</td>
<td>36</td>
<td>2</td>
<td>M8 depth 9</td>
</tr>
</tbody>
</table>

When outer mount shock absorber set is installed. (shaded section) shows outer mount shock absorber set.

Note: When outer mount shock absorber set is installed on A3 type, A1 type is provided.
Consult with CKD on A2 type. (Refer to Page 34 for installation position.)
GRC-F/GRC-KF Series

Specifications

<table>
<thead>
<tr>
<th>Descriptions</th>
<th>GRC-F-5</th>
<th>GRC-F-10</th>
<th>GRC-F-20</th>
<th>GRC-F-30</th>
<th>GRC-F-50</th>
<th>GRC-F-80</th>
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</thead>
<tbody>
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<td>Logical torque Note 1</td>
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<tr>
<td>Min. working pressure MPa</td>
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<tr>
<td>Cushion</td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>Oscillating angle specifications</td>
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<td>Cushion</td>
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<td></td>
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</tr>
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<td></td>
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</table>

Clean room specifications (Catalog No. CB-033SA)

GRC-F - P73 GRC-KF - P73

Switch specifications

<table>
<thead>
<tr>
<th>1 color/2 color indicator</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptions</td>
<td>Proximity 2 wire</td>
</tr>
<tr>
<td>Applications</td>
<td>Programmable controller, relay</td>
</tr>
<tr>
<td>Output method</td>
<td>PN/PN</td>
</tr>
<tr>
<td>Power voltage</td>
<td>10 to 30 VDC</td>
</tr>
<tr>
<td>Load current</td>
<td>5 to 100mA (Note 1)</td>
</tr>
<tr>
<td>Leakage current</td>
<td>1mA or less with 200 VAC</td>
</tr>
</tbody>
</table>

With preventive maintenance output.

| Descriptions                    | Proximity 3 wire      | Proximity 4 wire      |
| Applications                    | Programmable controller, relay | Programmable controller, relay |
| Output method                   | NPN output            | NPN output            |
| Power voltage                   | 10 to 28 VDC         | 10 to 28 VDC         |
| Load current                    | 5 to 20mA            | 5 to 20mA            |
| Leakage current                 | 1mA or less          | 1mA or less          |

Dimensions

It is the same as the basic type GRC Series or the high load type GRC-K Series. Refer to pages 32 to 38.

Technical data)

Refer to page 806, “Pneumatic Cylinders” for Technical data of measuring method.
How to order

- Without switch
  GRC-F - 10 - 90 - A1
- With switch
  GRC-F - 30 - 180 - T2H* - R - A2

### Table: Model no.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Model no.</td>
</tr>
<tr>
<td>GRC-F</td>
<td>Basic type</td>
</tr>
<tr>
<td>GRC-KF</td>
<td>High accuracy type</td>
</tr>
</tbody>
</table>

### Table: Size

<table>
<thead>
<tr>
<th>Model no.</th>
<th>Logical torque (N·m)</th>
<th>GRC-F</th>
<th>GRC-KF</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>0.5</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1.0</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>20</td>
<td>2.0</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>30</td>
<td>3.0</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>50</td>
<td>5.2</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>80</td>
<td>8.1</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

### Table: Port thread type

- Blank: Rc thread
- NN: NPT thread (size 50 and over) (custom order)
- GN: G thread (size 50 and over) (custom order)

### Table: Oscillating angle

| Oscillating angle | 90° | 180° |

### Table: Switch model no.

<table>
<thead>
<tr>
<th>Axial lead wire</th>
<th>Radial lead wire</th>
<th>Contact</th>
<th>Indicator</th>
<th>Lead wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1H*</td>
<td>T1V*</td>
<td>1 color indicator type</td>
<td>2-wire</td>
<td></td>
</tr>
<tr>
<td>T2H*</td>
<td>T2V*</td>
<td>1 color indicator type (custom order)</td>
<td>2-wire</td>
<td></td>
</tr>
<tr>
<td>T3H*</td>
<td>T3V*</td>
<td>2 color indicator type</td>
<td>3-wire</td>
<td></td>
</tr>
<tr>
<td>T2YH*</td>
<td>T2YV*</td>
<td>With preventive maintenance output</td>
<td>3-wire</td>
<td></td>
</tr>
<tr>
<td>T3YH*</td>
<td>T3YV*</td>
<td></td>
<td>3-wire</td>
<td></td>
</tr>
<tr>
<td>T2YFH*</td>
<td>T2YFV*</td>
<td></td>
<td>4-wire</td>
<td></td>
</tr>
<tr>
<td>T3YFH*</td>
<td>T3YFV*</td>
<td></td>
<td>4-wire</td>
<td></td>
</tr>
<tr>
<td>T2YMH*</td>
<td>T2YMV*</td>
<td></td>
<td>3-wire</td>
<td></td>
</tr>
<tr>
<td>T3YMH*</td>
<td>T3YMV*</td>
<td></td>
<td>3-wire</td>
<td></td>
</tr>
</tbody>
</table>

### Table: Lead wire length

- Blank: 1m (standard)
- 3: 3m (option)
- 5: 5m (option)

### Table: Switch quantity

- R: With counterclockwise 1 piece
- L: With clockwise rotation 1 piece
- D: Two

### Table: Option

- Blank: Hexagon socket head set screw type stopper with urethane rubber
- A: With outer mount shock absorber
- A1: Installation position (1)
- A2: Installation position (2)
- A3: Outer mount shock absorber later installation (installation groove machined)

### Note on model no. selection

1. Port position of basic type / high accuracy type is provided on side surface. Other ports are plugged.
2. Outer mount shock absorber can not be installed onto basic type / high accuracy type later. Select the A3 type by an option when installed later.
3. If an outer mount shock absorber is retrofit on the A3 type, the state will be the same as the A1 type. Consult CKD for A2 type.
4. Refer to page 29 for discrete switch, option model No.

### Example of model number

GRC-F-10-180-T2V-D-A1

- Double acting
- Model no. : Basic type
- Size : 10
- Port thread type : Rc thread
- Oscillating angle : 180°
- Switch model no. : Proximity/2 wire, radial lead wire, lead wire 1m
- Switch quantity : Two
- Option : With outer mount shock absorber installation position (1)

### Installation position

1. GRC-*-A1
2. GRC-*-A2

### Outer mount shock absorber installation drawing

- Installation position (1) GRC**-A1
- Installation position (2) GRC**-A2

### Note on model no. selection

- If an outer mount shock absorber is retrofit on the A3 type, the state will be the same as the A1 type.
- Consult CKD for A2 type.
Selection method

Select based on the following procedures.

**Step 1  Oscillating time confirmation**
If oscillating time is set exceeding specifications range, actuator may be operated unstably, or actuator may be damaged. Always use this product within specified oscillating time adjusting range.

<table>
<thead>
<tr>
<th>Oscillating time (S)</th>
<th>Using with 90°</th>
<th>Using with 180°</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2 to 1.5</td>
<td>0.4 to 3.0</td>
<td></td>
</tr>
</tbody>
</table>

**Step 2  Size (torque) selection**
Selecting method is roughly categorized with 3 types per load type.
Calculate required torque according to conditions. Total each torque to obtain required torque for combined load. Select size from theoretical torque table or actual torque diagram per working pressure to meet required torque.

1. **Static load (Ts)**
   When static pushing force is required for clamp, etc.
   \[ Ts = Fs \times L \]
   - Ts: Required torque (N·m)
   - Fs: Required force (N)
   - L: Length from center of rotation to pressure cone apex (m)

2. **Resistance load (TR)**
   When force caused by frictional force, gravity and other external force are applied.
   \[ TR = K \times Fr \times L \]
   - Tr: Required torque (N·m)
   - K: Slack coefficient
     - No load fluctuates K = 2
     - Load fluctuates K = 5
   - Fr: Required force (N)
   - L: Length from center of rotation to pressure cone apex (m)

3. **Inertia load (TA)**
   To rotate object
   \[ TA = 5 \times I \times \omega^2 \]
   \[ \omega = \frac{2 \theta}{t^2} \]
   - TA: Required torque (N·m)
   - I: Moment of inertia (kg·m²)
   - \( \omega \): Angular acceleration (rad/s²)
   - \( \theta \): Oscillating angle (rad)
   - t: Oscillating time (s)
   Calculate moment of inertia with using moment of inertia and oscillating time (Page 48) or figure etc. for moment of inertia calculation (Page 49).

**Step 3  Allowable energy confirmation**
For inertia load, if load kinetic energy exceeds allowable value at end of oscillating, actuator may be damaged. Select one within allowable energy according to table 1.
If energy is too large, stop load with using external shock absorber etc.

\[ E = \frac{1}{2} I \times \omega^2 \]
\[ \omega = \frac{2 \theta}{t} \]
- E: Kinetic energy (J)
- I: Moment of inertia (kg·m²)
- \( \omega \): Angular speed (rad/s)
- \( \theta \): Oscillating angle (rad)
- t: Oscillating time (s)
Calculate moment of inertia with using moment of inertia and oscillating time (Page 48) or figure etc. for moment of inertia calculation (Page 49).
Selection method

Step 4  Allowable load confirmation

If load applies to table, load is to be within allowable value on Table 2.
If combined load is applied, total of ratio for allowable value per load is to be 1.0 or less.

Load is categorized with following 3 types.
(1) Thrust load (axial load)

(2) Radial load (sideways load)

(3) Moment load

Substitute result to following formula, and check after each load is calculated.

\[
\frac{W_s}{W_{s\max}} + \frac{W_r}{W_{r\max}} + \frac{M}{M_{\max}} \leq 1.0
\]

\(W_s\) : Thrust load (N)
\(W_r\) : Radial load (N)
\(M\) : Moment load (N-m)
\(W_{s\max}\) : Allowable thrust load (N)
\(W_{r\max}\) : Allowable radial load (N)
\(M_{\max}\) : Allowable moment load (N-m)
**Selection example (1)**

Load of rectangular parallelepiped applies

![Rectangular parallelepiped](image)

**<Operation conditions>**
- **Pressure**: 0.5 (MPa)
- **Oscillating angle**: 90°
- **Oscillating time**: 0.6 (s)
- **Load (material: aluminum alloy)**: 0.5 (kg)

**Step1 Oscillating time confirmation**
Oscillating time is 0.6 (s/90°) according to operation conditions. Since oscillating time is within adjusting range 0.2 to 1.5 (s/90°), go to next step.

**Step2 Size (torque) selection**
First, calculate moment of inertia \( I \) due to inertia load.

\[
I = 0.5 \times \frac{0.06^2}{6} = 3 \times 10^{-4} \text{(kg·m}^2) \quad \cdots \cdot
Selection guide: Selection example

Selection example (2)

Load of rectangular parallelepiped applies to rectangle plate.

<Operation conditions>
Pressure : 0.5 (MPa)
Oscillating angle : 90°
Oscillating time : 1.0 (s)
Load (material: steel)
<Rectangle plate on left from center of rotation> : 0.21 (kg)
<Rectangle plate on right from center of rotation> : 1.40 (kg)
<Cube> : 7.8 (kg)

Step1  Oscillating time confirmation
Oscillating time is 1.0 (s/90°) according to operation conditions.
Since oscillating time is within adjusting range 0.2 to 1.5 (s/90°), go to next step.

Step2  Size (torque) selection
First, calculate moment of inertia (I) due to inertia load.

<Rectangle plate>
I = 1.40 × [4 × 0.20² + 0.06²] / 12
+ 0.21 × [4 × 0.03² + 0.06²] / 12
= 1.92 × 10⁻² (kg·m²)

<Cube>
I = 7.8 × [0.1² / 6] + 7.8 × 0.15²
= 0.189 (kg·m²)

Therefore, total moment of inertia (I) is following.
I = I₁ + I₂ = 0.21 (kg·m²)  (1)

Next, calculate angular acceleration (ω).

According to conditions θ = 90° = π / 2 (rad), t = 1.0 (s)
Therefore,
ω = g / t² = π / 1.0² = 3.14 (rad/s)
(2)

Therefore, inertia load (TA) from (1) (2)
TA = 5 × 0.21 × 3.14 = 3.30 (N·m)
(3)

According to (3) value and operational conditions, from torque at 0.5 (MPa)

GRC - 50 - 90 - A1, A2  (A)

can be selected.

Step3  Allowable energy confirmation
Check if value is within allowable energy after kinetic energy is calculated.
Calculate average angular speed (ω).

According to conditions θ = 90° = π / 2 (rad), t = 1.0 (s)
Therefore,
ω = g / t² = π / 1.0² = 3.14 (rad/s)
(2)

Therefore, kinetic energy (E) is
E = 1 / 2 × 0.19 × 3.14²
= 0.937 (J)  (4)

From (A) selected at (4) and Step 2
GRC - 80 - 90 - A1, A2  (B)
can be selected.

Step4  Allowable load confirmation
Finally, check if value is within allowable load range after load that applies to table is calculated.

<Thrust load>
Total weight
7.8 + 1.40 + 0.21 = 9.41 (kg)
Thus, thrust load (Ws)
Ws = 9.41 × 9.8 = 92.2 (N)  (5)

<Radial load>
Since no radial load is applied.
W_R = 0 (N)  (6)

<Moment load>
Moment load (M) by rectangle plate
1.40 × 9.8 = 13.72 (N·m)
0.21 × 9.8 = 2.06 (N·m)
Therefore,
M₁ = 13.72 × 0.1 - 2.06 × 0.015 = 1.34 (N·m)
Moment load (M₂) by rectangular parallelepiped
7.8 × 9.8 = 76.44 (N)
Therefore,
M₂ = 76.44 × 0.15 = 11.47 (N·m)
Therefore, if total M₁ and M₂.
M = 1.34 + 11.47 = 12.81 (N·m)
(7)

According to (5) (6) (7) and (B)

W_s max
W_s
W_R max
W_R
M max
M

450
400
320
300
13
10
12.8
12.6
1.48 > 1.0
(8)

Increase size, and recalculate with GRC-80-90. Since moment load is exceeding allowable value.

W_s max
W_s
W_R max
W_R
M max
M

580
540
400
320
15
13
12.8
12.6
1.14 > 1.0
(9)

Since total load value is still exceeding allowable value, select high accuracy type, and calculate following.

W_s max
W_s
W_R max
W_R
M max
M

650
600
480
400
15
12.8
12.6
0.99 ≤ 1.0
(10)

According to (C), total load value is within allowable load value,

GRC - K - 80 - 90 - A1, A2

can be selected.
Horizontal rectangle plate load applies to rotary shaft.

\[
\omega = \frac{2 \theta}{t^2} = \frac{2 \pi}{0.5^2} = 25.13 \text{(rad/s}^2) \quad \text{(3)}
\]

Therefore, inertia load \((T_x)\) from (2) (3)
\[
T_x = 5 \times 2.88 \times 10^{-3} \times 25.13 = 0.362 \text{(N·m)} \quad \text{(4)}
\]

According to (1), (4) total torque
\[
T = 1.03 + 0.362 = 1.39 \text{(N·m)} \quad \text{(5)}
\]

According to (5) value and operational conditions, from torque at 0.5 (MPa)

\[
\text{GRC - 20 - 180} \quad \text{(A)}
\]
can be selected.

**Step3  Allowable energy confirmation**

Check if value is within allowable energy after kinetic energy is calculated.

Calculate average angular speed \(\omega\).

According to conditions \(\theta = 180^\circ = \pi \text{ (rad)}, t = 0.5 \text{ (s)}\)

Therefore,
\[
\omega = \frac{2 \theta}{t} = \frac{2 \pi}{0.5} = 12.57 \text{(rad/s)}
\]

Therefore, kinetic energy \((E)\) is
\[
E = \frac{1}{2} \times 2.88 \times 10^{-3} \times 12.57^2
\]

\[
= 0.23 \text{(J)} \quad \text{(6)}
\]

From (A) selected at (6) and Step 2

\[
\text{GRC - 20 - 180 - A1, A2} \quad \text{(B)}
\]
can be selected.
Step4  Allowable load confirmation

Finally, check if value is within allowable load range after load that applies to table is calculated.

<Thrust load>
Since no thrust load is applied, thrust load (Ws)

\[ W_s = 0 \text{(N)} \]  \hspace{1cm} \text{(7)}

<Radial load>
Total weight

\[ W_R = 0.7 \times 9.8 = 6.9 \text{(N)} \]  \hspace{1cm} \text{(8)}

<Moment load>
Since no moment load is applied, moment load (M)

\[ M = 0.03 \times (0.2 + 0.5) \times 9.8 \]
\[ = 0.21 \text{(N·m)} \]  \hspace{1cm} \text{(9)}

According to (7), (8), (9) and (B)

\[ \frac{W_s}{W_{s_{\text{max}}}} = \frac{6.9}{150}, \quad \frac{W_R}{W_{R_{\text{max}}}} = \frac{0.7}{20} \]
\[ = 0.046, \quad 1.0 \]

Total load value is within allowable load value according to (B) and (C).

\[ \text{GRC - 20 - 180 - A1, A2} \]

can be selected.
1. Energy absorbing performance and oscillating time

(1) Relations between moment of inertia and oscillating time are shown as diagram below. Always use within the lower right range of the graph as the shaft, etc., could break. Refer to diagram for selection etc.

- **Basic type / high accuracy type**

![Graph showing relations between moment of inertia and oscillating time](image1)

- **Size 5, 10, 20**

- **Size 30, 50, 80**

(2) The relation of the absorption energy and oscillating time when an external shock absorber is installed is shown with the following line graph. Always use within the lower left range of the graph as the shaft, etc., could break. Refer to diagram for selection etc.

- **Absorbed energy and oscillating time**

![Graph showing absorbed energy and oscillating time](image2)
## 2. Moment of inertia calculation

The installation direction is horizontal.

If vertical installation attitude, oscillating time varies.

When M₂ is extremely small comparing to M₁, may be calculated as M₂ = 0

When shape of gear is increasing, gear moment of inertia should be considered.

### 2.1 Moment of inertia calculation

#### Concentrated load

\[ I = M_1 (R_1^2 + k_1^2) + \frac{M_2 R_2^2}{3} \]

#### Table: Moment of inertia calculation

<table>
<thead>
<tr>
<th>Sketch</th>
<th>Requirements</th>
<th>Moment of inertia I kg/m²</th>
<th>Radius of gyration K²</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dial plate</td>
<td>● Diameter: d (m)</td>
<td>[ I = \frac{Md^4}{8} ]</td>
<td>( \frac{d^4}{8} )</td>
<td>No installation direction</td>
</tr>
<tr>
<td>Dial plate with step</td>
<td>● Diameter: d₁ (m), d₂ (m)</td>
<td>[ I = \frac{1}{8} (M_1 d_1^4 + M_2 d_2^4) ]</td>
<td>( \frac{d_1^4 + d_2^4}{8} )</td>
<td>Ignore, when d₁ section is extremely small comparing to d₂ section</td>
</tr>
<tr>
<td>Thin rod</td>
<td>● Bar length: R (m)</td>
<td>[ I = \frac{MR^2}{3} ]</td>
<td>( \frac{R^3}{3} )</td>
<td>The installation direction is horizontal.</td>
</tr>
<tr>
<td>Thin rod</td>
<td>● Bar length: R₁, R₂</td>
<td>[ I = \frac{M_1 R_1^2}{3} + \frac{M_2 R_2^2}{3} ]</td>
<td>( \frac{R_1^3 + R_2^3}{3} )</td>
<td>If vertical installation attitude, oscillating time varies</td>
</tr>
<tr>
<td>Rectangular parallelepiped</td>
<td>● Plate length: a₁, a₂</td>
<td>( I = \frac{M_1}{12} (4a_1^2 + b^2) + \frac{M_2}{12} (4a_2^2 + b^2) )</td>
<td></td>
<td>The installation direction is horizontal.</td>
</tr>
<tr>
<td>Rectangular parallelepiped</td>
<td>● Plate length: a₁, a₂</td>
<td>( I = \frac{M_1}{12} (4a_1^2 + b^2) + \frac{M_2}{12} (4a_2^2 + b^2) )</td>
<td></td>
<td>If vertical installation attitude, oscillating time varies</td>
</tr>
<tr>
<td>Rectangular parallelepiped</td>
<td>● Length of side: b</td>
<td>[ I = \frac{M}{12} (a^2 + b^2) ]</td>
<td>( \frac{a^2 + b^2}{12} )</td>
<td>No installation direction</td>
</tr>
<tr>
<td>Rectangular parallelepiped</td>
<td>● Length of side: a(m), b(m)</td>
<td>[ I = \frac{M}{12} (a^2 + b^2) ]</td>
<td>( \frac{a^2 + b^2}{12} )</td>
<td>When using with sliding, please consult with CKD</td>
</tr>
</tbody>
</table>

### How to convert load JL to rotary actuator shaft rotation when using with gear

\[ I = \frac{M_1 R_i^2}{3} \]

#### Gear

\[ I = \frac{(a_1^2 + a_2^2 + b^2) L_i}{N-m} \]
## Technical data

### Sketch

#### Rectangular parallelepiped

- **Length of side** \(a(m)\)
- **Distance from rotary shaft to load center** \(b(m)\)
- **Weight** \(M(kg)\)

**Moment of inertia** \(I = \frac{M}{12} (a^2 + b^2) + MR^2\)

- **Remarks**: Same for cube

#### Rectangular parallelepiped of hollow

- **Length of side** \(h_1(m)\)
- **Distance from rotary shaft to load center** \(R(m)\)
- **Weight** \(M(kg)\)

**Moment of inertia** \(I = \frac{M}{12} (h_1^2 + h_2^2) + MR^2\)

- **Remarks**: Cross section is for cube only

#### Cylinder

- **Diameter** \(d(m)\)
- **Distance from rotary shaft to load center** \(R(m)\)
- **Weight** \(M(kg)\)

**Moment of inertia** \(I = \frac{Md^2}{16} + MR^2\)

#### Cylinder of hollow

- **Diameter** \(d_1(m)\), \(d_2(m)\)
- **Distance from rotary shaft to load center** \(R(m)\)
- **Weight** \(M(kg)\)

**Moment of inertia** \(I = \frac{M}{16} (d_1^2 + d_2^2) + MR^2\)

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*To find moment of inertia, first, convert model load, jig etc., to simple shapes, then calculate values. The moment of inertia calculation and total is made for combined load.*
3. Table deflection (reference value)

If moment load is applied to GRC, displacement (reference value) of table at 100mm away from center of rotation is shown below. (It is assumed that the table is in a non-rotating stationary state.)

Measuring method

Table deflection

![Diagram showing table deflection](image)

Table deflection of GRC (basic type)

Table deflection of GRC-K (high accuracy type)
4. Effective torque diagram

Note that torque at oscillation end is half of the value on following graph.
5. Oscillating angle adjustment method

- Basic type / high accuracy type

**With outer mount shock absorber (GRC-*-A1)**

180° specifications

90° specifications
With outer mount shock absorber (GRC-*-A2)

Max. oscillating range 186°
Min. oscillating range 174°

Clockwise end adjusting range 6°
Counter clockwise end adjusting range 6°

Oscillation direction

180° specifications

90° specifications