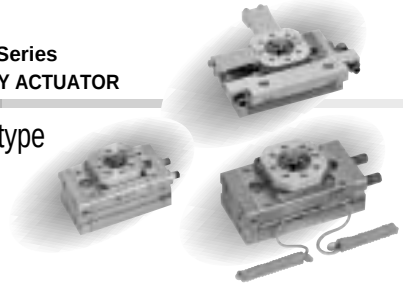
High load / accurate positioning

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

GRC Series
TABLE TYPE ROTARY ACTUATOR

Rack and pinion type



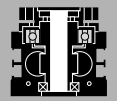
1 Flexible design

- Small GRC-5 $^{\text{GRC-5}}_{\text{Torque5 (0.5N·m)}}$ with 0.5N·m debuts first in industry.

  Small torque never achieved
  6 types of 5 / 10 / 20 / 30 / 50 / 80

- Basic type and high precision type are available with same dimensions.

  Products changes in manufacturing lines (basic type and high precision type) are conducted speedy.

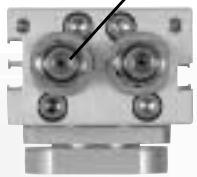
Basic type **GRC**	High precision type **GRC-K**
	
Reliable operation with radial bearing	Cross roller bearing used for high precision / high load

- 90° specifications and 180° specifications are available.

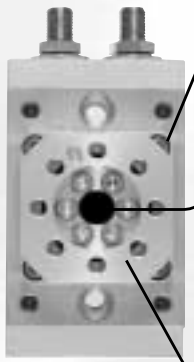
  Realizing more compact type for oscillating angle 90° type

GRC series variation

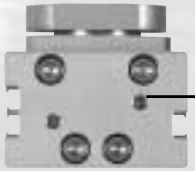
	Basic type GRC	High precision type GRC-K
With switch	●	●
Torque (at torque value, 0.5MPa)		
5(0.5N·m)	●	—
10(1.0N·m)	●	●
20(2.0N·m)	●	●
30(3.0N·m)	●	●
50(5.0N·m)	●	●
80(8.0N·m)	●	●
Oscillating angle		
90° type	●	●
180° type	●	●
Option		
Shock absorber type stopper	●	●



Rubber cushioned angle adjusting bolt for oscillating angle adjustment



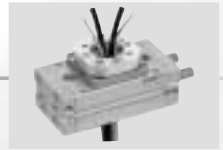
Rotary table enabling direct mount of load.



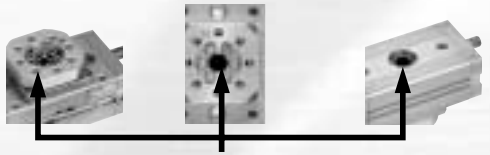
2 Easy installation

- Outlet direction of piping port can be selected from 3 sides.
- Simple piping / wiring due to large hollow

  Hollow diameters 4 to 17 dia. are available.



- Socket and spigot for positioning is available on table top (4 points) or main body bottom (1 point).

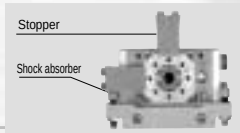


Socket and spigot for positioning

3 Easy operation

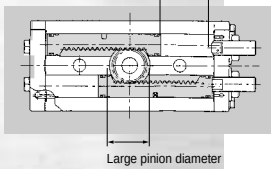
- Reliable operation due to external stopper.

  Due to external stopper and shock absorber (option), smooth stop is achieved without backlash.

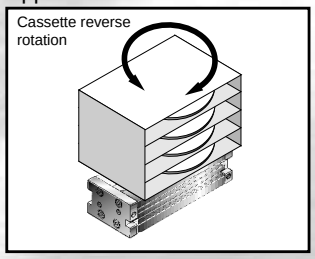


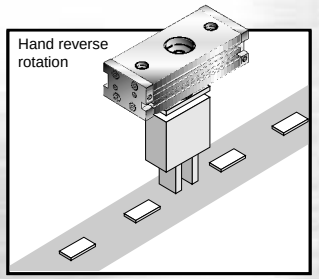
- Low speed operation of **1.5** seconds/90°

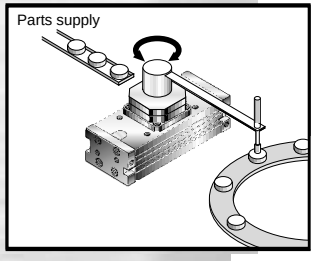
  Low speed operation realized due to large pinion diameter and long piston stroke length



Applications







Series variation

Table type rotary actuator GRC series

●: Standard, ◎: Option, : Not available

Variation	Model No. / JIS symbol	Effective torque (at 0.5MPa) (N·m)							Max. oscillating angle (°)		Option			Switch	Page
		0.5	1.0	2.0	3.0		5.0	8.0	90	180	With outer mount shock absorber (1) A1	With outer mount shock absorber (2) A2	Outer mount shock absorber for later installation Installation groove machined A3		
Basic type	GRC	●	●	●	●		●	●	●	●	◎	◎	◎	◎	26
High precision type	GRC-K		●	●	●		●	●	●	●	◎	◎	◎	◎	26
Fine speed type	GRC-F	●	●	●	●		●	●	●	●	◎	◎	◎	◎	40
High precision type / fine speed type	GRC-KF		●	●	●		●	●	●	●	◎	◎	◎	◎	40

Note: Refer to Page 34 for outer mount shock absorber installation position.

Pneumatic Components

Safety Precautions

Always read before starting use.
Refer to Intro 45 for general details on the cylinder, and to Intro 52 for details on the cylinder switch.

Rotary actuator GRC Series

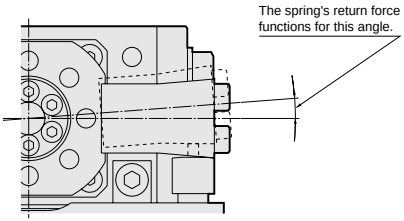
CAUTION Design & Selection

1 Select the modal 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.

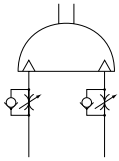
2 If torque required by the load is small even during oscillation, the actuator could be damaged by load inertia. Consider the load moment of inertia, kinetic energy, and oscillation time, and use at a level below tolerable energy.

3 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.



4 Precautions for fine speed (GRC-F)

- **Use with oil-free specifications. (Must be oil-free)**
  Features may change if the device is lubricated.
- **Assemble the flow control valve near the rotary actuator.**
  If the flow 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 flow control valve.
- **Generally, higher air pressure, and smaller load result in more stable operation.**
  Use a load at 50% or less.
- **Operation will stabilize if speed is controlled at the meter-out circuit.**



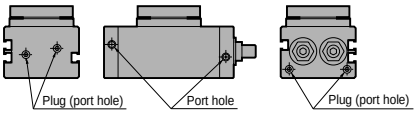
PUSH : Meter-out
PULL : Meter-out

- **Avoid use with vibration.**
  The product will be adversely affected by vibration and operation will become unstable.

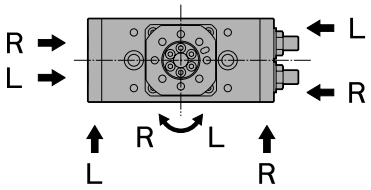
1 Do not further machine the product.
If so, strength will decrease and could lead to product damage. This may result in injury or damage to operator, component, or equipment.

2 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 flow control valve on piping, etc.

3 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 : Japan LOCTITE
Three Bond 1334 : Three Bond



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



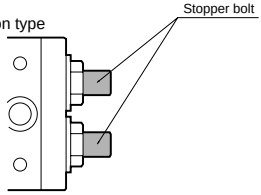
R: Clockwise rotation (right rotation)
L: Counterclockwise rotation (left rotation)

5 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.

6 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).

7 The adjustment angle per rotation of the angle adjusting screw (stopper bolt of shock absorber) is shown below.

Basic type, high precision type



With external shock absorber

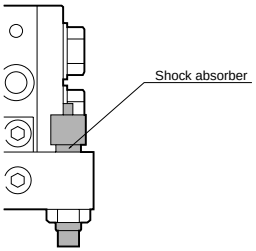


Table 1

Size	Adjustment angle per stopper bolt rotation	Adjustment angle per shock absorber rotation
5	8.7°	1.1°
10	4.9°	1.0°
20	5.7°	1.1°
30	3.8°	0.9°
50	3.5°	0.7°
80	3.5°	0.9°

Safety Precautions

Always read before starting use.
Refer to Intro 45 for general details on the cylinder, and to Intro 52 for details on the cylinder switch.

Rotary actuator GRC Series

CAUTION Installation & Adjustment

8 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.

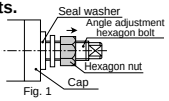


Fig. 1

(2) Separate the seal washer from the head cover as shown in Fig. 2.

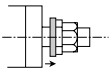


Fig. 2

(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.

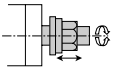


Fig. 3

(4) After adjusting the angle, move the seal washer near the head cover by hand as shown in Fig. 4.

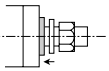


Fig. 4

(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.

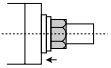


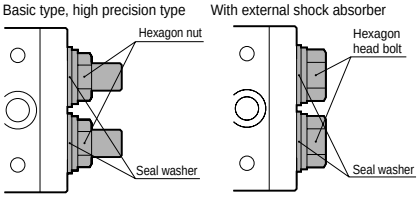
Fig. 5

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.

Table 2

Size	Tightening torque (N·m)
5	5.9 ±10%
10	11.8 ±10%
20	11.8 ±10%
30	11.8 ±10%
50	22.1 ±10%
80	22.1 ±10%

9 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 3. Otherwise, air may leak.



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

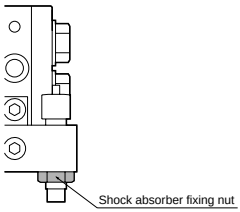


Table 3

Size	5	10	20	30	50	80
Tightening torque N·M	1.47		1.96		5.14	8.58

CAUTION Installation & Adjustment

11 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.

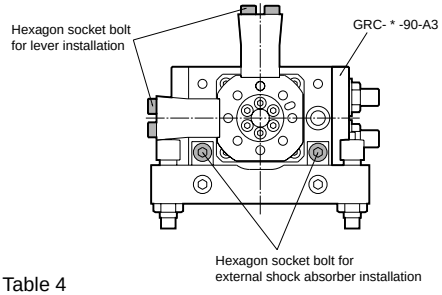
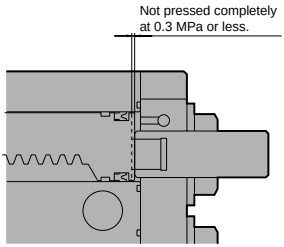


Table 4

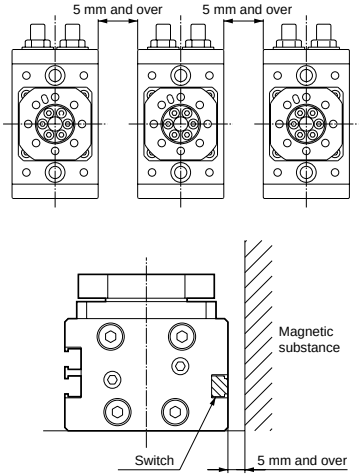
Size	Lever installation bolt	External shock absorber installation bolt
	Tightening torque	Tightening torque
5	0.6 ±20%	1.4 ±20%
10	1.4 ±20%	2.9 ±20%
20	2.8 ±20%	4.8 ±20%
30	2.8 ±20%	4.8 ±20%
50	12.0 ±20%	12.0 ±20%
80	12.0 ±20%	12.0 ±20%

12 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 0.3 MPa or more.



13 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.



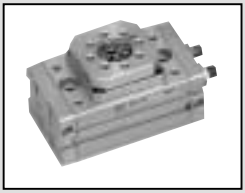


Table type rotary actuator
Basic type / high precision type

GRC/GRC-K Series

• Size: 5 / 10 / 20 / 30 / 50 / 80

JIS symbol

CAD DATA AVAILABLE.

Specifications

Descriptions			GRC-5	GRC-10 GRC-K-10	GRC-20 GRC-K-20	GRC-30 GRC-K-30	GRC-50 GRC-K-50	GRC-80 GRC-K-80
Size			5	10	20	30	50	80
Logical torque Note 1		N·m	0.5	1.0	2.0	3.0	5.2	8.1
Actuation			Rack & pinion type					
Working fluid			Compressed air					
Max. working pressure		MPa	1.0					
Min. working pressure Note 2	Basic type	MPa	0.10					
	High precision type		—	0.15			0.10	
	With outer mount shock absorber		0.25	0.20	0.15			
Withstanding pressure		MPa	1.6					
Ambient temperature		°C	0 to 60 (to be unfrozen)					
Port size			M5				Rc1/8	
Cushion	Basic type / high accuracy type		Rubber cushion					
	With outer mount shock absorber		Shock absorber					
	Shock absorber model No.		NCK-0.3		NCK-0.7		NCK-1.2	NCK-2.6
Allowable energy absorption J	Basic type / high precision type		0.005	0.008	0.03		0.04	0.11
	With outer mount shock absorber		0.46	0.59	1.41	1.71	2.33	2.78
Shock absorber stroke length		mm	3.5	3.5	5	5	5.5	6.5
Lubrication			Not required (use turbine oil ISOVG32 for lubrication.)					
Volumetric capacity Note 3		cm³	90°	1.3	3.5	7.0	10.5	18.1	28.3
			180°	3.4	6.6	13.4	20.0	34.4	53.7
Oscillating angle adjusting range Note 4	Basic type / high precision type		90°	0° to 100°					
			180°	90° to 190°					
	With outer mount shock absorber		90°	90° ±6°					
			180°	180° ±6°					
Oscillating time adjusting range Note 5		s/90°	0.2 to 1.5					
Table deflection (reference value) Note 6		Basic type	±0.17°			±0.23°	±0.26°	±0.32°
		High accuracy type	—	±0.026°				

Note 1: Logical torque is value when working pressure 0.5MPa.
Note 2: Working pressure to be 0.3MPa and over to push over rubber cushion integrated in basic / high precision types.
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 0.5MPa.
Note 6: Displacement of table at 100mm away from the center of rotation is shown on technical data (Page 51).

Switch specifications

• One color/bi-color indicator

Descriptions	Proximity 2 wire		Proximity 3 wire	
	T2H / T2V	T2YH / T2YV	T3H / T3V	T3YH / T3YV
Applications	Programmable controller		Programmable controller, relay	
Power voltage	—		DC10 to 28V	
Load voltage	DC10 to 30V		DC30V or less	
Load current	5 to 20mA (note 1)		100mA or less	50mA or less
Light	LED (ON lighting)	Red/green LED (ON lighting)	LED (ON lighting)	Red/green LED (ON lighting)

Note 1 : Max. load current above: 20mA is value at 25 °C. When ambient temperature around switch is higher than 25 °C, value is lower than 20mA. (5 to 10mA at 60 °C)

• With preventive maintenance output

Descriptions		Proximity 3 wire	Proximity 4 wire	Proximity 3 wire	Proximity 4 wire
		T2YFH/V	T3YFH/V	T2YMH/V	T3YMH/V
Applications		Programmable controller	Programmable controller, relay	Programmable controller	Programmable controller, relay
Light	Installation position adjustment part	Red/green LED (ON lighting)			
	Preventive maintenance output section	—		Yellow LED (ON lighting)	
Output section	Current voltage	—	DC10V to 28V	—	DC10V to 28V
	Load voltage	DC10V to 30V	DC30V or less	DC10V to 30V	DC30V or less
	Load current	DC5 to 30mA	DC50mA or less	DC5 to 20mA	DC50mA or less
Preventive maintenance output section	Load voltage	DC30V or less			
	Load current	DC20mA or less	DC50mA or less	DC5 to 20mA or less	DC50mA or less

Min. oscillating angle when switch installed

Torque	5	10	20	30	50	80
T type proximity T type 2 color indicator	20°	15°	17.5°	12.5°	12.5°	12.5°

Theoretical torque table

(Unit: N·m)

Size	Working pressure (MPa)									
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
5	—	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
10	—	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0
20	—	0.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0
30	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0
50	1.0	2.1	3.1	4.1	5.2	6.2	7.3	8.3	9.3	10.4
80	1.6	3.2	4.9	6.5	8.1	9.7	11.3	13.0	14.6	16.2

Product mass

(Unit: kg)

Oscillating angle / Model No.	90°		180°		Outer mount shock absorber mass	Switch mass (per piece)
	Basic type	High precision type	Basic type	High precision type		
GRC- 5	0.39	—	0.43	—	0.20	0.02
GRC-10	0.48	0.50	0.56	0.58	0.30	
GRC-20	0.78	0.80	0.88	0.90	0.40	
GRC-30	1.05	1.30	1.25	1.50	0.50	
GRC-50	1.80	2.10	2.10	2.40	0.60	
GRC-80	2.30	2.60	2.70	3.00	0.70	

How to order

• Without switch

GRC - 10 - 90 ——— A1

• With switch

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

Ⓐ Model

Ⓑ Torque

Ⓒ Oscillating angle

Ⓓ Switch model No.

Ⓔ Switch quantity

Ⓕ Option

Symbol	Descriptions
Ⓐ Model	
GRC	Basic type
GRC-K	High precision type

Ⓑ Torque (at 0.5MPa)			
Model		GRC	GRC-K
5	0.5[N·m]	●	–
10	1.0[N·m]	●	●
20	2.0[N·m]	●	●
30	3.0[N·m]	●	●
50	5.0[N·m]	●	●
80	8.0[N·m]	●	●

Ⓒ Oscillating angle	
90	90°
180	180°

Ⓓ Switch model No.				
Axial lead wire	Radial lead wire	Contact	Display	Lead wire
T2H *	T2V *	Proximity	1 color indicator	2 wire
T3H *	T3V *			3 wire
T2YH *	T2YV *		2 color indicator	2 wire
T3YH *	T3YV *			3 wire
T2YFH *	T2YFV *		With preventive maintenance output	3 wire
T3YFH *	T3YFV *			4 wire
T2YMH *	T2YMV *			3 wire
T3YMH *	T3YMV *			4 wire

***Lead wire length**	
Blank	1m (standard)
3	3m (option)
5	5m (option)

Ⓔ Switch quantity	
R	Clockwise rotation 1 piece
L	Counterclockwise 1 piece
D	2 pieces

Ⓕ 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 for later installation (installation groove machined)

⚠Note on model No. selection

Note 1: Port position of basic type / high precision type is provided on side surface. Other ports are plugged.

Note 2: Outer mount shock absorber is to basic type / high precision type later. If it will be installed later, select optional A3 type.

Note 3: When install outer mount shock absorber onto A3 type later, in the same manner with A1 type. Consult with CKD on A2 type use.

[Example of model number]

GRC-10-180-T2V-D-A1

Double acting

Ⓐ Model : Basic type

Ⓑ Torque : 10°

Ⓒ Oscillating angle : 180°

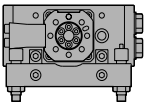
Ⓓ Switch model No. : Proximity / 2 wire
Radial lead wire / lead wire 1m

Ⓔ Switch quantity : 2 pieces

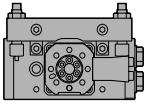
Ⓕ Option : With outer mount shock absorber
Installation position (1)

Outer mount shock absorber installation drawing

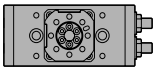
GRC-*-A1
(Installation position (1))



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



GRC-*-A3
(Installation position (3))



How to order switch

• Switch main body only

SW - T2H3 (D)

Switch model No.
(Previous page D)

How to order repair kits

• Sets of packing seal etc. repair parts

GRC - 5 K (B)

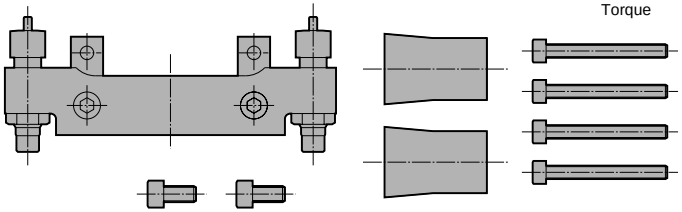
Torque
(Previous page B)

How to order outer mount shock absorber set

• Set of plate, shock absorber and lever
• Used when installing outer mount shock absorber onto A3 type later.

GRC - 5 - A 2 (C)

Torque



C Oscillating angle	
1	90° specifications
2	180° specifications

Indicate 1, 2 to section C.

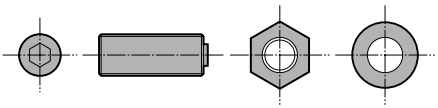
Note: Set descriptions differ per 90° specifications and 180° specifications. Figure shows 90° specifications.

How to order stopper bolt set for adjustable angle

• Set with urethane rubber of hexagon head hole set screw, hexagon nut and plain washer
• Used when using without outer mount shock absorber

GRC - 5 S (B)

Torque
(Previous page B)

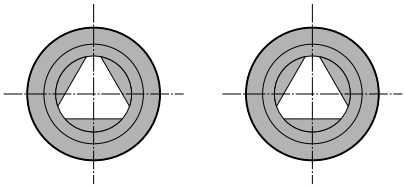


How to order seal washer set

• Used at seal washer replacement
• Seal washer 2 pc.

GRC - 5 D (B)

Torque
(Previous page B)

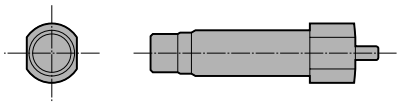


How to order shock absorber set for adjustable angle

• Set of shock absorber and stopper

GRC - 5 - A01 (B)

Torque
(Previous page B)

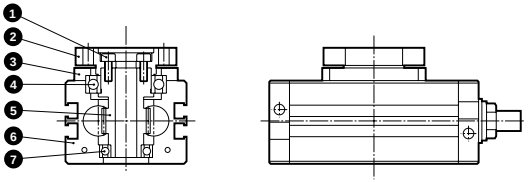


Applicable shock absorber model No.

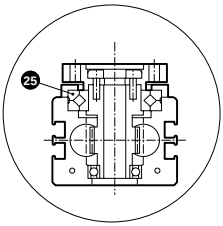
Model	Shock absorber model No.
GRC-5	NCK-00-0.3
GRC-10	NCK-00-0.3
GRC-20	NCK-00-0.7
GRC-30	NCK-00-0.7
GRC-50	NCK-00-1.2
GRC-80	NCK-00-2.6

Internal structure and parts list

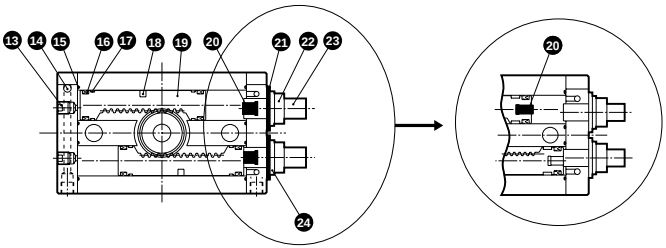
- GRC (basic type)
- GRC-K (high precision type)



Sectional view of high accuracy type



Position of cushion rubber differs for GRC-*-5.



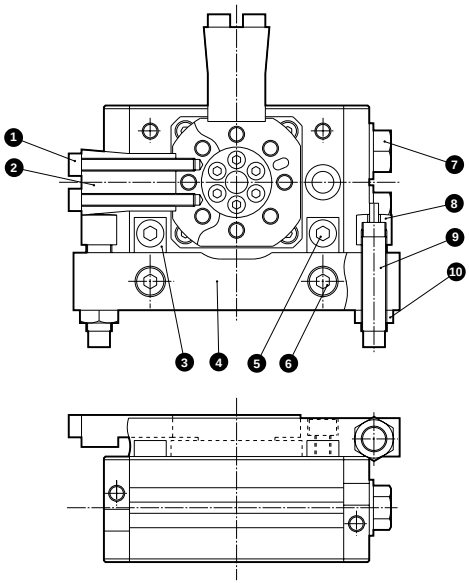
Parts list

No.	Parts name	Material	Remarks	No.	Parts name	Material	Remarks
1	Hexagon socket head cap screw	Stainless steel		13	Hexagon socket head set screw	Stainless steel	
2	Table	Aluminum alloy	Alumite	14	Steel ball	Stainless steel	
3	Bearing cover	Aluminum alloy (high accuracy type is stainless steel)	Alumite	15	Cylinder gasket	Nitrile rubber	
4	Ball bearing (1)	Alloy steel		16	Piston packing seal	Nitrile rubber	
5	Shaft	Alloy steel		17	Wear ring	Acetar resin	
6	Cylinder main body	Aluminum alloy	Hard alumite	18	Magnet	Plastic (5.10 for special alloy)	
7	Ball bearing (2)	Alloy steel		19	Piston	Stainless steel	
8	Hexagon socket head cap screw	Stainless steel		20	Cushion rubber	Urethane rubber	
9	Head cover (1)	Aluminum alloy	Alumite	21	Seal washer	Steel, nitrile rubber	Galvanizing
10	Gasket	Nitrile rubber		22	Hexagon nut	Steel	Nickeling
11	Hexagon socket head cap screw	Stainless steel		23	Stopper bolt	Alloy steel	Nickeling
12	Head cover (2)	Aluminum alloy	Alumite	24	Plain washer	Stainless steel	
				25	Cross roller bearing	Alloy steel	

Internal structure and parts list

• GRC-*-A (with outer mount shock absorber)

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



Parts list

No.	Parts name	Material	Remarks
1	Hexagon socket head cap screw	Stainless steel	
2	Lever	Alloy steel	Nickeling
3	Connector	Steel	Nickeling
4	Plate	Aluminum alloy	Alumite
5	Hexagon socket head cap screw	Stainless steel	
6	Hexagon socket head cap screw	Stainless steel	
7	Hexagon head bolt	Stainless steel	
8	Stopper	Stainless steel	
9	Shock absorber		
10	Hexagon nut	Steel	Nickeling

Repair kits

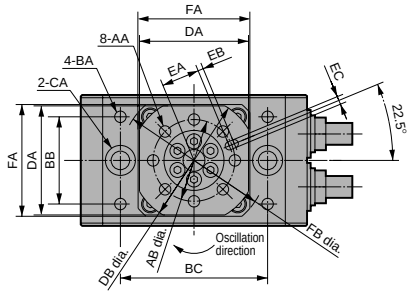
Kit number	Repair parts number
GRC-5K	⑩ ⑮ ⑯ ⑰ ⑳
GRC-10K	
GRC-20K	
GRC-30K	
GRC-50K	
GRC-80K	

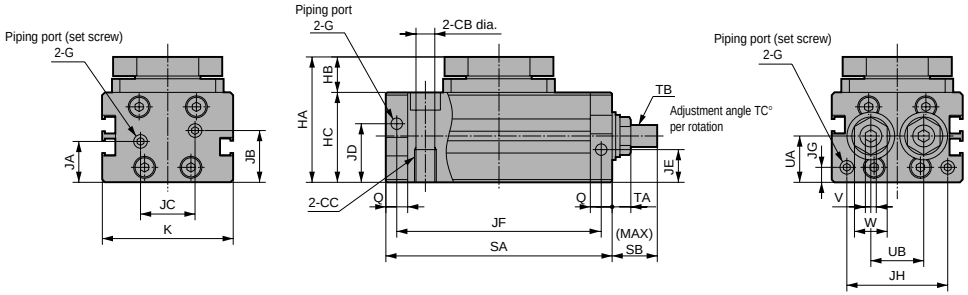
Note 1: Indicate kit number when ordering repair parts.
Note 2: Avoid disassembling / repair, since high accuracy type uses highly controlled precision part.
When repairing high accuracy type, consult with CKD.

Dimensions

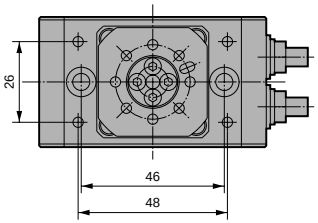
- GRC basic type
- GRC-K high accuracy type

CAD (File name: Page 55 or Ending 153 to 154)

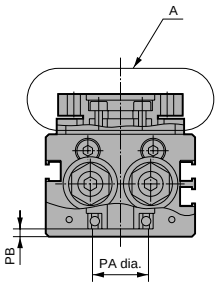


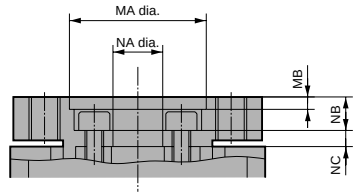


GRC-5

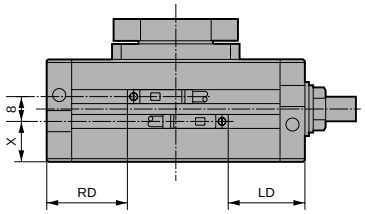


Positions of 4-BA and 2-CA differ for GRC-5 only.





Section A details



Switch installation position

Size	AA	AB	BA	BB	BC	CA	CB	CC	DA	DB	EA	EB	EC	FA	FB	G	HA	HB	HC	JA	JB	JC	JD	JE	JF 90°	JF 180°	JG	JH	K	MA	MB	NA	NB	NC	PA	PB	Q
5	M4 Depth 7	24	M4 Depth 6.5	26	48	Spot face 9.5 dia. Depth 5.4	5.2	M6 Depth 12	35	42	11	2	$3^{+0.07}_{+0.02}$ depth 3.5	36	48h9	M5	43	13	30	15	18	16	21	11.5	65	82	5.6	29	42	17H9	2	4H9	5.5	2.4	12H9	3.5	8
10	M5 Depth 7	30	M5 Depth 7	32	54	Spot face 11 dia. Depth 6.5	6.6	M8 Depth 12	40	46	14	2	$3^{+0.07}_{+0.02}$ depth 3.5	41	54h9	M5	46	13	33	15	19	20	21.5	12	75	99	5.6	37	48	22H9	2	8H9	5.5	2.4	18H9	2.5	8
20	M6 Depth 9	36	M6 Depth 8	42	62	Spot face 11 dia. Depth 6.5	6.9	M8 Depth 12	47	55	17	2	$4^{+0.07}_{+0.02}$ depth 4.5	48	64h9	M5	53	16	37	14.5	20.5	27	22	13	86	115	5.6	47	58	27H9	2	11H9	6.5	3.9	20H9	2.5	10
30	M6 Depth 9	44	M6 Depth 8	52	74	Spot face 14 dia. Depth 8.6	8.7	M10 Depth 15	58	67	21	2	$4^{+0.07}_{+0.02}$ depth 4.5	59	78h9	M5	55	18	37	14.5	20.5	37	22	13	111	155	5.6	57	68	32H9	2	13H9	7.5	2.9	26H9	2.5	10
50	M8 Depth 13	50	M8 Depth 12	60	88	Spot face 17.5 dia. Depth 10.8	10.5	M12 Depth 18	66	74	24	2	$5^{+0.07}_{+0.02}$ depth 5.5	69	92h9	Rc1/8	71	23	48	21.5	27.5	36	32.5	17.5	129	177	8.1	58	75	37H9	4	14H9	10.5	5.3	28H9	4.5	15
80	M8 Depth 13	54	M8 Depth 12	66	94	Spot face 17.5 dia. Depth 10.8	10.5	M12 Depth 18	69	80	26	2	$5^{+0.07}_{+0.02}$ depth 5.5	76	101h9	Rc1/8	80	25	55	24	30	40	35	19	135	183	8.1	58	80	40H9	3	17H9	9.5	4.4	36H9	3.5	15

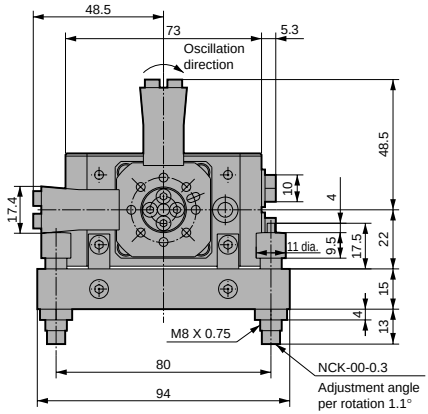
Size	SA 90°	SA 180°	SB	TA	TB	TC	UA	UB	V	W	X	LD 90°	LD 180°	RD 90°	RD 180°
5	73	90	14	6.5	M6 X 1	8.7	16.6	16	3	10	12.6	21.5	25.5	22.5	25.5
10	83	107	15	4.9	M8 X 0.75	4.9	17.1	19.4	4	11	13.1	24.5	30.5	26	30.5
20	96	125	17	6.1	M10 X 1	5.7	17.6	24	5	13	13.6	31	37.5	31	37.5
30	121	165	25	6.1	M10 X 1	3.8	17.6	34	5	13	13.6	38.5	49.5	40	49.5
50	144	192	29.5	7	M12 X 1	3.5	24.6	35	6	14	20.6	48.5	61	51	61
80	150	198	29.5	7	M12 X 1	3.5	27.1	36	6	14	23.1	51.5	64	54	64

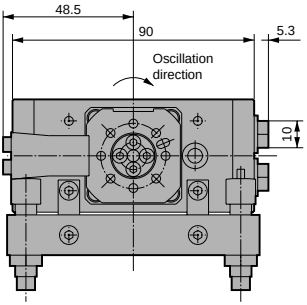
Dimensions: With outer mount shock absorber Torque5

• GRC-5-*-A1/A2

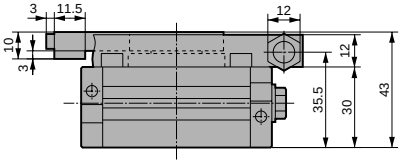
(File name: Page 55 or Ending 153 to 154)

Note: Figure shows A1 type (installation position (1)).



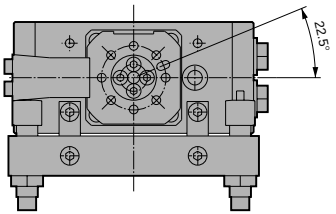


180° specifications

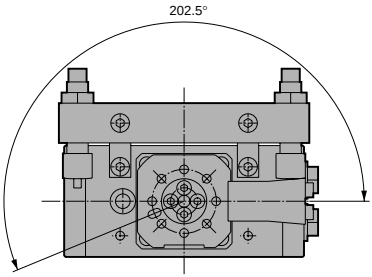


90° specifications

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.



GRC-5-*-A1

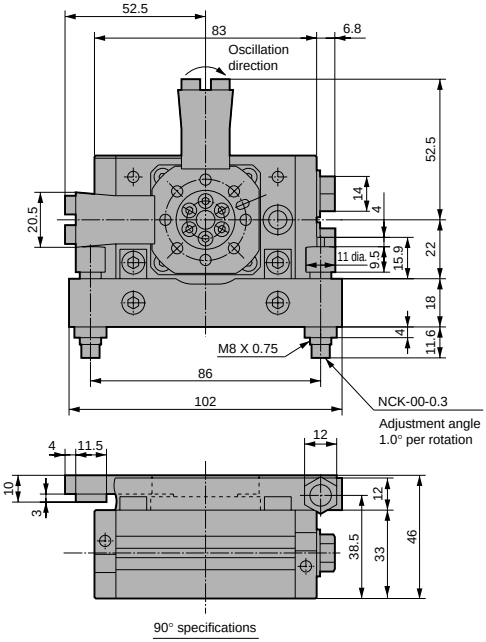


GRC-5-*-A2

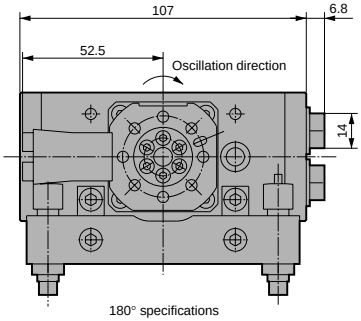
Dimensions: Torque 10, 20 with outer mount shock absorber

• GRC-10-*-A1/A2 (File name: Page 55 or Ending 153 to 154)

Note: Figure shows A1 type (installation position (1)).



90° specifications

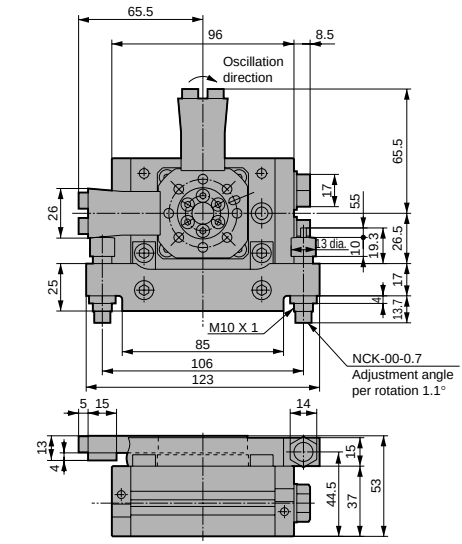


180° specifications

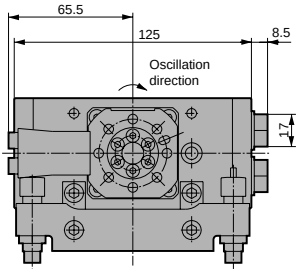
Note: Dimensions of rotary actuator main body are as same as basic type, however the body can not be fixed with using 4 taps on main body top. Position for dowel hole differs depending on installation position of outer mount shock absorber on table top.
(Refer to GRC-5-*-A1/A2.)

• GRC-20-*-A1/A2 (File name: Page 55 or Ending 153 to 154)

Note: Figure shows A1 type (installation position (1)).



90° specifications



180° specifications

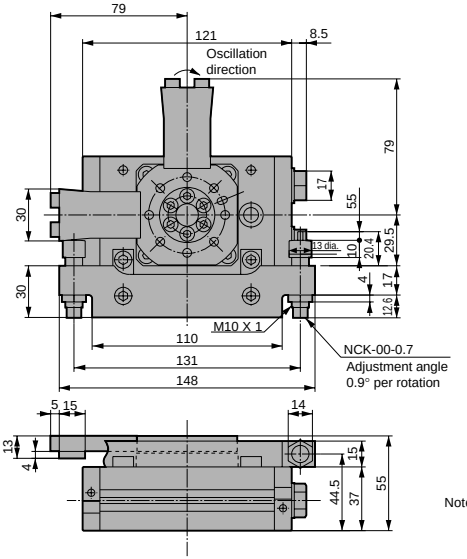
Note: Dimensions of rotary actuator main body are as same as basic type, however the body can not be fixed with using 4 taps on main body top. Position for dowel hole differs depending on installation position of outer mount shock absorber on table top.
(Refer to GRC-5-*-A1/A2.)

Dimensions: Torque 30, 50 with outer mount shock absorber

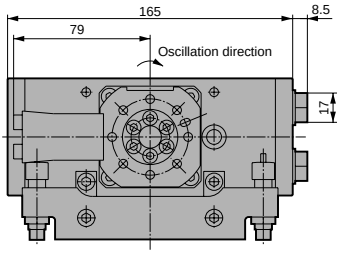
• GRC-30-*-A1/A2

CAD (File name: Page 55 or Ending 153 to 154)

Note: Figure shows A1 type (installation position (1)).



90° specifications



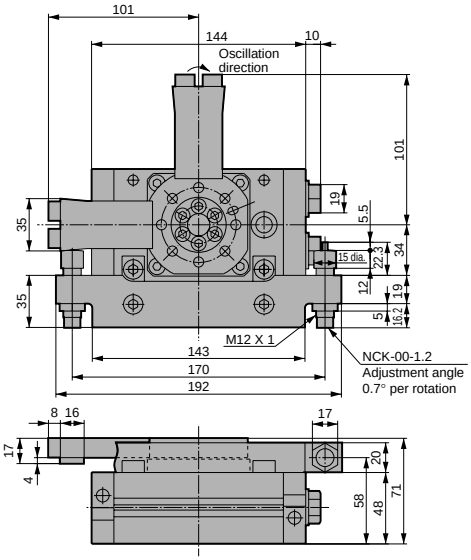
180° specifications

Note: Dimensions of rotary actuator main body are as same as basic type, however 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.)

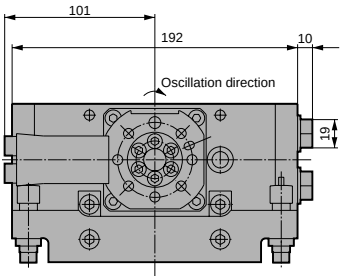
• GRC-50-*-A1/A2

CAD (File name: Page 55 or Ending 153 to 154)

Note: Figure shows A1 type (installation position (1)).



90° specifications



180° specifications

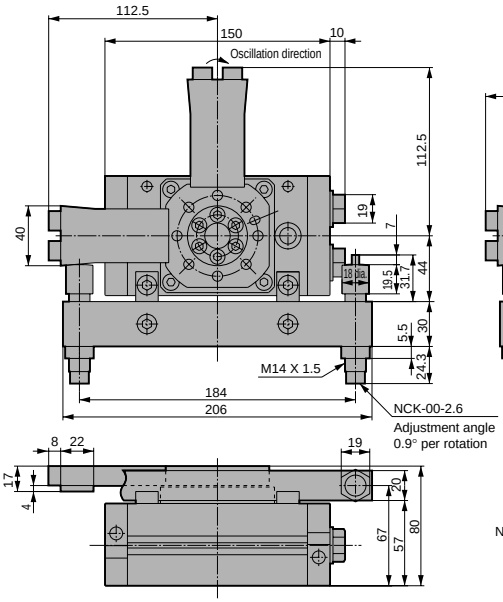
Note: Dimensions of rotary actuator main body are as same as basic type, however can not be fixed with using 4 taps on main body top. Position for dowel hole differs depending on installation position of outer mount shock absorber on table top.
(Refer to GRC-5-*-A1/A2.)

Dimensions: Torque 80 with outer mount shock absorber

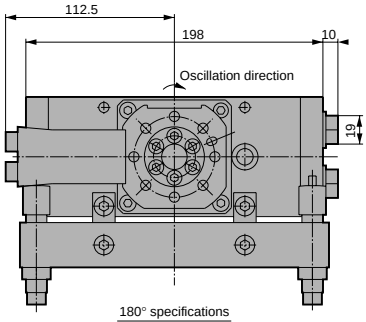
• GRC-80-*-A1/A2

CAD (File name: Page 55 or Ending 153 to 154)

Note: Figure shows A1 type (installation position (1)).



90° specifications

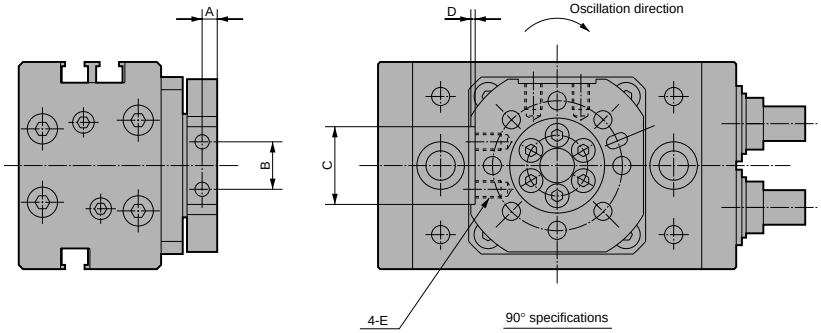


180° specifications

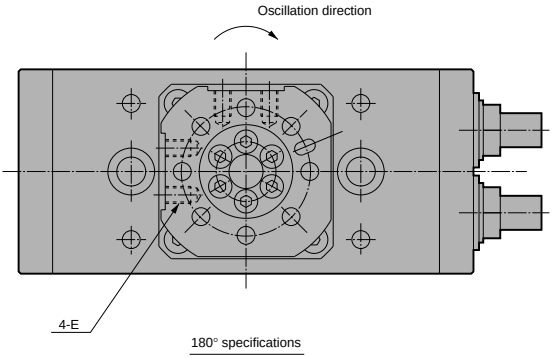
Note: Dimensions of main bodies of rotary actuator are as same as basic type, however the body can not be fixed with using 4 taps on main body top. Position for dowel hole differs depending on installation position of outer mount shock absorber on table top. (Refer to GRC-5-*-A1/A2.)

Dimensions: Outer mount shock absorber torque 5 to 80 for later installation

• GRC-*-A3 CAD (File name: Page 55 or Ending 153 to 154)

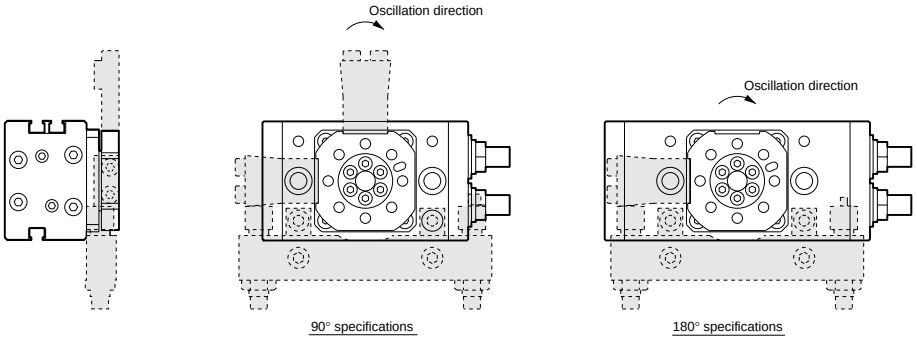


Torque	A	B	C	D	E
5	3.5	8.4	$15^{+0.3}_{0}$	1	M3 Depth 6.5
10	3.5	11	$18^{+0.3}_{0}$	1	M4 Depth 6
20	4.5	13.4	$23^{+0.3}_{0}$	1	M5 Depth 7.5
30	4.5	17	$27^{+0.3}_{0}$	2	M5 Depth 8.5
50	6.5	18.4	$32^{+0.3}_{0}$	2	M8 Depth 9
80	6.5	20	$36^{+0.3}_{0}$	2	M8 Depth 9



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.
If A2 type, consult with CKD (refer to Page 34 for installation position.)



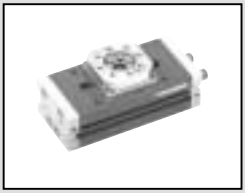


Table type rotary actuator
Fine speed type / high precision fine speed type

GRC-F/GRC-KF Series

• Size: 5 / 10 / 20 / 30 / 50 / 80

JIS symbol

Specifications

Descriptions			GRC-F-5	GRC-F-10 GRC-KF-10	GRC-F-20 GRC-KF-20	GRC-F-30 GRC-KF-30	GRC-F-50 GRC-KF-50	GRC-F-80 GRC-KF-80
Working fluid			Compressed air					
Max. working pressure		MPa	1.0					
Min. working pressure MPa	Basic type		0.10					
	High precision type		—	0.15		0.10		
	With outer mount shock absorber		0.25	0.20	0.15			
Withstanding pressure		MPa	1.6					
Ambient temperature		°C	5 to 60					
Allowable absorbing energy J	Basic type / high precision type		0.005	0.008	0.03		0.04	0.11
	With outer mount shock absorber		0.46	0.59	1.41	1.71	2.33	2.78
Cushion	Basic type / high precision type		Rubber cushion					
	With outer mount shock absorber		Shock absorber					
	Shock absorber model No.		NCK-0.3		NCK-0.7		NCK-1.2	NCK-2.6
Adjustable angle range	Basic type / high precision type	90° spec.	0° to 100°					
		180° spec.	90° to 190°					
	With outer mount shock absorber	90° spec.	90° ±6°					
		180° spec.	180° ±6°					
Oscillating time adjusting range		s/90°	0.2 to 25					
Port size			M5				Rc1/8	
Lubrication			Must be oil free					

Note: Adjustable angle range is value when adjusted by both stopper bolts (shock absorber) .
If shock absorber is installed, shock absorber section does not achieve fine speed specifications.

Switch specifications

• One color/bi-color indicator

Descriptions	Proximity 2 wire		Proximity 3 wire	
	T2H / T2V	T2YH / T2YV	T3H / T3V	T3YH / T3YV
Applications	Programmable controller		Programmable controller, relay	
Power voltage	—		DC10 to 28V	
Load voltage	DC10 to 30V		DC30V or less	
Load current	5 to 20mA (note 1)		100mA or less	50mA or less
Light	LED (ON lighting)	Red/green LED (ON lighting)	LED (ON lighting)	Red/green LED (ON lighting)

Note 1: Max. load current above: 20mA is value at 25 °C. When ambient temperature around switch is higher than 25 °C, the value is lower then 20mA, (5 to 10mA at 60 °C.)

• With preventive maintenance output

Descriptions		Proximity 3 wire	Proximity 4 wire	Proximity 3 wire	Proximity 4 wire
		T2YFH/V	T3YFH/V	T2YMH/V	T3YMH/V
Applications		Programmable controller	Programmable controller, relay	Programmable controller	Programmable controller, relay
Light	Installation position adjustment part	Red/green LED (ON lighting)			
	Preventive maintenance output section	—		Yellow LED (ON lighting)	
Output section	Current voltage	—	DC10 to 28V	—	DC10 to 28V
	Load voltage	DC10 to 30V	DC30V or less	DC10 to 30V	DC30V or less
	Load current	DC5 to 30mA	DC50mA or less	DC5 to 20mA	DC50mA or less
Preventive maintenance	Load voltage	DC30V or less			
	Load current	DC20mA or less	DC50mA or less	DC5 to 20mA or less	DC50mA or less

Dimensions

As same as basic type GRC series and high load type GRC-K series. Refer to Page 32 to 38.

Technical data

Refer to "Pneumatic cylinders I" Page 741 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

Ⓐ Model

Ⓑ Torque

Ⓒ Oscillating angle

Ⓓ Switch model No.

Ⓔ Switch quantity

Ⓕ Option

Symbol	Descriptions
Ⓐ Model	
GRC-F	Basic type
GRC-KF	High precision type

Ⓑ Torque			
Model		GRC-F	GRC-KF
5	0.5[N·m]	●	–
10	1.0[N·m]	●	●
20	2.0[N·m]	●	●
30	3.0[N·m]	●	●
50	5.0[N·m]	●	●
80	8.0[N·m]	●	●

Ⓒ Oscillating angle	
90	90°
180	180°

Ⓓ Switch model No.

Axial lead wire	Radial lead wire	Contact	Indicator	Lead wire
T2H *	T2V *	Proximity	1 color indicator	2 wire
T3H *	T3V *			3 wire
T2YH *	T2YV *		2 color indicator	2 wire
T3YH *	T3YV *			3 wire
T2YFH *	T2YFV *		With preventive maintenance output	3 wire
T3YFH *	T3YFV *			4 wire
T2YMH *	T2YMV *			3 wire
T3YMH *	T3YMV *			4 wire

*Lead wire length	
Blank	1m (standard)
3	3m (option)
5	5m (option)

Ⓔ Switch quantity	
R	Clockwise rotation 1 piece
L	Counterclockwise 1 piece
D	2 pieces

Ⓕ 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 for later installation (installation groove machined)

⚠ Note on model No. selection

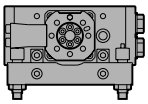
Note 1: Port position of basic type / high precision type is provided on side surface. Other ports are plugged.
Note 2: Outer mount shock absorber can not be installed onto basic type / high precision type later. If it will be installed later, select optional A3 type.
Note 3: When install outer mount shock absorber onto A3 type later, in the same manner with A1 type. Consult with CKD on A2 type use.
Note 4: Refer to Page 29 for discrete switch, option model No..

[Example of model number]
GRC-F-10-180-T2V-D-A1

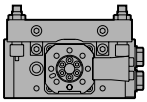
Double acting
Ⓐ Model : Basic type
Ⓑ Torque : 10
Ⓒ Oscillating angle : 180°
Ⓓ Switch model No. : Proximity / 2 wire radial lead wire, lead wire 1m
Ⓔ Switch quantity : 2 pieces
Ⓕ Option : Installation position with outer mount shock absorber (1)

Outer mount shock absorber installation drawing

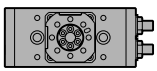
Installation position (1)
GRC-*-A1



Installation position (2)
GRC-*-A2

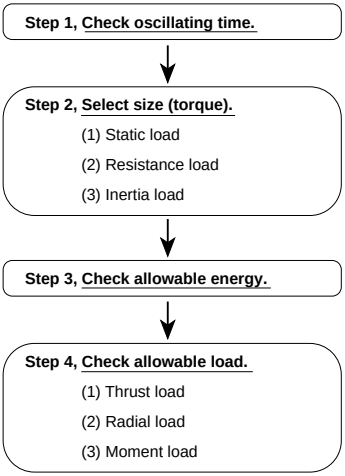


Outer mount shock absorber for later installation
GRC-*-A3



Selection method

Follow following procedures.



Step 1, Check oscillating time

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.

	When using with 90°.	When using with 180°.
Oscillating time (S)	0.2 to 1.5	0.4 to 3.0

Step 2, Select size (torque)

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.

$$T_S = F_S \times L$$

T_S : Required torque (N·m)
F_S : Required force (N)
L : Length from center of rotation to pressure cone apex (m)

(2) Resistance load (T_R)
When force caused by frictional force, gravity and other external force are applied.

$$T_R = K \times F_R \times L$$

T_R : Required torque (N·m)
K : Slack coefficient ┌ No load fluctuates K=2
└ Load fluctuates K=5
F_R : Required force (N)
L : Length from center of rotation to pressure cone apex (m)

(3) Inertia load (TA)
To rotate body.

$$T_A = 5 \times I \times \dot{\omega}$$
$$\dot{\omega} = \frac{2\theta}{t^2}$$

T_A : Required torque (N·m)
I : Moment of inertia (kg·m^2)
$\dot{\omega}$: Angular acceleration (rad/s^2)
θ : 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, Check allowable energy.

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.

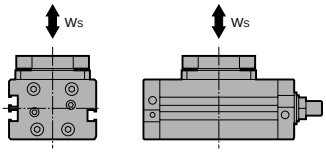
$$E = \frac{1}{2} \times I \times \omega^2$$
$$\omega = \frac{2\theta}{t}$$

E : Kinetic energy (J)
I : Moment of inertia (kg·m^2)
ω : Angular speed (rad/s)
θ : 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).

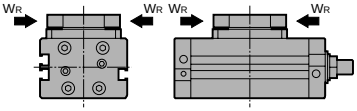
Selection method

Step 4, check allowable load

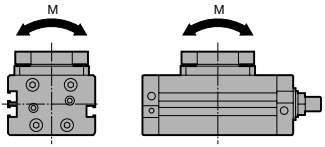
If load applies to table, load is to be within allowable value on Table 2.
If combined load is applied, total of ratio for allowable value per load is to be 1.0 or less.
Load is categorized with following 3 types.
(1) Thrust load (axial load)



(2) Radial load (sideways load)



(3) Moment load



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

$$\frac{W_S}{W_{Smax}} + \frac{W_R}{W_{Rmax}} + \frac{M}{M_{max}} \leqq 1.0$$

W_S : Thrust load (N)
W_R : Radial load (N)
M : Moment load (N·m)
W_{Smax} : Allowable thrust load (N)
W_{Rmax} : Allowable radial load (N)
M_{max} : Allowable moment load (N·m)

Allowable value per allowable energy absorption value and load is shown in the following table.

Table 1 Allowable energy absorption value [J]

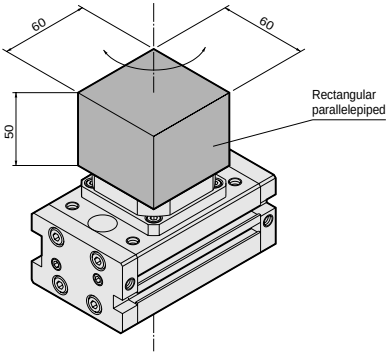
Size	5	10	20	30	50	80
Basic type / high accuracy type	0.005	0.008	0.03		0.04	0.11
With outer mount shock absorber	0.46	0.59	1.41	1.71	2.33	2.78

Table 2 Allowable load value $W_{Smax.}$ $W_{Rmax.}$ M_{max}

Size		5	10	20	30	50	80
Thrust load	Basic	50	80	140	200	450	580
W_{Smax}[N]	High accuracy	–	120	220	440	550	650
Radial load	Basic	30	80	150	200	320	400
W_{Rmax}[N]	High accuracy	–	100	160	240	380	480
Moment load	Basic	1.5	2.5	4.0	5.5	10.0	13.0
M_{max}[N·m]	High accuracy	–	3.0	5.0	7.0	12.0	15.0

Selection example (1)

Load of rectangular parallelepiped applies.



< Operational conditions >

Pressure	: 0.5 (MPa)
Oscillating angle	: 90°
Oscillating time	: 0.6 (s)
Load (Material: Aluminum alloy)	
< Rectangular parallelepiped >	: 0.5 (kg)

Step1, Check oscillating time.

Oscillating time is obtained with 0.6 (s/90°) according to operational conditions. since oscillating time is within adjusting range 0.2 to 1.5 (s/90°), therefore go to next step.

Step2, Select size (torque).

First, calculate moment of inertia (I) due to inertia load.
< Rectangular parallelepiped >

$$I = 0.5 \times \frac{0.06^2}{6} = 3 \times 10^{-4}\ (kg \cdot m^2) \quad \cdots\cdots (1)$$

Next, calculate angular acceleration ($\dot{\omega}$) .
According to conditions

$$\theta = 90^\circ = \frac{\pi}{2}\ (rad),\ t = 0.6(s)$$

Therefore,

$$\dot{\omega} = \frac{2\theta}{t^2} = \frac{\pi}{0.6^2} = 8.73\ (rad/s^2) \quad \cdots\cdots (2)$$

Therefore, inertia load (T_A) from (1) (2)

$T_A = 5 \times 3 \times 10^{-4} \times 8.73$

$= 0.0131\ (N \cdot m)$ ..... (3)

From (3) value, operation conditions and torque at 0.5 (MPa)

GRC-5-90 ..... (A)

can be selected.

Step 3 Check allowable energy.

Check if within allowable energy after kinetic energy is calculated.
Calculate average angular speed ω.

According to conditions

$$\theta = 90^\circ = \frac{\pi}{2}\ (rad),\ t = 0.6(s)$$

Therefore,

$$\omega = \frac{2\theta}{t} = \frac{\pi}{0.6} = 5.24\ (rad/s)$$

Therefore, kinetic energy (E) is

$$E = \frac{1}{2} \times 3 \times 10^{-4} \times 5.24^2$$

$= 0.00412(J)$ ..... (4)

From (4) and (A) selected at Step 2

GRC-5-90 ..... (B)

can be selected.

Step4, Check allowable load.

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

< Thrust load >

Thrust load (Ws)

Ws=0.5 X 9.8=4.9 (N) ..... (5)

< Radial load >

Since no radial load is applied.

W_R=0 (N) ..... (6)

< Moment load >

Since no moment load is applied.

M=0 (N·m) ..... (7)

From (5) (6) (7) and (B)

$$\frac{W_S}{W_{Smax}} + \frac{W_R}{W_{Rmax}} + \frac{M}{M_{max}}$$

$$= \frac{4.9}{50} + \frac{0}{30} + \frac{0}{1.5} = 0.098 \leqq 1.0 \quad \cdots\cdots (C)$$

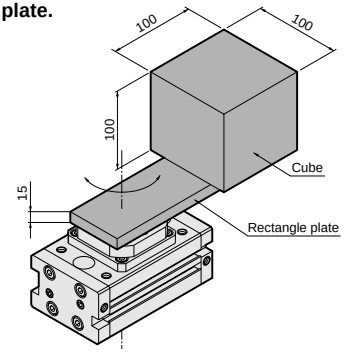
Since total load value is within allowable load value according to (B) and (C).

GRC-5-90

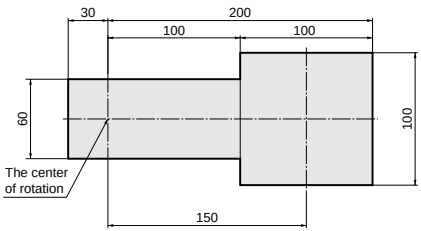
can be selected.

Selection example (2)

Load of rectangular parallelepiped applies to rectangle plate.



Load details



(Distance from center of rotation to cube load center)

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

Step 1, Check oscillating time.

Oscillating time is obtained with 1.0 (s/90°) according to operational conditions. Since oscillating time adjusting range is within 0.2 to 1.5 (s/90°), therefore go to next step.

Step 2, Select size (torque) .

First, calculate moment of inertia (I) due to inertia load.
< Rectangle plate >

$$I_1 = 1.40 \times \frac{4 \times 0.20^2 + 0.06^2}{12} + 0.21 \times \frac{4 \times 0.03^2 + 0.06^2}{12}$$

$$= 1.92 \times 10^{-2}\ (\mathrm{kg \cdot m^2})$$

< Cube >

$$I_2 = 7.8 \times \frac{0.1^2}{6} + 7.8 \times 0.15^2$$

$$= 0.189\ (\mathrm{kg \cdot m^2})$$

Therefore, total moment of inertia (I) is following.
$I = I_1 + I_2 = 0.21\ (\mathrm{kg \cdot m^2})$ ..... (1)
Next, calculate angular acceleration ($\dot{\omega}$) .
According to conditions

$$\theta = 90^\circ = \frac{\pi}{2}\ (\mathrm{rad}),\ t = 1.0\ (\mathrm{s})$$

Therefore,

$$\dot{\omega} = \frac{2\theta}{t^2} = \frac{\pi}{1.0^2} = 3.14\ (\mathrm{rad/s^2})$$ ..... (2)

Therefore, inertia load (T_A) from (1) and (2)
$T_A = 5 \times 0.21 \times 3.14$
$= 3.30\ (\mathrm{N \cdot m})$ ..... (3)
According to (3) value and operational conditions, from torque at 0.5 (MPa)
GRC-50-90 ..... (A)
can be selected.

Step 3, Check allowable energy.

Check if value is within allowable energy after kinetic energy is calculated.
Calculate average angular speed ω.

According to conditions

$$\theta = 90^\circ = \frac{\pi}{2}(\mathrm{rad}),\ t = 1.0\ (\mathrm{s})$$

Therefore,

$$\omega = \frac{2\theta}{t} = \frac{\pi}{1.0} = 3.14\ (\mathrm{rad/s})$$

Therefore, kinetic energy (E) is

$$E = \frac{1}{2} \times 0.19 \times 3.14^2$$

$$= 0.937\ (\mathrm{J})$$ ..... (4)

From (A) selected at (4) and Step 2
GRC-50-90-A1, A2 ..... (B)
can be selected.

Selection example (2)

Step4, Check allowable load.

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

< Thrust load >

Total mass

7.8+1.40+0.21=9.41 (kg)

Therefore thrust load (Ws) is

Ws=9.41 X 9.8=92.2 (N) ..... (5)

< Radial load >

Since no radial load is applied.

W_R=0 (N) ..... (6)

< Moment load >

Moment load by rectangle plate (M_1)

1.40 X 9.8=13.72 (N)

0.21 X 9.8=2.06 (N)

Therefore,

M_1=13.72 X 0.1-2.06 X 0.015

=1.34(N·m)

Moment load by rectangular parallelepiped (M_2)

7.8 X 9.8=76.44 (N)

Therefore,

M_2=76.44 X 0.15=11.47 (N·m)

Therefore, if total M_1 and M_2.

M=1.34+11.47=12.81 (N·m) ..... (7)

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

$$\frac{W_S}{W_{Smax}} + \frac{W_R}{W_{Rmax}} + \frac{M}{M_{max}}$$

$$= \frac{92.2}{450} + \frac{0}{320} + \frac{12.8}{10} = 1.48 > 1.0$$

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

$$\frac{W_S}{W_{Smax}} + \frac{W_R}{W_{Rmax}} + \frac{M}{M_{max}}$$

$$= \frac{92.2}{580} + \frac{0}{400} + \frac{12.8}{13} = 1.14 > 1.0$$

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

$$\frac{W_S}{W_{Smax}} + \frac{W_R}{W_{Rmax}} + \frac{M}{M_{max}}$$

$$= \frac{92.2}{650} + \frac{0}{480} + \frac{12.8}{15} = 0.99 \leqq 1.0 \quad \text{..... (C)}$$

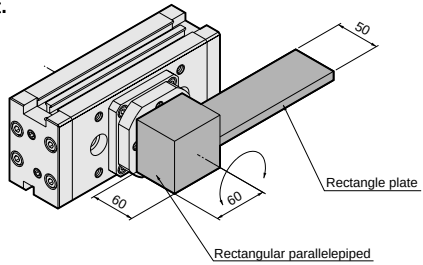
According to (C), total load value is within allowable load value,

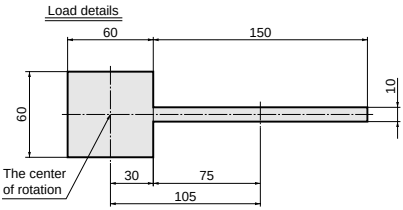
GRC-K-80-90-A1, A2

can be selected.

Selection example (3)

Horizontal rectangle plate load applies to rotary shaft.





(Distance from center of rotation to rectangle plate load center)

< Operational conditions >
Pressure : 0.5 (MPa)
Oscillating angle : 180°
Oscillating time : 0.5 (s)
Load (Material: Aluminum alloy)
< Rectangle plate > : 0.2 (kg)
< Rectangular parallelepiped > : 0.5 (kg)

Step 1, Check oscillating time.

Oscillating time is obtained with 0.5 (s/180°) according to operational conditions. Since oscillating time adjusting range is within 0.4 to 3.0 (s/180°), therefore go to next step.

Step 2, Select size (torque) .

Calculate resistance load (T_R) and moment of inertia (I) since resistance load and inertia load are caused by gravity.
< Resistance load >
Resistance load varies per rotation of table.
$F_R = 0.2 \times 9.8 = 1.96$(N)
R = 0.105(m)
Therefore,
$T_R = 5 \times 1.96 \times 0.105 = 1.03$(N·m) ..... (1)
< Inertia load >
[Rectangle plate]

$$I_1 = 0.2 \times \frac{0.15^2}{12} + 0.2 \times 0.105^2$$

$$= 2.58 \times 10^{-3} (kg \cdot m^2)$$

[Rectangular parallelepiped section]

$$I_2 = 0.5 \times \frac{0.06^2}{6} = 3 \times 10^{-4} (kg \cdot m^2)$$

Therefore, total moment of inertia (I) is following.
$I_1 = I_1 + I_2 = 2.88 \times 10^{-3} (kg \cdot m^2)$ ..... (2)
Next, calculate angular acceleration ($\dot{\omega}$) .
According to conditions $\theta = 180° = \pi$(rad), t=0.5(s)
Therefore,

$$\dot{\omega} = \frac{2\theta}{t^2} = \frac{2\pi}{0.5^2} = 25.13 \ (rad/s^2)$$ ..... (3)

Therefore, inertia load (T_A) from (2) (3)
$T_A = 5 \times 2.88 \times 10^{-3} \times 25.13$
$= 0.362$(N·m) ..... (4)
According to (1) (4) total torque
T =1.03 + 0.362 = 1.39(N·m) ..... (5)
According to (5) value and operational conditions, from torque at 0.5 (MPa)
GRC-20-180 ..... (A)
can be selected.

Step 3, Check allowable energy.

Check if within allowable energy after kinetic energy is calculated.
Calculate average angular speed ω.
According to conditions $\theta = 180° = \pi$ (rad), t = 0.5(s)
Therefore,

$$\omega = \frac{2\theta}{t} = \frac{2\pi}{0.5} = 12.57 \ (rad/s)$$

Therefore, kinetic energy (E) is

$$E = \frac{1}{2} \times 2.88 \times 10^{-3} \times 12.57^2$$

$$= 0.23(J)$$ ..... (6)

From (A) selected at (6) and Step 2
GRC-20-180-A1, A2 ..... (B)
can be selected.

Step4, Check allowable load.

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)
Ws = 0(N) ..... (7)
< Radial load >
Total mass
0.2 + 0.5 = 0.7(kg)
Therefore,
$W_R = 0.7 \times 9.8 = 6.9$(N) ..... (8)
< Moment load >
Since no moment load is applied, moment load (M)
M = 0(N·m) ..... (9)
According to (7) (8) (9) and (B)

$$\frac{W_s}{W_{smax}} + \frac{W_R}{W_{Rmax}} + \frac{M}{M_{max}}$$

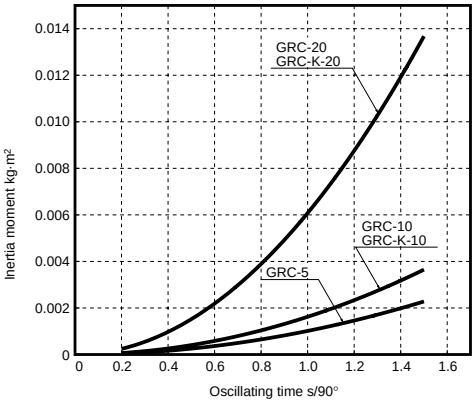
$$= \frac{6.9}{150} + \frac{0}{140} + \frac{0}{4.0} = 0.046 \leqq 1.0$$ ..... (C)

Total load value is within allowable load value according to (B) and (C).
GRC-20-180-A1, A2
can be selected.

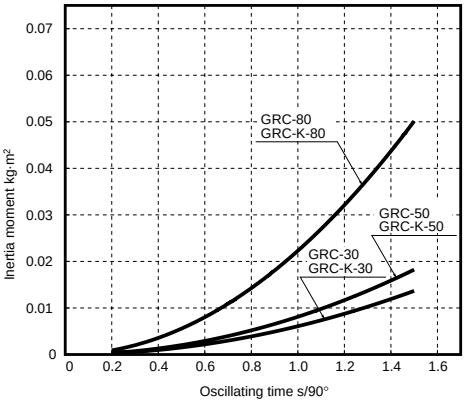
1. Moment of inertia and oscillating time

Relations between moment of inertia and oscillating time are shown as diagram below. Always use model in right below area of graph, or shaft etc. may be damaged. Refer to diagram for selection etc.

• Basic type / high precision type

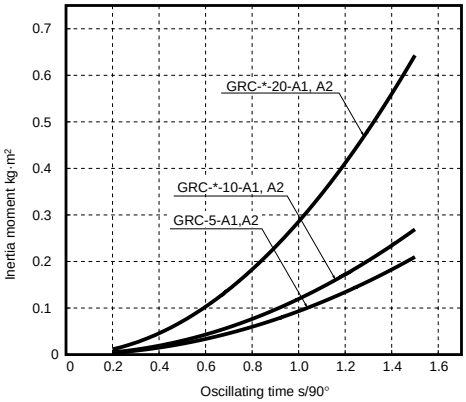


Torque 5, 10, 20

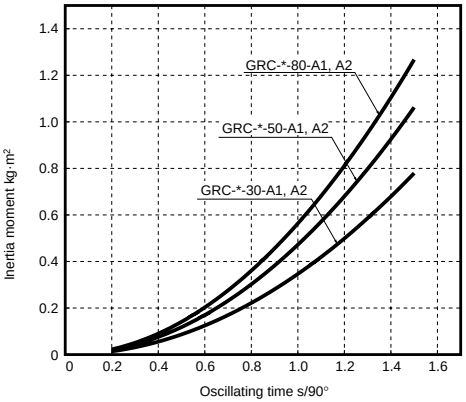


Torque 30, 50, 80

• With outer mount shock absorber



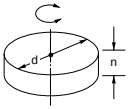
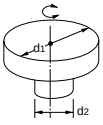
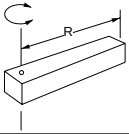
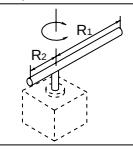
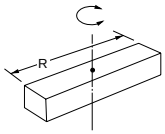
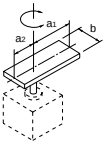
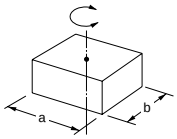
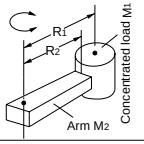
Torque 5, 10, 20



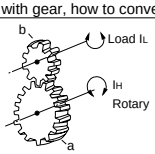
Torque 30, 50, 80

2. Moment of inertia calculation

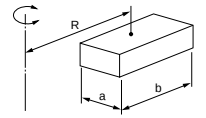
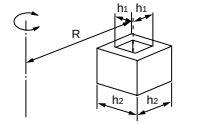
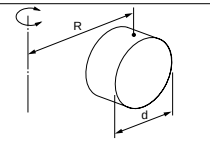
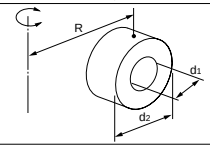
• When rotary shaft goes through workpiece.

Shape	Rough sketch	Requirements	Moment of inertia J kg·m²	Radius of gyration K_1^2	Remarks
Dial plate		• Diameter d(m) • Mass M(kg)	$J=\frac{Md^2}{8}$	$\frac{d^2}{8}$	• Installation attitude is not specified. • When using with sliding, please consult with CKD.
Dial plate with step		• Diameter d_1(m) d_2(m) • Mass d_1 section M_1(kg) d_2 section M_2(kg)	$J=\frac{1}{8}(M_1d_1^2+M_2d_2^2)$	$\frac{d_1^2+d_2^2}{8}$	• Ignore, when d_2 section is extremely small comparing to d_1 section.
Rod(center of rotation at end)		• Rod length R (m) • Mass M(kg)	$J=\frac{MR^2}{3}$	$\frac{R^2}{3}$	• Horizontal installation attitude • If vertical installation attitude, oscillating time varies.
Narrow rod		• Rod length R_1 R_2 • Mass M_1 M_2	$J=\frac{M_1\cdot R_1^2}{3}+\frac{M_2\cdot R_2^2}{3}$	$\frac{R_1^2+R_2^2}{3}$	• Horizontal installation attitude • If vertical installation attitude, oscillating time varies.
Rod (center of gravity on center of rotation)		• Rod length R (m) • Mass M(kg)	$J=\frac{MR^2}{12}$	$\frac{R^2}{12}$	• Installation attitude is not specified.
Thin rectangle plate (rectangular parallelepiped)		• Plate length a_1 a_2 • Edge length b • Mass M_1 M_2	$J=\frac{M_1}{12}(4a_1^2+b^2)+\frac{M_2}{12}(4a_2^2+b^2)$	$\frac{(4a_1^2+b^2)+(4a_2^2+b^2)}{12}$	• Horizontal installation attitude • If vertical installation attitude, oscillating time varies.
Rectangular parallelepiped		• Edge length a(m) b(m) • Mass M(kg)	$J=\frac{M}{12}(a^2+b^2)$	$\frac{a^2+b^2}{12}$	• Installation attitude is not specified. • When using with sliding, consult wit CKD.
Concentrated load		• Shape of concentrated load • Length to center of gravity of concentrated load R_1(m) • Arm length R_2(m) • Mass of concentrated load M_1(kg) • Mass of arm M_2(kg)	$J=M_1(R_1^2+k_1^2)+\frac{M_2R_2^2}{3}$	Calculate k_1^2 according to shape of concentrated load.	• Horizontal installation attitude • When M_2 is extremely small comparing to M_1, may be calculated as M_2=0.

When using with gear, how to convert load J_L to rotary actuator shaft rotation.

Shape	Rough sketch	Requirements	Moment of inertia J kg·m²	Radius of gyration K_1^2	Remarks
Gear		• Gear rotary side a Load side b • Load inertia Moment N·m	Rotary shaft rotation moment of inertia for load $J_H=\left(\frac{a}{b}\right)^2 I_L$		• When shape of gear is increasing, gear moment of inertia should be considered.

• Rotary shaft offsets from workpiece

Shape	Rough sketch	Requirements	Moment of inertia I kg·m²	Remarks
Rectangular parallelepiped		• Edge length a(m) • Distance from rotary shaft to load center b(m) R(m) • Mass M(kg)	$I = \frac{M}{12}(a^2+b^2) + MR^2$	• Same for cube
Hollow rectangular parallelepiped		• Edge length h1(m) h2(m) • Distance from rotary shaft to load center R(m) • Mass M(kg)	$I = \frac{M}{12}(h_1^2+h_2^2) + MR^2$	• Cross section is for cube only.
Cylinder		• Diameter d(m) • Distance from rotary shaft to load center R(m) • Mass M(kg)	$I = \frac{Md^2}{16} + MR^2$	
Hollow cylinder		• Diameter d1(m) d2(m) • Distance from rotary shaft to load center R(m) • Mass M(kg)	$I = \frac{M}{16}(d_1^2+d_2^2) + MR^2$	

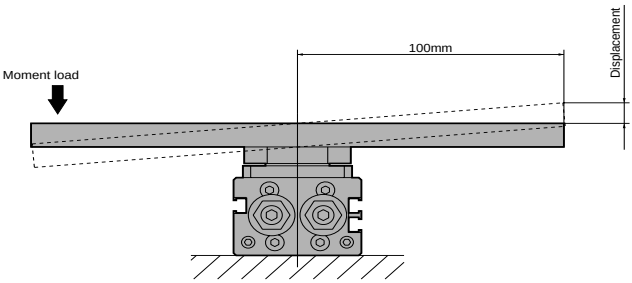
* To find moment of inertia, first, convert model load / jig etc., to simple shapes, then calculate values.
Calculate each moment of inertia, and total them for combined load.

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.

Measuring method

Table deflection



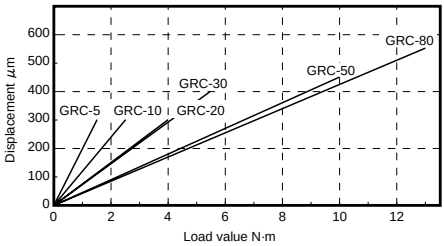


Table deflection volume of GRC (basic type)

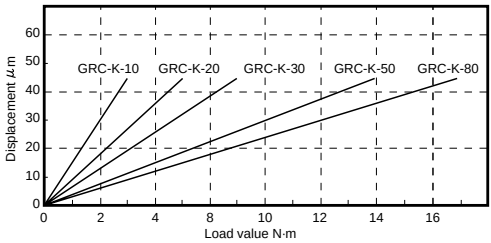
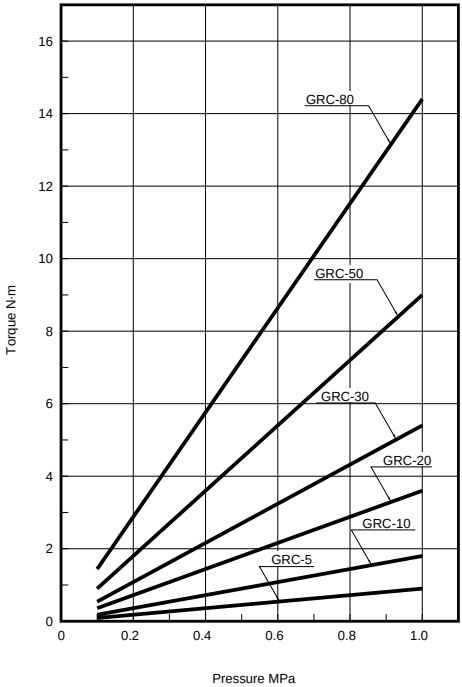


Table deflection volume of GRC-K (high precision type)

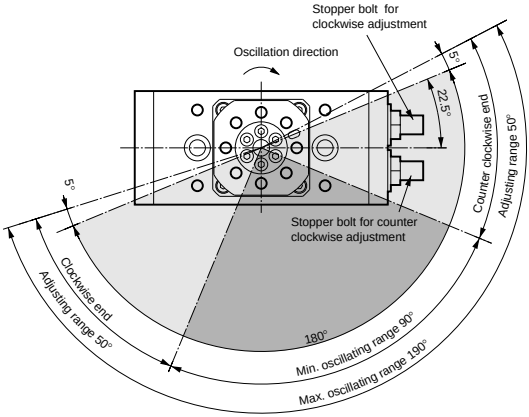
4. Effective torque diagram

Note that torque at oscillation end is half of following graph.

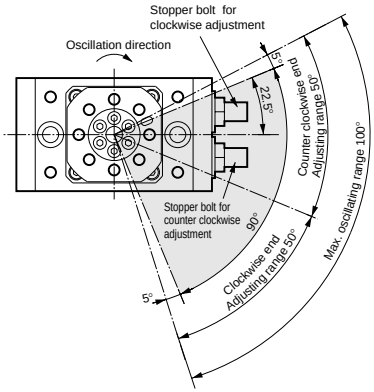


5. Oscillating angle adjustment method

• Basic type / high precision type

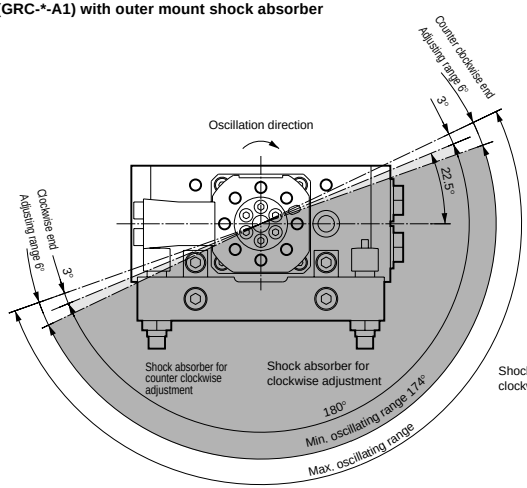


180° specifications

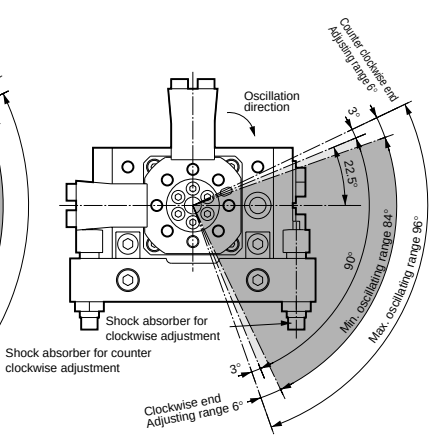


90° specifications

• (GRC-*-A1) with outer mount shock absorber

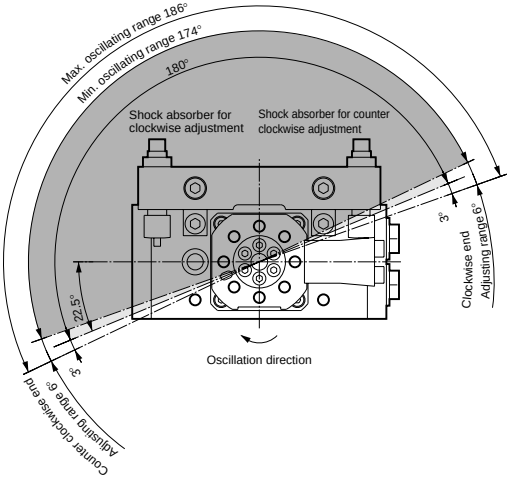


180° specifications

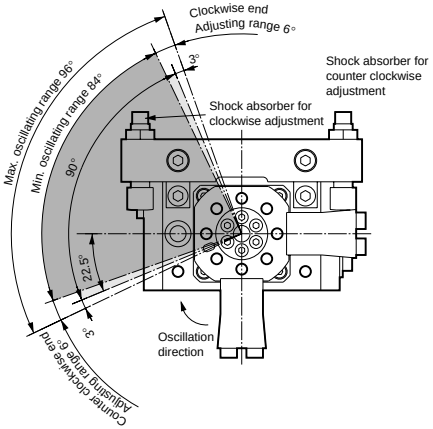


90° specifications

• (GRC-*-A2) with outer mount shock absorber



180° specifications



90° specifications