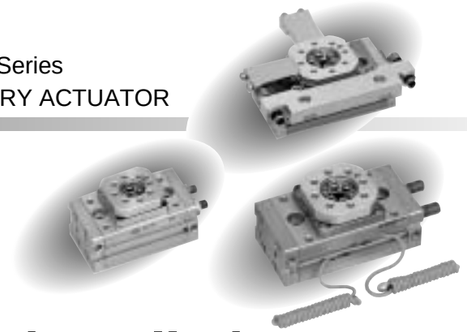
High load and accurate positioning

GRC Series
TABLE TYPE ROTARY ACTUATOR



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 Torque 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 areavailable in same dimension

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

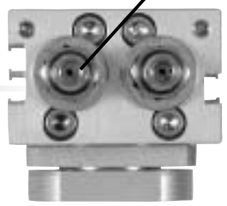
Basic type **GRC**	High accuracy type **GRC-K**
Reliable operation with radial bearing	Cross roller bearing used for high accuracy / high load

- 90° and 180° specifications are available.

  Realizing more compact type for oscillating angle 90° type.

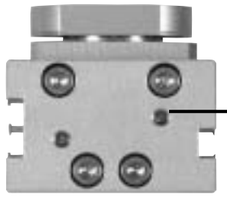
GRC SERIES variations

	Basic type GRC	High accuracy type GRC-K
With switch	●	●
Size (torque value at 0.5MPa)		
5 (0.5 N·m)	●	-
10 (1.0N·m)	●	●
20 (2.0N·m)	●	●
30 (3.0N·m)	●	●
50 (5.2 N·m)	●	●
80 (8.1 N·m)	●	●
Oscillating angle		
90° type	●	●
180° type	●	●
Option		
Shock absorber type stopper	●	●



Rubber cushioned angle adjusting bolt for oscillating angle adjustment

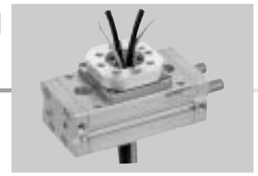
Rotary table enabling direct mount of load



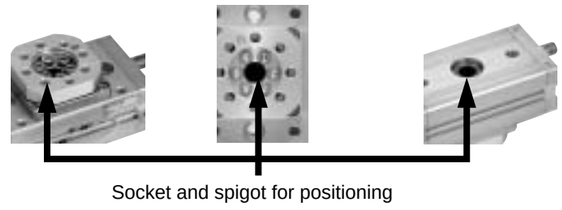
2 Easy installation

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

  Hollow diameter ϕ 4 to ϕ 17 is available.

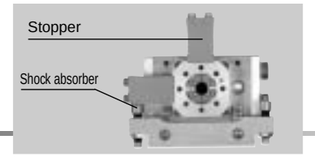


- Socket and spigot for positioning is available on table top (4 points) or main body bottom (1 point).



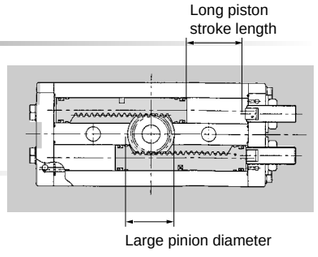
Socket and spigot for positioning

3 Easy operation



- Reliable operation due to external stopper

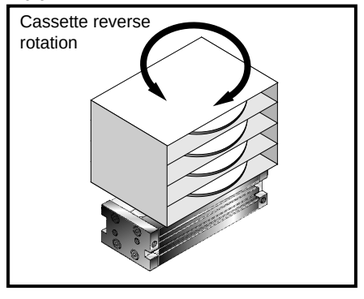
  Due to external stopper and shock absorber (option), smooth stop is achieved without backlash.

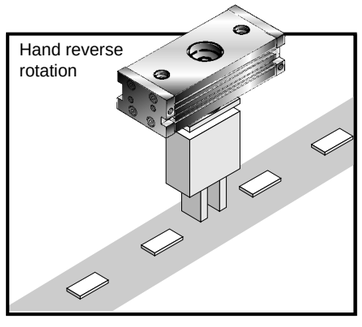


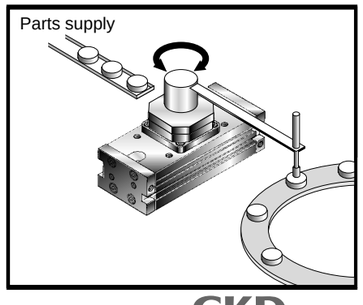
- Low speed operation of **1.5** seconds/90°

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

Applications







●: Standard, ◎: Option, : Not available

Variation	Model no. JIS symbol	Size							Maximum oscillating angle (degrees)		Option			Switch	Page
		5	10	20	30		50	80	90	180	With outer mount shock absorber (1) A1	With outer mount shock absorber (2) A2	Outer mount shock absorber later installation Installation groove machined A3		
Basic type	GRC	●	●	●	●		●	●	●	●	◎	◎	◎	◎	26
High accuracy type	GRC-K		●	●	●		●	●	●	●	◎	◎	◎	◎	26
Fine speed type	GRC-F	●	●	●	●		●	●	●	●	◎	◎	◎	◎	40
High accuracy/fine speed type	GRC-KF		●	●	●		●	●	●	●	◎	◎	◎	◎	40

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

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

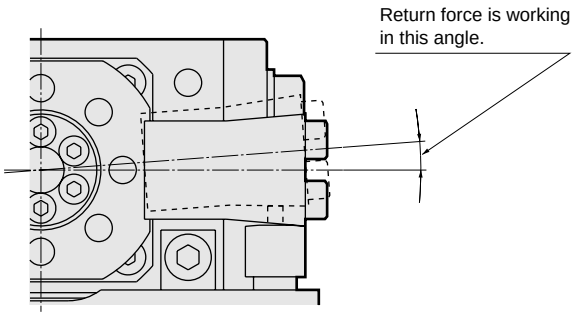
1. Common

⚠ 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

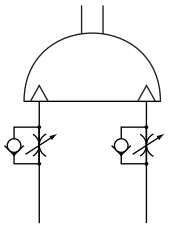
⚠ CAUTION

■ 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.

Installation & Adjustment

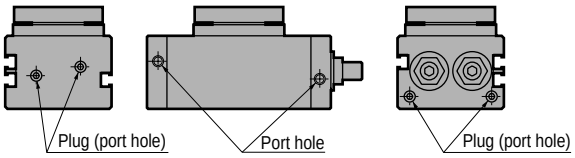
1. Common

⚠ CAUTION

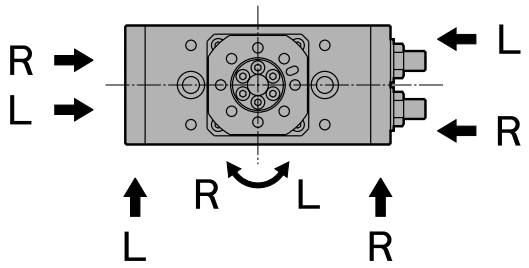
■ Do not further machine the product.
If so, strength will decrease and could lead to product damage. This may result in injury or damage to operator, component, or equipment.

■ 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.



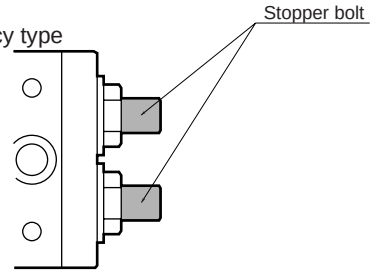
R: Clockwise rotation
L: Counterclockwise rotation

■ 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).

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

Basic type/high accuracy type



With outer mount shock absorber

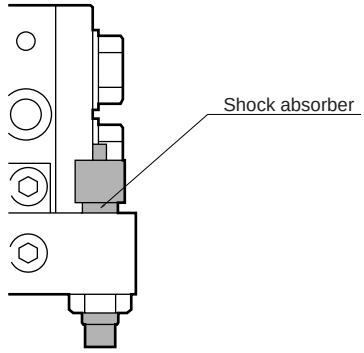


Table 1

Size	Adjustment angle per stopper bolt 1 rotation	Adjustment angle per shock absorber 1 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°

■ 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.

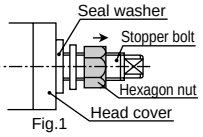


Fig.1

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

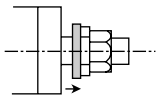


Fig.2

(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.

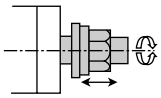


Fig.3

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

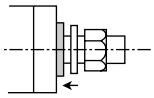


Fig.4

(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.

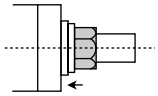
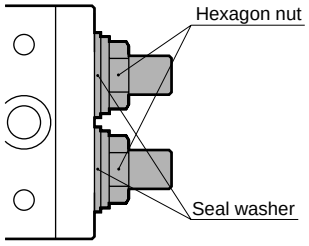


Fig.5

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.

■ 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.

Basic type/high accuracy type



With external shock absorber

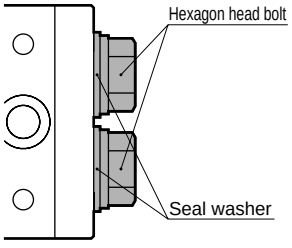


Table 2

Size	Tightening torque (N·m)	
	Basic type/high accuracy type	With outer mount shock absorber
5	5.9±10%	4±10%
10	9.4±10%	4.9±10%
20	11.8±10%	6.9±10%
30	11.8±10%	6.9±10%
50	22.1±10%	8.8±10%
80	22.1±10%	8.8±10%

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

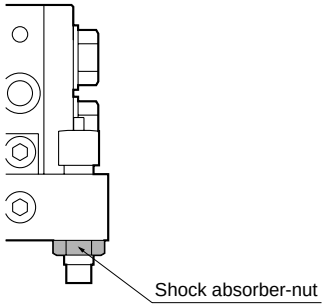


Table 3

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

■ 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.

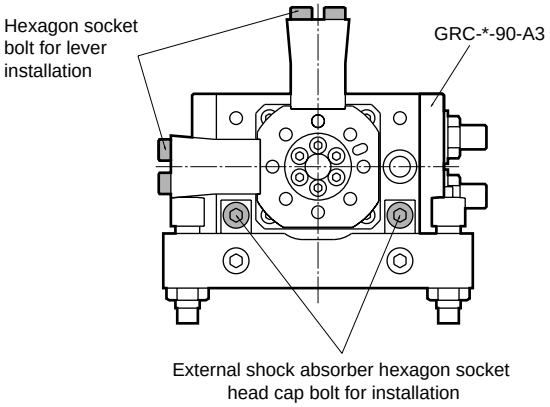
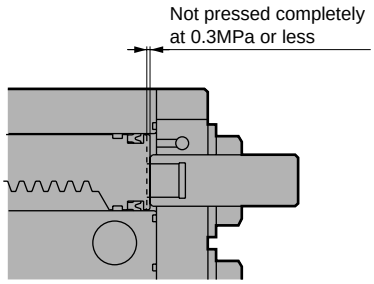


Table 4

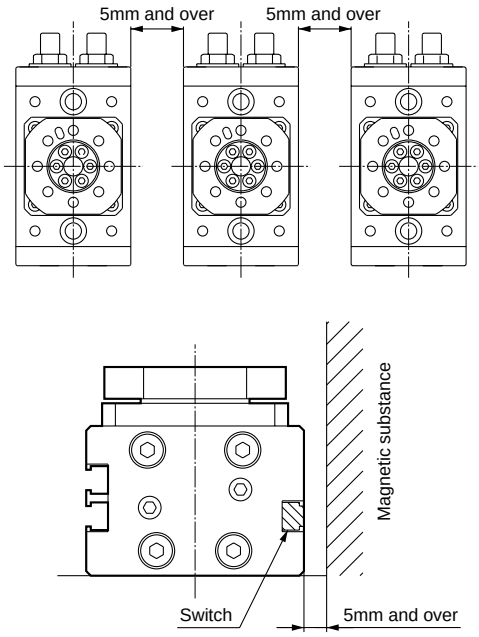
Size	Lever installation bolt	Outer mount shock absorber installation bolt
	Tightening torque (N·m)	Tightening torque (N·m)
5	0.6±20%	1.4±20%
10	1.4±20%	2.9±20%
20	2.8±20%	4.8±20%
30	2.8±20%	4.8±20%
50	12.0±20%	12.0±20%
80	12.0±20%	12.0±20%

■ 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.

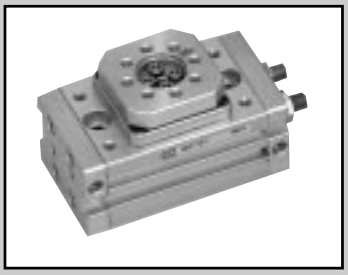


Table type rotary actuator
Basic type/high accuracy type

GRC/GRC-K Series

● Size: 5, 10, 20, 30, 50, 80

JIS symbol

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		0.10					
MPa	High accuracy type		–	0.15		0.10		
	With shock absorber		0.25	0.20	0.15			
Withstanding pressure		MPa	1.6					
Ambient temperature		℃	0 to 60 (no freezing)					
Port size			M5				Rc1/8	
Cushion	Basic type/high accuracy type		Rubber cushion					
	With shock absorber		Shock absorber					
	Shock absorber model no.		NCK-0.3		NCK-0.7		NCK-1.2	NCK-2.6
Allowable energy absorption	Basic type/high accuracy type		0.005	0.008	0.03		0.04	0.11
J	With shock absorber		0.46	0.59	1.15	1.71	2.33	2.78
Shock absorber stroke		mm	3.5	3.5	5	5	5.5	6.5
Lubrication			Not required (when lubricating, use turbine oil ISOVG32.)					
Volumetric capacity Note 3		cm^3	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 accuracy type		90°	0° to 100°					
			180°	90° to 190°					
	With 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: Theoretical torque is value when working pressure 0.5MPa.
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			Proximity 3 wire		
	T1H/T1V	T2H/T2V	T2YH/T2YV	T3H/T3V	T3PH/T3PV (Custom order)	T3YH/T3YV
Applications	Programmable controller, relay, small solenoid valve	Programmable controller		Programmable controller, relay		
Output method	-			PNP output		
Power voltage	-			10 to 28 VDC		
Load voltage	85 to 265 VAC	10 to 30 VDC		30 VDC or less		
Load current	5 to 100mA	5 to 20mA (Note 1)		100mA or less		50mA or less
Light	LED (ON lighting)	LED (ON lighting)	Red/green LED (ON lighting)	LED (ON lighting)	Green LED (ON lighting)	Red/green LED (ON lighting)
Leakage current	1mA or less with 100 VAC 2mA or less with 200 VAC	1mA or less		10μA or less		

● 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
Output method		NPN output			
Light	Installation position adjustment section	Red/green LED (ON lighting)			
	Preventive maintenance output	-		Yellow LED (ON lighting)	
Regular output	Power voltage	-	10 to 28 VDC	-	10V to 28 VDC
	Load voltage	10V to 30 VDC	30 VDC or less	10 to 30 VDC	30 VDC or less
	Load current	5 to 20mA	50mA or less	5 to 20mA	50mA or less
	Leakage current	1mA or less	10μA or less	1.2mA or less	10μA or less
Preventive maintenance Output	Load voltage	30 VDC or less			
	Load current	20mA or less	50mA or less	5 to 20mA or less	50mA or less
	Leakage current	10μA or less			

Note 1: Refer to Ending 1 for other switch specifications.

Note 2: Maximum load current: 20mA above is the value at 25℃. The current will be lower than 20mA if ambient temperature around switch is higher than 25℃. (5 to 10mA when 60℃)

Minimum oscillating angle with switch

Size	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 weight

(Unit: kg)

Oscillating angle / Model no.	90°		180°		Outer mount shock absorber weight	Switch weight (per switch)
	Basic type	High accuracy type	Basic type	High accuracy 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	

Clean room specifications

(Catalog No. CB-033SA)

● Dust preventive structure for inside the clean room

GRC - ····· - P73
GRC - ····· - P53
GRC-K - ····· - P73
GRC-K - ····· - P53

How to order

● Without switch

GRC - 10 ( ) - 90 ——— A1

● With switch

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

Ⓐ Model no.
Ⓑ Size
Ⓒ Port thread type
Ⓓ Oscillating angle
Ⓔ Switch model no.
Ⓕ Switch quantity
Ⓖ Option

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.

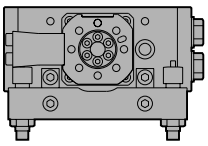
<Example of model number>

GRC-10-180-T2V-D-A1

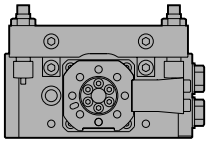
Double acting
Ⓐ Model no. : Basic type
Ⓑ Size : 10
Ⓒ Port thread type : Rc thread
Ⓓ Oscillating angle : 180°
Ⓔ Switch model no. : Proximity 2 wire
Radial lead wire/lead wire 1m
Ⓕ Switch quantity : Two
Ⓖ Option : With outer mount shock absorber
Installation position (1)

Outer mount shock absorber installation drawing

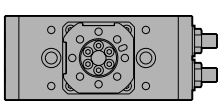
GRC-*-A1
(Installation position 1)



GRC-*-A2
(Installation position 2)



GRC-*-A3
(Installation position 3)



Symbol	Descriptions
Ⓐ Model no.	
GRC	Basic type
GRC-K	High accuracy type

Ⓑ Size (0.5MPa)

Model no.	Logical torque	GRC	GRC-K
5	0.5 (N・m)	●	—
10	1.0 (N・m)	●	●
20	2.0 (N・m)	●	●
30	3.0 (N・m)	●	●
50	5.2 (N・m)	●	●
80	8.1 (N・m)	●	●

Ⓒ Port thread type

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

Ⓓ Oscillating angle

90	90°
180	180°

Ⓔ Switch model no.

Axial lead wire	Radial lead wire	Contact	Indicator	Lead wire
T1H*	**T1V***	Proximity	1 color indicator type	2-wire
T2H*	**T2V***			2-wire
T3H*	**T3V***			3-wire
T3PH*	**T3PV***		1 color indicator type (custom order)	3-wire
T2YH*	**T2YV***		2 color indicator type	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	With clockwise rotation 1 piece
L	With counterclockwise rotation 1 piece
D	Two

Ⓖ 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

SW - T2H3

Switch model no.
(Item Ⓔ previou page)

How to order repair kits

- Sets of packing seal repair parts, etc.

GRC - 5 K

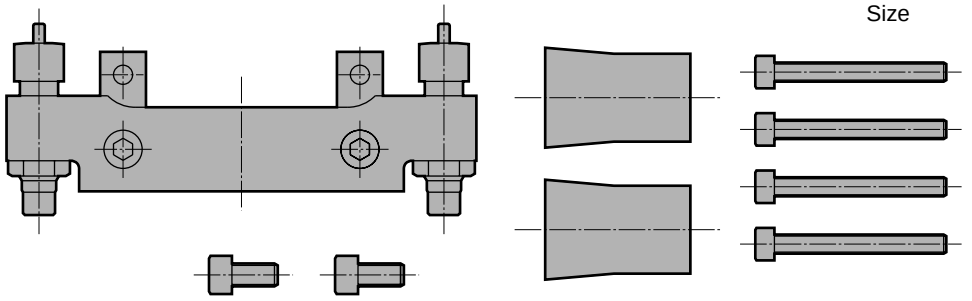
Size
(Item Ⓑ previou page)

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.

GRC - 5 - A 2

Size



Ⓒ Oscillating angle	
1	90° specifications
2	180° specifications

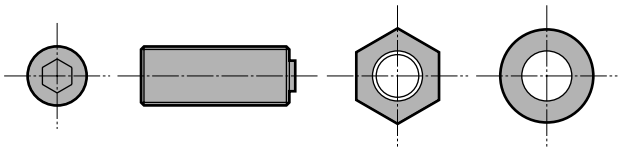
Indiocate 1 or 2 for Ⓓ.
Note: Set descriptions differ between 90° specifications and 180° specifications.
The figure shows the 90° specification.

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

GRC - 5 S

Size
(Item Ⓑ previou page)

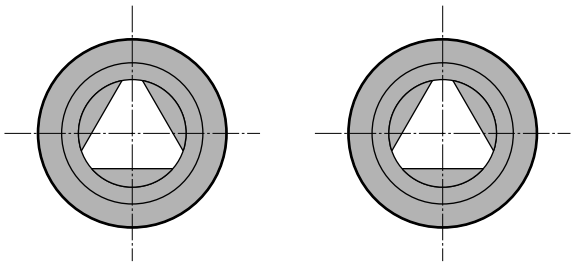


How to order seal washer set

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

GRC - 5 D

Size
(Item Ⓑ previous page)

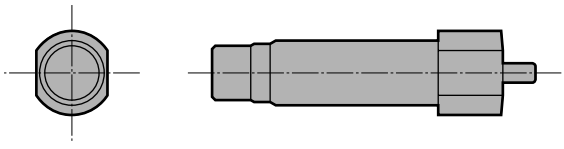


How to order shock absorber set for adjustable angle

- Sets of shock absorber and stopper

GRC - 5 - A01

Size
(Item Ⓑ previou page)

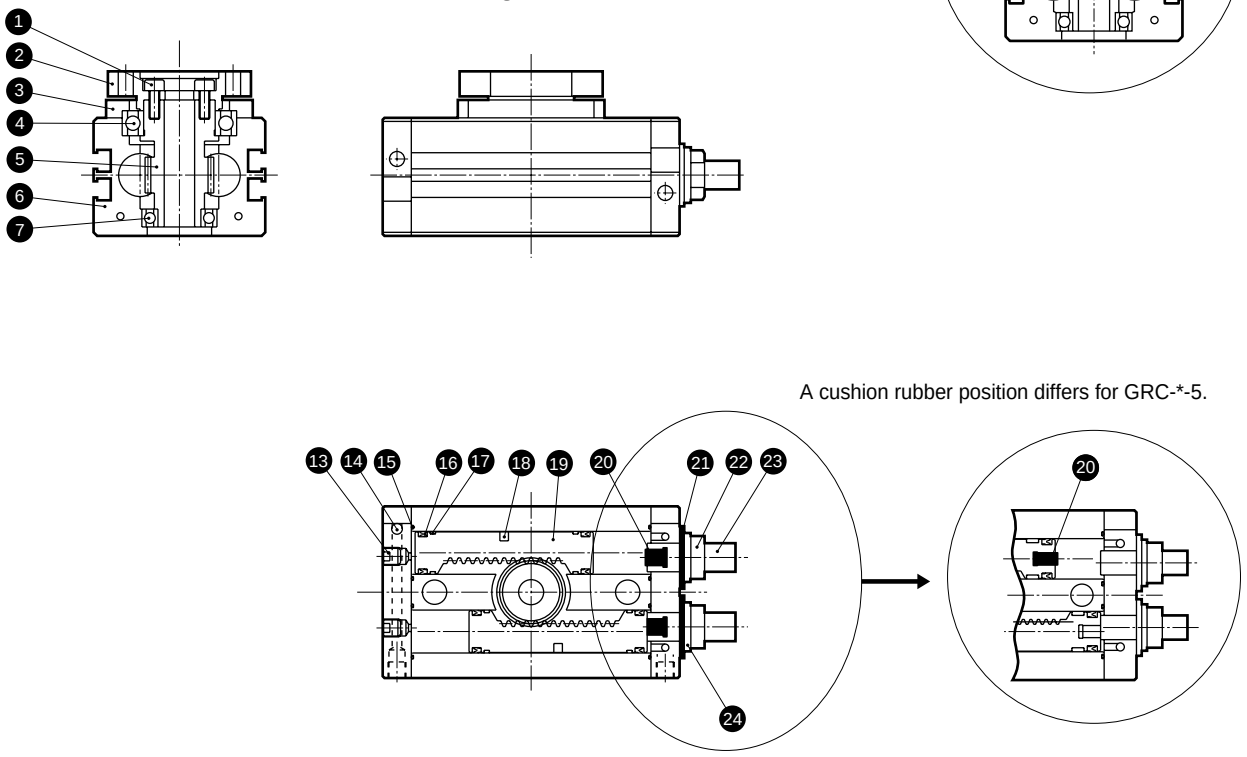


Applicable shock absorber model No.

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 accuracy type)



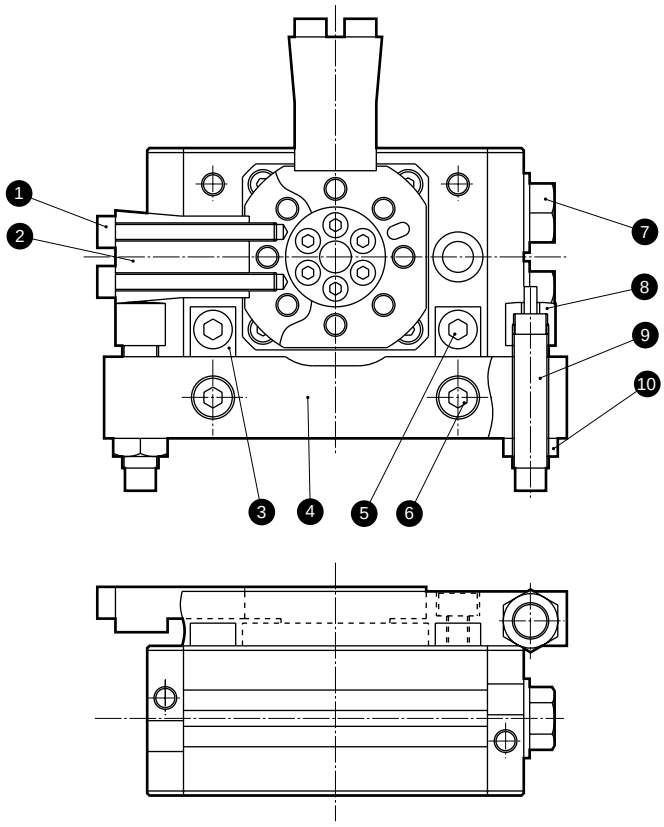
Part list

No.	Parts name	Material	Remarks	No.	Parts name	Material	Remarks
1	Hexagon socket head cap bolt	Stainless steel		13	Hexagon socket head set screw	Stainless steel	
2	Table	Aluminum alloy	Alumite	14	Steel ball	Stainless steel	
3	Bearing guard	Aluminum alloy (stainless steel for high accuracy type)	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 body	Aluminum alloy	Hard alumite	18	Magnet	Plastic (5.10 is special alloy.)	
7	Ball bearing (2)	Alloy steel		19	Piston	Stainless steel	
8	Hexagon socket head cap bolt	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 bolt	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: The figure shows 90° specifications. 180° specifications use same material etc.



Part list

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

Repair kits

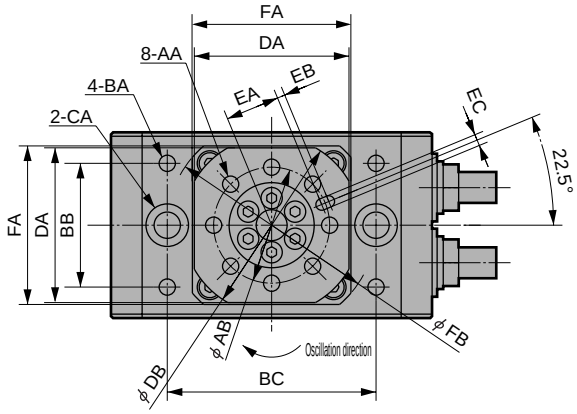
Kit No.	Repair parts number
GRC-5K	⑩ ⑮ ⑯ ⑰ ⑳
GRC-10K	
GRC-20K	
GRC-30K	
GRC-50K	
GRC-80K	

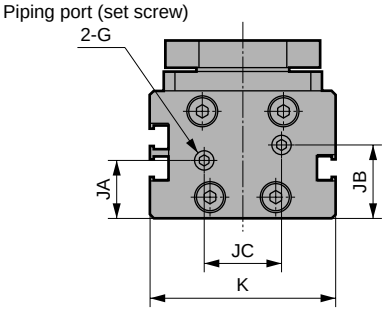
Note 1: Specify the kit No. when odering consumable parts.
Note 2: Avoid disassembling/repair, since high accuracy type uses highly controlled precision part.
When repairing high accuracy type, consult with CKD.

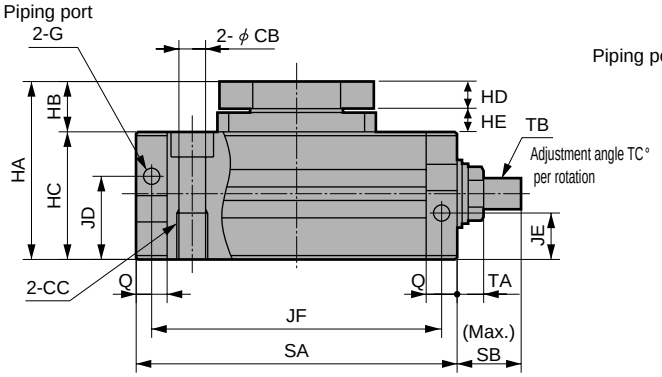
Dimensions

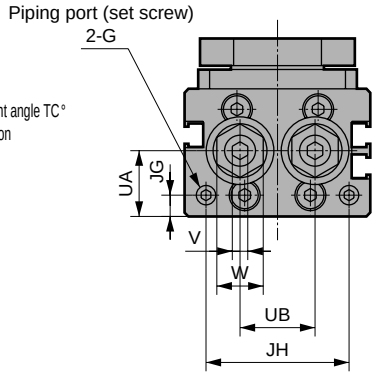
CAD

- GRC basic type
- GRC-K high accuracy type





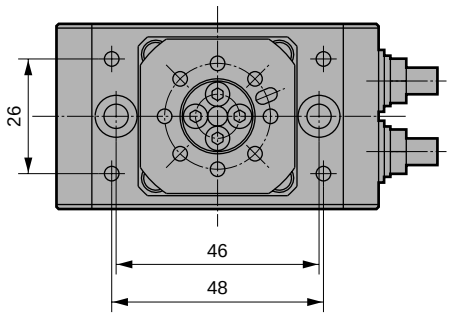




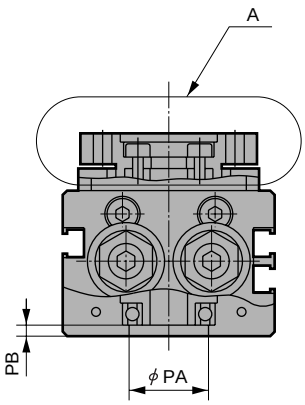
Size	AA	AB	BA	BB	BC	CA	CB	CC	DA	DB	EA	EB	EC	FA	FB	G	HA	HB
5	M4 depth 7	24	M4 depth 6.5	26	48	Spot face ϕ9.5 depth 5.4	5.2	M6 depth 12	35	42	11	2	3 +0.07 +0.02 depth 3.5	36	48h9	M5	43	13
10	M5 depth 7	30	M5 depth 7	32	54	Spot face ϕ11 depth 6.5	6.6	M8 depth 12	40	46	14	2	3 +0.07 +0.02 depth 3.5	41	54h9	M5	46	13
20	M6 depth 9	36	M6 depth 8	42	62	Spot face ϕ11 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
30	M6 depth 9	44	M6 depth 8	52	74	Spot face ϕ14 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
50	M8 depth 13	50	M8 depth 12	60	88	Spot face ϕ17.5 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
80	M8 depth 13	54	M8 depth 12	66	94	Spot face ϕ17.5 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

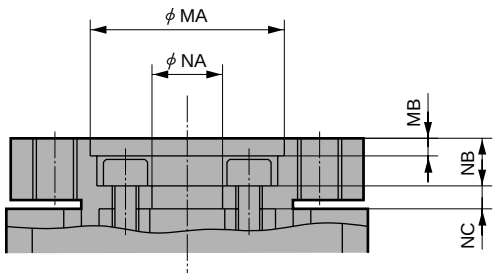
Size	SA		SB	TA	TB	TC	UA	UB	V	W	X	LD		RD	
	90°	180°										90°	180°	90°	180°
5	73	90	14	6.5	M6 x 1	8.7	16.6	16	3	10	12.6	21.5	25.5	22.5	25.5
10	83	107	15	4.9	M8 x 0.75	4.9	17.1	19.4	4	11	13.1	24.5	30.5	26	30.5
20	96	125	17	6.1	M10 x 1	5.7	17.6	24	5	13	13.6	31	37.5	31	37.5
30	121	165	25	6.1	M10 x 1	3.8	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

GRC-5

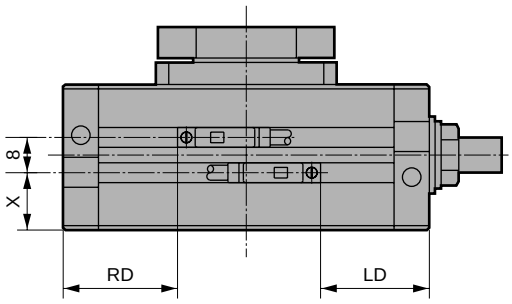


Position of 4-BA and 2-CA differ for GRC-5 only.





A section details



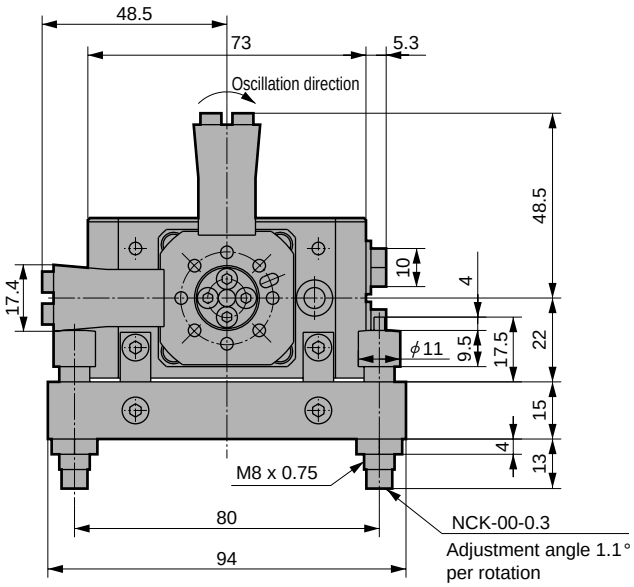
Switch installation positon

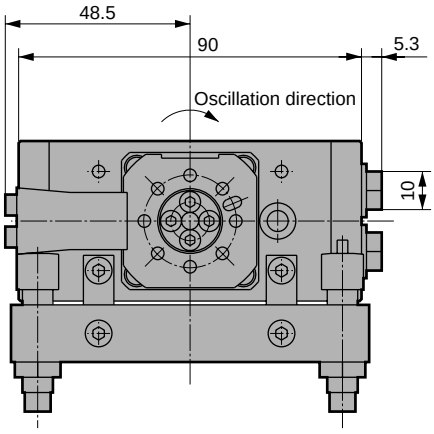
	HC	HD	HE	JA	JB	JC	JD	JE	JF 90°	JF 180°	JG	JH	K	MA	MB	NA	NB	NC	PA	PB	Q
	30	7	6	15	18	16	21	11.5	65	82	5.6	29	42	17H9	2	4H9	5.5	2.4	12H9	3.5	8
	33	7	6	15	19	20	21.5	12	75	99	5.6	37	48	22H9	2	8H9	5.5	2.4	18H9	2.5	8
	37	9	7	14.5	20.5	27	22	13	86	115	5.6	47	58	27H9	2	11H9	6.5	3.9	20H9	2.5	10
	37	9	9	14.5	20.5	37	22	13	111	155	5.6	57	68	32H9	2	13H9	7.5	2.9	26H9	2.5	10
	48	13	10	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
	55	13	12	24	30	40	35	19	135	183	8.1	58	80	40H9	3	17H9	9.5	4.4	36H9	3.5	15

Dimensions: with outer mount shock absorber size 5

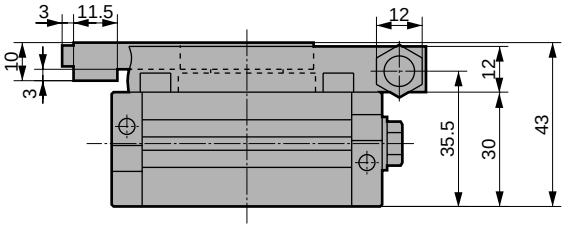
● GRC-5-*-A1/A2

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



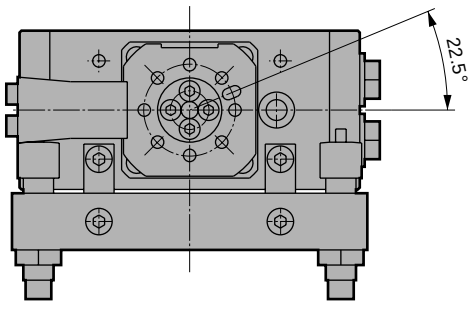


180° specifications

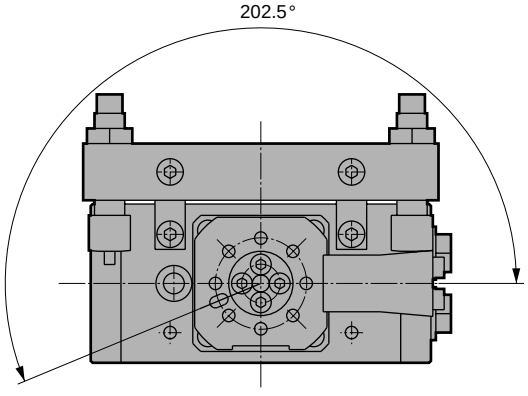


90° specifications

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

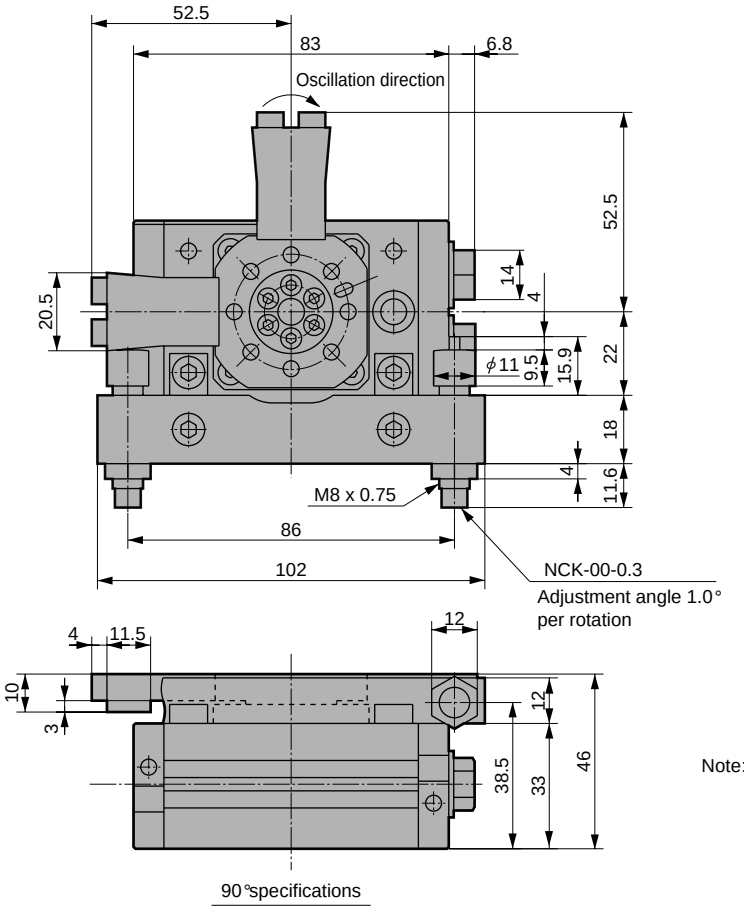


GRC-5-*-A2

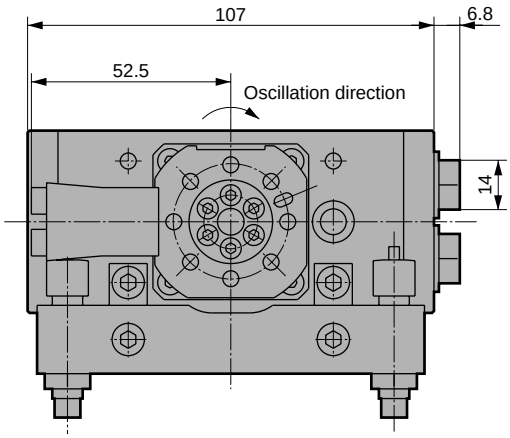
Dimensions: with outer mount shock absorber size 10, 20

● GRC-10-*-A1/A2

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



90°specifications

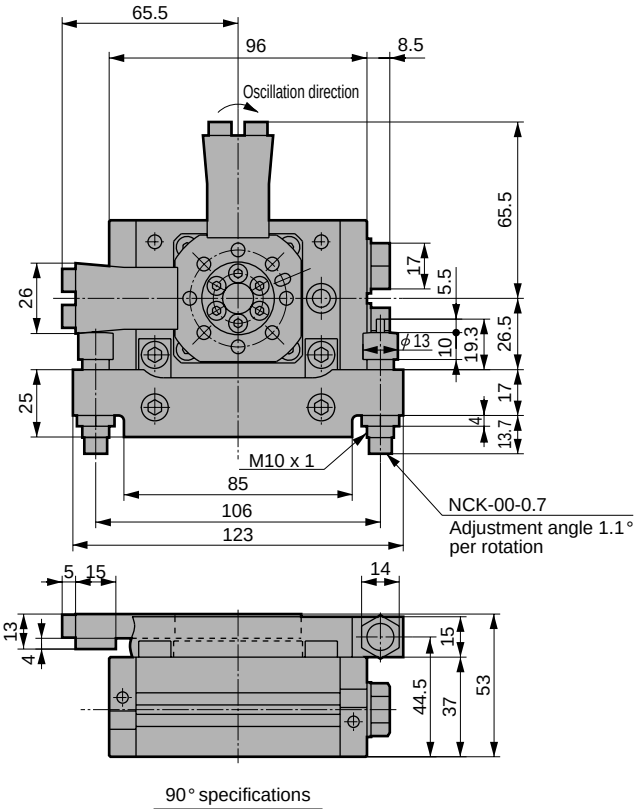


180° specifications

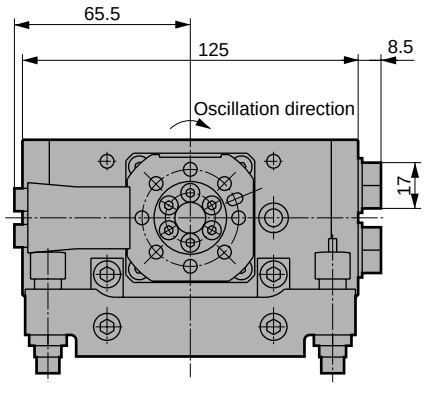
Note: Dimensions of rotary actuator main body are as same as basic type, however the body can not be fixed with using 4 taps on main body top. Position for dowel hole differs depending on installation position of outer mount shock absorber on table top.
(Refer to GRC-5-*-A1/A2.)

● GRC-20-*-A1/A2

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



90° specifications



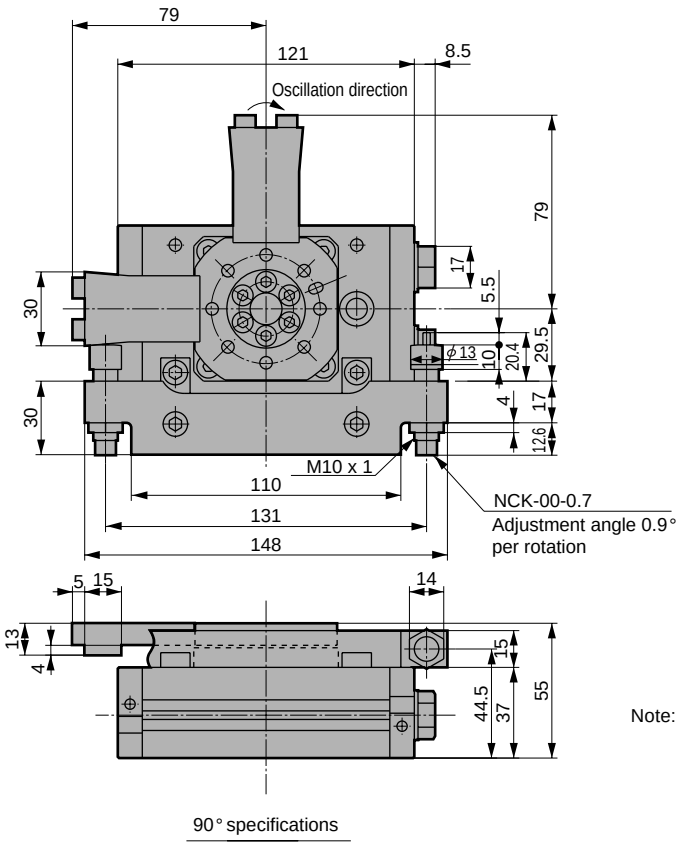
180° specifications

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.)

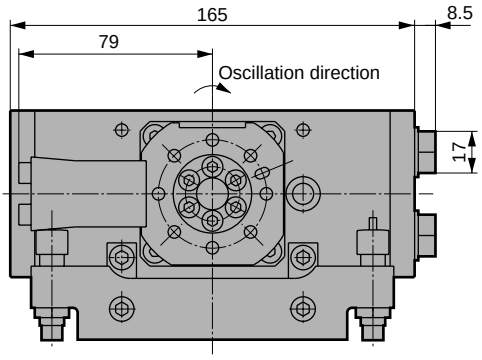
Dimensions: with outer mount shock absorber size 30, 50 CAD

●GRC-30-*-A1/A2

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



90° specifications

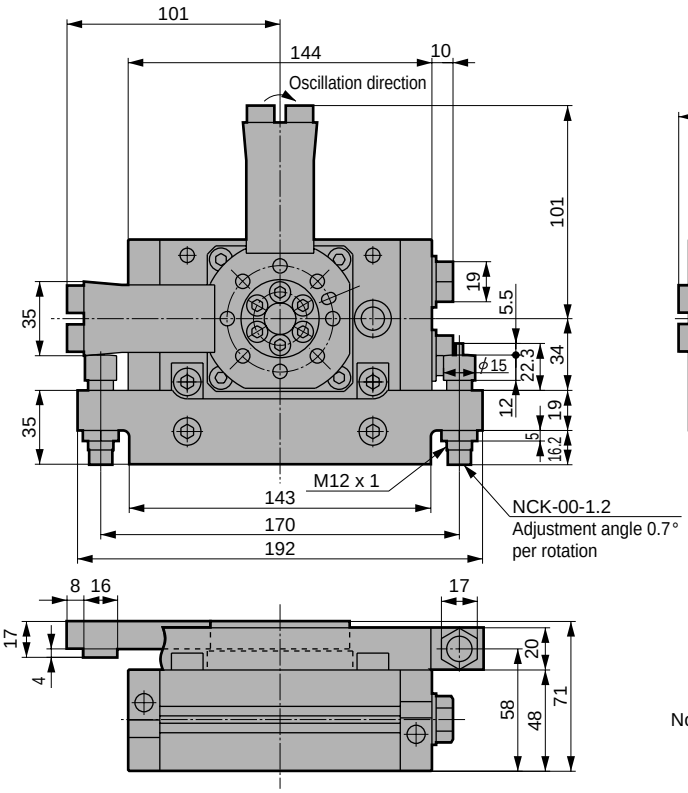


180° specifications

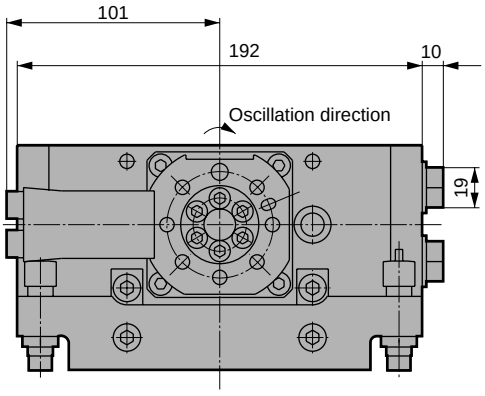
Note: Dimensions of rotary actuator main body are as same as basic type, however the body can not be fixed with using 4 taps on main body top. Position for dowel hole differs depending on installation position of outer mount shock absorber on table top.
(Refer to GRC-5-*-A1/A2.)

●GRC-50-*-A1/A2

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



90° specifications



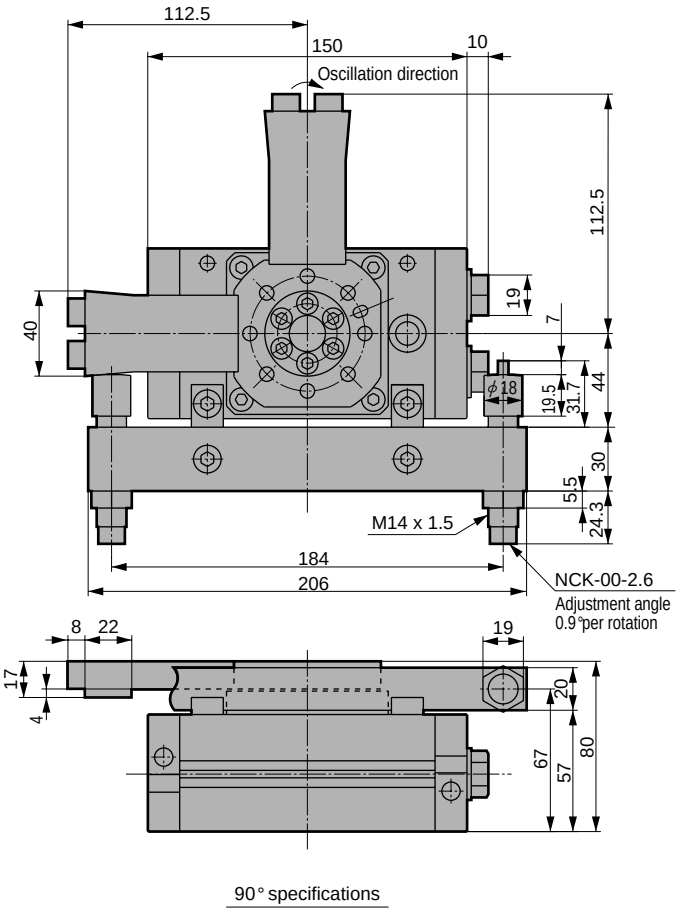
180° specifications

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.)

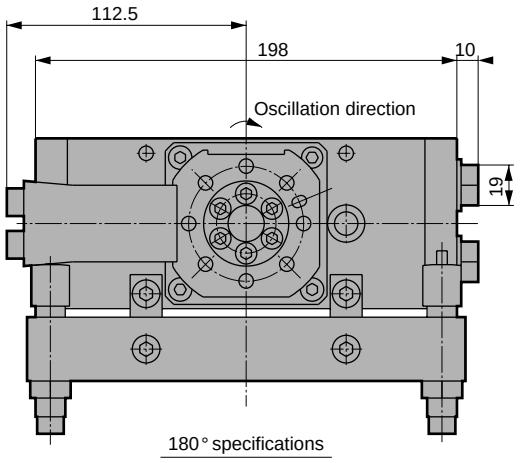
Dimensions: with outer mount shock absorber size 80

● GRC-80-*-A1/A2

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



90° specifications

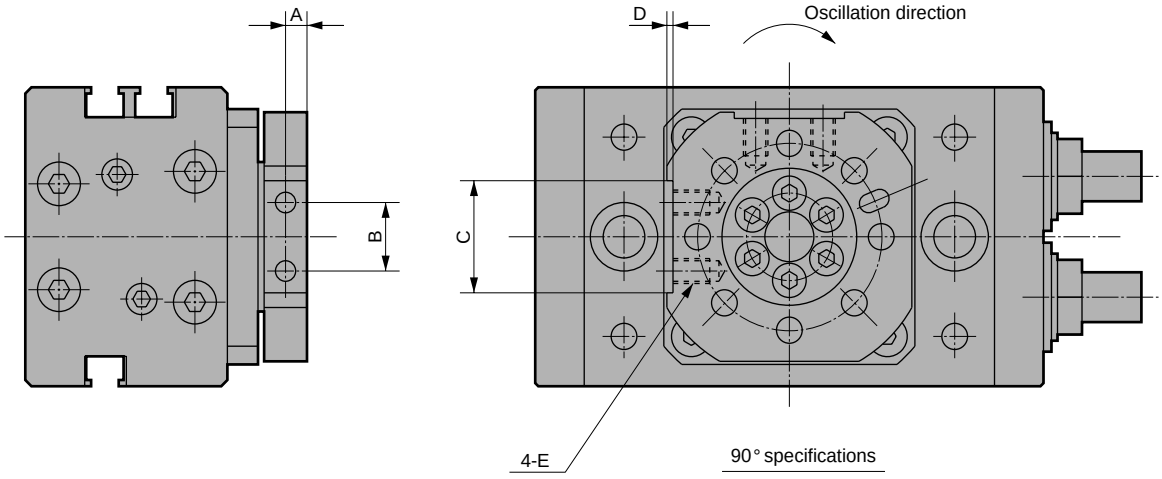


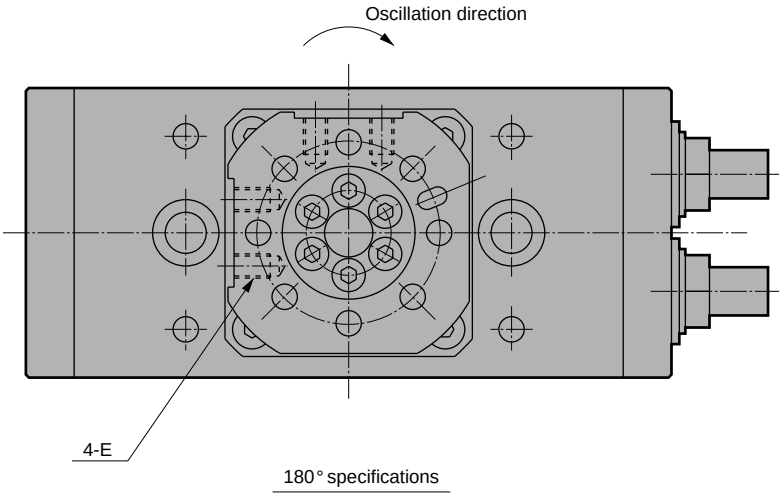
180° specifications

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: outer mount shock absorber later installation size 5 to 80

● GRC-*-A3

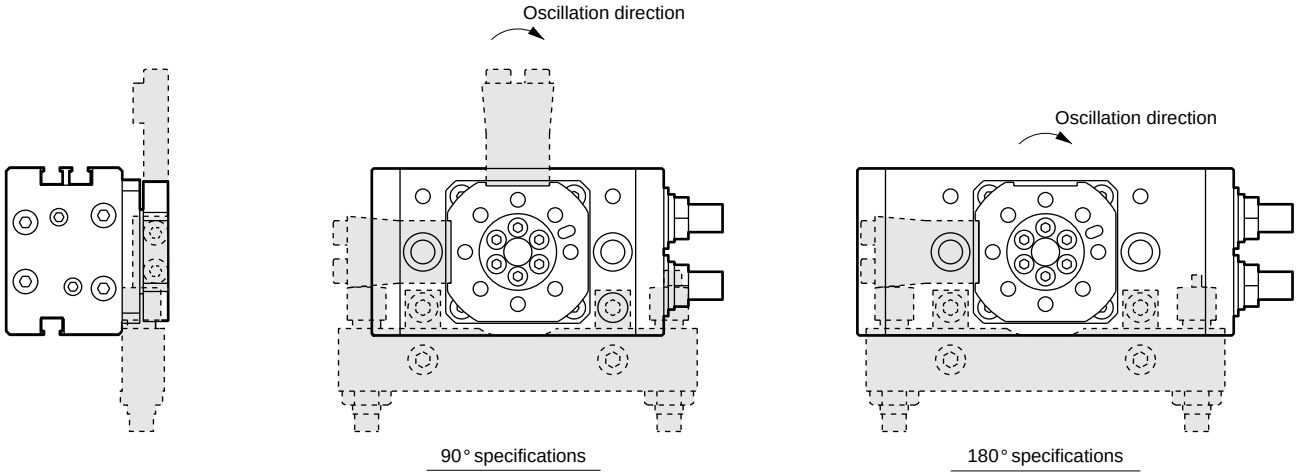




Size	A	B	C	D	E
5	3.5	8.4	$15^{+0.3}_{0}$	1	M3 depth 6.5
10	3.8	11	$18^{+0.3}_{0}$	1	M4 depth 6
20	4.5	13.4	$23^{+0.3}_{0}$	1	M5 depth 7.5
30	4.5	17	$27^{+0.3}_{0}$	2	M5 depth 8.5
50	6.9	18.4	$32^{+0.3}_{0}$	2	M8 depth 9
80	6.9	20	$36^{+0.3}_{0}$	2	M8 depth 9

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.
Consult with CKD on A2 type. (Refer to Page 34 for installation position.)



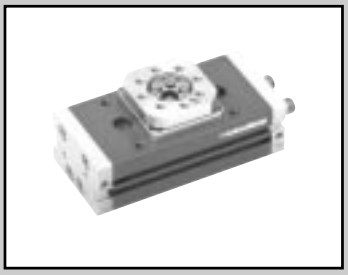


Table type rotary actuator
Fine speed/accuracy fine speed types

GRC-F/GRC-KF Series

● Size: 5, 10, 20, 30, 50, 80

JIS symbol

RoHS CAD

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
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 MPa	Basic type		0.10					
	High accuracy type		-	0.15		0.10		
	With outer mount shock absorber		0.25	0.20	0.15			
Withstanding pressure		MPa	1.6					
Ambient temperature		℃	5 to 60					
Allowable absorbing energy J	Basic type/high accuracy type		0.005	0.008	0.03		0.04	0.11
	With outer mount shock absorber		0.46	0.59	1.15	1.71	2.33	2.78
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
Oscillating angle adjusting range Note 2	Basic type/high accuracy type	90° specifications	0° to 100°					
		180° specifications	90° to 190°					
	With outer mount shock absorber	90° specifications	90°±6°					
		180° specifications	180°±6°					
Oscillating time adjusting range		S/90°	0.2 to 25					
Port size			M5				Rc1/8	
Lubrication			Must be oil free					

Note 1: Theoretical torque is value when working pressure 0.5MPa.
Note 2: The angle adjustment range applies when adjusted with the stopper bolts (shock absorbers) on both sides.
If a shock absorber is provided, the fine speed specifications will not apply to the shock absorber section.

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

● Dust preventive structure for inside the clean room

GRC-F - ····· - P73 GRC-KF - ····· - P73

Switch specifications

● 1 color/2 color indicator

Descriptions	Proximity 2 wire			Proximity 3 wire		
	T1H/T1V	T2H/T2V	T2YH/T2YV	T3H/T3V	T3PH/T3PV (Custom order)	T3YH/T3YV
Applications	Programmable controller, relay, small solenoid valve	Programmable controller		Programmable controller, relay		
Output method	—			PNP output		
Power voltage	—			10 to 28 VDC		
Load voltage	85 to 265 VAC	10 to 30 VDC		30 VDC or less		
Load current	5 to 100mA (Note 1)	5 to 20mA (Note 1)		100mA or less		50mA or less
Light	LED (ON lighting)	LED (ON lighting)	Red/green LED (ON lighting)	LED (ON lighting)	Green LED (ON lighting)	Red/green LED (ON lighting)
Leakage current	1mA or less with 100 VAC 2mA or less with 200 VAC	1mA or less		10μA or less		

● With preventive maintenance output

Descriptions		Proximity 3 wire T2YFH/V	Proximity 4 wire T3YFH/V	Proximity 3 wire T2YMH/V	Proximity 4 wire T3YMH/V
Applications		Programmable controller	Programmable controller, relay	Programmable controller	Programmable controller, relay
Output method		NPN output			
Light	Installation position adjustment	Red/green LED (ON lighting)			
	Preventive maintenance output	-		Yellow LED (ON lighting)	
Regular output	Power voltage	-	10 to 28 VDC	-	10V to 28 VDC
	Load voltage	10V to 30 VDC	30 VDC or less	10 to 30 VDC	30 VDC or less
	Load current	5 to 20mA	50mA or less	5 to 20mA	50mA or less
	Leakage current	1mA or less	10μA or less	1.2mA or less	10μA or less
Preventive maintenance output	Load voltage	30 VDC or less			
	Load current	20mA or less	50mA or less	5 to 20mA or less	50mA or less
	Leakage current	10μA or less			

Note 1: Refer to Ending 1 for other switch specifications.
Note 2: Maximum load current: 20mA above is the value at 25℃. The current will be lower than 20mA if ambient temperature around switch is higher than 25℃. (5 to 10mA when 60℃))

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, "Puneumatic 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

Ⓐ Model no.

Ⓑ Size

Ⓒ Port thread type

Ⓓ Oscillating angle

Ⓔ Switch model no.

Ⓕ Switch quantity

Ⓖ Option

Symbol	Descriptions
Ⓐ Model no.	
GRC-F	Basic type
GRC-KF	High accuracy type

Ⓑ Size			
Model no.	Logical torque	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	5.2 (N・m)	●	●
80	8.1 (N・m)	●	●

Ⓒ Port thread type	
Blank	Rc thread
NN	NPT thread (size 50 and over) (custom order)
GN	G thread (size 50 and over) (custom order)

Ⓓ Oscillating angle	
90	90°
180	180°

Ⓔ Switch model no.

Axial lead wire	Radial lead wire	Contact	Indicator	Lead wire
T1H*	**T1V***	Proximity	1 color indicator type	2-wire
T2H*	**T2V***			2-wire
T3H*	**T3V***			3-wire
T3PH*	**T3PV***		1 color indicator type (custom order)	3-wire
T2YH*	**T2YV***		2 color indicator type	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	With counterclockwise 1 piece
L	With clockwise rotation 1 piece
D	Two

Ⓖ 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

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

Note 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.

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 CKD for A2 type.

Note 4: Refer to page 29 for discrete switch, option model No.

<Example of model number>

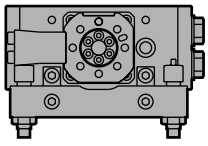
GRC-F-10-180-T2V-D-A1

Double acting

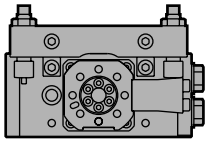
Ⓐ Model no. : Basic type
Ⓑ Size : 10
Ⓒ Port thread type : Rc thread
Ⓓ Oscillating angle : 180°
Ⓔ Switch model no. : Proximity/2 wire, radial lead wire, lead wire 1m
Ⓕ Switch quantity : Two
Ⓖ Option : With outer mount shock absorber installation position (1)

Outer mount shock absorber installation drawing

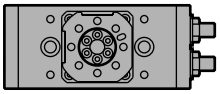
Installation position (1)
GRC-*-A1



Installation position (2)
GRC-*-A2

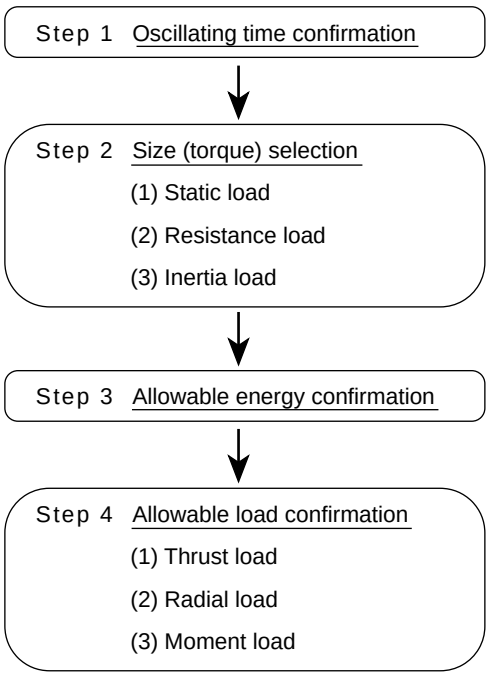


Outer mount shock absorber later installation
GRC-*-A3



Selection method

Select based on the following procedures.



Step1 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.

	Using with 90°	Using with 180°
Oscillating time (S)	0.2 to 1.5	0.4 to 1.5

Step2 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.

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

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 object

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

TA : 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).

Step3 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.

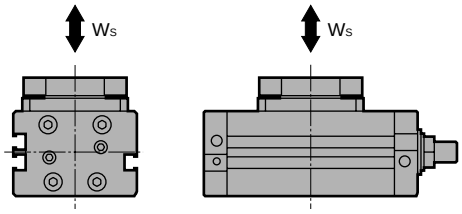
$$E = \frac{1}{2} \times I \times \omega^2$$
$$\omega = \frac{2\theta}{t}$$

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).

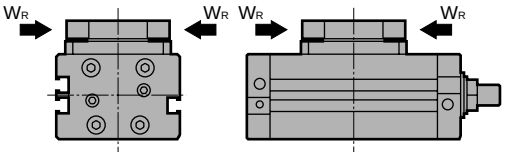
Selection method

Step4 Allowable load confirmation

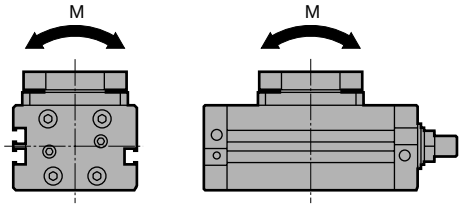
If load applies to table, load is to be within allowable value on Table 2.
If combined load is applied, total of ratio for allowable value per load is to be 1.0 or less.
Load is categorized with following 3 types.
(1) Thrust load (axial load)



(2) Radial load (sideways load)



(3) Moment load



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

$$\frac{Ws}{Wsmax} + \frac{WR}{WRmax} + \frac{M}{Mmax} \leqq 1.0$$

Ws : Thrust load (N)
WR : Radial load (N)
M : Moment load (N·m)
WSmax : Allowable thrust load (N)
WRmax : Allowable radial load (N)
Mmax : 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 (J)

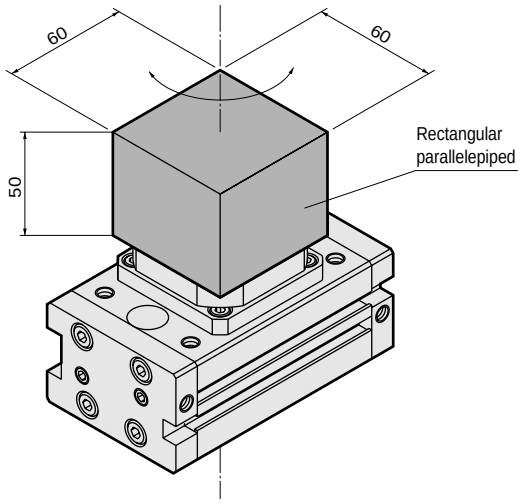
Size	5	10	20	30	50	80
Basic type/high accuracy type	0.005	0.008	0.03		0.04	0.11
With outer mount shock absorber	0.46	0.59	1.15	1.71	2.33	2.78

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

Size		5	10	20	30	50	80
Thrust load	Basic type	50	80	140	200	450	580
WSmax. (N)	High accuracy type	-	120	220	440	550	650
Radial load	Basic type	30	80	150	200	320	400
WRmax. (N)	High accuracy type	-	100	160	240	380	480
Moment load	Basic type	1.5	2.5	4.0	5.5	10.0	13.0
Mmax. (N·m)	High accuracy type	-	3.0	5.0	7.0	12.0	15.0

Selection example (1)

Load of rectangular parallelepiped applies



<Operation conditions>

Pressure	: 0.5 (MPa)
Oscillating angle	: 90°
Oscillating time	: 0.6 (s)
Load (material: aluminum alloy)	
<Rectangular parallelepiped>	: 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.
<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 $\theta = 90° = \frac{\pi}{2}$ (rad), t = 0.6 (s)

Therefore,

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

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

$$T_A = 5 \times 3 \times 10^{-4} \times 8.73$$
$$= 0.0131 \ (N \cdot m) \cdots\cdots\cdots(3)$$

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

GRC - 5 - 90 ·····(A)

can be selected.

Step3 Allowable energy confirmation

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

According to conditions $\theta = 90° = \frac{\pi}{2}$ (rad), t = 0.6 (s)

Therefore,

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

Therefore, kinetic energy (E) is

$$E = \frac{1}{2} \times 3 \times 10^{-4} \times 5.24^2$$
$$= 0.00412 \ (J) \quad \cdots\cdots\cdots(4)$$

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

GRC - 5 - 90 ·····(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>
Thrust load (Ws),

$$Ws = 0.5 \times 9.8 = 4.9 \ (N) \quad \cdots\cdots\cdots(5)$$

<Radial load>
Since no radial load is applied,

$$W_R = 0 \ (N) \quad \cdots\cdots\cdots(6)$$

<Moment load>
Since no moment load is applied,

$$M = 0 \ (N \cdot m) \quad \cdots\cdots\cdots(7)$$

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

$$\frac{Ws}{Wsmax} + \frac{W_R}{W_{Rmax}} + \frac{M}{Mmax}$$
$$= \frac{4.9}{50} + \frac{0}{30} + \frac{0}{1.5} = 0.098 \leqq 1.0 \cdots\cdots\cdots(C)$$

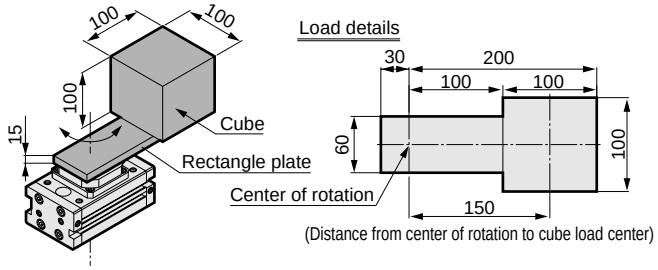
Since total load value is within allowable load value according to (B) and (C),

GRC - 5 - 90

can be selected.

Selection example (2)

Load of rectangular parallelepiped applies to rectangle plate.



<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>

$$I_1=1.40\times\frac{4\times0.20^2+0.06^2}{12}+0.21\times\frac{4\times0.03^2+0.06^2}{12}$$

$$=1.92\times10^{-2}(kg\cdot m^2)$$

<Cube>

$$I_2=7.8\times\frac{0.1^2}{6}+7.8\times0.15^2$$

$$=0.189(kg\cdot m^2)$$

Therefore, total moment of inertia (I) is following.

$I = I_1 + I_2 = 0.21(kg\cdot m^2)$ ·····(1)

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

According to conditions $\theta=90°=\frac{\pi}{2}$ (rad), t=1.0(s)

Therefore,

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

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

$T_A = 5 \times 0.21 \times 3.14$

$= 3.30(N\cdot m)$ ····· (3)

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

GRC - 50 - 90 ·····(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 $\theta=90°=\frac{\pi}{2}$ (rad), t=1.0(s)

Therefore, .

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

Therefore, kinetic energy (E) is

$$E=\frac{1}{2}\times0.19\times3.14^2$$

$=0.937(J)$ ·····(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)

$Ws = 9.41 \times 9.8 = 92.2$ (N) ·····(5)

<Radial load>

Since no radial load is applied.

$W_R = 0$ (N)·····(6)

<Moment load>

Moment load (M_1) by rectangle plate

$1.40 \times 9.8 = 13.72$ (N)

$0.21 \times 9.8 = 2.06$ (N)

Therefore,

$M_1 = 13.72 \times 0.1 - 2.06 \times 0.015$

$= 1.34$ (N·m)

Moment load (M_2) by rectangular parallelepiped

$7.8 \times 9.8 = 76.44$ (N)

Therefore,

$M_2 = 76.44 \times 0.15 = 11.47$ (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.

$$\frac{W_S}{W_{Smax}}+\frac{W_R}{W_{Rmax}}+\frac{M}{M_{max}}=\frac{92.2}{650}+\frac{0}{480}+\frac{12.8}{15}=0.99\leqq1.0$$ ·····(C)

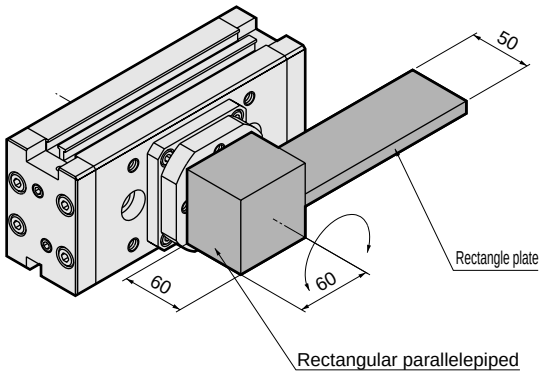
According to (C), total load value is within allowable load value,

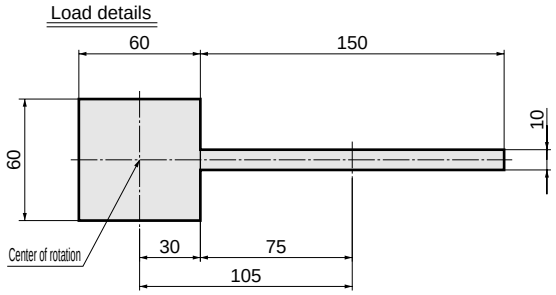
GRC - K - 80 - 90 - A1,A2

can be selected.

Selection example (3)

Horizontal rectangle plate load applies to rotary shaft.





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

<Operation 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)

Step1 Oscillating time confirmation

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.

Step2 Size (torque) selection

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,
$T_R = 5 \times 1.96 \times 0.105 = 1.03(N \cdot m)$ ·····(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.
$I = I_1 + I_2 = 2.88 \times 10^{-3}(kg \cdot m^2)$····· (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)
$T_A = 5 \times 2.88 \times 10^{-3} \times 25.13$
$= 0.362(N \cdot m)$ ·····(4)
According to (1), (4) total torque
$T = 1.03 + 0.362 = 1.39(N \cdot m)$ ·····(5)
According to (5) value and operational conditions, from torque at 0.5 (MPa)
GRC - 20 - 180 ·····(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 $\theta = 180° = \pi$ (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.

Selection example (3)

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)

Ws = 0(N) ·····(7)

<Radial load>

Total weight

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)

$M = 0.03 \times (0.2 + 0.5) \times 9.8$

$= 0.21(N \cdot m)$ ·····(9)

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

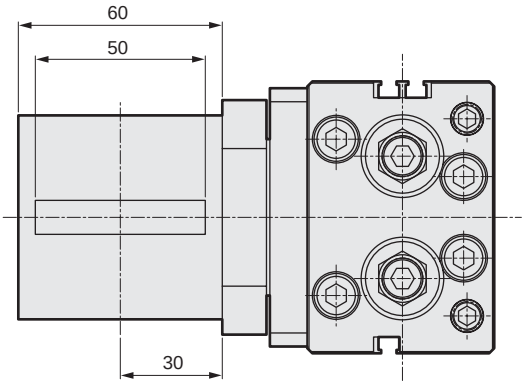
$$\frac{W_S}{W_{Smax}} + \frac{W_R}{W_{Rmax}} + \frac{M}{M_{max}}$$

$$= \frac{0}{150} + \frac{6.9}{140} + \frac{0.21}{4.0} = 0.101 \leqq 1.0 \cdots\cdot(C)$$

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

GRC - 20 - 180 - A1, A2

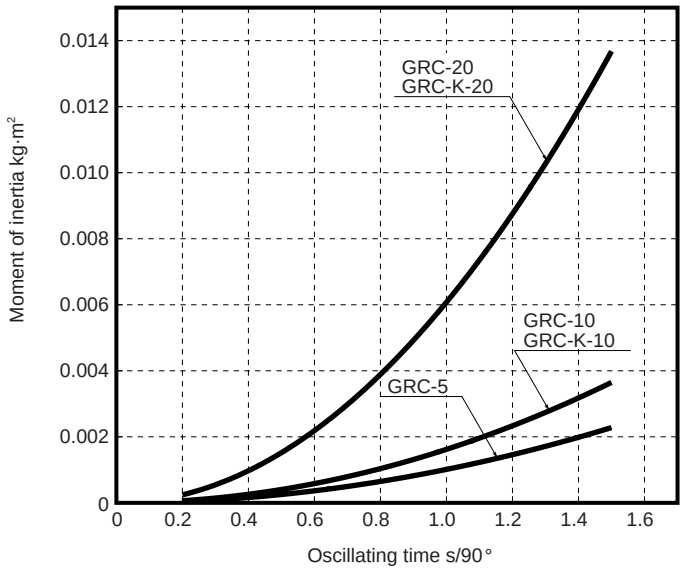
can be selected.



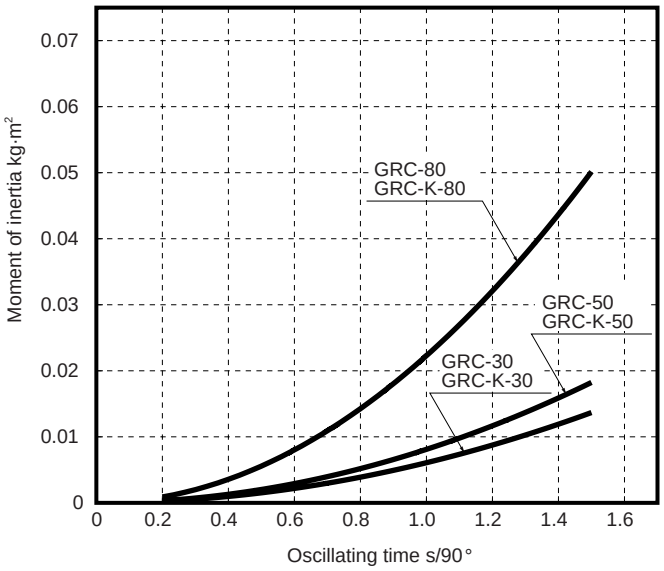
1. Energy absorbing performance and oscillating time

(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



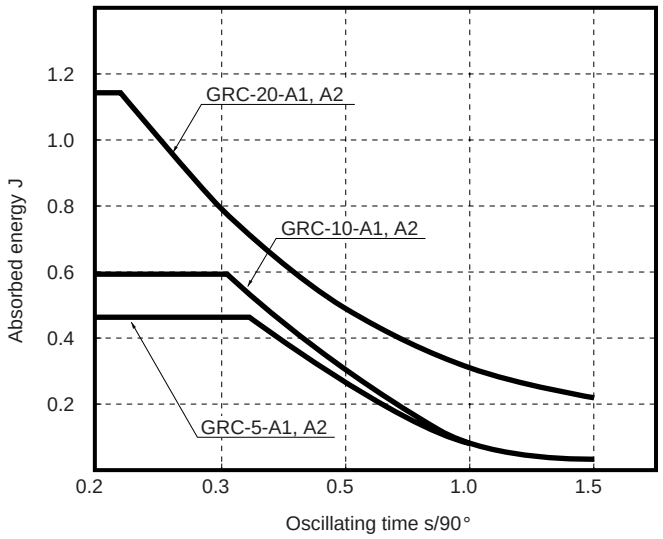
Size 5, 10, 20



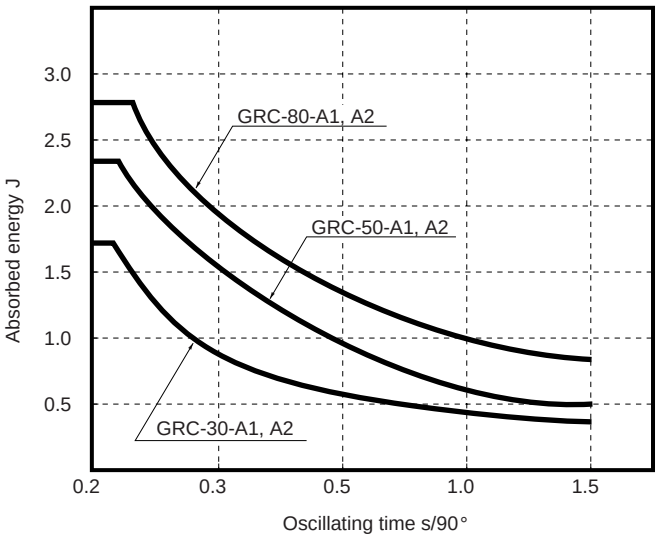
Size 30, 50, 80

(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



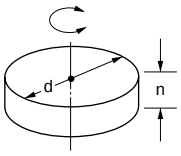
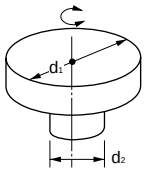
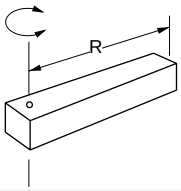
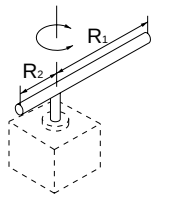
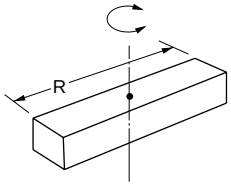
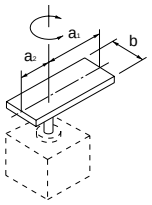
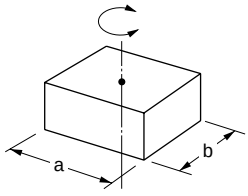
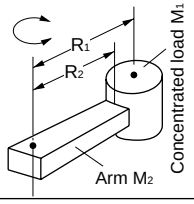
Size 5, 10, 20



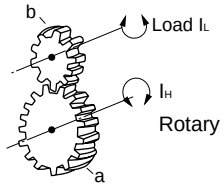
Size 30, 50, 80

2. Moment of inertia calculation

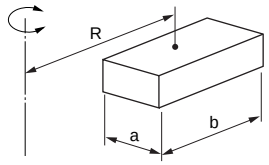
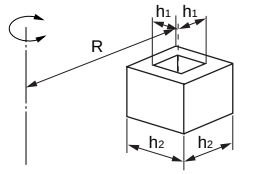
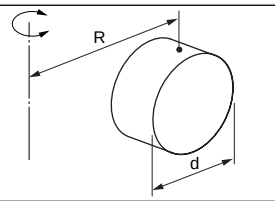
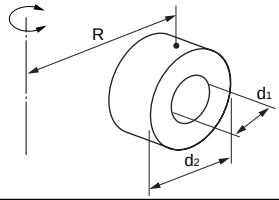
When rotary shaft goes through workpiece

Shape	Sketch	Requirements	Moment of inertia I kg/m²	Radius of gyration K_1^2	Remarks
Dial plate		● Diameter d (m) ● Weight M (kg)	$I = \frac{Md^2}{8}$	$\frac{d^2}{8}$	● No installation direction ● When using with sliding, please consult with CKD
Dial plate with step		● Diameter d_1 (m) d_2 (m) ● Weight d_1 section M_1 (kg) d_2 section M_2 (kg)	$I = \frac{1}{8}(M_1d_1^2 + M_2d_2^2)$	$\frac{d_1^2 + d_2^2}{8}$	● Ignore, when d_2 section is extremely small comparing to d_1 section
Bar (center of rotation is an end.)		● Bar length R (m) ● Weight M(kg)	$I = \frac{MR^2}{3}$	$\frac{R^2}{3}$	● The installation direction is horizontal. ● If vertical installation attitude, oscillating time varies
Thin rod		● Bar length R_1 R_2 ● Weight M_1 M_2	$I = \frac{M_1 \cdot R_1^2}{3} + \frac{M_2 \cdot R_2^2}{3}$	$\frac{R_1^2 + R_2^2}{3}$	● The installation direction is horizontal. ● If vertical installation attitude, oscillating time varies
Bar (center of rotation is center of gravity.)		● Bar length R (m) ● Weight M(kg)	$I = \frac{MR^2}{12}$	$\frac{R^2}{12}$	● No installation direction
Thin rectangle plate (rectangular parallelepiped)		● Plate length a_1 a_2 ● Length of side b ● Weight M_1 M_2	$I = \frac{M_1}{12}(4a_1^2 + b^2) + \frac{M_2}{12}(4a_2^2 + b^2)$	$\frac{(4a_1^2 + b^2) + (4a_2^2 + b^2)}{12}$	● The installation direction is horizontal. ● If vertical installation attitude, oscillating time varies
Lectangular parallelepiped		● Length of side a(m) b(m) ● Weight M(kg)	$I = \frac{M}{12}(a^2 + b^2)$	$\frac{a^2 + b^2}{12}$	● No installation direction ● When using with sliding, please consult with CKD
Concentrated load		● Shape of concentrated load ● Length to center of gravity of concentrated load R_1 ● Arm length R_2(m) ● Concentrated load weight M_1(kg) ● Arm weight M_2(kg)	$I = M_1(R_1^2 + k_1^2) + \frac{M_2R_2^2}{3}$		● The installation direction is horizontal. ● When M_2 is extremely small comparing to M_1, may be calculated as $M_2 = 0$

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

Gear		● Gear Rotary side (the tooth number) a Load side (the tooth number) b ● Load inertia Moment N·m	Moment of inertia of load rotary shaft rotation $I_H = \left(\frac{a}{b}\right)^2 I_L$		● When shape of gear is increasing, gear moment of inertia should be considered.

● Rotary shaft offsets from workpiece

Shape	Sketch	Requirements	Moment of inertia I kg/m²	Remarks
Rectangular parallelepiped		● Length of side a(m) ● Distance from rotary shaft to load center b(m) R(m) ● Weight M(kg)	$I = \frac{M}{12}(a^2+b^2) + MR^2$	● Same for cube
Rectangular parallelepiped of hollow		● Length of side h_1(m) h_2(m) ● Distance from rotary shaft to load center R(m) ● Weight 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) ● Weight M(kg)	$I = \frac{Md^2}{16} + MR^2$	
Cylinder of hollow		● Diameter d_1(m) d_2(m) ● Distance from rotary shaft to load center R(m) ● Weight M(kg)	$I = \frac{M}{16}(d_1^2 + d_2^2) + MR^2$	

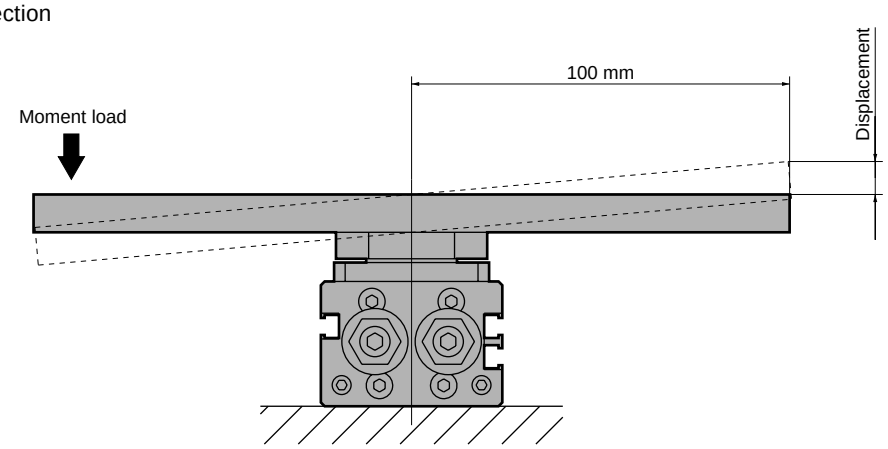
* To find moment of inertia, first, convert model load, jig etc., to simple shapes, then calculate values.
The moment of inertia calculation and total is made for combined load.

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



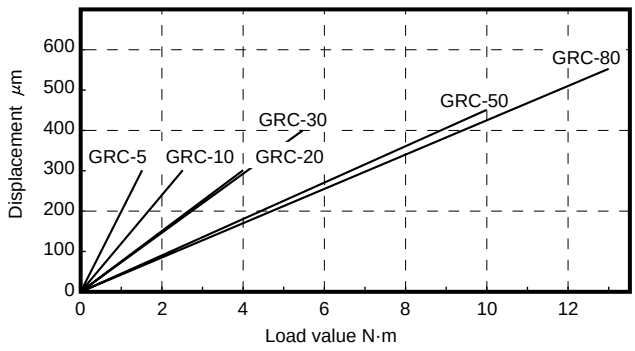


Table deflection of GRC (basic type)

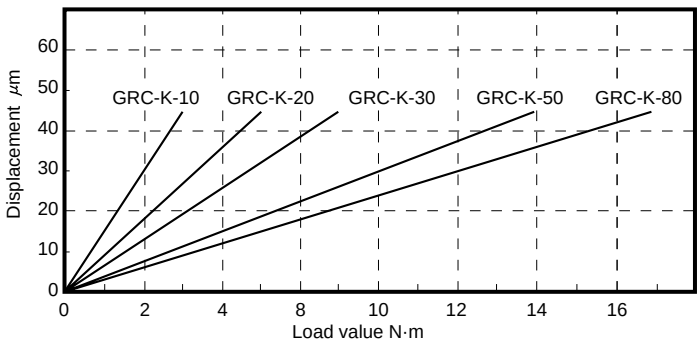
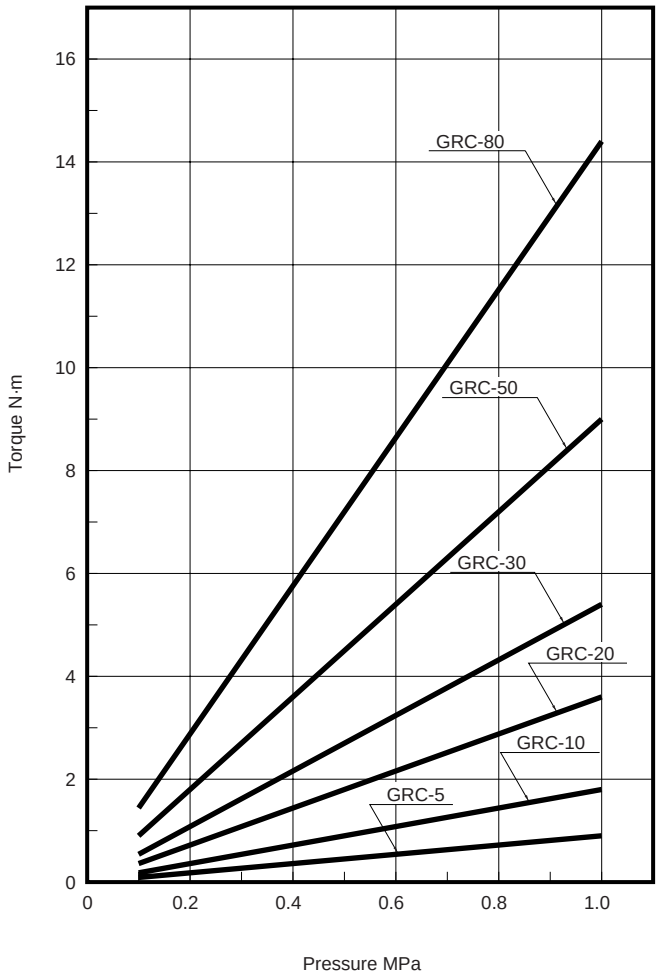


Table deflection of GRC-K (high accuracy type)

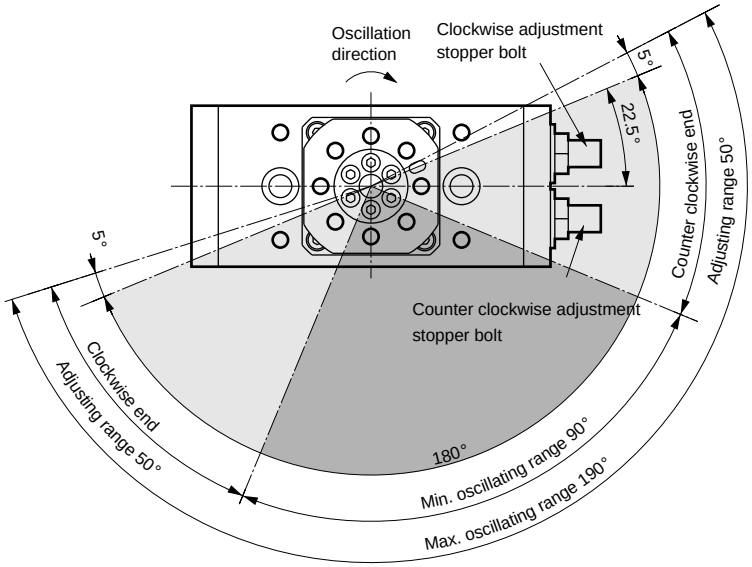
4. Effective torque diagram

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

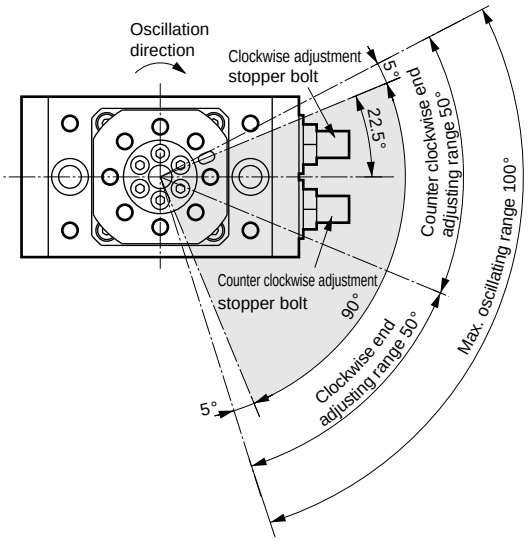


5. Oscillating angle adjustment method

● Basic type / high accuracy type

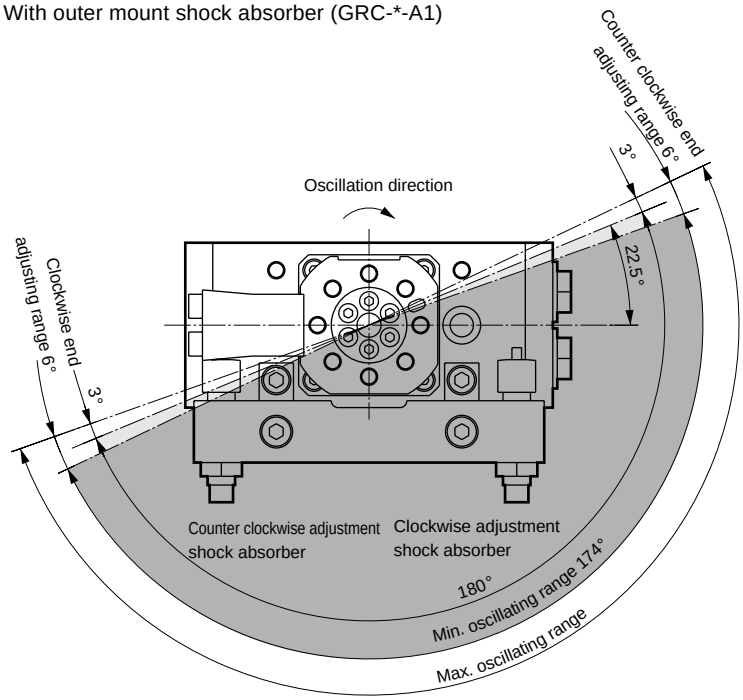


180° specifications

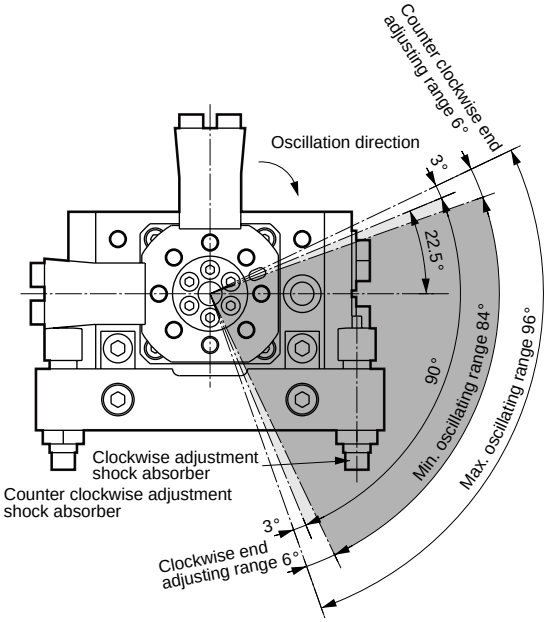


90° specifications

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

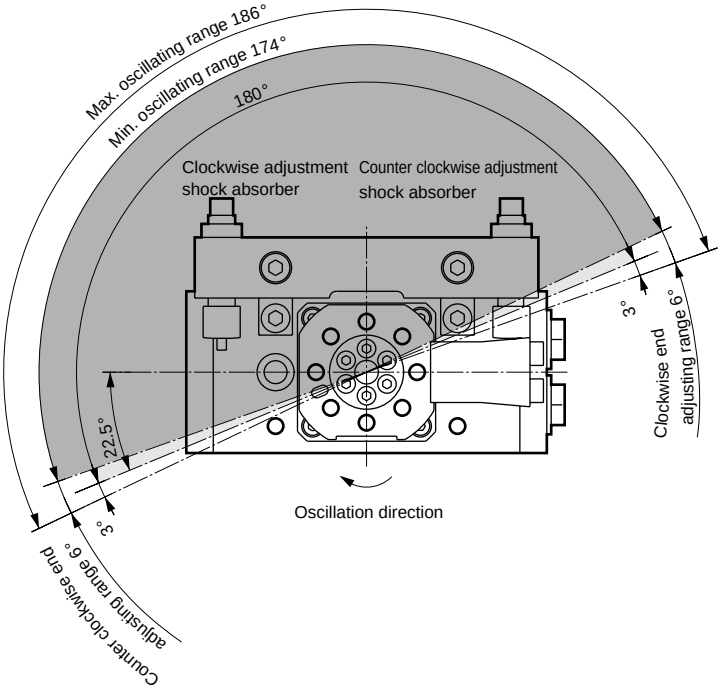


180° specifications

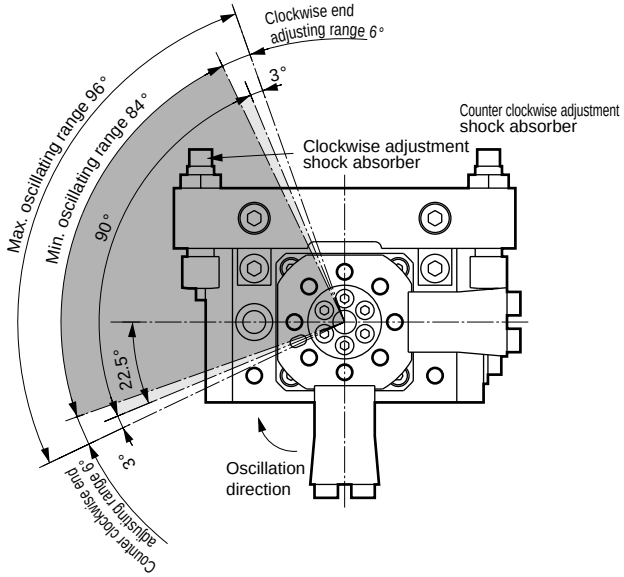


90° specifications

● With outer mount shock absorber (GRC-*-A2)



180° specifications



90° specifications